

# Appendix F

**Review of Landscape & Visual Impact  
Assessment by William James Landscape  
Architect (May 2021)**

**FLAT ROCKS WIND FARM**  
**REVIEW OF LANDSCAPE AND VISUAL ASSESSMENT**  
**BASED ON REVISED ZONE OF VISUAL INFLUENCE MAPPING**



Thursday, 13 May 2021

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## 1. INTRODUCTION

This document is a Review of the 2011 Landscape and Visual Assessment of a proposed wind farm at Kojonup in Western Australia. The proposed wind farm is on private farmland approximately 20km south east of Kojonup, 27km north west of Tambellup, 16 km west of Broomehill and 27km south west of Katanning in the Great Southern region of Western Australia. The development is spread over six farming properties. The total area of the development envelope is 6,480ha of which approximately 20ha will be directly affected.

This document should be read in conjunction with the 2011 Review of a Landscape and Visual Assessment.

The proponent of the wind farm, a local consortium, Moonies Hill Energy Pty Ltd., asked the author to review the original Assessment to determine the change in visual impact resulting from a revised layout of wind turbines. The revised layout has come about due to the proposed substitution of the original turbines with fewer, but larger, turbines.

The author carried out a similar Review in 2016 based on a revised layout using larger but fewer turbines than the original approved scheme. The 2016 Review found that the revised layout would result in less visual impact than the original 2011 layout. This Review compare the impacts of the 2021 layout with the 2011 layout.

The original turbine towers were 84m high with 112m diameter blades, giving an overall height of 140m. There were 74 turbines. The proposed 2016 turbine towers were 117m high with a tip height of 180m. There were 41 turbines. The proposed 2021 turbine towers are 125m high with a height to the tip of the blades 200m. There are now 42 proposed turbines.

The original 2011 and revised 2021 turbine layouts are shown in Figure 1 and 2. Figure 3 is an illustrative comparison of the sizes of the three turbine options.

This review is based on a comparison of the Zone of Visual Influence mapping of the original and the revised turbine layout and a consideration of the relative impact of the increased turbine size.

## 2. REVIEW PROCESS

The Zone of Visual Influence (ZVI)<sup>1</sup> of the new layout was compared with ZVI of the original layout. In particular, the number of turbines potentially seen from non-stakeholder houses, in the original and new layout. The number of turbine hubs and tips potentially seen in the 2011 and 2021 layouts are tabulated. A bar graph is used to graphically demonstrate the difference in the hubs and tips seen in the two layouts.

The relative sizes of the turbines assessed in 2011, the 2016 revision and the 2021 revision are illustrated in Figure 2. The comparison is an illustrative example only and does not represent a simulation of a particular view or of a specific turbine model.

The difference in numbers potentially seen, combined with a consideration of the relative sizes of the turbines, provides a basis for predicting the relative impact of the 2011 and the 2021 layouts.

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<sup>1</sup> Zone of Visual Influence mapping is based on landform only and does not allow for intervening vegetation or structures.

