



# Odour Field Assessment in the Vicinity of GD Pork, West Pinjarra

**Version: Final**

December 2016

## Document Control

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**Accessibility**

This document is available in alternative formats and languages on request.

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## Purpose

This study was designed to investigate the potential presence of odours in the vicinity of the GD Pork piggery in West Pinjarra by performing Odour Field Assessment (OFA) following the VDI 3940 Part 2 standard [1].

## Introduction

The Department of Environment Regulation (DER) has received intermittent complaints relating to odours in the vicinity of the GD Pork piggery in West Pinjarra since 2014, peaking in early 2015. The OFA was proposed by DER to:

- establish the presence (or otherwise) of odours in the vicinity of the GD Pork facility; and
- characterise the nature and extent of odours which could reasonably be attributed to GD Pork emissions, via a systematic odour survey.

Odour field surveys were performed by DER odour panellists at various locations and times in the vicinity of the identified potential odour sources. The purpose of the survey was to establish the presence of odour, if any, but not the offensiveness or the unreasonableness of the possible odour impacts.

The field surveys were originally intended to be conducted between June and September 2015. However, due to periods of unsuitable weather conditions, field surveys were postponed and performed between September and November 2015.

## 1. Project Description

### 1.1. Methodology

DER odour complaints were reviewed prior to planning the odour field surveys. This review was used to locate appropriate measurement points and select appropriate wind directions and time periods to perform the odour field surveys.

The spatial distribution of odour complaints was mapped from DER's complaints database. Primary areas of interest for this OFA were ascertained from this map. The complaints were analysed to determine seasonal patterns and dominant time periods during which most complaints occurred.

These analyses were essential prerequisites for planning the odour survey. They were used to identify measurement points, wind directions and time periods most likely to capture odour episodes. Early morning and late afternoon were identified as suitable times to conduct the odour surveys.

Maps and a description of the odour measurement points are presented in **Appendix A**. It includes:

- the initial map with the pre-located measurement points (**Attachment A1**) and the point descriptions (**Attachment A2**); and
- two maps with supplementary measurement points (**Attachments A3 and A4**) were prepared to accommodate conditions encountered during some surveys.

The survey was broadly designed to follow the internationally recognised German Standards VDI 3940 Part 2.2010 [1] and Part 3.2006 [2]. DER odour panellists were selected based on the validation of their odour sensitivity using n-butanol pens following the St Croix Sensory procedures [3].

A reconnaissance of the zone to be surveyed by the DER field operator identified no other odour sources that would have interfered with the odours characteristic of the piggery. Other non-piggery sources identified were cows, manure and vegetation. Considering these limited odour sources, there was no requirement for formal training on odour reconnaissance for the purpose of the assessment. The DER field operator in charge verified that panellists who took part in the surveys were able to discriminate between piggery and other odours.

The decision on which days to perform a survey was made by the field operator in charge of the panel, based on the forecast average wind conditions. Once in the field, the measurement locations were chosen by the field operator, based on field observations of wind direction and odour prevalence, immediately prior to each survey.

Stopwatches were issued to all panellists to facilitate accurate timing of each odour assessment. The stopwatches were synchronised before each single measurement to ensure simultaneous assessment across the array of measurement points. A single measurement is by definition the 10-minute period of odour impact measurement by a panellist at one measurement point. According to the VDI 3940 Part 2, each panellist must “sniff” the air every 10 seconds and record the odour characteristic and odour intensity level according to the scale provided in the VDI 3940 Part 3 standard. It should be noted that the only data recorded were the odours perceived at each 10 second marker. An example of a log-form where panellists recorded their measurements is presented in **Appendix B**. The odour intensity scale used is presented in **Table 1** (extracted from VDI3940 Part 3).

**Table 1: Category scale for odour intensity**

**GD Pork Odour Field Assessment December 2016**

| <b>Odour</b>     | <b>Intensity Level</b> |
|------------------|------------------------|
| Extremely strong | 6                      |
| Very strong      | 5                      |
| Strong           | 4                      |
| Distinct         | 3                      |
| Weak             | 2                      |
| Very weak        | 1                      |

It must be noted that when using the intensity scale for evaluating odours in ambient air, the lowest level (1 = ‘very weak’) is applied if the recognition threshold is exceeded. This means the odour being assessed (for example, facility odour) has been clearly identified and assigned an odour character from the key in the panellist log-form (see **Appendix B**), and there is no uncertainty or guessing involved.

## 1.2. Implementation

DER odour panellists performed odour field measurements while downwind of the identified potential odour sources within the facility and assessed whether emissions from those sources were impacting the surrounding area.

Two surveys were carried out during the early morning (Surveys 1 and 2) and three surveys during early evening (Surveys 3, 4 and 5) under different regimes of wind speed and direction. Survey dates, periods of the day, average wind speeds and directions and temperature are presented in **Table 2**. Wind speed and wind directions were recorded with a hand-held anemometer during the survey and represent current conditions at the times and locations of the survey.

**Table 2: Survey periods and climatic conditions during the odour surveys**

| Survey | Date         | Period        | Average wind speed range (m/s) | Average wind origin | Temperature (°C) |
|--------|--------------|---------------|--------------------------------|---------------------|------------------|
| 1      | 4 Sept. 2015 | 5.45am–9.40am | 0–1.5                          | SW to N             | 5 to 15          |
| 2      | 2 Oct. 2015  | 5.40am–9.25am | 0–4.5                          | NW to NE            | 13 to 23         |
| 3      | 15 Oct. 2015 | 5.40pm–7.20pm | 0–1.5                          | SW                  | 17 to 13         |
| 4      | 21 Oct. 2015 | 4.40pm–7.40pm | 0–2.5                          | SSE to SW           | 26 to 19         |
| 5      | 11 Nov. 2015 | 5pm–5.40pm    | 0–4                            | S to SW             | 25 to 23         |

Following each morning survey, the field operator (assisted by a DER odour panellist) contacted the GD Pork representative to enter the site and review operations that occurred at the facility while the odour measurements were taken offsite. The purpose of the site visit was to determine what operations or management actions onsite could have resulted in recognised piggery odours offsite. There was no activity onsite during late afternoon-early evening surveys except animal feeding. Therefore, no site visits were initially planned for the evening surveys. However, DER officers did enter the site for an inspection following Survey 5 because some odours were recognised and they were able to perform a site visit during daylight.

## 2. Survey Findings

### 2.1. Survey 1: 4 September 2015: 5.45am–9.40am

On Friday 4 September 2015, winds were calm to light before 8am and the temperature of the air was low (around 5°C). Some odours from the piggery were recognised at the boundary. There were a small number of measurements where piggery odour was recognised beyond the premises boundary.

After 8am, measurements were carried out between 1,000 m and 1,700 m south of the facility under north-westerly to north-easterly winds below 1.5 m/s. Piggery odours were recognised for a maximum of 12 per cent of a 10-minute single measurement at one measurement point (1,500 m in distance) and 10 per cent at another location (1,200 m in

distance). At both locations, intensity level (IL) was rated 1–2 (very weak to weak) according to the VDI 3940 Part 3 scale presented in Table 2. Most of the other single measurements returned “no odour” detected.

The facility representative reported that no specific activities occurred onsite during the period of the odour survey on this day. The site visit post-survey by DER officers did not reveal any specific potential activity or source of odour.

## **2.2. Survey 2: 2 October 2015: 5.40am–9.25am**

On Friday 2 October 2015, calm conditions occurred for most of the period between 5.40am and 6.40am, with brief periods of light winds from a mostly northerly direction. Measurements were carried out south of the facility. Most of the measurements returned “no odour” except for a single measurement which showed odours from the facility at an IL of 1–2 for 12 per cent of the single measurement.

The wind freshened at around 7.50am, between 1 and 4.5 m/s from the north-westerly to north-easterly sector. The panel continued performing surveys south of the facility at selected measurement points between 1,000 m and 1,700 m from the facility. The wind was significantly stronger than during survey 1. However, results were similar with a very small number of odours recognised. Odours at an IL of 1–2 were found at a maximum frequency of 10 per cent of a 10-minute single measurement (1,200 m in distance). Most of the other single measurements returned “no odour”.

During the post-survey site visit, the site representative indicated that the major operation that occurred during the survey period was the manure/straw cleaning to a stockpile on the premises between 6am and 9.30am. DER officers did not note any particular operation or source that could have been a potential odour source during the site visit.

## **2.3. Survey 3: 15 October 2015: 5.40pm–7.20pm**

On Thursday 15 October 2015, surveys were performed under west-south-westerly to southerly winds. Winds initially blew between 1 and 1.5 m/s and decreased in speed to become calm by 7.20pm. The wind remained calm until 7.45pm when the rest of the survey was called off. Four single measurements were performed by three panellists to the north-east of the facility.

In general, higher odour IL was recorded during this survey in comparison to the two previous morning surveys. Measurements were also carried at shorter distances from the sources on the premises than the morning surveys, within a range of 100 m (point 2) to 650 m (point 3).

Odours with an IL of 4 (strong) were recognised for 5 per cent of the single measurement at the facility entrance (100 m).

Odours with IL of 3 (distinct) were recognised for a maximum of 28 per cent of the single measurement at distances up to 350 m under the meteorological conditions of this period (low wind).

Some very weak and weak odours (IL = 1–2) were recognised at 650 m (point 3) for 32 per cent of the single measurement. IL 1 and 2 were recognised at various distances between the gate (100 m) and point 3 (650 m) at frequencies between 20 per cent and 62 per cent of the single measurement.

The DER field operator and panellists also noted that odours were only occasionally recognised under calm conditions and more likely when there was wind movement detected.

Animal feeding was the only activity on site during this period of the day.

#### **2.4. Survey 4: 21 October 2015: 4.40pm–7.40pm**

On Wednesday 21 October 2015, surveys were performed under low wind speeds originating from the south-westerly to south-easterly quadrant. At the beginning of the survey, it was noted that odours from the piggery could be recognised for wind speeds above 1 m/s and barely recognised below this velocity.

Distinct (IL = 3) odours were recognised at the gate (100 m) between 2 per cent and 7 per cent of the single measurement. Lower odour levels (IL = 1-2) were recognised up to 650m distance from the facility. These levels of odour were recorded for a maximum of 97 per cent of a single measurement at point 4 (450 m). It is noted that a complaint was received by DER for the same time and from a location nearby.

During single measurements at points 3, 5 and 6, it was also possible to observe the level of dilution of the piggery odours between points 2, 3 and 4 that were approximately aligned under south to south-westerly light wind conditions. The IL or the percentage of recognised odour per IL decreased with the distance and the increasing dilution.

There was no specific activity at the piggery for the duration of this survey.

#### **2.5. Survey 5: 11 November 2015: 5pm–5.40pm**

On Wednesday 11 November 2015, three single measurements were performed by two panellists to the north-east of the facility under south-westerly to southerly winds. The forecast varied late in the day and the decision to do the survey was made late, which resulted in the limited availability of DER odour panellists. Winds initially blew between 2 and 4 m/s and decreased to 0–2.8 m/s by 5.30pm. Similar to surveys 3 and 4, most of the odours were only detected while the wind was noticeably moving, whereas odours were rarely experienced under still conditions.

Only three single measurements were performed before the DER field operator took the decision to enter the site because some odours were recognised and it was still early enough to perform a site visit during daylight.

Odour emissions from sheds appeared to be limited. Some biogas bubbles were observed at the surface of some sections of the anaerobic pond as expected for such a process. Downwind of this pond, DER officers experienced some odours similar to odours experienced offsite.

### 3. Study Summary and Conclusions

#### Important Note:

*A limited number of surveys have been carried in accordance with the objective of the project which was to establish the presence of odours, if any, in the vicinity of the GD Pork facility. Some odours were recognised at different IL and frequencies per single measurement and at various distances, under variable meteorological conditions. It is not intended to generalise any findings of this survey due to the limited number of measurements carried out.*

A total of five surveys were carried out between September and November 2015 in the vicinity of the GD Pork facility in West Pinjarra under various regimes of wind speed and direction. Most of the surveys were performed under light wind or calm conditions.

It was found that under still conditions or very light wind and cool temperatures, odours were recognised very close to the site. During morning measurements under calm winds (1.5 m/s), piggery odours were recognised on a small number of occasions (nine out of 46 single measurements south of the plant). Odours were recognised up to 12 per cent of a 10-minute measurement and at distances up to 1,500 m from the piggery.

For surveys performed during the early evening, measurements took place in the quadrant north to east of the site due to the prevailing south to south-west wind during those periods. Measurements were performed for wind speeds ranging from calm conditions to 4 m/s. Strong and distinct odours were only recognised at the boundary of the site, with the exception of three measurements where odours with an IL 3 were experienced:

- at 350 m from the source for 28 per cent of one single 10-minute measurement; and
- at 450 m from the source for 2 per cent of two separate single 10-minute measurements.

Frequencies up to 60 per cent of a single 10-minute measurement were reached for weak and very weak odours (IL 1 and 2) at distances up to 650 m. For a single measurement located at 450 m from the site, IL 1 and 2 odours were experienced up to 97 per cent of the 10-minute measurement duration. This measurement coincided with a complaint logged at a similar time and at a nearby location.

Site visits generally did not identify any specific activities or operations onsite which may have contributed to the odours. The last visit undertaken in the early evening identified that sections of the anaerobic ponds could have been the source of odours recognised offsite under the meteorological conditions at the time. The DER field operator experienced the same odour while performing measurements for the surveys in the vicinity of GD Pork facility.

