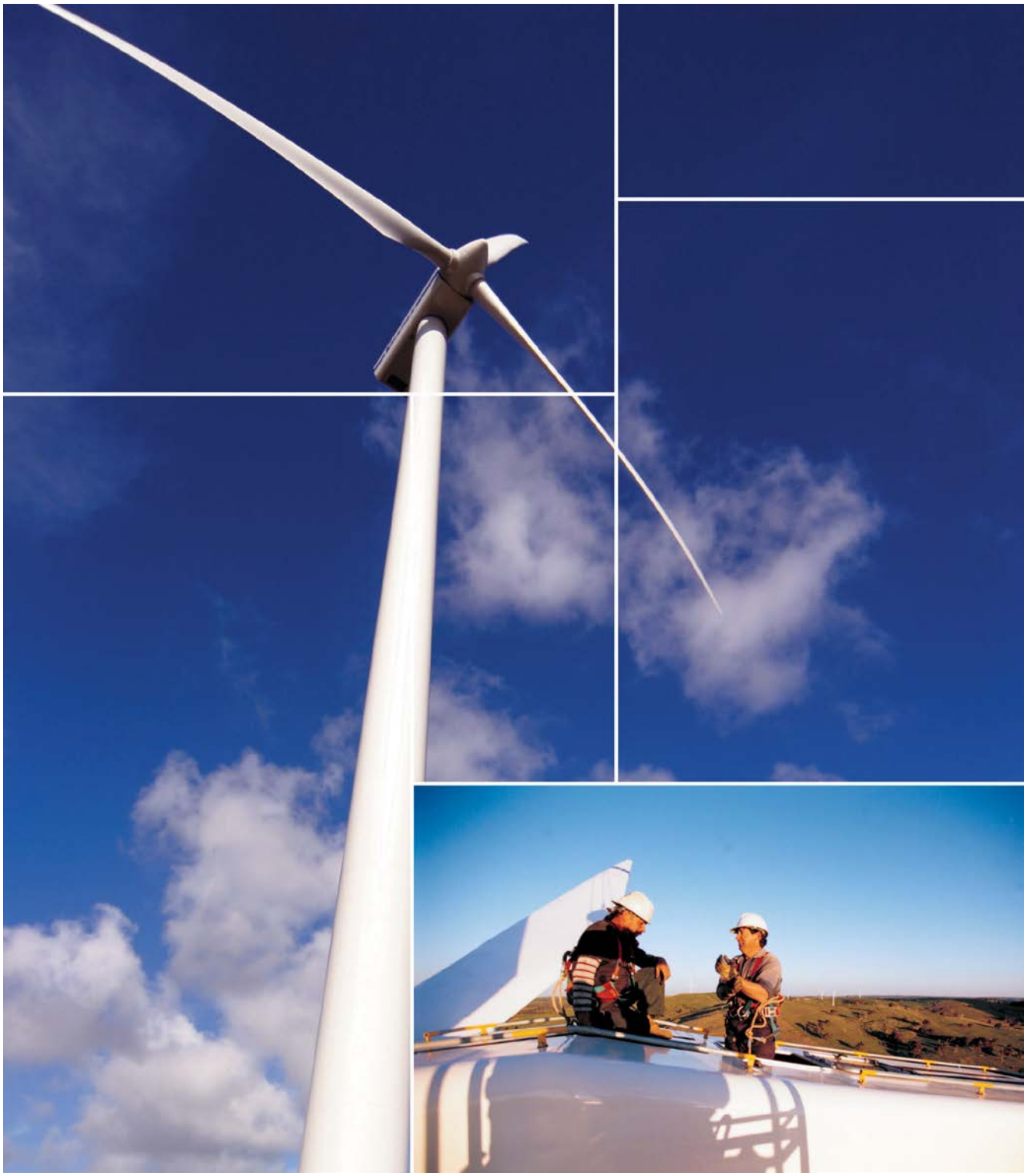

aurecon

Flyers Creek Wind Farm

Substation Plan

Infigen Energy

17 July 2015
Revision: 2
Reference: 218524-003

Document control record

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Document control						
Report title	Flyers Creek Substation Plan					
Document ID		**Project number**	218524-003			
File path	C:\Users\heather.tilley\AppData\Roaming\OpenText\OTEdit\EC_cs\c142895549\218524-003 - Flyers Creek Wind Farm Substation Plan_Final.docx					
Client	Infigen Energy	**Client contact**	Jonathan Upson			
Rev	**Date**	**Revision details/status**	**Prepared by**	**Author**	**Verifier**	**Approver**
A	16 January 2015	Draft	HT	HT/AK	HT	ML
0	4 February 2015	Final Draft	HT	HT/AK	HT	ML
1	13 February 2015	Final	HT	HT/AK	HT	ML
2	17 July 2015	Final inc DPE comments	HT	HT/AK	HT	ML
Current revision	**2**					

Approval			
Author signature		Approver signature	
Name	Anthony Ko	Name	Mike Luger
Title	Environmental Scientist	Title	Technical Director

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Appendices

Figures

Tables

1 Introduction

1.1 Background

Flyers Creek Wind Farm (FCWF) was granted approval on 14 March 2014 by the Planning Assessment Commission (MP 08_0252). The approval was for the construction and operation of a wind farm comprising up to 42 turbines and associated infrastructure including access tracks, local road infrastructure upgrades and electrical connections between the turbines (both underground cable and under and above ground power lines). The approval also includes an on-site substation (inclusive of a switch room, control room and auxiliary services building) and transmission connection from the substation to the Essential Energy 132 kV transmission line on the Cadia Mines site to the northwest of the site.

The substation was proposed to be located in Slatterys Creek Valley, in the north western side of the wind farm site. Due to concerns raised prior to approval of the project that the substation was only 400 metres from the nearest non-associated residences, Infigen agreed to find a location at least 800 metre from this dwelling. Based on this the Planning Assessment Commission (PAC) imposed an additional requirement in the Project Approval [Condition B2 d)] to ensure that this was done. This report (substation plan) addresses the requirements of this Condition of Approval.