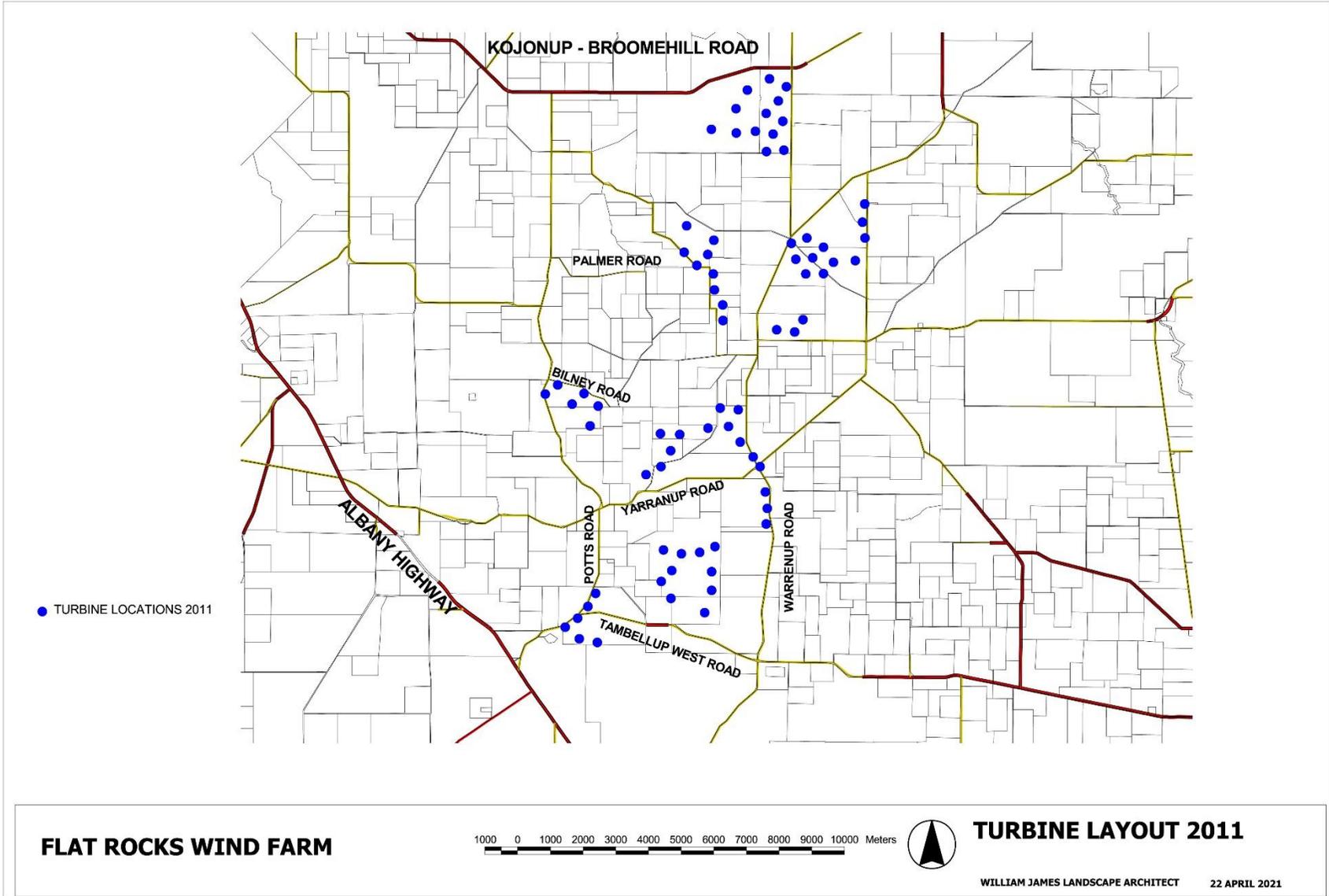


Figure 1: Original 2011 Turbine Layout

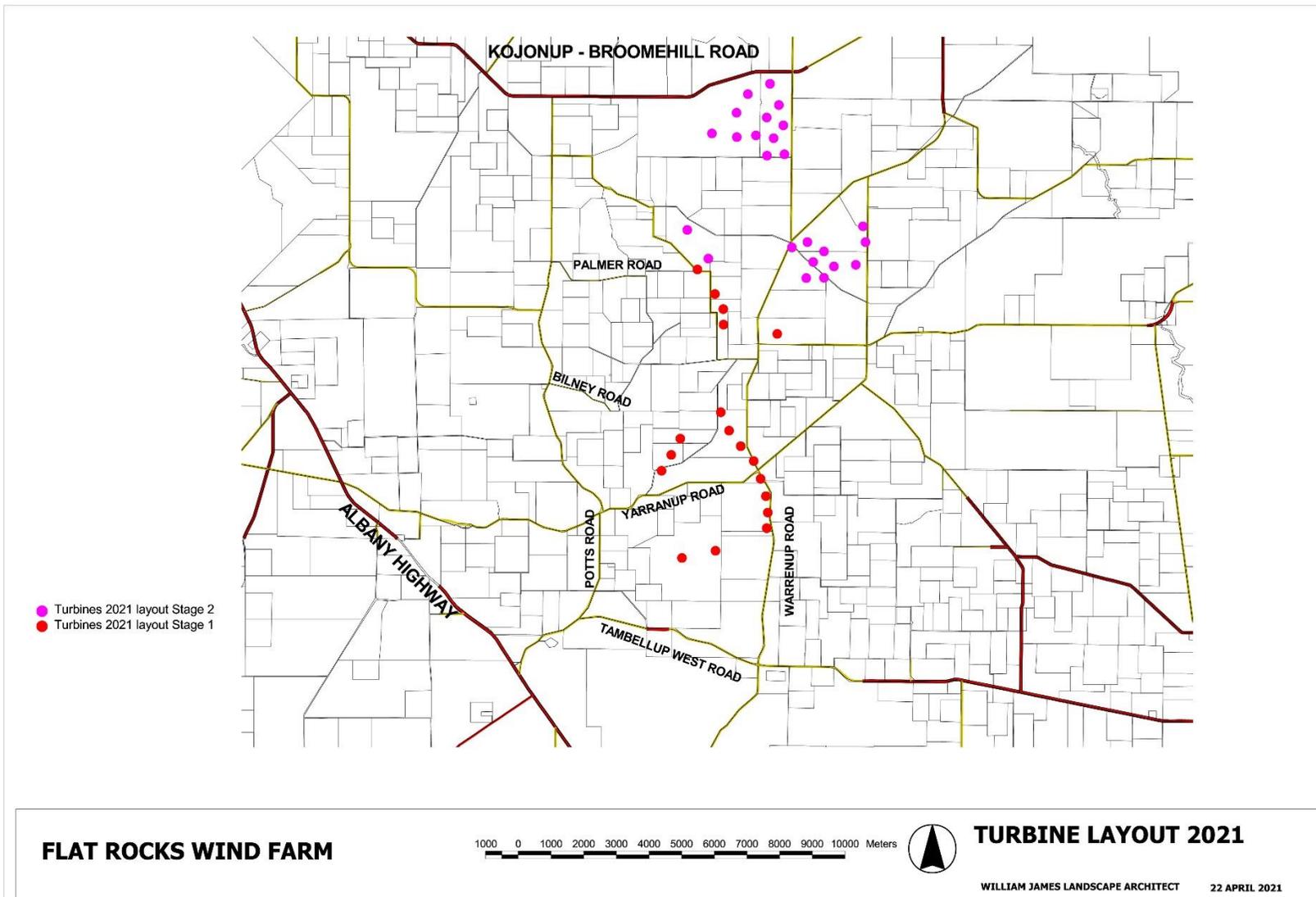


Figure 2: Revised 2021 Turbine Layout



Original



2016 Revision



2021 Revision

Figure 3: Illustrative comparison of turbine sizes

### 3. ZONE OF VISUAL INFLUENCE

The Zone of Visual Influence (ZVI) maps of the new and original layouts are represented in Figures 4, 5, 6, 7, 8 and 9. The ZVI maps were supplied by DNV Energy Systems, the same party who provided the original and 2016 maps<sup>2</sup>. The ZVI maps are based on landform only and do not allow for intervening vegetation or structures. The ZVI analysis does not determine which hubs may be seen from where, just how many will be seen from given locations – in this case non-stakeholder and stakeholder houses.

Two maps were provided, one showing the ZVI of the turbine hubs and the other showing the ZVI of the blade tips.

A spreadsheet summarising the comparison of the number of turbines shown from non-stakeholder houses is given in Table 1. There are a total of 42 turbines. There is no NHS No. 17

Table 1 indicates that all non-stakeholder houses will be less visually affected by the turbine tips in the new layout.

The comparison of the visual impact of the turbine hubs on non-stakeholder houses is as follows:

- 13 out of a total of 23 comparisons result in less hubs being visible in the 2021 layout than in the original 2011 layout.
- 6 out of 23 comparisons are less clear cut as the range of possible sightings has changed from the original 2011 ZVI mapping. On probabilities, however, it is likely that less will be visible in the 2021 layout.<sup>3</sup>
- One out of 23 comparisons would see more hubs<sup>4</sup> in the new layout.
- 3 out 23 non-stakeholder house would possibly see more hubs in the new layout<sup>5</sup>. Given that there will be fewer tips visible it is likely that the total impact on these houses will be the same for the original and the revised layouts. One house that may see more hubs is uninhabited.
- There are four new non-stakeholder houses identified in the 2021 ZVI mapping. As these were not included in the original assessment it is not possible to compare the impacts between the original and new layout.

The differing ranges between the two ZVI maps has been accommodated by averaging the ranges to arrive at figures that can be more readily compared. These averages are used in preparing the bar graphs that graphically compare the potential sightings.

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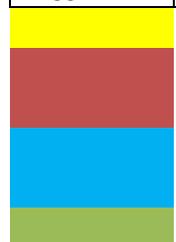
<sup>2</sup> DNV were formerly GL Garrad Hassan.

<sup>3</sup> The original range was 41-50, the new range is 40-42.

<sup>4</sup> Depending on intervening vegetation.

<sup>5</sup> Depending on intervening vegetation.