Other findings were:

- odours from the premises were rarely recognised under still conditions in early morning or late afternoon during the surveys; and
- from the experience in the field and review of the findings, it appears that odours from the piggery do not have a strong persistence, that is their intensity decreases rapidly with dilution and distance.

## References

- [1] VDI 3940 Part 2, 2006, Verein Deutscher Ingenieure – Measurement of odour impact by field inspection – Measurement of the impact frequency of recognizable odours.
- [2] VDI 3940 Part 3, 2010, Verein Deutscher Ingenieure – Measurement of odour impact by field inspection – Determination of odour intensity and hedonic odour tone.
- [3] Alice M. Lay, Charles M. McGinley, P.E., A Nasal Chemosensory Performance Test for Odor Inspectors, Water Environment Federation Odors and Air Emissions 2004 Bellevue, WA: 18–21 April 2004.

## Appendices

## **Appendix A – Maps and Measurement points for GD Pork Pinjarra OFA**

**Attachment A1:** Initial Map (Map 1) for GD Pork Pinjarra OFA

**Attachment A2:** Initial List of Measurement Points for GD Pork Pinjarra OFA (Map 1)

**Attachment A3:** Map 2 for GD Pork Pinjarra OFA

**Attachment A4:** Map 3 for GD Pork Pinjarra OFA

### Meas. Points - GD Pork OFA Pinjarra



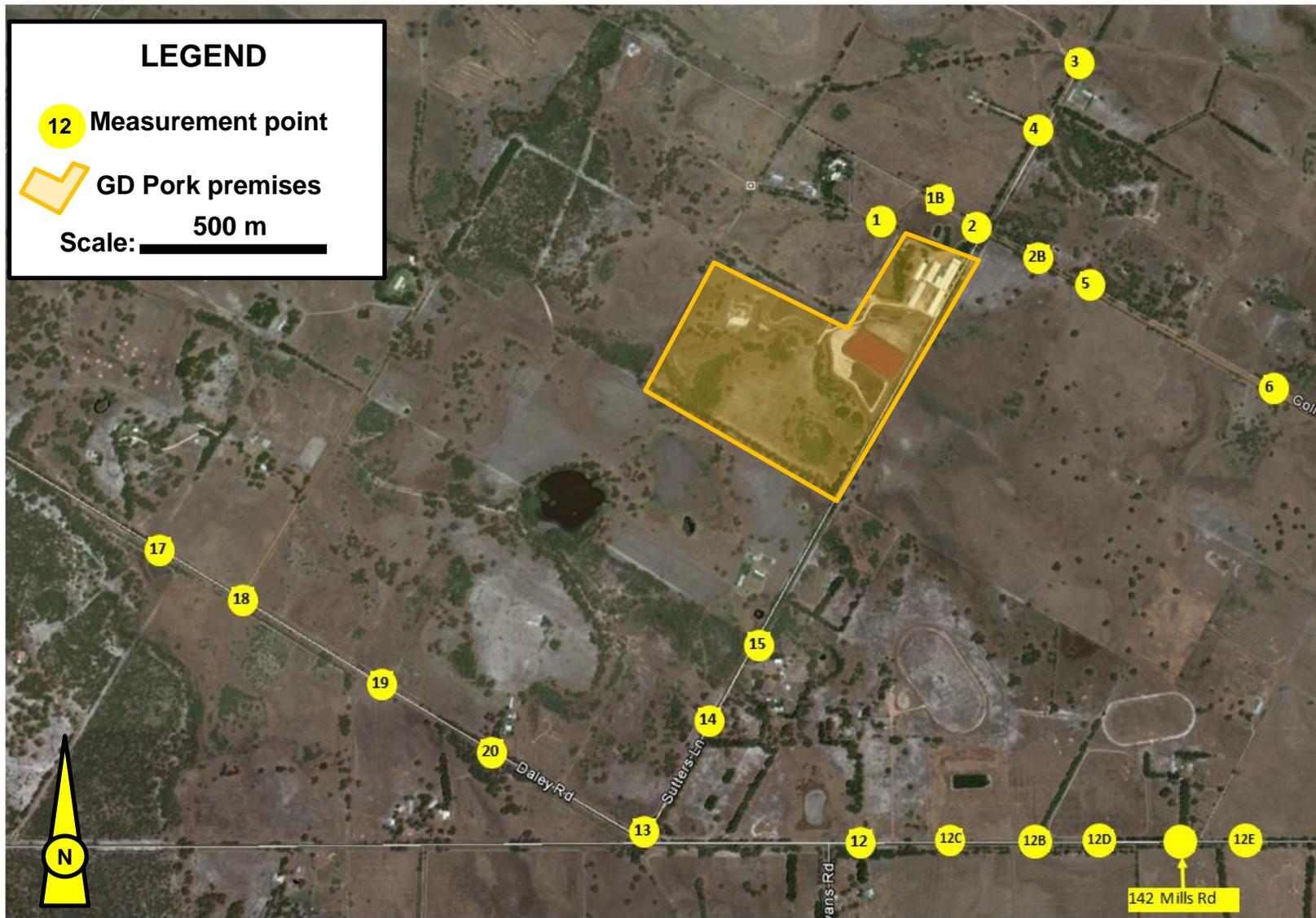
Pre-location of the measurement points for the GD Pork West Pinjarra OFA



**Attachment A2** – Initial list of the measurement points for GD Pork Pinjarra OFA (Map 1)

1. 2<sup>nd</sup> bend road to house NW of the site (turn over possible at the bend)
2. Site entrance from Sutters Lane
3. End of Sutters Lane (turn over possible at the end)
4. No 794: entry of the property
5. Blue ribbon – Collins Rd
6. Blue Ribbon – Collins Rd (ribbon on a gate)
7. Blue Ribbon – Collins Rd
8. Collins Road – 50 m on Collins Rd from Cnr with Old Bunbury Rd
9. No 485 Old Bunbury Rd – Ranch View entrance
10. Mills Rd – at the level of the pond
11. Mills Rd – under power lines
12. Entrance No 218 Mills Rd
13. Cnr Sutters Lane and Mills Rd
14. 30 m North of 1<sup>st</sup> property Sutters Lane
15. End of Sutters Lane (turn over possible at the end)
16. Before the gate
17. No 156 Daley Rd (100 m SE clear view)
18. No 122 Daley Rd
19. Phone pole Daley Rd
20. No 40 Daley Rd (Warning: dog = noise)
21. Paull Rd – between No 550 and 527
22. End of Marsh Rd (turn over possible at the end)
23. Marsh Rd - South of a row of small eucalyptus trees
24. Marsh Rd – level of the brook
25. Between two rows of trees
26. Cnr Paull Rd and Marsh Rd
27. No 415 Paull Rd
28. Paull Rd – Bus stop towards Pinjarra
29. Paull Rd – Bus stop towards Forrest Hwy
30. 150 m east of No 225 Paull Rd
31. No 211 Paull Rd
32. Paull Rd – under power lines
33. Paull Rd
34. No 28 Paull Rd
35. Cnr Old Bunbury Rd and Paull Rd
36. Coolep Flats, No 418 Old Bunbury Rd
37. No 450 Old Bunbury Rd

Attachment A3: Map 2 for the GD Pork West Pinjarra OFA



Attachment A4: Map 3 for the GD Pork Pinjarra OFA



## Appendix B – Log-form Used by Panellist to Record Detected Odours

Investigating Officer: \_\_\_\_\_

Location: \_\_\_\_\_

Date: \_\_\_\_\_

Start Time: \_\_\_\_\_

Odour Character: Manure - M | Piggery - P | Exhaust Fumes - EF | Vegetation - V | Smoke - S



| Minutes | +00       | +10 | +20 | +30 | +40 | +50 |
|---------|-----------|-----|-----|-----|-----|-----|
| 0       | Strength  |     |     |     |     |     |
|         | Character |     |     |     |     |     |
| 1       |           |     |     |     |     |     |
| 2       |           |     |     |     |     |     |
| 3       |           |     |     |     |     |     |
| 4       |           |     |     |     |     |     |
| 5       |           |     |     |     |     |     |
| 6       |           |     |     |     |     |     |
| 7       |           |     |     |     |     |     |
| 8       |           |     |     |     |     |     |
| 9       |           |     |     |     |     |     |

Other Odour Comments:

Add other odour codes and short description if needed

-----

Location: \_\_\_\_\_

Start Time: \_\_\_\_\_

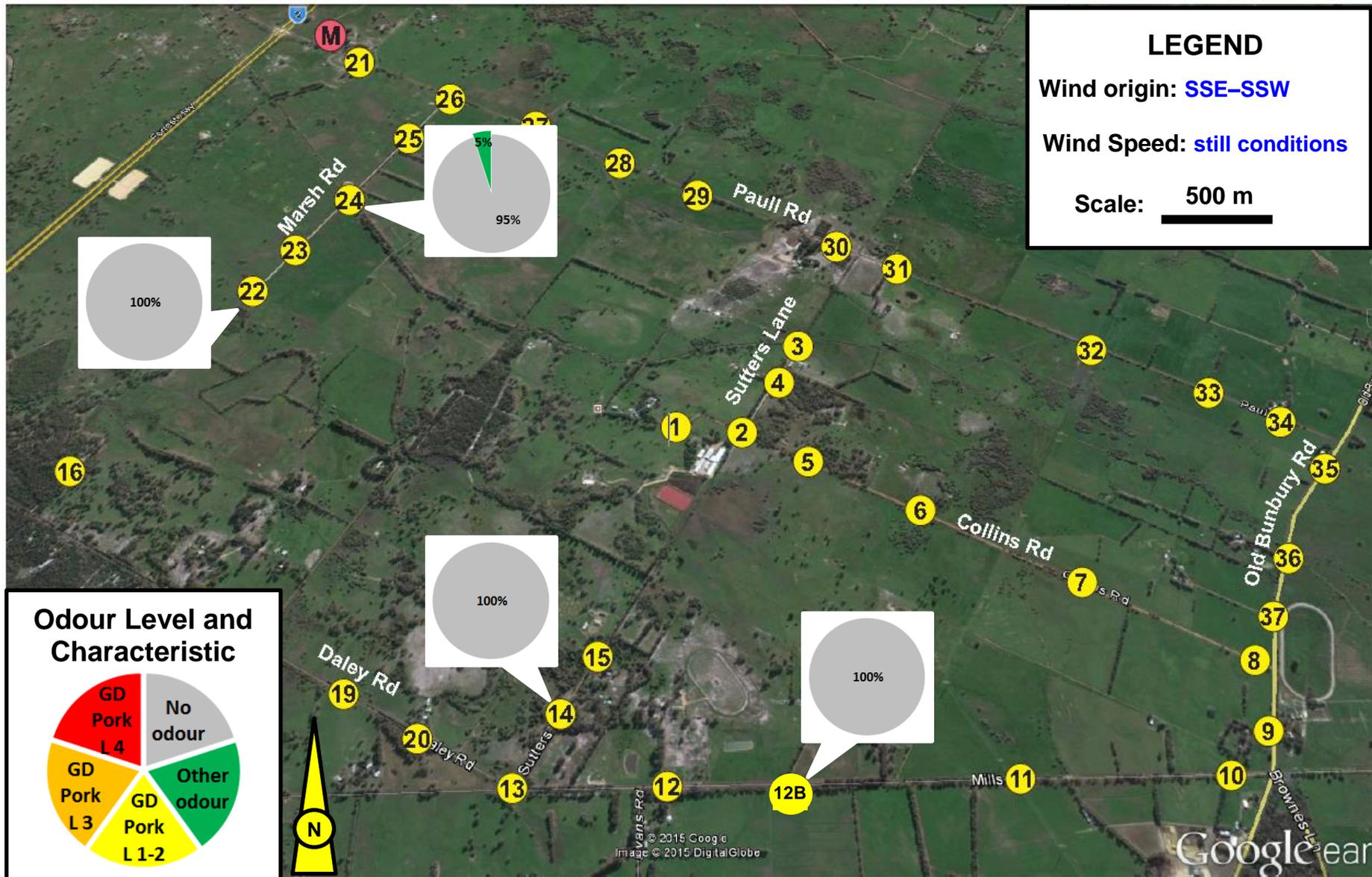


| Minutes | +00       | +10 | +20 | +30 | +40 | +50 |
|---------|-----------|-----|-----|-----|-----|-----|
| 0       | Strength  |     |     |     |     |     |
|         | Character |     |     |     |     |     |
| 1       |           |     |     |     |     |     |
| 2       |           |     |     |     |     |     |
| 3       |           |     |     |     |     |     |
| 4       |           |     |     |     |     |     |
| 5       |           |     |     |     |     |     |
| 6       |           |     |     |     |     |     |
| 7       |           |     |     |     |     |     |
| 8       |           |     |     |     |     |     |
| 9       |           |     |     |     |     |     |