1.2 Purpose of this report

In accordance with Project Approval Condition B2 d) of Project Approval (MP 08_0252), dated 14 March 2014, Infigen Energy is required to prepare and submit to the Director General, a revised substation plan. Aurecon was engaged to assist with the preparation of this plan.

Approval Condition B2 d) states:

The Proponent shall undertake and submit the following for the approval of the Director- General:

d) a revised substation plan and impact assessment, demonstrating the substation:

i. is at least 800m from any non-associated receptor dwelling;

ii. visual intrusion would be minimised and screened (both in relation to views of the substation and lighting impacts, see conditions D29 and D30 of schedule D);

iii. can be safely accessed; and

iv. noise impacts would be managed within the criteria in this approval, to the satisfaction of the Director General.

This report demonstrates that this condition of approval has been met.

2 Substation site

2.1 Approved substation

The approved substation is proposed to comprise 33 kV and 132 kV switch yards, two transformers (rated at about 50 to 80 MVA) and associated buildings. The substation will have an estimated area of 1 hectare with approximate dimensions for the site being 120 metres by 80 meter.

It was proposed to be located in Slatterys Creek Valley, in the north western side of the wind farm site (see Figure 1). The general location was chosen after consideration of the potential intra wind farm collection arrangements, proximity to the existing Essential Energy 132 kV overhead line, the available property, environmental issues and visibility considerations for surrounding public viewpoints.

It was proposed to be located in an area of exotic pasture which avoided the existing remnant woodland on the site. The substation site was also located such that it would have no visibility from the nearest neighbouring residence (R87) and limited visibility from neighbouring residences due to the distance involved, the low profile of the substation, the local variations in ground level and the position of nearby trees. It was also proposed that following construction, additional screening would be provided by trees planted to the northwest of the substation site to limit the substation's visibility from the Beneree to Errowanbang Road.