NSH No.#	HUBS		BLADE TIPS	
	ORIGINAL	2021	ORIGINAL	2021
1	11-20	5-10	21-30	10-15
2	31-40	25-30	41-50	30-35
3	51-60	40-42	71-74	40-42
4	41-50	40-42	51-60	40-42
(new NHS 04)		40-42		40-41
5	41-50	40-42	71-74	40-42
6	41-50	40-42	71-74	40-42
7	41-50	40-42	71-74	40-42
7a		40-42		40-42
7b		40-42		40-42
8	51-60	40-42	31-40	15-20
8A	51-60	20-25	41-50	30-35
9	51-60	40-42	71-74	40-42
10	51-60	40-42	61-70	40-42
11	41-50	40-42	51-60	40-42
11a	41-50	40-42	71-74	40-42
12	41-50	20-25	61-70	40-42
13	31-40	15-20	41-50	25-30
14	6-15	10-15	21-30	10-15
15	11-15	5-10	21-30	10-15
16	11-15	5-10	21-30	10-15
17				
18	31-40	35-40	41-50	35-40
19	51-60	35-40	41-50	35-40
20	11-15	15-20	31-40	25-30
21	31-40	35-40	51-60	40-42
22	51-60	40-42	71-74	40-42
33*		40-42		40-42



More seen in revised layout than original layout.

Not able to fully determine change due to changed range of values, however it is likely that more would be seen in the revised layout.

Not able to fully determine change due to changed range of values, however it is likely that more seen in original layout.

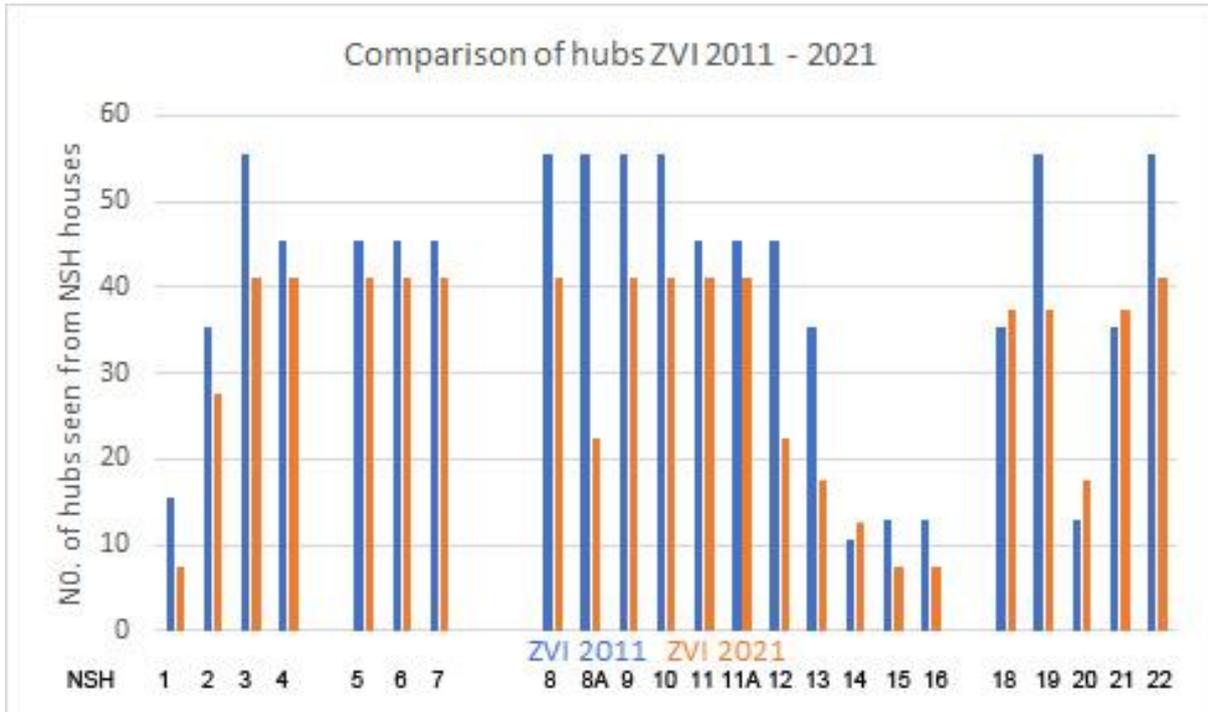
More seen in original layout.

NSH No. Non-Stakeholder house number on 2016 ZVI map. NSH did not have numbers on 2011 ZVI maps

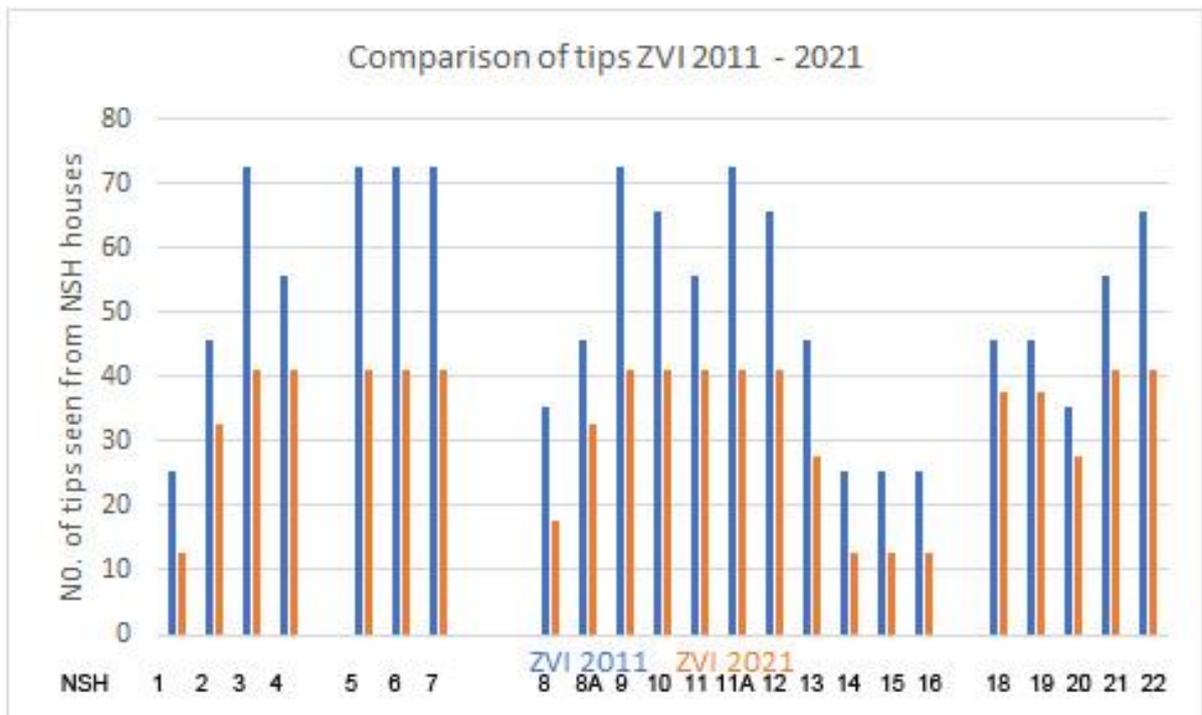
\* SH 4 is now NSH 33.