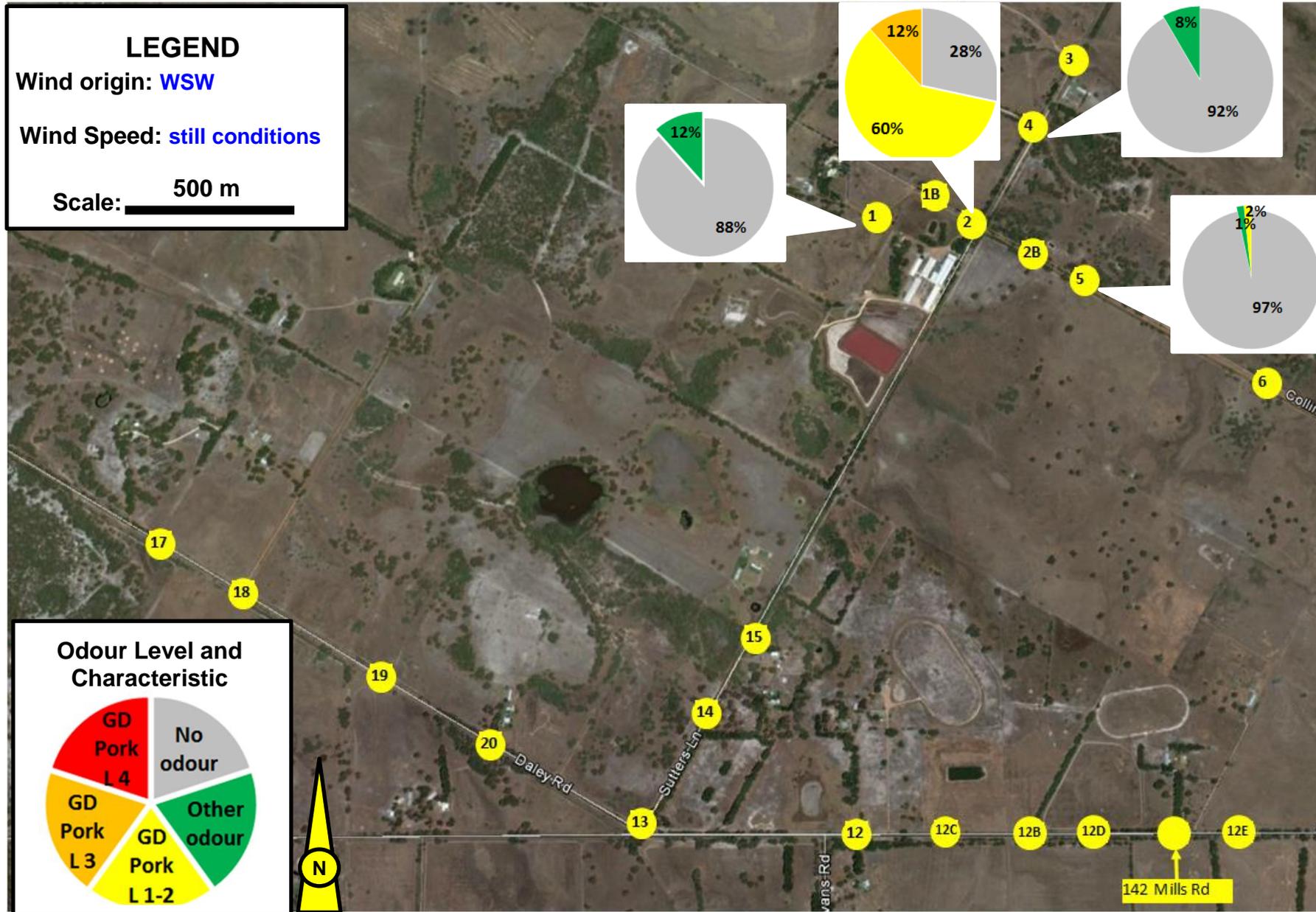
Other Odour Comments:

## Appendix C – Maps With Measurements of Survey 1: 4 September 2015

Survey 1: 4 September 2015 – Single measurement **1** (5.45am–5.55am)



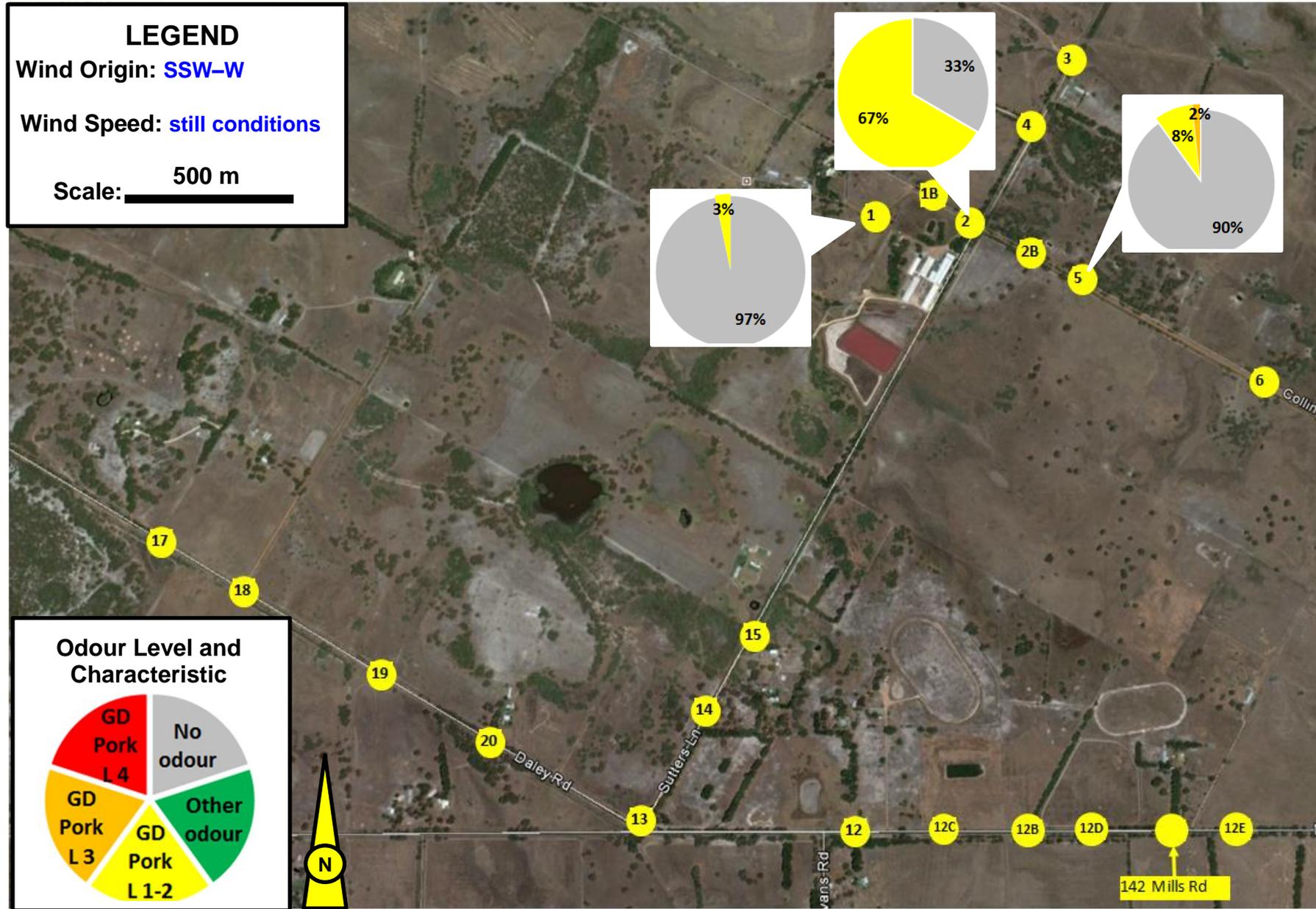
Survey 1: 4 September 2015 – Single measurement **2** (6.20am–6.30am)

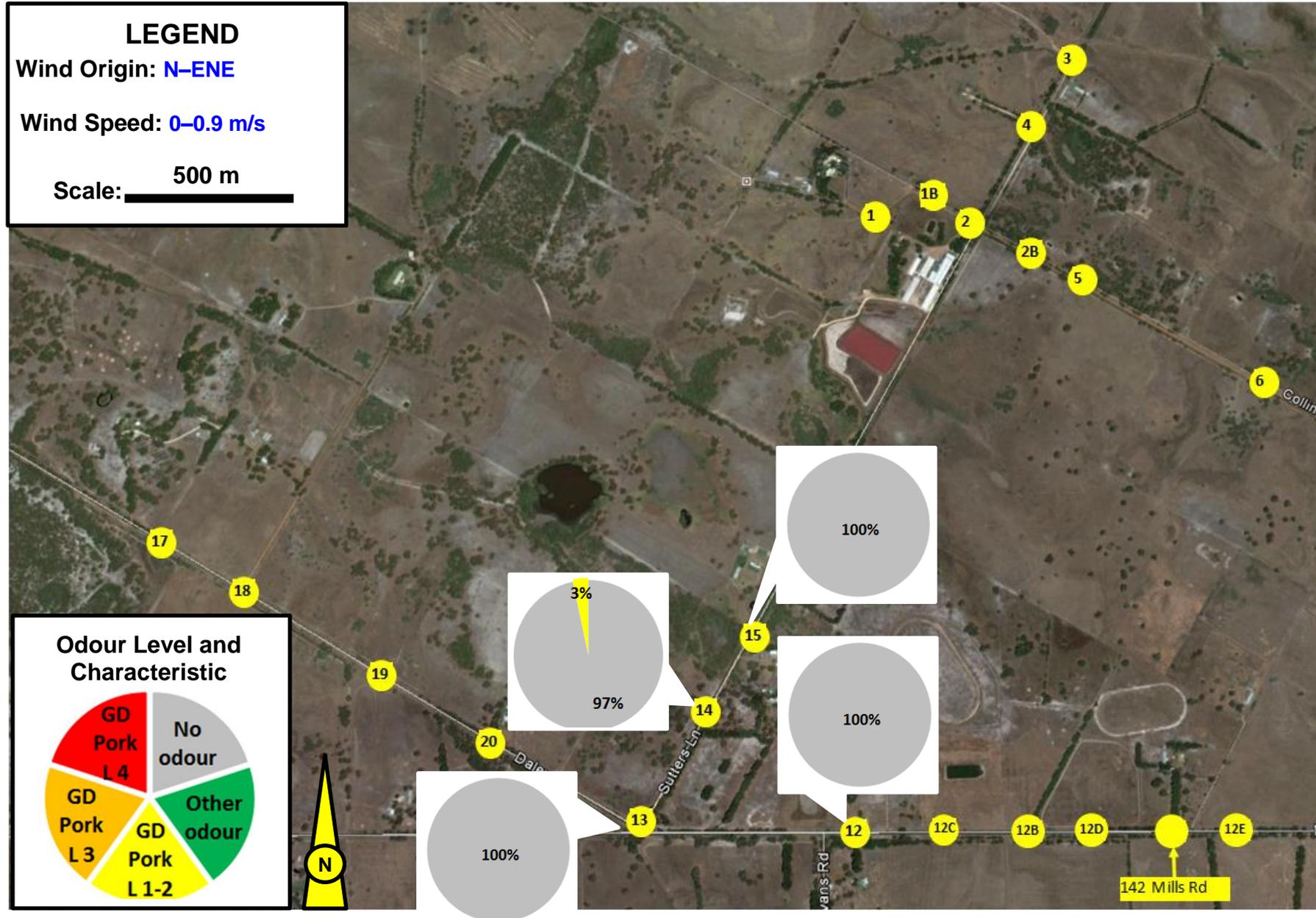


Odour Field Assessment in the Vicinity of GD Pork West Pinjarra (December 2016)

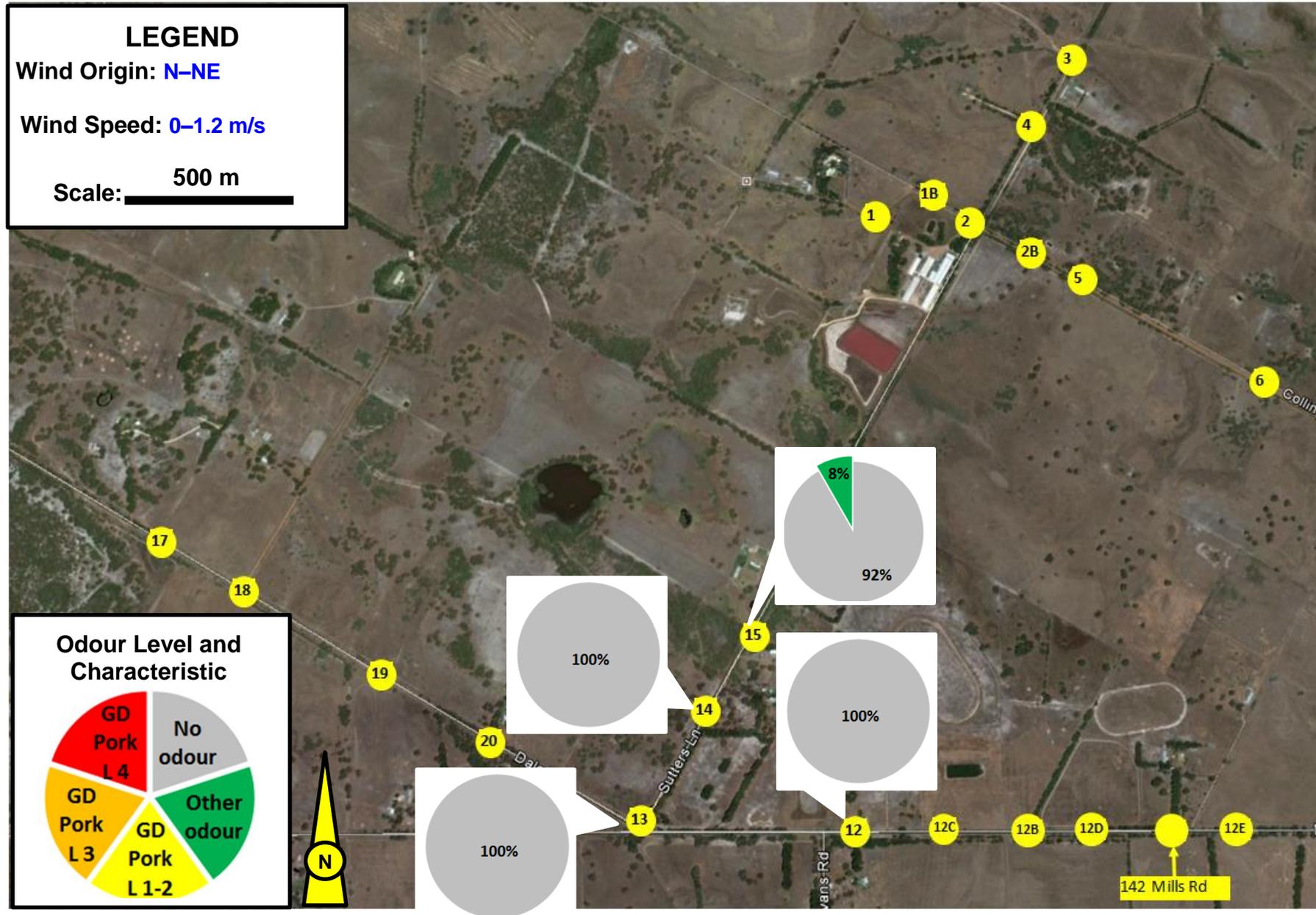


Survey 1: 4 September 2015 – Single measurement 3 (6.40am–6.50am)