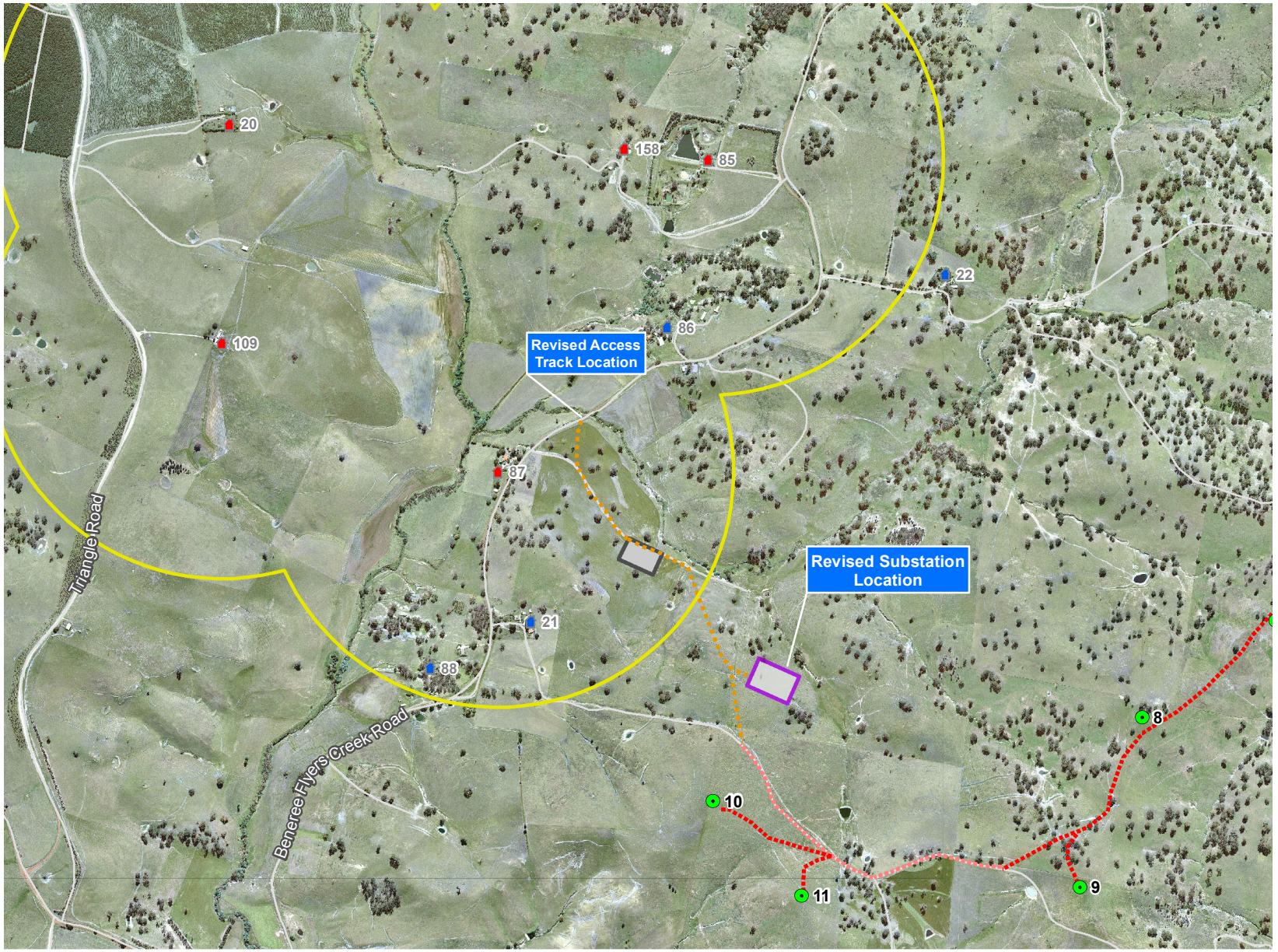
One associated receiver residence (R87) and three non-associated receivers were located at distances of less than one kilometre from the substation. However, there is a low ridge between the associated receiver (R87) and the proposed substation providing some noise mitigation. A ridge also exists between the non- associated residences 21 and 88 and the substation such that the acoustic amenity impact would also be mitigated at these residences.