# NSH numbers have changed from Original ZVI and 2016 ZVI maps - See Attachment 1. This Review applies 2016 NHS numbers.

**Table 1. Comparison of Zone of Visual Influence Mapping for original and revised turbine layouts.**



**Figure 4: Bar graph of numbers of hubs potentially visible in 2011 and 2021 layouts**



**Figure 5 : Bar graph of number of tips potentially visible in 2011 and 2021 layouts**

The above comparisons are derived from averaging within the range of hubs and tips seen in both layouts (e.g., if the range is 41-50 the value 45.5 is given).

The blank columns represent the non-stakeholder houses not mapped in 2011 but mapped in 2021.

#### **4. THE VISUAL IMPACT OF RELATIVE TURBINE SIZE**

The relative size of turbines will affect the visual impact, but less so than the relative number of turbines seen from any specific site. As a general principal, it is preferable to have fewer, larger objects introduced into a landscape than more objects of a smaller size. The latter results in more visual clutter in the landscape.

Size becomes more important the closer the viewer is to the object. If the viewer is close to two objects of different sizes it will be immediately apparent that one object is larger than the other. The further away the objects are the less apparent will be the difference in size.

This principle can be applied to dealing with specific situations. If the number of turbines close to a specific viewing location has remained relatively constant but the size has increased, it can be concluded that the potential impact will be greater. This can be remedied by relocating some of the turbines further away or by ensuring effective screening from the affected location. The specific locations where these remedies should be considered are the cluster south west of NSH 03<sup>6</sup>; the cluster north of NSH 06; and the cluster to the east of NSH 13.

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<sup>6</sup> These NSH numbers refer to the 2011 ZVI maps. They correspond to NSH 3, 21 and 19 respectively on the 2011 ZVI maps.

ZVI map for the Flat Rocks Wind Farm, calculated at a hub height of 125 m agl

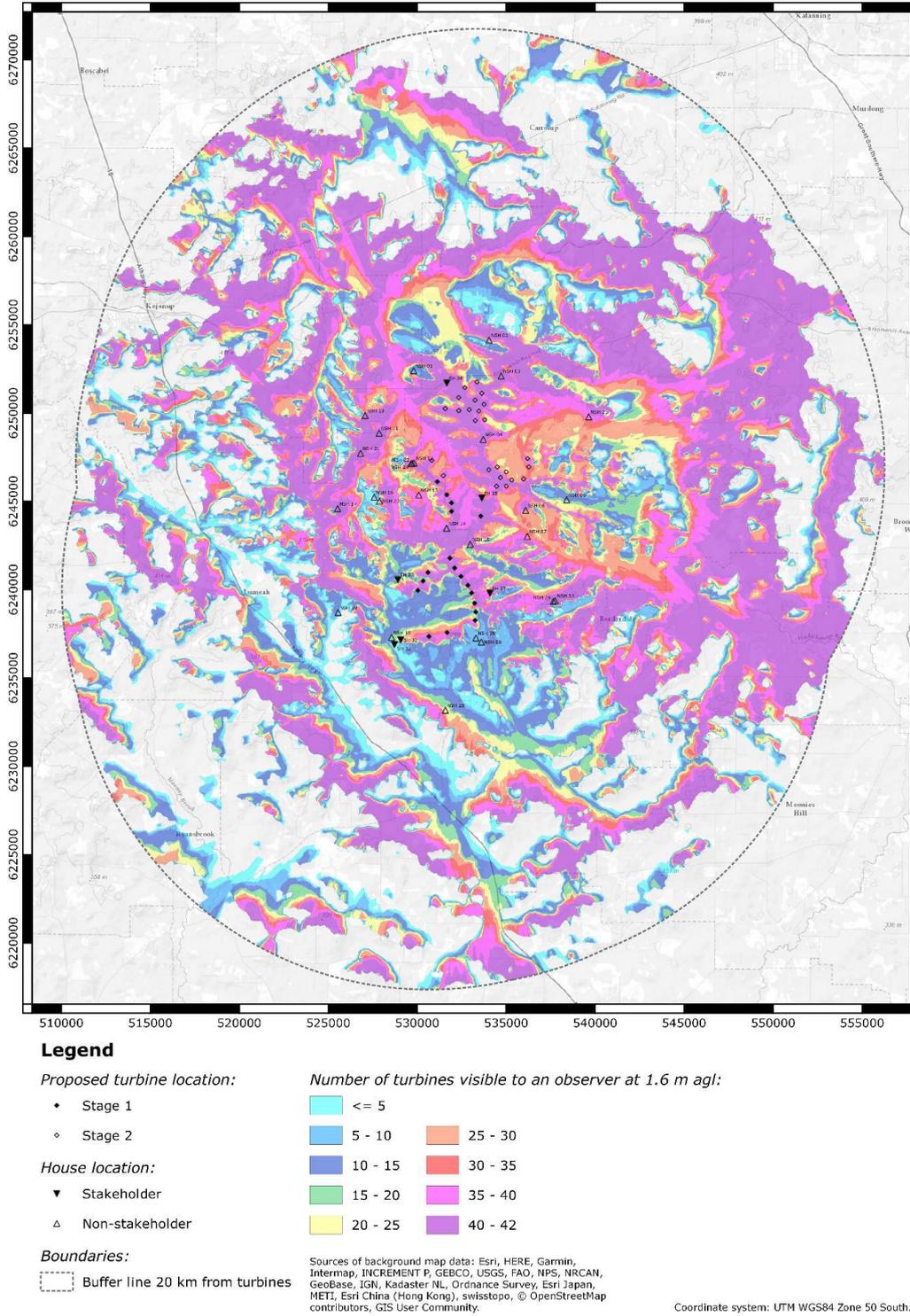
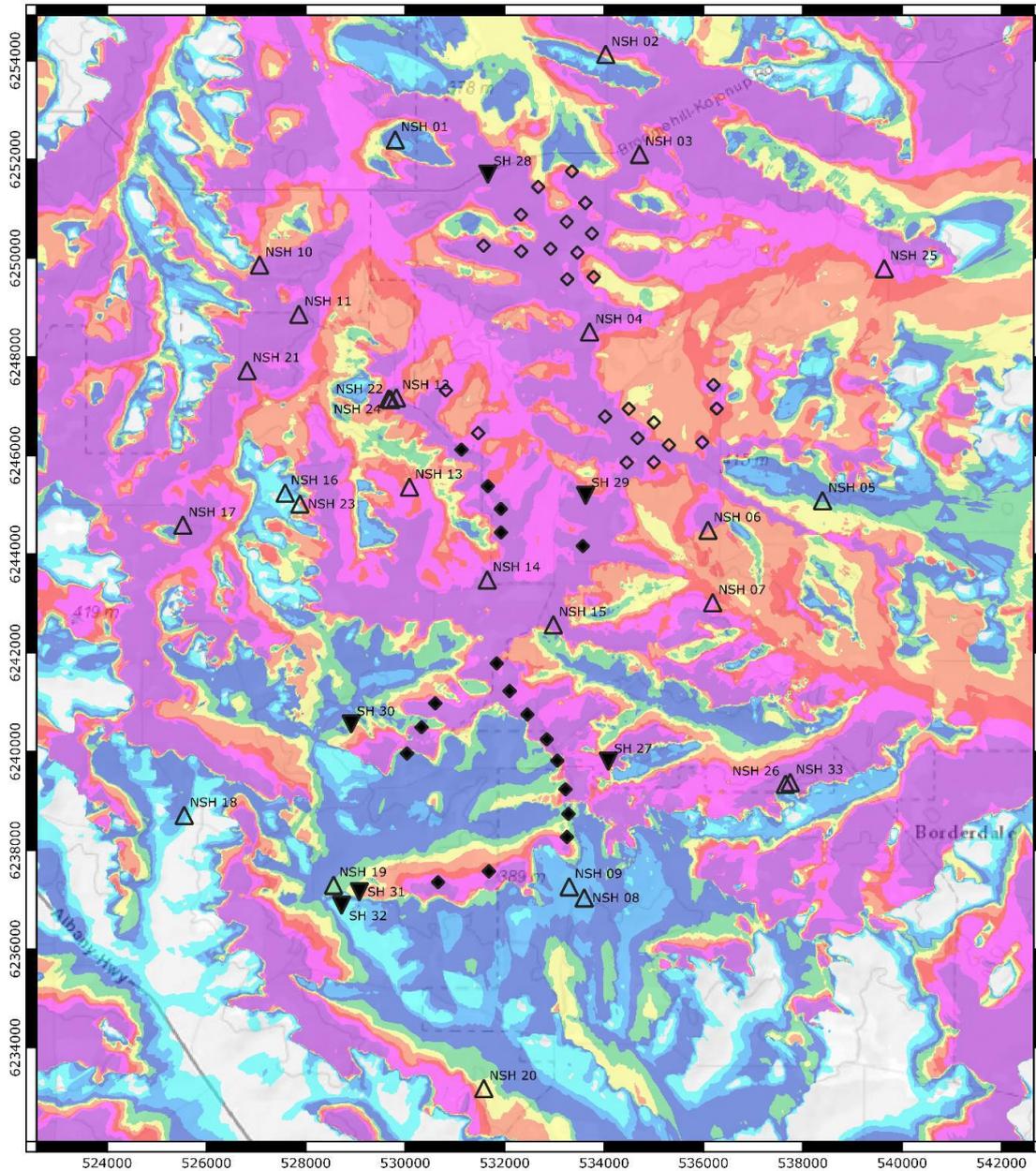