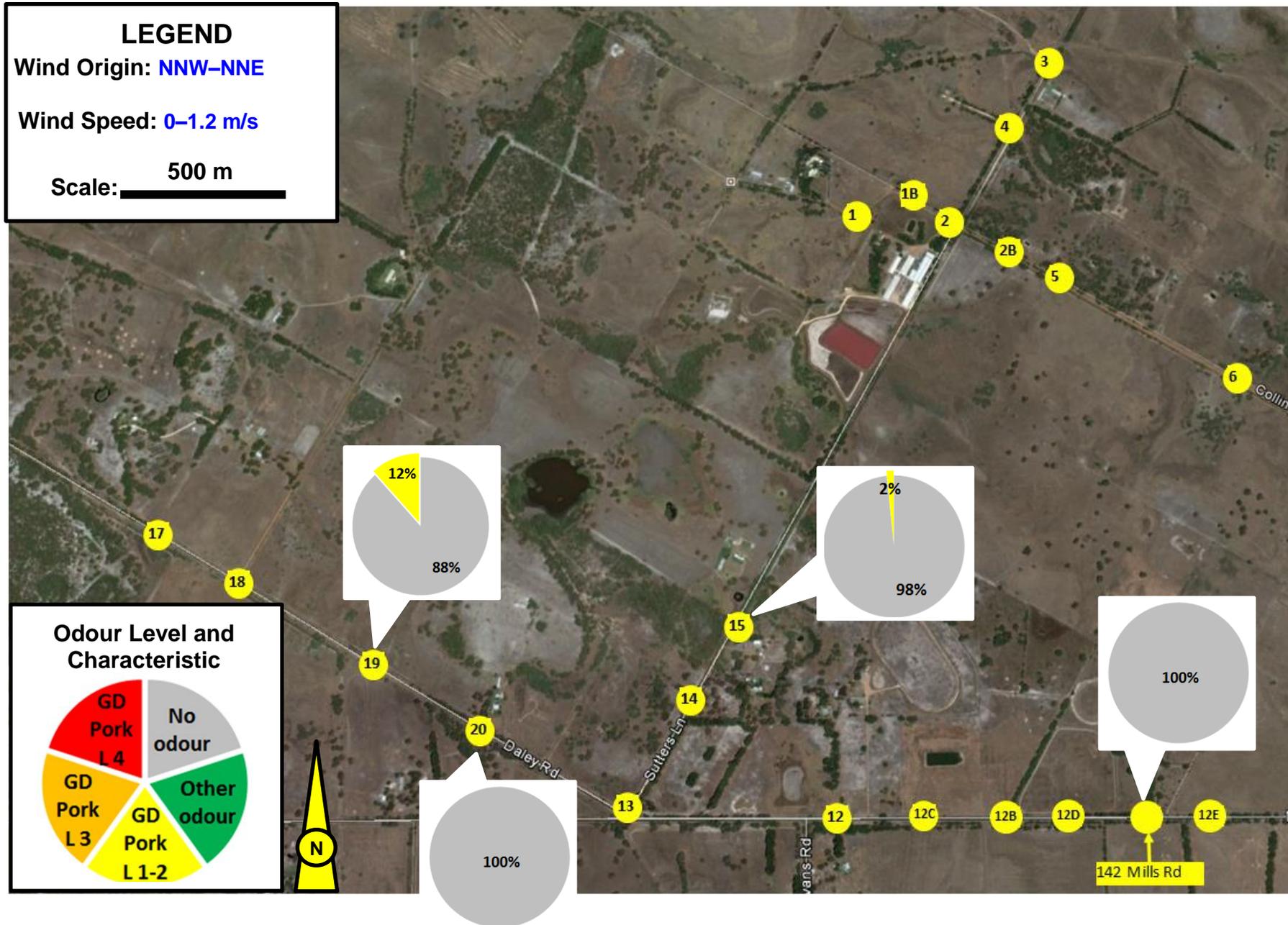




Survey 1: 4 September 2015 – Single measurement **5** (8.30am–8.40am)

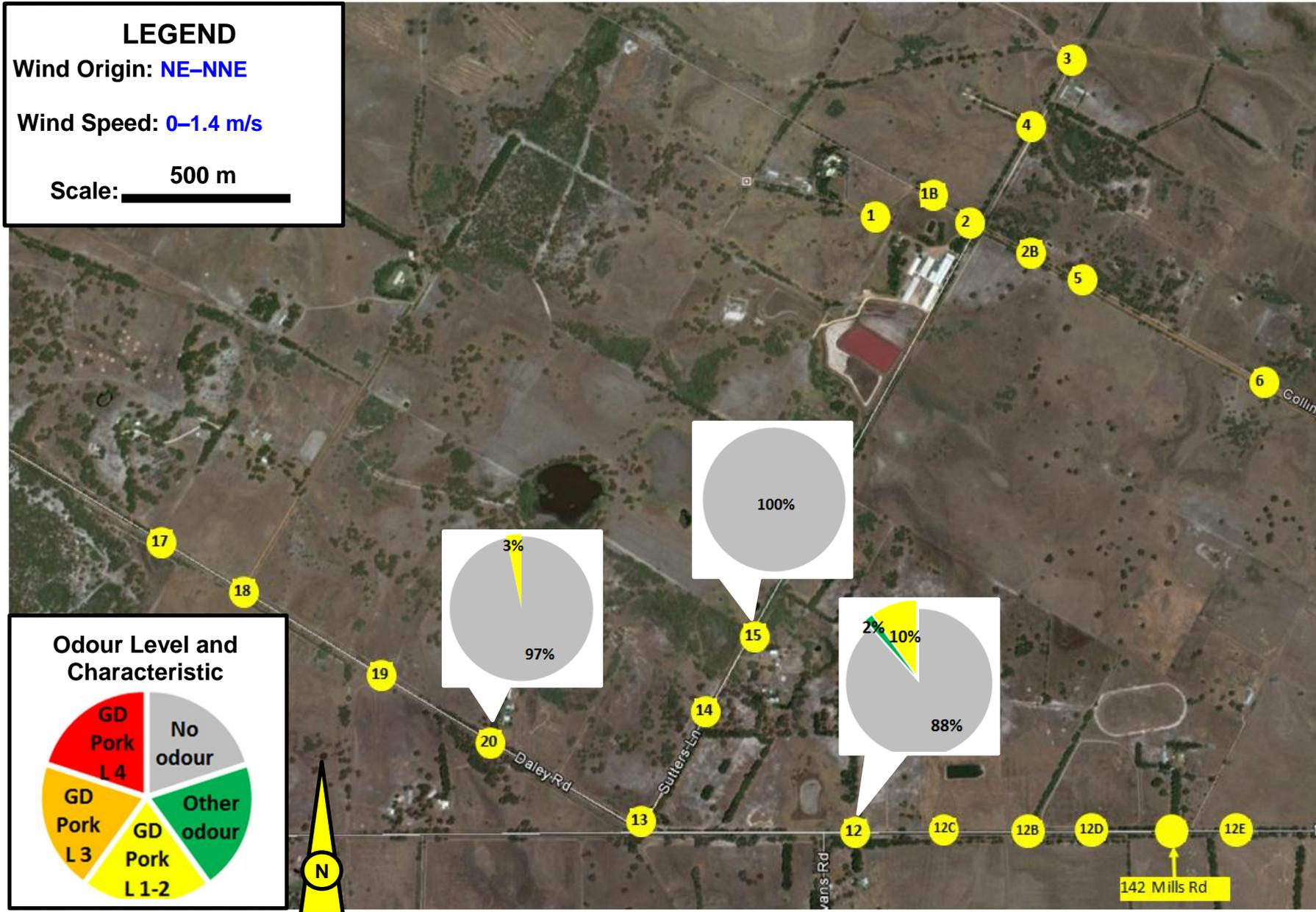


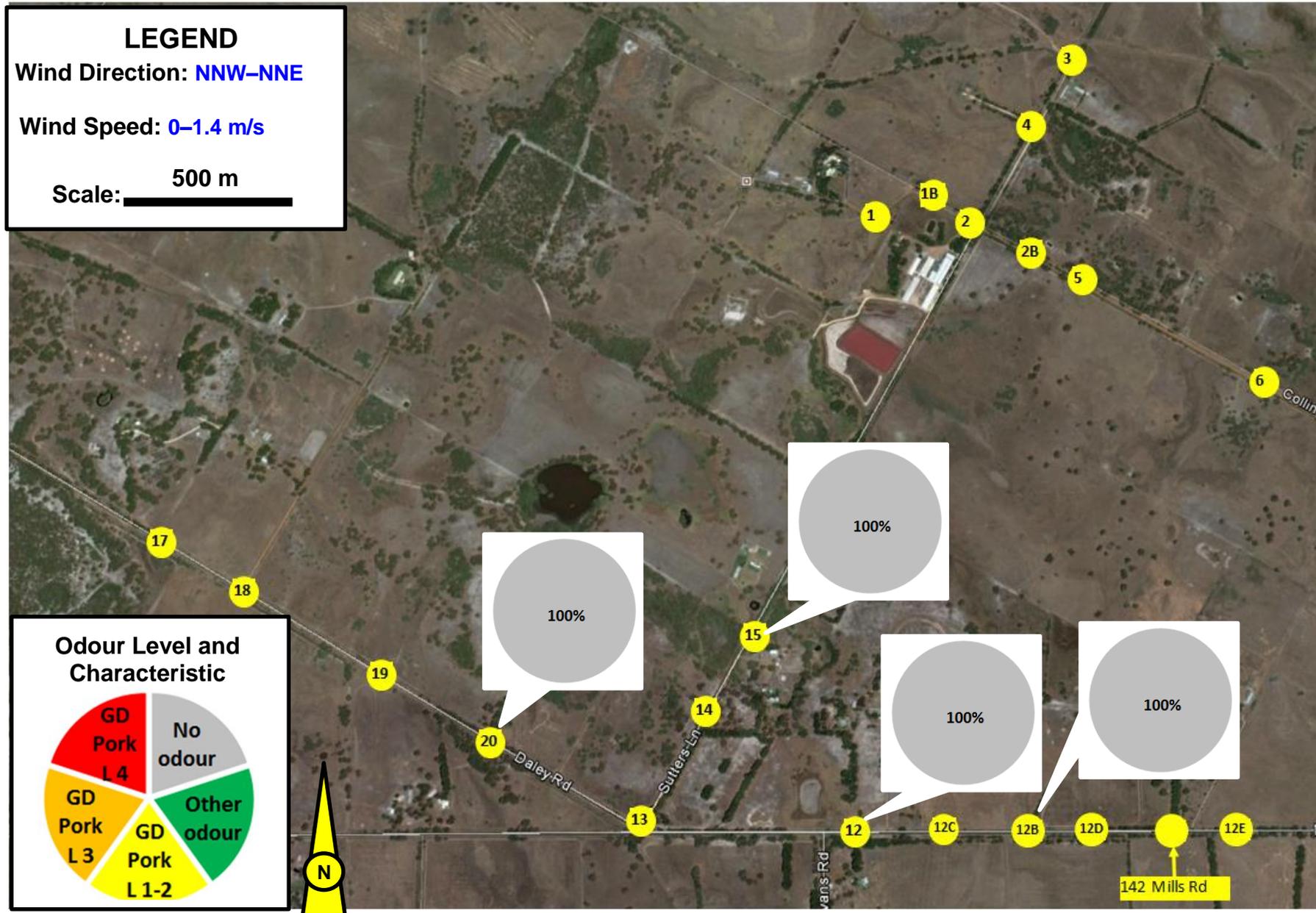
Survey 1: 4 September 2015 – Single measurement **6** (8.50am–9am)