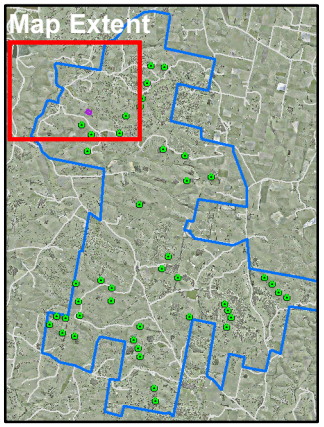
2.2 Revised substation location

Figure 1 shows the revised location of the substation site. This site is approximately 1,100 metres from the non-associated receptor dwellings identified as 87. For purposes of the assessment, a footprint of 100 metres by 150 metres has been used.

The Approval Conditions also require that the substation site can be safely accessed during transportation of the oversize and overmass equipment. It is proposed to locate the entrance just south of the Slatterys Creek bridge on Beneree Flyers Creek Road. This is a straighter section of the road and will provide improved safety for the transport of the equipment compared to the original location of the access track.

The visual impacts are assessed in more detail in Section 3 and the potential noise impacts associated with the revised location of the substation are addressed in Section 4. Section 5 briefly discusses the other potential impacts arising from the revised substation location.





Legend

- Non associated dwelling 800m buffer
- Wind Turbine Layout
- Non associated dwelling
- Associated dwelling
- Revised access track
- Approved access tracks
- Approved access track
- Revised Substation Location
- Approved Substation Location

Source: Aurecon, Infigen Energy

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0 250 500m

Projection: GDA 1994 MGA Zone 55

Infigen Energy **Flyers Creek Wind Farm Substation Plan**

FIGURE 1: Substation Locations

3 Visual Assessment

A visual assessment of the revised substation location has been compared to the approved substation location in the section below. A viewshed analysis based upon a 1 metre Digital Terrain Model (DTM) was undertaken for both substation sites (Figure 2). This analysis is an indicative worst case scenario and does not take into account screening which may be provided by existing vegetation or other structures.

3.1 Visual assessment for the approved substation location

The approved substation and associated buildings located at the north-western side of the wind farm site in Slatterys Creek Valley was assessed as having a minimal visual impact to neighbouring properties due to its location in the valley close to Beneree to Errowabang Road. The substation and associated buildings could be screened by vegetation as well as topography.

Dwelling 87 at Beneree Flyers Creek Road (Figure 2) is the nearest non-associated dwelling to the approved substation site, located approximately 498 m north west of the site. However, the existing topography of the area (a small ridgeline) would provide full screening of the substation buildings which would not be visible.

The approved substation location would be visible from non-associated Dwellings 85 and 158 located approximately 1,300 metres north of the approved substation, with existing stands of remnant vegetation providing some screening of the substation buildings.

3.2 Visual assessment for the revised substation location

The revised substation site is located at a greater distance from all neighbouring non-associated dwellings located within two kilometres of the approved substation site and in accordance with Condition B2.d ii) will no longer be located within 800 metres of a non-associated dwelling. A comparison in distances between the approved and revised substation sites and dwelling locations is provided in Table 1 below.

Table 1 – Comparison in visual impacts between approved and new substation location

Dwelling	Approved Substation Location		Revised Substation Location	
	Distance (m)	Visible	Distance (m)	Visible
87	498	**No**	1,088	**No**
85	1,319	**Yes**	1,707	**No**
158	1,330	**Yes**	1,794	**Yes**
109	1,534	**No**	2,124	**No**
20	1,951	**Yes**	2,580	**Yes**

Whilst the new substation location would potentially be visible to more areas north east and north west of the site (Figure 2), this area comprises remnant vegetation stands and cleared pastoral areas, with no dwellings located within these areas.