Figure 6: Zone of Visual Influence of Hubs (125m high) overall - new layout

ZVI map for the Flat Rocks Wind Farm, calculated at a hub height of 125 m agl



**Legend**

*Proposed turbine location:*

- ◆ Stage 1
- ◇ Stage 2

*House location:*

- ▼ Stakeholder
- △ Non-stakeholder

*Boundaries:*

- ⊞ Buffer line 20 km from turbines

*Number of turbines visible to an observer at 1.6 m agl:*

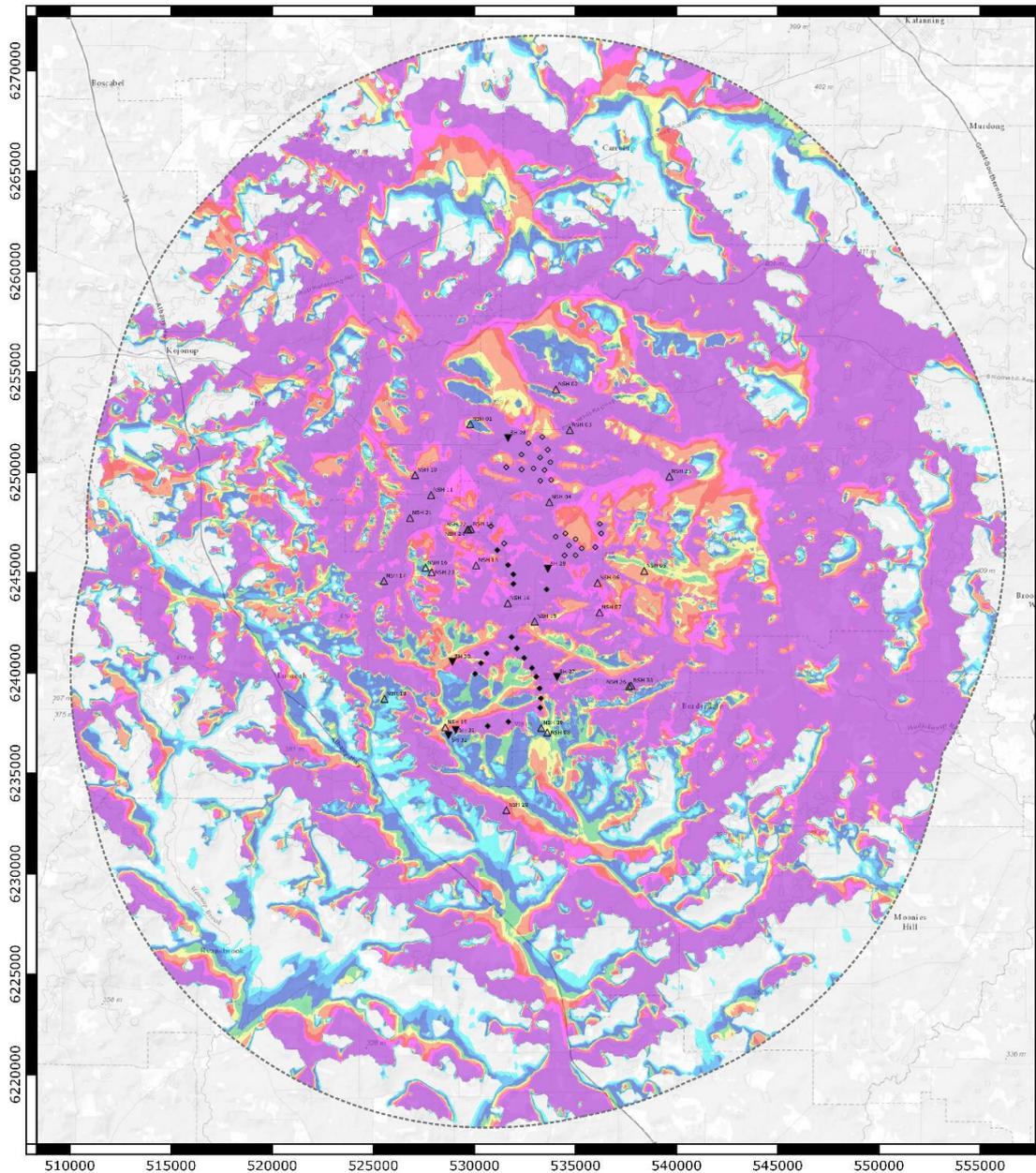
Light Blue	<= 5	Orange	25 - 30
Blue	5 - 10	Red	30 - 35
Dark Blue	10 - 15	Pink	35 - 40
Green	15 - 20	Purple	40 - 42
Yellow	20 - 25		