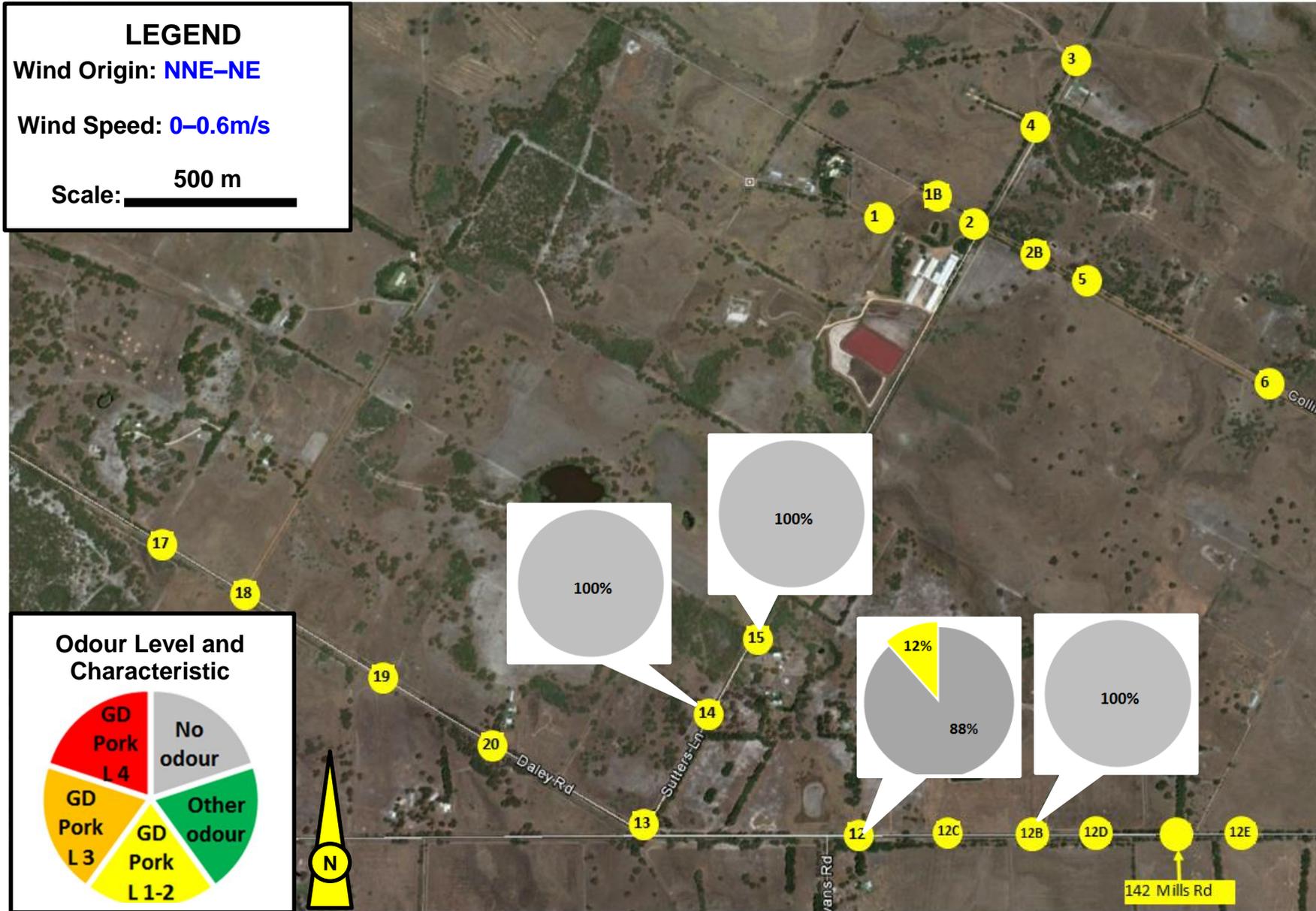
Odour Field Assessment in the Vicinity of GD Pork West Pinjarra (December 2016)