As shown in Table 1, the revised site location will create a lesser visual impact to neighbouring properties due to the increased distance from the properties and the site would also no longer be

visible from Dwelling 85 (non-associated). Dwelling 85 previously had views of the approved substation location.

The nearest non-associated dwellings with potential views of the new substation location is Dwelling 158, which is located 1,794 metres north of the site. Existing stands of remnant vegetation and Dwelling 86 (an associated dwelling) would provide partial or potentially full screening of the site.

Due to the greater separation distance between the revised substation site and the neighbouring properties, there will be an improvement in the visual amenity of the locality in comparison to the approved substation site. It is anticipated that there would be no significant visual impacts resulting from the revised location of the substation site.

Condition B2.d ii) states that visual intrusion of the substation should be minimised and implies the substation should be screened (presumably with vegetation). The nearest relevant receiver that has sight of the substation is almost 1,800 metres away and due to the presence of existing stands of remnant vegetation and the local topography, screening vegetation may not be warranted. However, if the Department of Planning consider that screening vegetation is warranted as mentioned in Condition D-29, it could be provided.

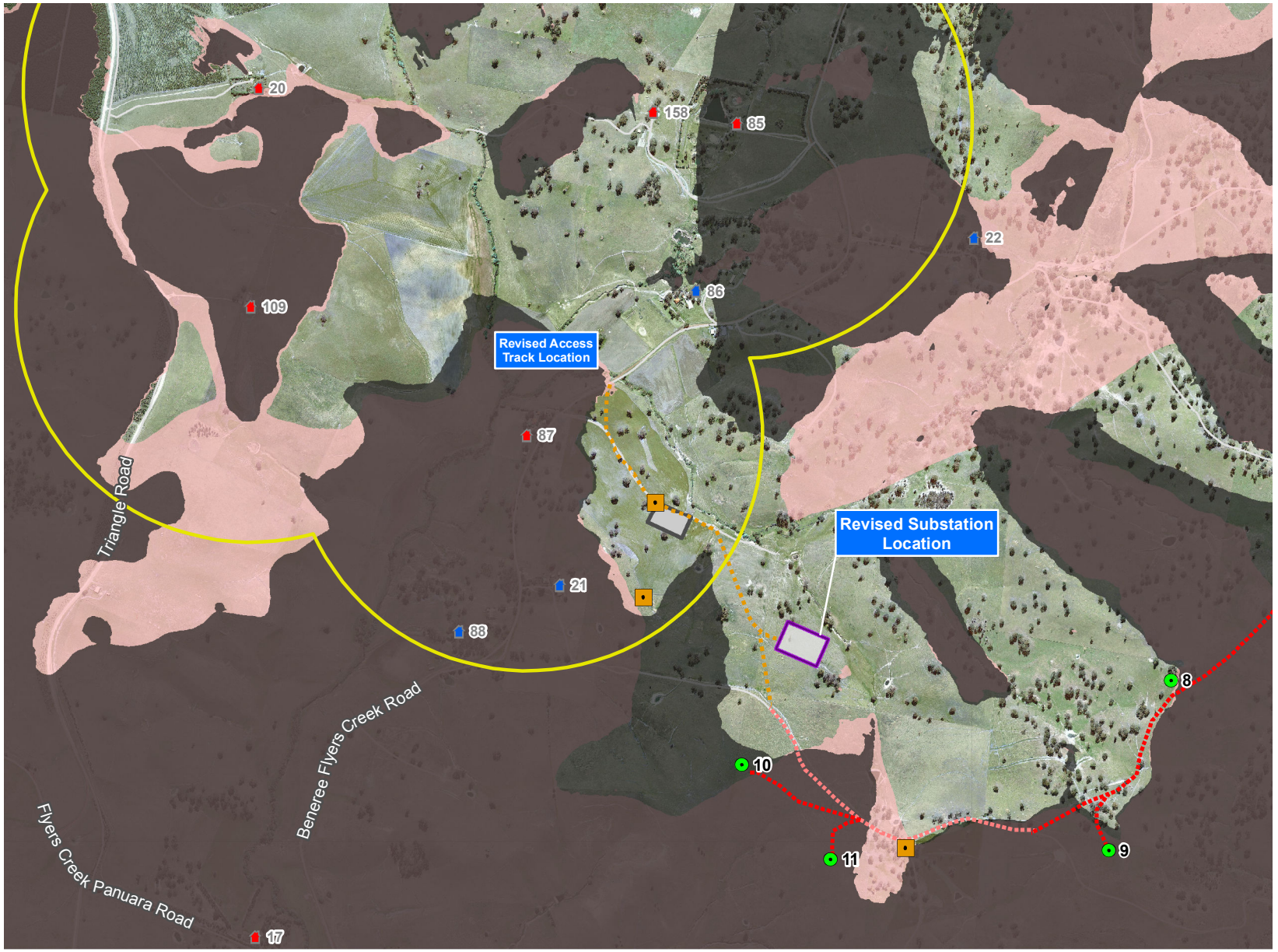
Condition D-30 relates to the provision of *"no external lighting other than low intensity security night lighting".* As stated in the Environment Assessment, *"Night lighting at the substation will be minimised as far as practicable and will be activated by security sensors and shut-off remotely once any security risk has been cleared*". This is proposed for the revised substation location as well, and as such, impacts from night lighting will be minimised.