Sources of background map data: Esri, HERE, Garmin, Intermap, INCREMENT P, GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, GIS User Community.

Coordinate system: UTM WGS84 Zone 50 South.

**Figure 7: Zone of Visual Influence of hubs (125m high) detail - new layout**

ZVI map for the Flat Rocks Wind Farm, calculated at maximum blade tip height of 200 m agl



**Legend**

*Proposed turbine location:*

- ◆ Stage 1
- ◇ Stage 2

*House location:*

- ▼ Stakeholder
- △ Non-stakeholder

*Boundaries:*

- ⋯ Buffer line 20 km from turbines

*Number of turbines visible to an observer at 1.6 m agl:*

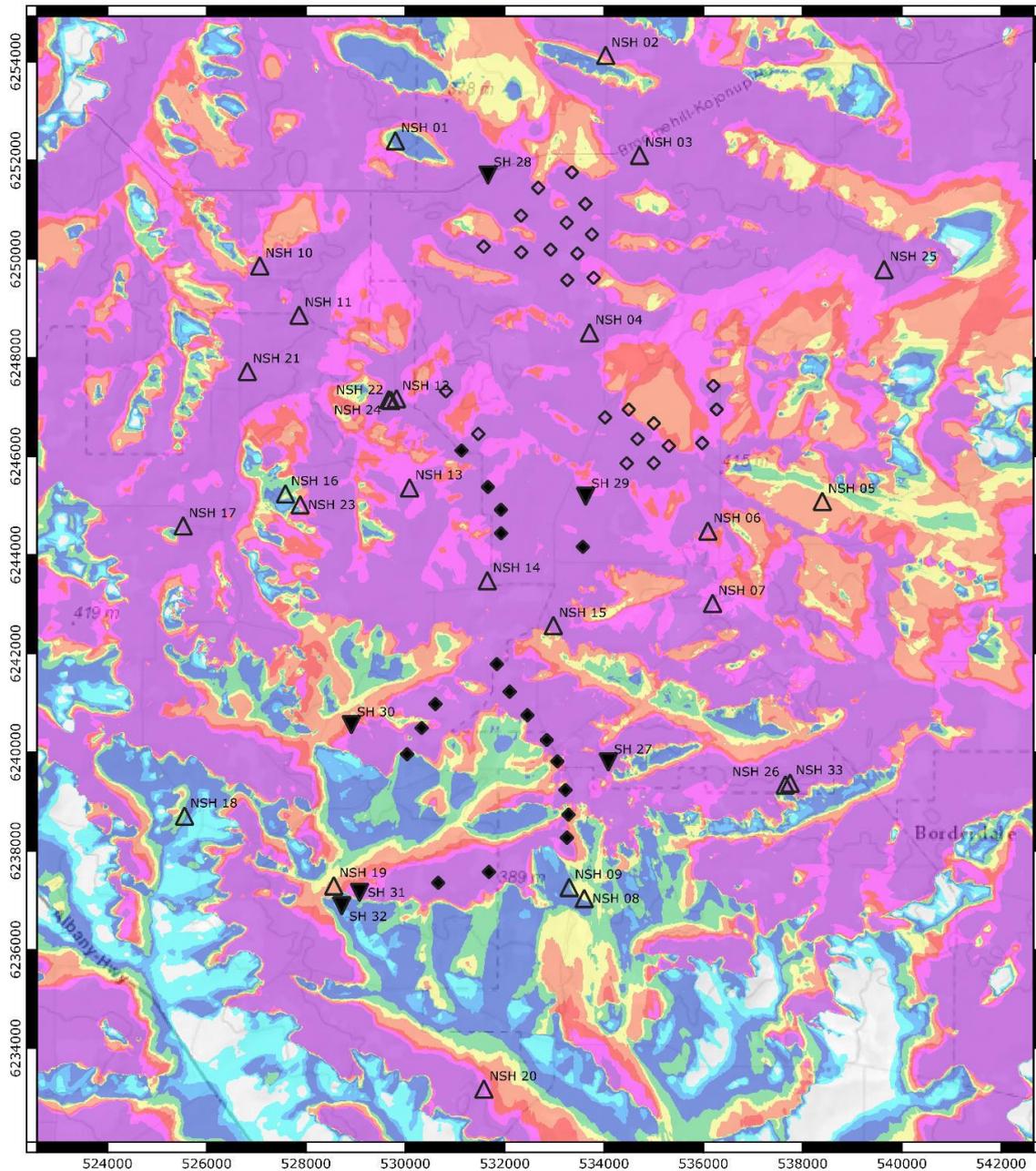
	<= 5		25 - 30
	5 - 10		30 - 35
	10 - 15		35 - 40
	15 - 20		40 - 42
	20 - 25		

Sources of background map data: Esri, HERE, Garmin, Intermap, INCREMENT P, GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, GIS User Community.

Coordinate system: UTM WGS84 Zone 50 South.