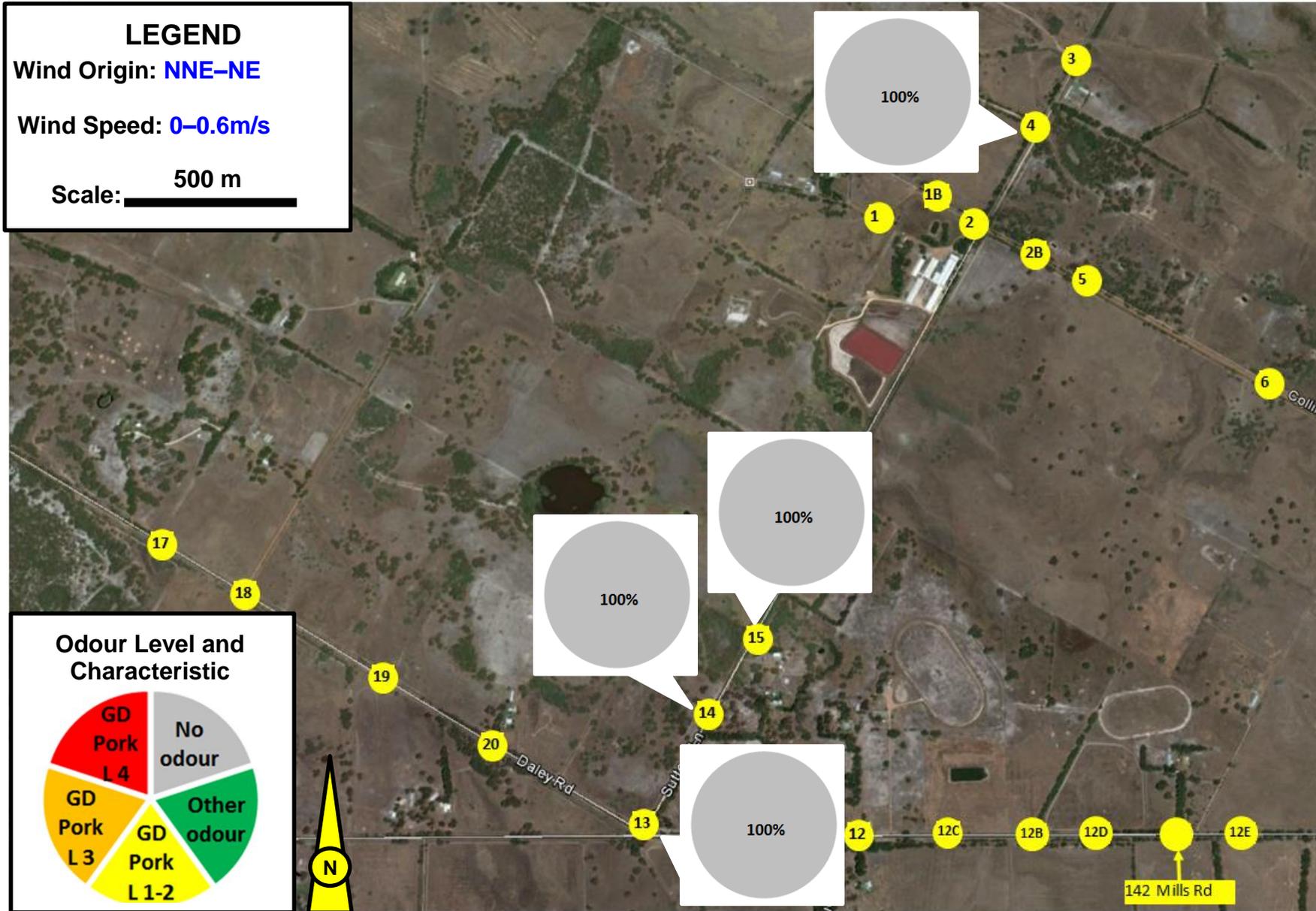


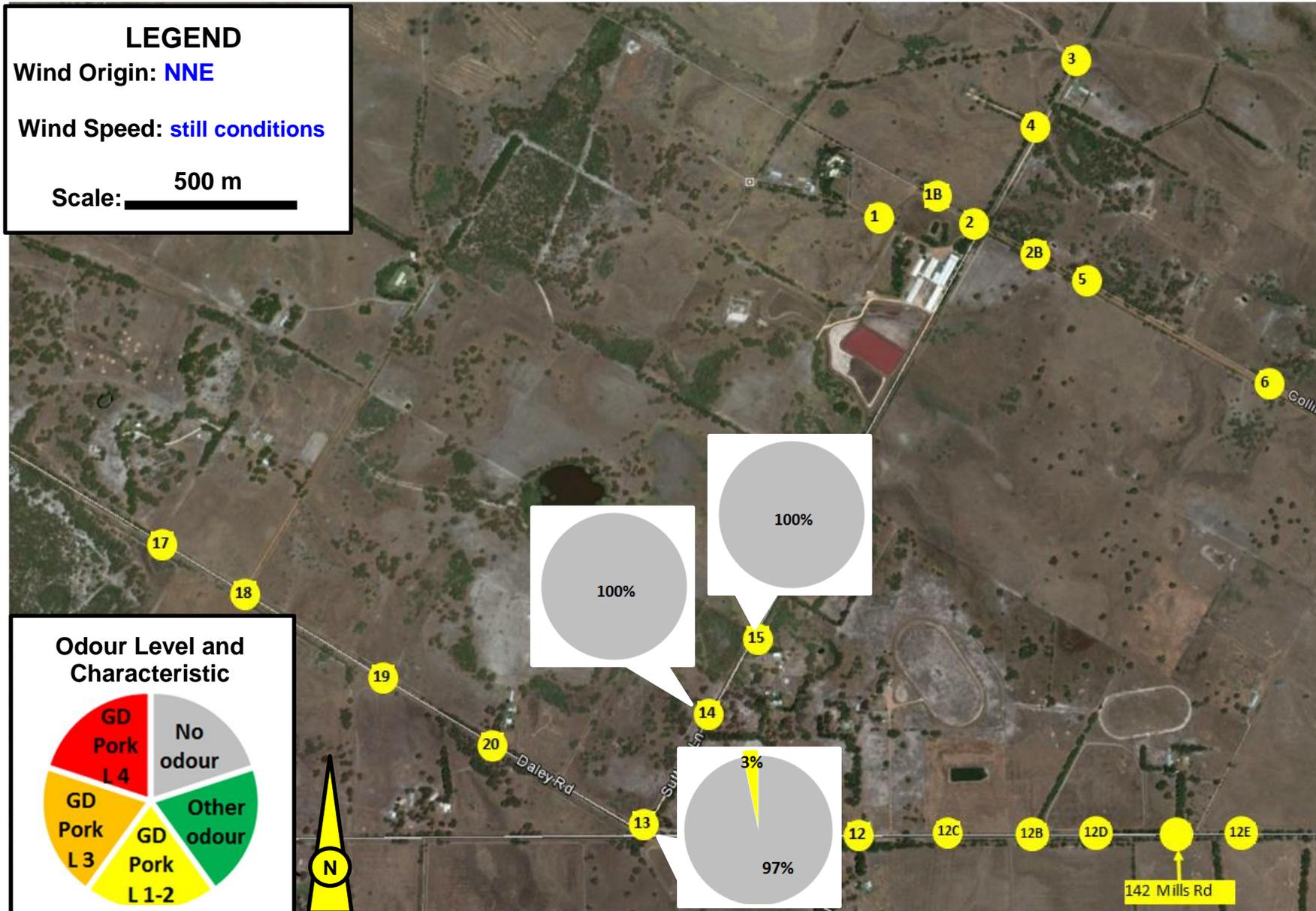


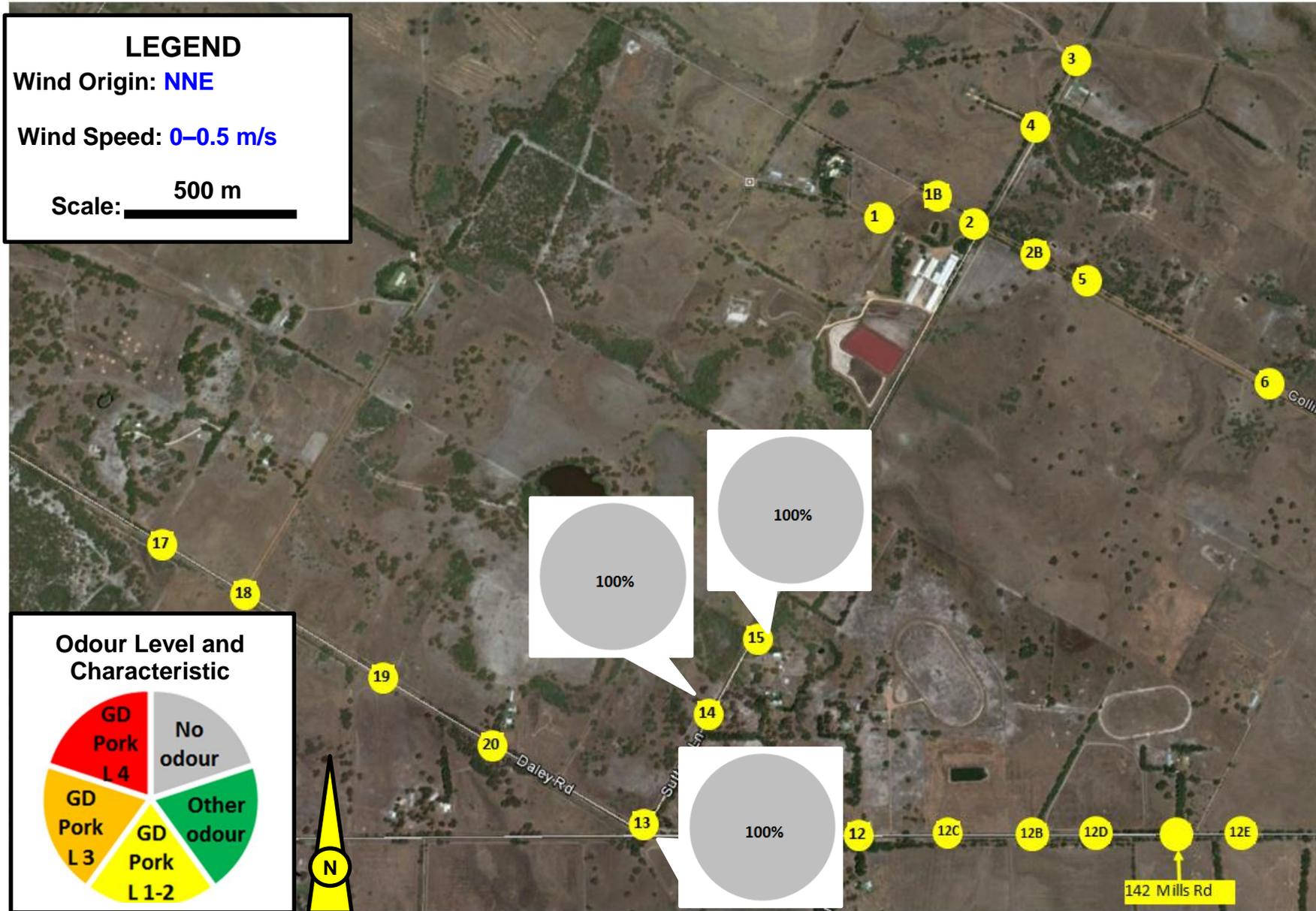


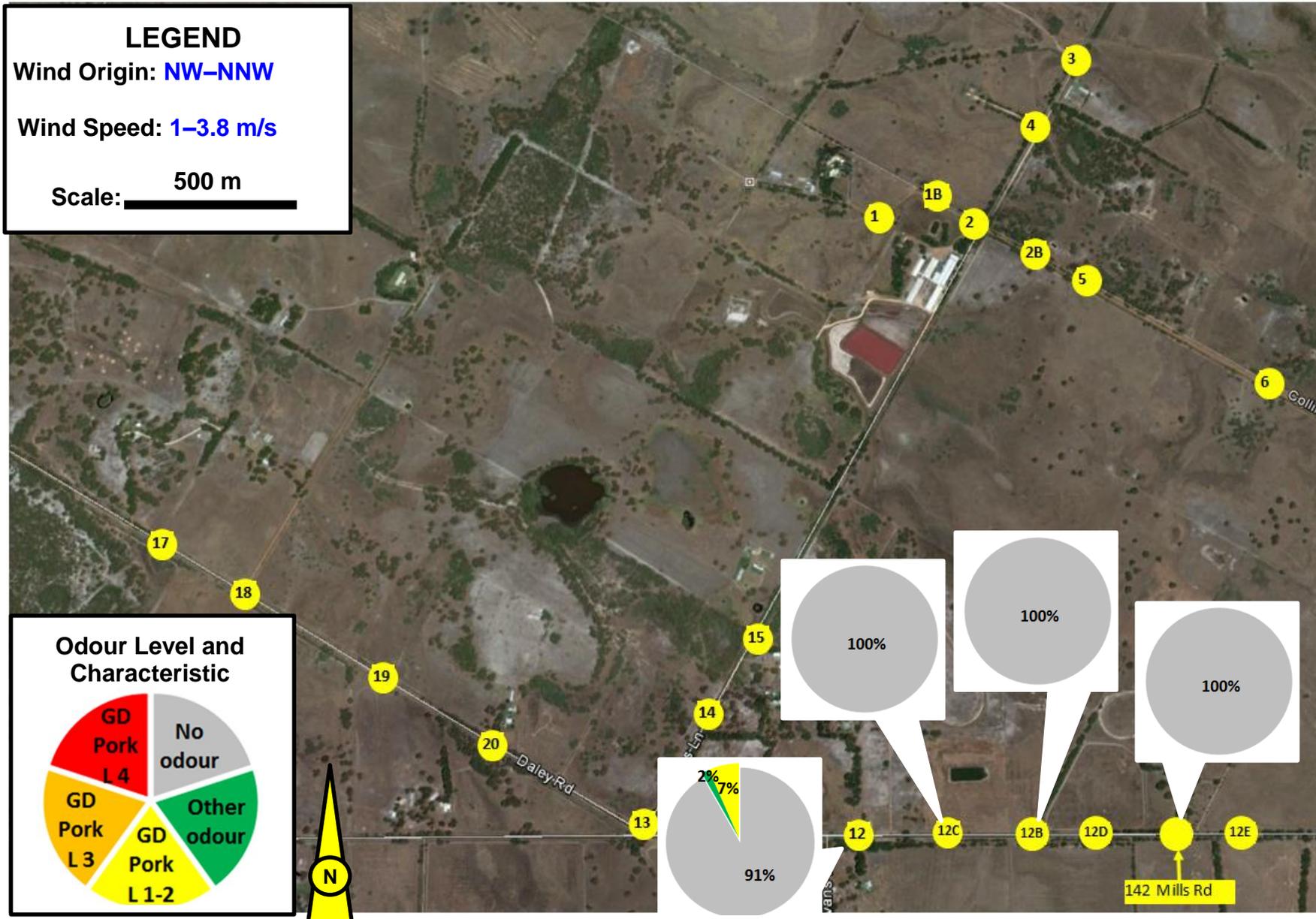
## Appendix D – Maps With Measurements of Survey 2: 2 October 2015