Based on the above assessment, the visual impact of the new proposed location is considered to be significantly less than the original location assessed in the EA.

3.3 Access to the substation

As shown on Figure 2, it is proposed to relocate the entrance on Beneree Flyers Creek Road to just south of the Slatterys Creek bridge, approximately 200 metres north east of the approved entrance. This entrance provides access to the substation and also access to wind turbines 10 and 11.

The proposed entrance is located on a straighter section of Beneree Flyers Creek Road which would make it safer for the large overmass and oversize vehicles to navigate and would accommodate the oversize vehicle swept paths. In addition this new access location would reduce any potential traffic impacts on non-associated dwelling 87, which is located close to the approved entrance.



P:\GIS\Project-2\project\Flyers Creek\2015\Maps\Viewshed Analysis_13022015.mxd\JOB No.\13-02-15\anthony.ko\Rev 0

Legend

- Non associated dwellings 800m buffer
- Aboriginal Heritage Site
- Wind Turbine Layout
- Non associated dwelling
- Associated dwelling
- Revised access track
- Approved access tracks
- Approved access track
- Revised Substation Location
- Approved Substation Location
- Aboriginal Heritage (PAD)

Viewshed Analysis (Revised Substation Location)

- Not Visible (revised site)
- Visible
- Not Visible (approved site)

Source: Aurecon, Infigen Energy

1:20,000

0 250 500m

Projection: GDA 1994 MGA Zone 55

Infigen Energy **Flyers Creek Wind Farm Substation Plan**

FIGURE 2: Access Road and Substation Viewshed

4 Noise Assessment

Condition B2 d) requires the noise impacts from the substation would be managed within the criteria in this approval, to the satisfaction of the Director General.

Condition G13 (Operational Noise Criteria – substation) states that "*the substation shall be designed, constructed, operated and maintained to ensure that the noise contributions from those components to the background acoustic environment do not exceed the maximum allowable noise contribution specified in Table 3, at the nearest existing sensitive receptor to the substation".* Table 3 as shown in the Approval is reproduced in Table 2 below.