**Figure 8: Zone of Visual Influence of tips (200m high) overall - new layout**

ZVI map for the Flat Rocks Wind Farm, calculated at maximum blade tip height of 200 m agl



**Legend**

*Proposed turbine location:*

- ◆ Stage 1
  - ◇ Stage 2
- House location:*
- ▼ Stakeholder
  - △ Non-stakeholder

*Boundaries:*

- Buffer line 20 km from turbines

*Number of turbines visible to an observer at 1.6 m agl:*

Light Blue	<= 5	Orange	25 - 30
Blue	5 - 10	Red	30 - 35
Dark Blue	10 - 15	Pink	35 - 40
Green	15 - 20	Purple	40 - 42
Yellow	20 - 25		

Sources of background map data: Esri, HERE, Garmin, Intermap, INCREMENT P, GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, GIS User Community.

Coordinate system: UTM WGS84 Zone 50 South.

**Figure 9: Zone of Visual Influence of tips (200m high) detail - new layout**

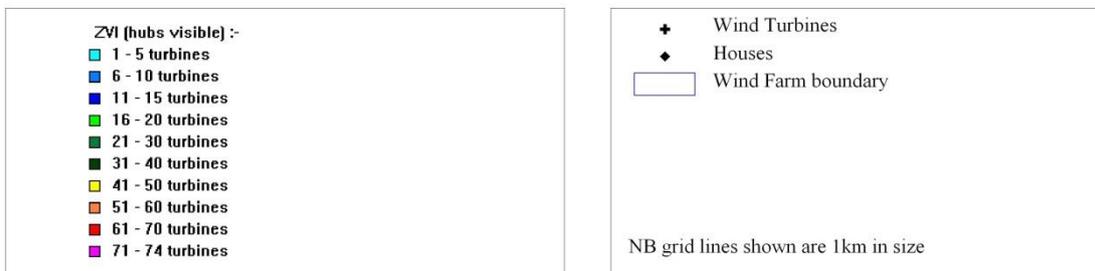
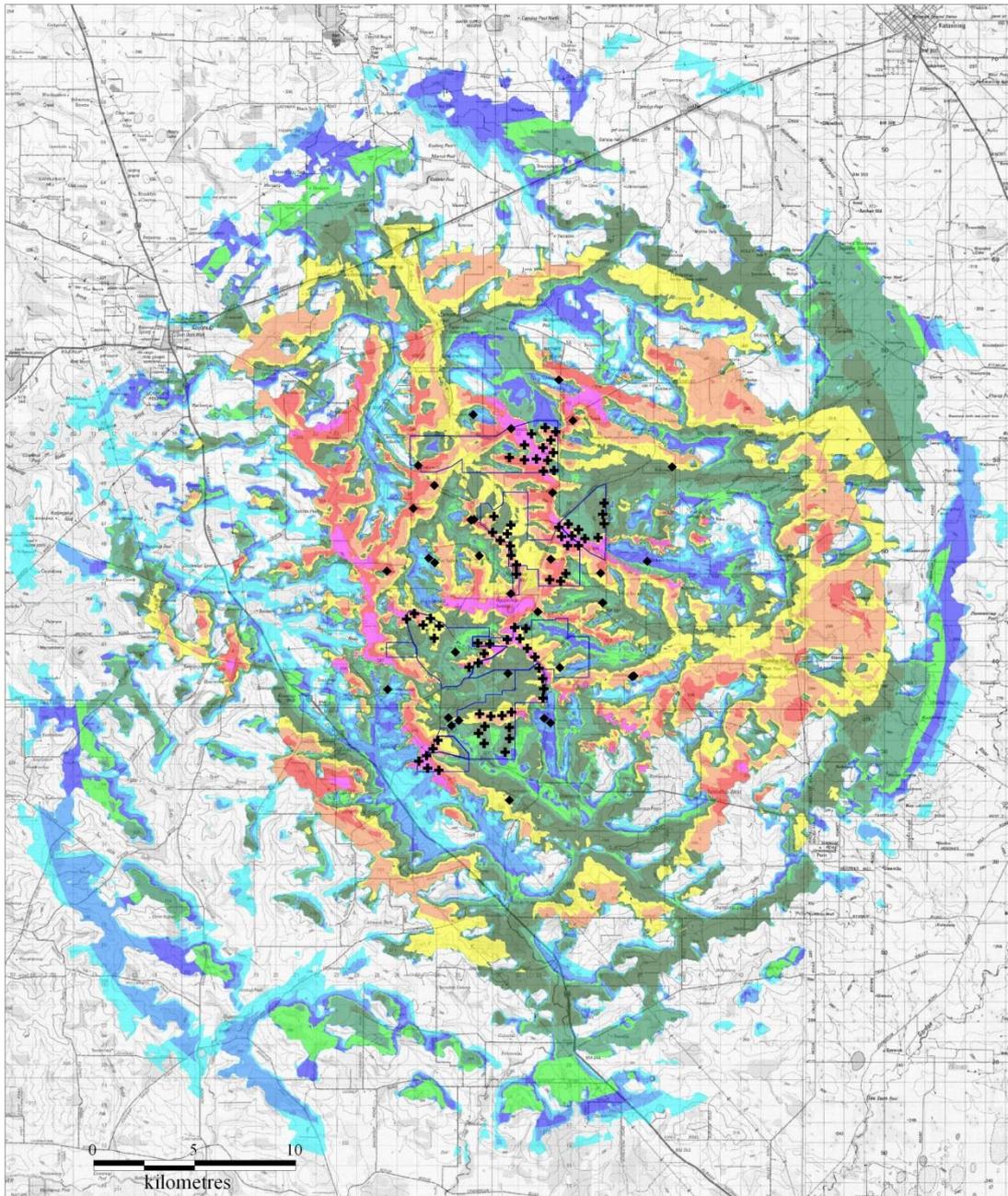


Figure 10: Zone of Visual Influence of hubs (117m high) overall – original 2011 layout