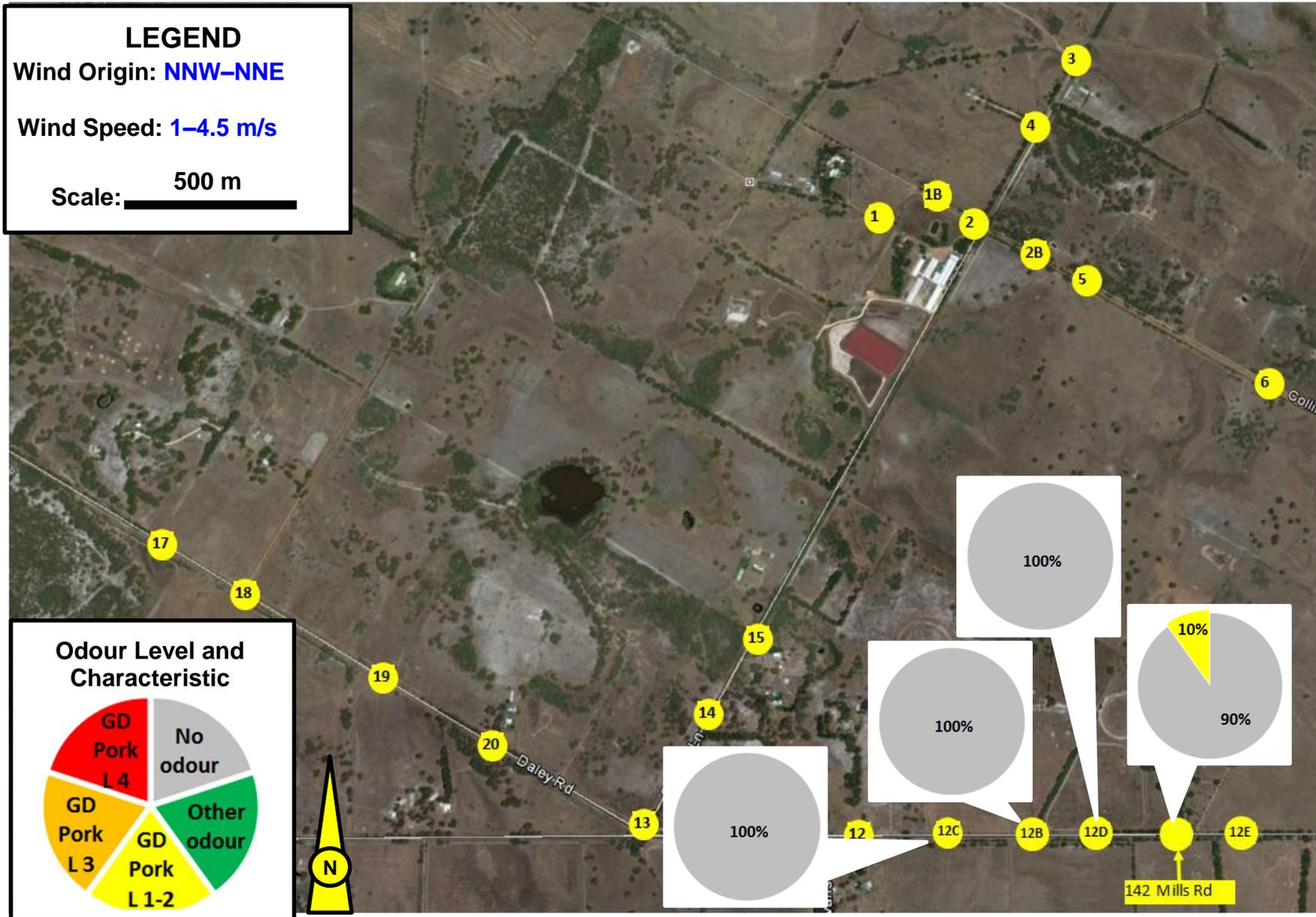


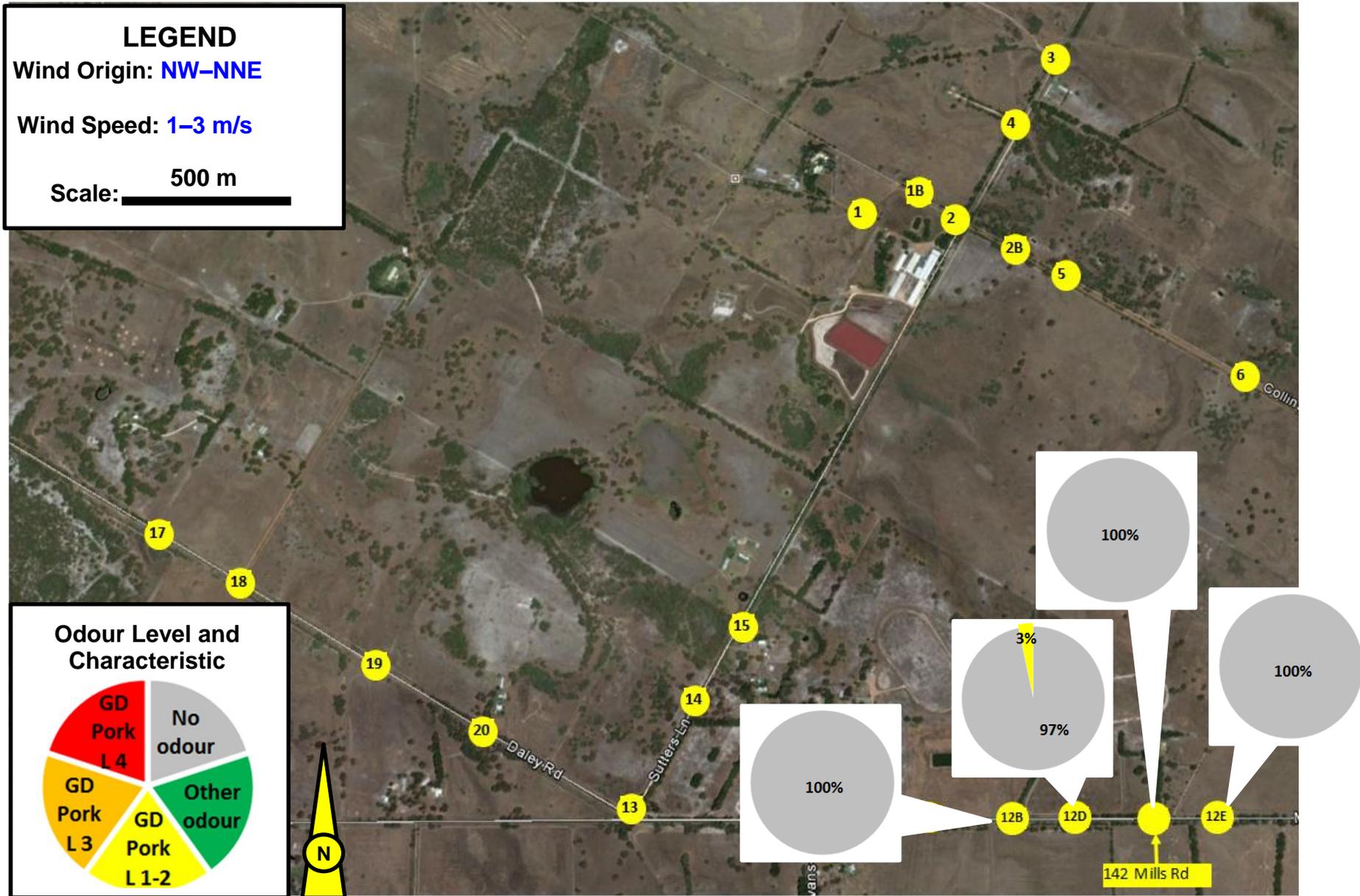






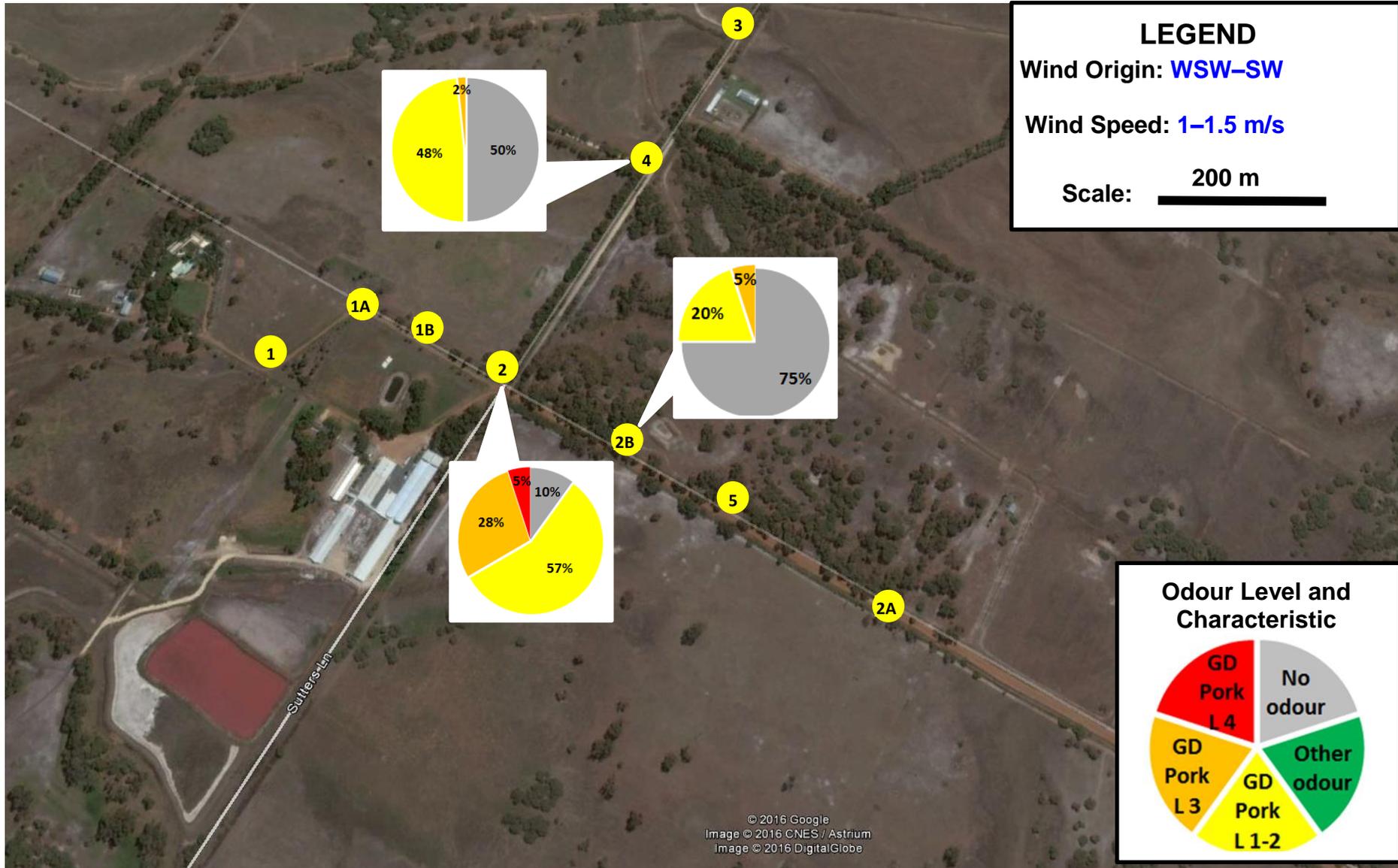




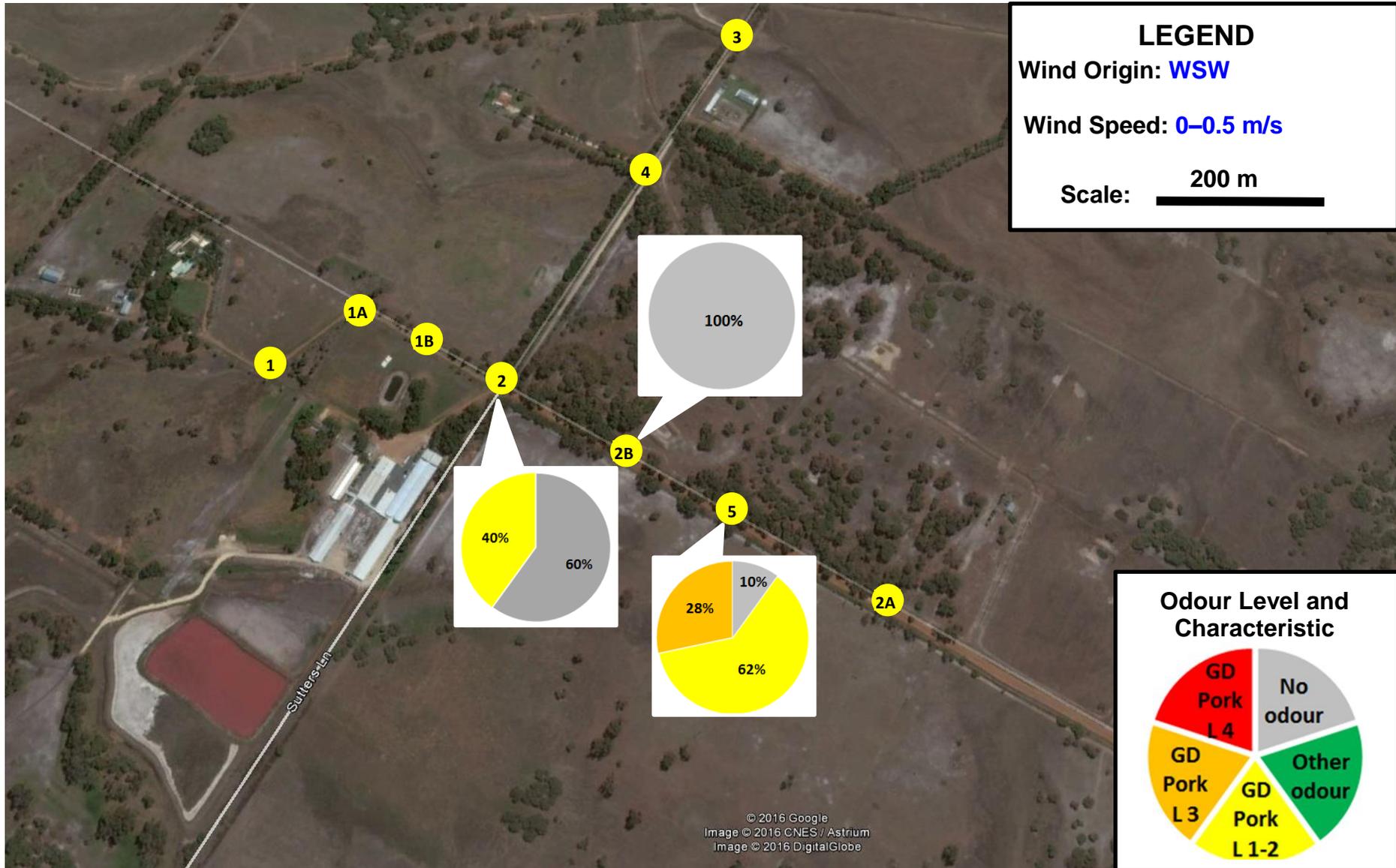


## Appendix E – Maps With Measurements of Survey 3: 15 October 2015

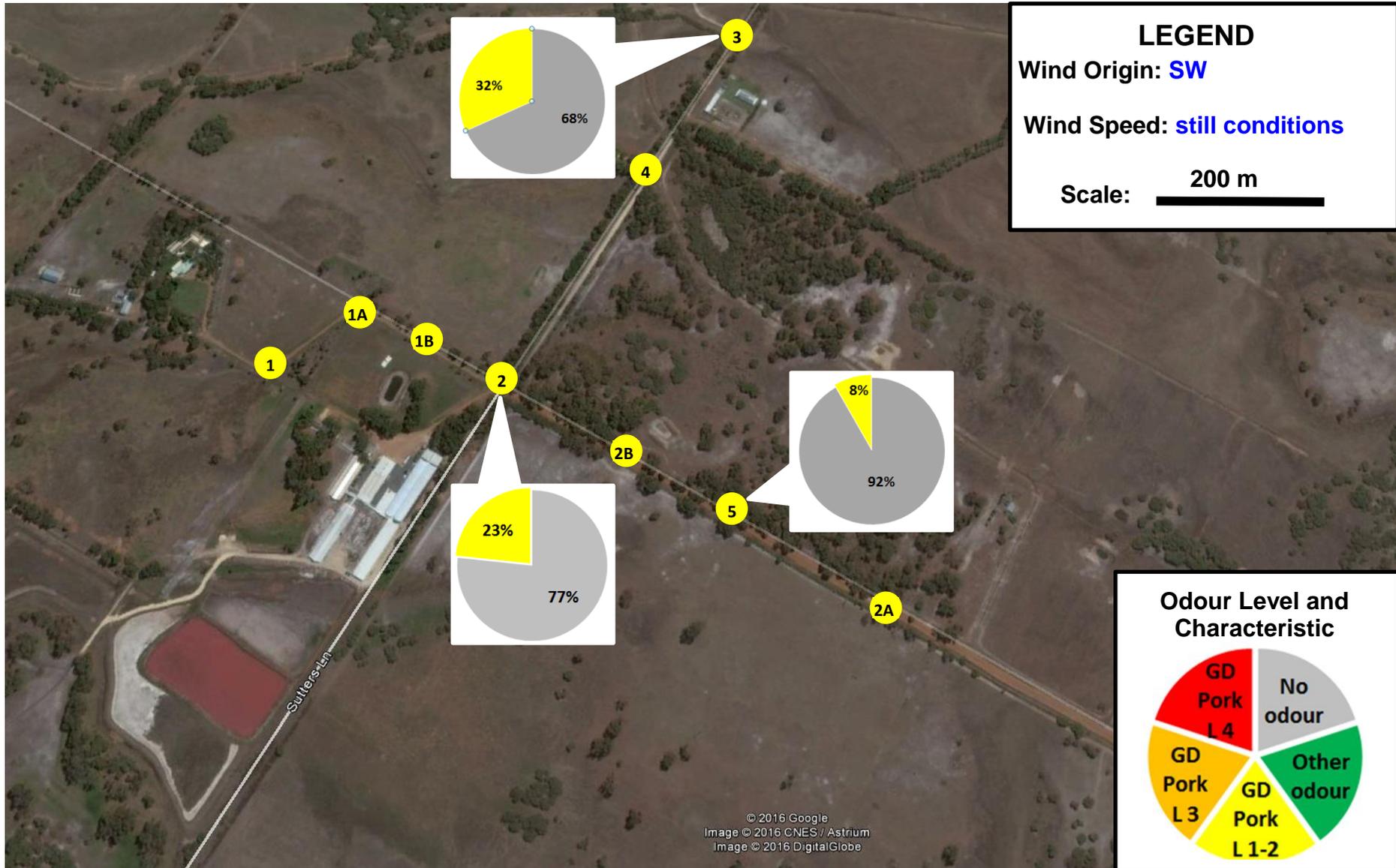
Survey 3: 15 October 2015 – Single measurement **1** (5.40pm–5.50pm)



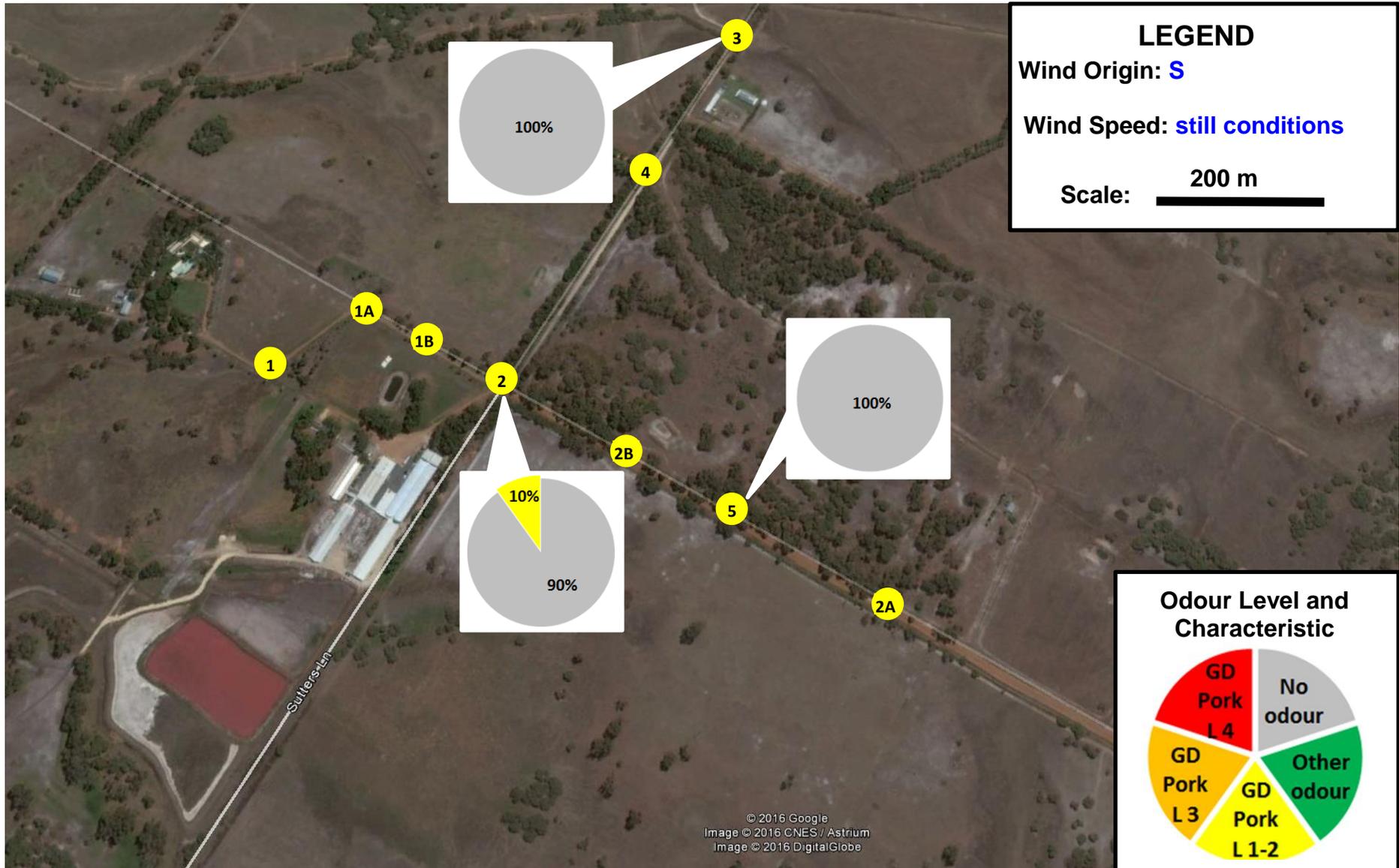
Survey 3: 15 October 2015 – Single measurement 2 (6pm–6.10pm)