Table 2 – Substation noise criteria

Day	Evening	Night	
7am to 6pm Mondays to Saturdays 8am to 6pm Sundays and public holidays	6pm to 10pm on any day	10pm to 7am Mondays to Saturdays 10pm to 8am Sundays and public holidays	
$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{Aeq(1\ minute)}$
35	35	35	45

Vipac was engaged to undertake a noise impact assessment of the revised substation location. The report has been provided in Appendix A. The results have been summarised in this section.

4.1 Noise assessment for approved substation location

The substation described in the May 2011 environmental assessment included two 33 kV/132 kV transformers. These are each rated between 50 to 80 MVA and are indicated to have a conservative sound level of 94 dB(A), with a combined conservative sound power level of 97 dB(A).

The noise levels at the closest non-associated residence, based on the combined conservative sound power level of 97 dB(A) was predicted to be about 30 dB(A) and up to 32 dB(A) in certain 'worst case' meteorological conditions.

The assessment indicated that for the majority of the time, the substation noise at surrounding neighbouring residences was unlikely to be audible.

4.2 Noise assessment for revised substation location

The revised location of the substation is approximately 1,100 metre from the nearest non-associated residential dwelling (Dwelling 87).

Based on the conservative 97dB(A) sound power level used in the original noise assessment (May 2011), the predicted noise level from the substation is likely to be 26 dB(A) and up to 28 dB(A) in certain worst case conditions.

Due to the distance between the substation and Dwelling 87, the 100 Hz frequency component of the transformer noise is not expected to be significant at the receiver locations and the noise criterion given in the NSW Industrial Noise Policy will be readily achieved.

5 Other Assessments

Site selection for the revised substation location was informed by constraints identified in the original Environmental Assessment. These included:

- Likelihood of Aboriginal Heritage significance
- Ecology
- Landscape and topography
- Waterbodies

The approved substation location was in close proximity to and overlapped sections of an item of Aboriginal Heritage value identified as (PAD2) in the Environmental Assessment. The revised substation location is located outside of the footprint. While not part of the development condition, it is understood that a cultural heritage and flora and fauna survey of the revised substation and access track is being undertaken and will be provided to Department of Planning and Environment. There are several stands of remnant vegetation around the site, and clearing of one tree (based upon aerial imagery) could potentially be required for construction of the revised substation and access tracks. The site has also been aligned with the existing topography and has been set back from an ephemeral creek which runs through the valley just north of the site.

Based on this high level assessment, the location of the revised substation is unlikely to have a greater potential environmental impact than what was originally assessed.

6 Conclusion

In accordance with Project Approval Condition B2 d) of Project Approval (MP 08_0252), dated 14 March 2014, Infigen Energy is required to prepare and submit to the Director General, a revised substation plan.

This plan demonstrates that the new substation location has addressed the separate requirements of Condition B2 d).

Location

In accordance with Condition B2d) i of the Approval, the substation should be located "*at least 800m from any non-associated receptor dwelling".* The new location of the substation is about 1,100 metres east of R087 (nearest non-associated receiver), placing it more than 800 metres from the nearest non-associated receiver.

Visual

In accordance with Condition B2d) ii the revised substation location will create a lesser visual impact to neighbouring properties due to the increased distance from the properties and the new site would also no longer be visible from Dwelling 85 (non-associated dwelling). Dwelling 85, previously had views of the approved substation location. Based on the visual assessment undertaken in this report, the visual impact of the new proposed location is considered to be less than the original location assessed in the EA.

Access and safety

In accordance with Condition B2d) iii a new location for the entrance to the substation has been proposed. The proposed entrance is located on a straighter section of Beneree Flyers Creek Road, allowing the large overmass and oversize vehicles to better navigate along the road and would also better accommodate the oversize vehicle swept paths. In addition this new access location would reduce any potential traffic impacts on non-associated Dwelling 87, which is located close to the location of the originally approved entrance.