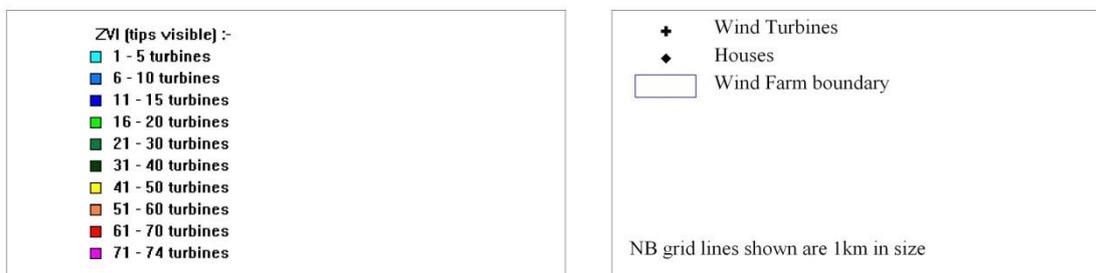
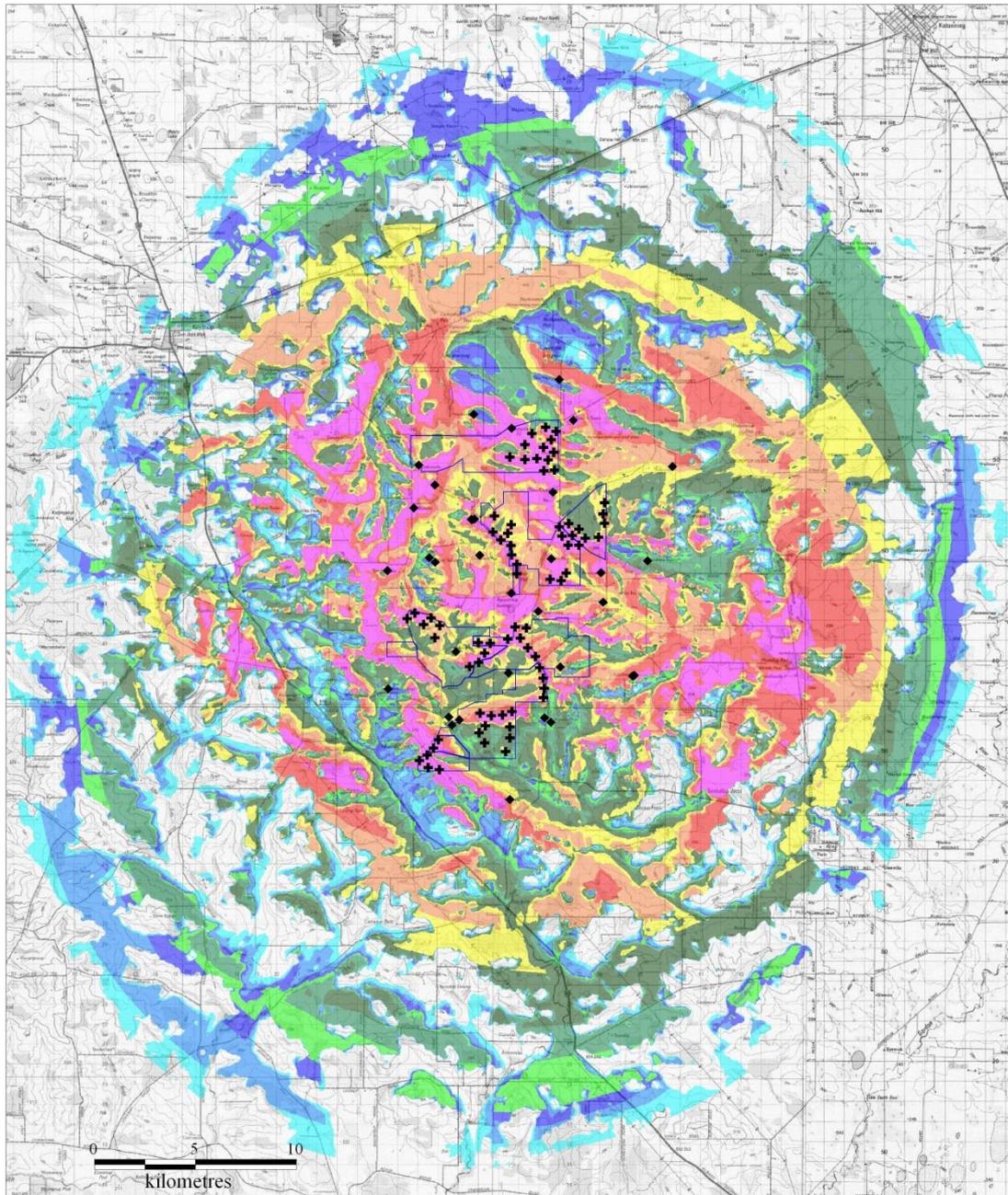


Figure 11: Zone of Visual Influence of tips overall (140m high) – original 2011 layout

## 5. CONCLUSIONS

- The Zone of Visual Influence mapping indicates that, compared with the original layout, significantly fewer turbines will be visible from non-stakeholder houses in the revised 2021 layout.
- It is reasonable to conclude that non-stakeholder houses that see fewer hubs and tips will be impacted less by the revised layout than the original layout.
- Non-stakeholder houses that will see the same number or more of hubs in the revised layout will be impacted more by the hubs. Balancing this, these houses will see fewer turbine tips resulting in less impact. Taken together, it is reasonable to conclude that impact on these houses will be the same or perhaps slightly more than with the original layout. The ZVI mapping does not tell us which turbines are potentially visible from which NSH house, just how many. It is, therefore, not possible to determine whether Stage 1 or Stage 2 turbines, or both, are potentially visible.
- While the height of the turbines has increased, the relative increase in height is not likely to be as visually significant as the reduction in numbers of turbines.
- Based on a comparison of Zone of Visual Influence mapping of the original and the revised layout, and considering the relative sizes of the proposed turbines, it can reasonably be predicted that the visual impacts of the revised turbine layout will be less than the original layout when viewed from a significant majority of potential viewing locations, both public and private.
- In specific situations, as discussed in Section 4, the impact of larger turbines relatively close to viewing locations, can be reduced by one of, or a combination of, the following remedies: relocating turbines or ensuring effective screening of the turbines from the impacted viewing locations<sup>7</sup>. This applies to the cluster south west of NSH 03<sup>8</sup>; the cluster north of NSH 06; and the cluster to the east of NSH 13. Of these three, only NHS 13 is relatively close to the Stage 1 turbines.

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<sup>7</sup> Effective screening will require a planting design specific to each viewing location. General principles underlying the design are: the closer the planting is to the viewer the more effective the screen; planting close to the view does not have to be as tall as planting further away; screening the turbine hubs and blades is more important than screening the lower portion of the towers.

<sup>8</sup> These NSH numbers refer to the 2011 ZVI maps. They correspond to NSH 3, 21 and 19 respectively on the 2011 ZVI maps.

## 6. ATTACHMENT 1. NON-STAKEHOLDER HOUSE NUMBERS USED IN 2011 AND 2021 ZVI MAPPING.

Non-stakeholder house number 2011	Non-stakeholder house number 2021
1	1
2	2
3	3
4	10
5	11
6	21
7	13
8	16
8a	23
9	17
10	4
11	13
11a	15
12	20
13	19
14	18
15	8
19	9
18	7
19	6
20	5
21	25
22	26
	22, 24 and
Stakeholder house 4	Non-stakeholder house 33