Noise

In accordance with Condition B2d) iv "*noise impacts would be managed within the criteria in this approval, to the satisfaction of the Director General".*

As shown in Table 3 below, the predicted operation noise impacts from the substation at the new location are lower than those predicted in the original Environmental Assessment. When comparing to the Condition G13 (Operational Noise Criteria – substation), the predictions revealed that the noise impacts from the substation will readily achieve the noise criteria in the Approval and the noise criterion given in the NSW Industrial Noise Policy.

Table 3 – Summary of predicted noise levels for Dwelling 87

	Criteria	May 2011	February 2014
Distance to substation (metres)	N/A	500	1,100
Predicted noise levels (dB(A))	35	30	26
Worst case meteorological condition (dB(A))	35	32	28

Other

Site selection for the revised substation location was informed by constraints identified in the original Environmental Assessment, including items of Aboriginal Heritage significance and ecology. Based on this high level assessment, the location of the revised substation is unlikely to have a greater potential environmental impact than what was originally assessed.

Appendix A
Noise Assessment

Vipac Engineers & Scientists Ltd.

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Aurecon Australia Pty Ltd

Level 2, 116 Military Road

Neutral Bay, South Australia, 2089, Australia

03 Feb 2015

Ref: 50B-08-0089-TRP-797044-1

Attention: Heather Tilley

Dear Heather,

Flyers Creek Wind Farm Noise Assessment

We understand that the proposed substation location for the Flyers Creek Wind Farm project has changed since our original noise impact assessment [1] for the substation noise levels to the nearby non-associated residential receivers. This report outlines our updated noise predictions for the new substation location at the nearest non-associated receivers.

1 REFERENCES

[1] *Noise Impact Assessment, Flyers Creek Wind Farm*, Vipac Document No. 50B-08-0089-TRP-773906-2, Vipac Engineers & Scientists, 21 December 2010

[2] NSW Industrial Noise Policy (EPA 2000)

2 NOISE PREDICTION AND ASSESSMENT

The proposed substation is to consist of two 33kV/132kV transformers each rated up to 80MVA. The two proposed 33kV/132kV (80MVA) transformers are indicated to have a conservative sound power level of 94 dB(A). Based on these figures a combined conservative sound power level of 97dB(A) is expected for the substation.

As outlined in the NSW Industrial Noise Policy [2], the predicted L_{Aeq} noise levels from the substation to the nearest residential receivers are not to exceed the Rating Background Level (RBL) + 5dB. We also note that if the RBL is found to be less than 30 dB(A), then the RBL is set to 30 dB(A). Therefore, for conservatism of criteria at the residential receivers from noise from the substation, we have assumed a RBL of 30dB(A), which gives a noise criterion of 35dB(A) at the residential receivers from the substation.

The proposed Flyers Creek Wind Farm substation is located approximately at the coordinates shown in Table 2-1:

Table 2-1: Approximate Location of Proposed Substation

Approximate Location UTM (WGS 84) Zone 55H	
Easting	Northing
690704	6289448

This location of the substation is approximately 1,200 metres from the nearest non-associated residential receiver (R087). Review of potential noise levels at the closest (based on the conservative 97dB(A) sound power level) indicates that the predicted noise level from the substation at the receivers is likely to be about **26dB(A)**, which meets the selected criteria. We note that these predicted noise levels from the substation are much lower than worst case wind turbine levels, and **up to 28dB(A)** in certain 'worst case' meteorological conditions. However, the maximum loading and noise generation from the substation will occur during periods of strong winds and associated high background noise levels of over 40 dB(A).

Due to the distance between the substation and the nearest receiver the 100Hz frequency component of transformer noise is not expected to be significant at the receiver locations.

Our Assessment has revealed that the noise impact from the proposed Substation at Flyers Creek Wind Farm will readily achieve the noise criterion given in the NSW Industrial Noise Policy [2].

Yours sincerely,

Vipac Engineers & Scientists Ltd

Andrew Leonard

Project Engineer

(reviewed By Dr Peter Teague)

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