Survey 3: 15 October 2015 – Single measurement 3 (6.25pm–6.35pm)

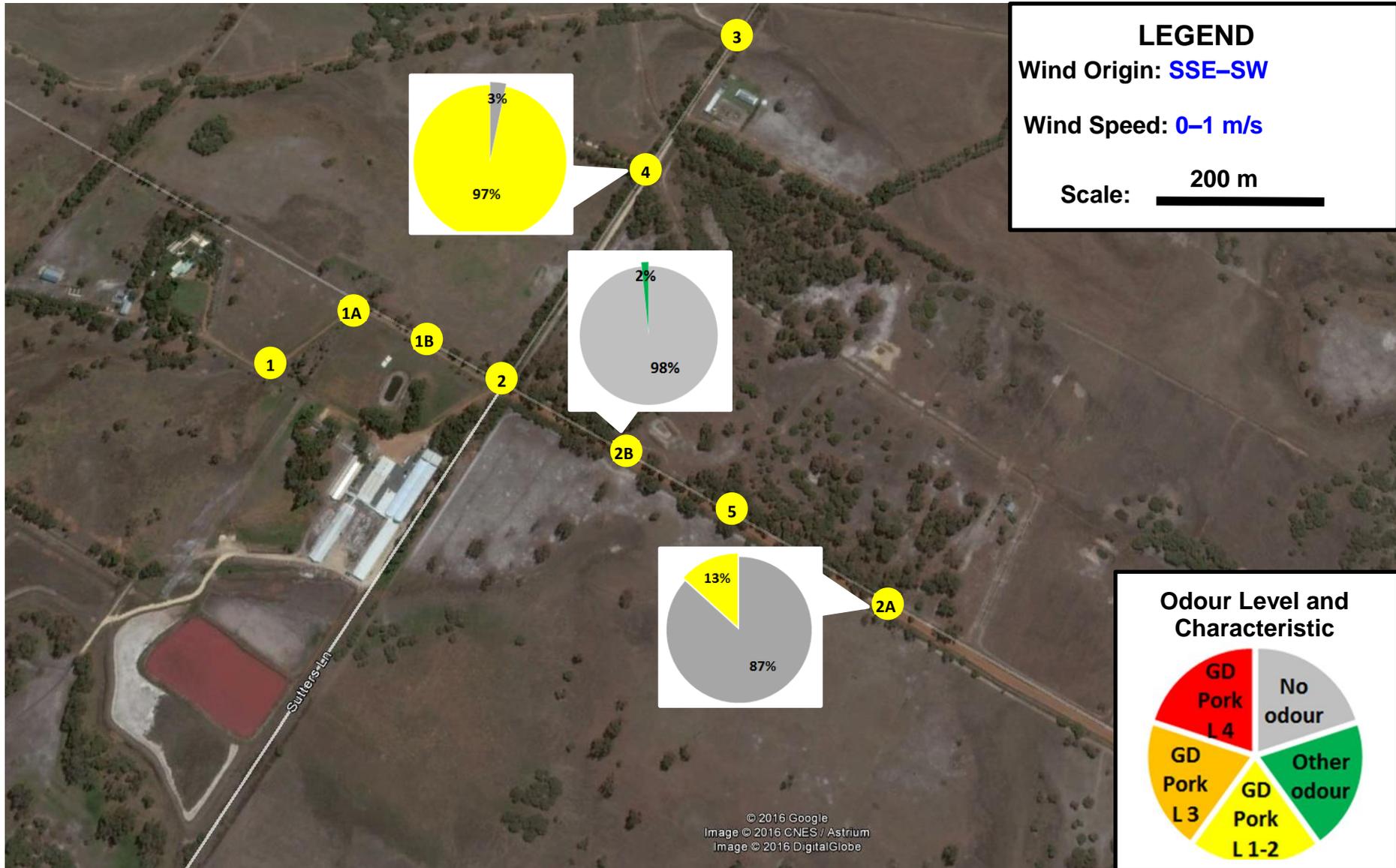


Survey 3: 15 October 2015 – Single measurement 4 (7.10pm–7.20pm)

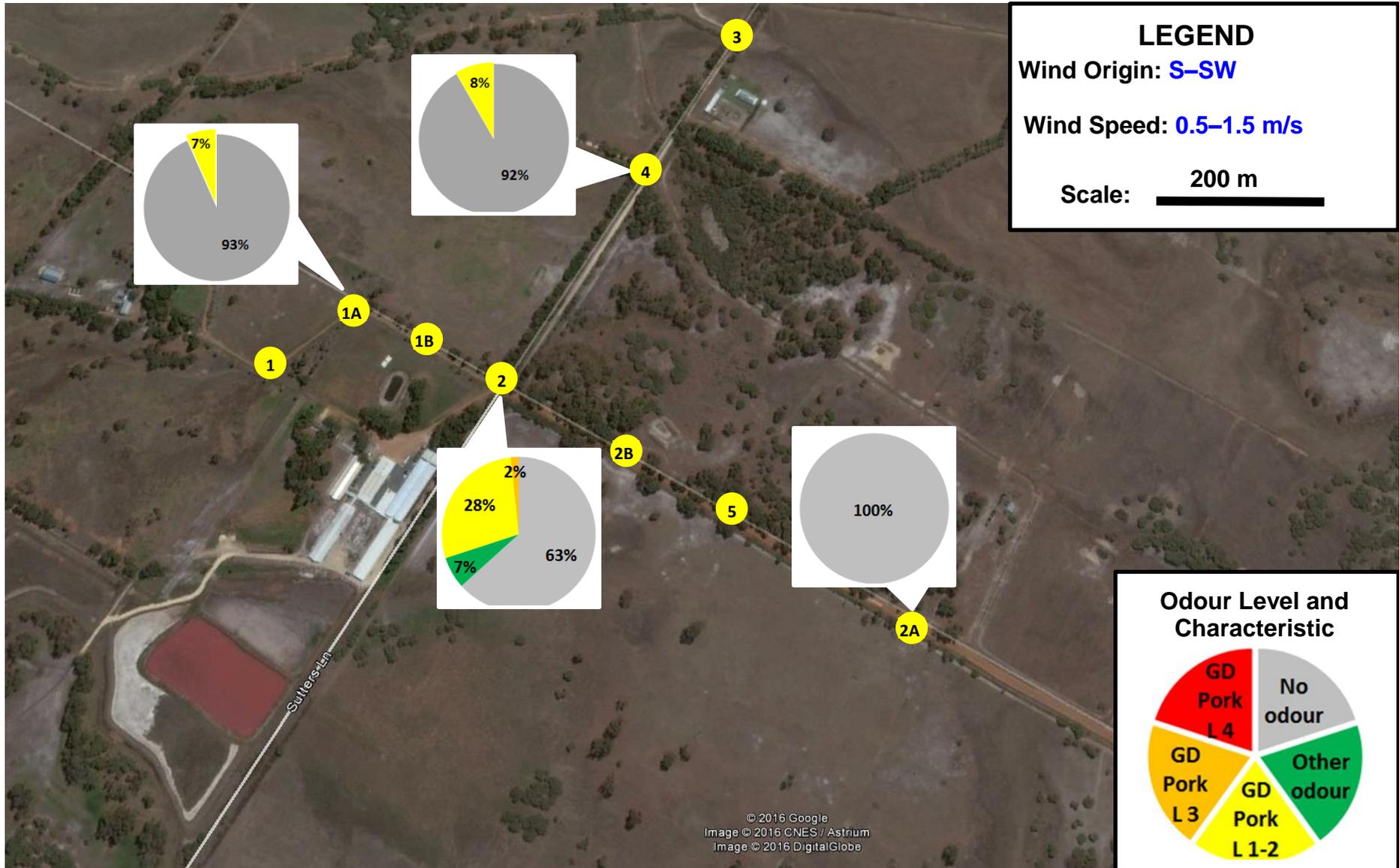


## Appendix F – Maps With Measurements of Survey 4: 21 October 2015

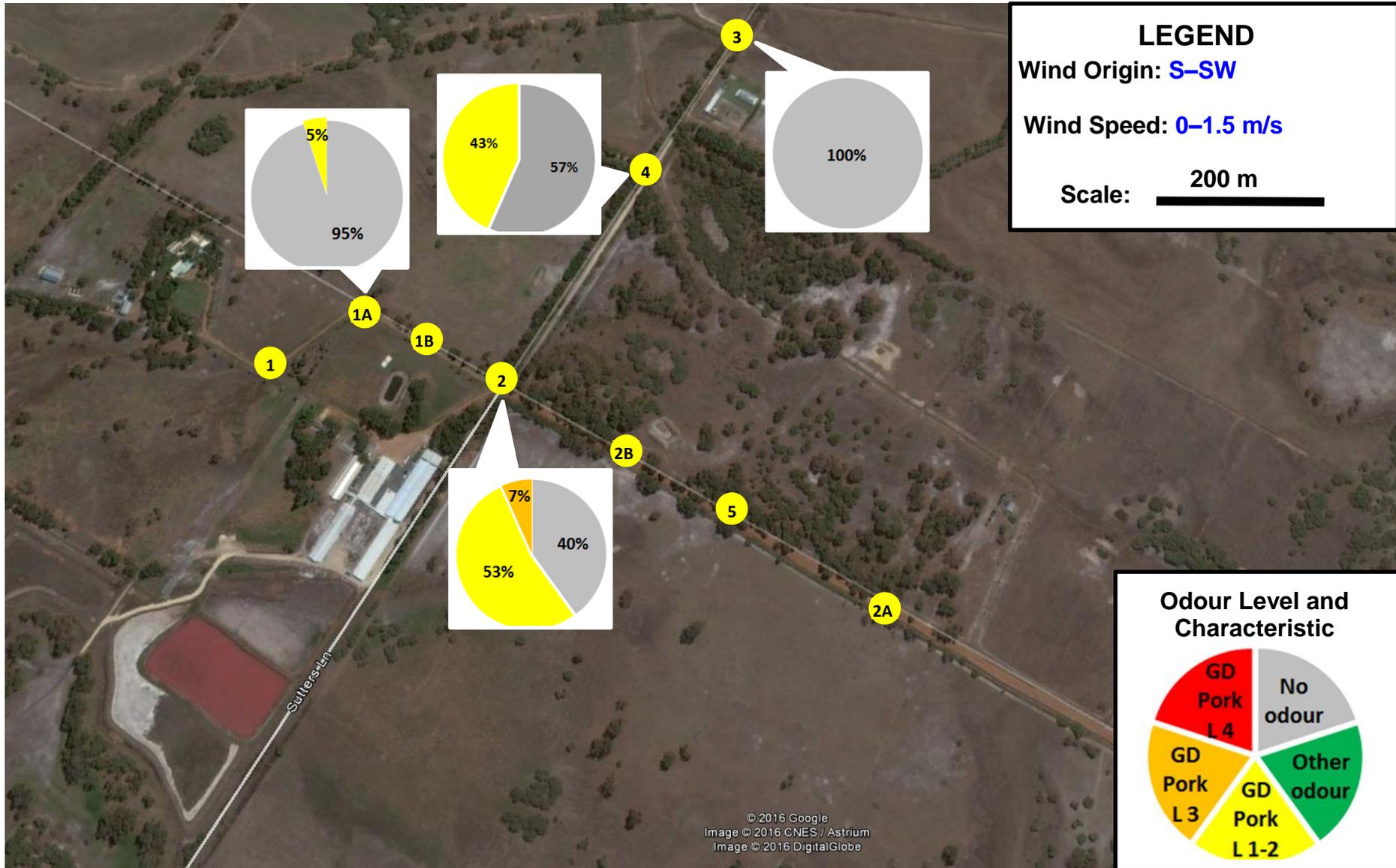
Survey 4: 21 October 2015 – Single measurement **1** (4.40pm–4.50pm)



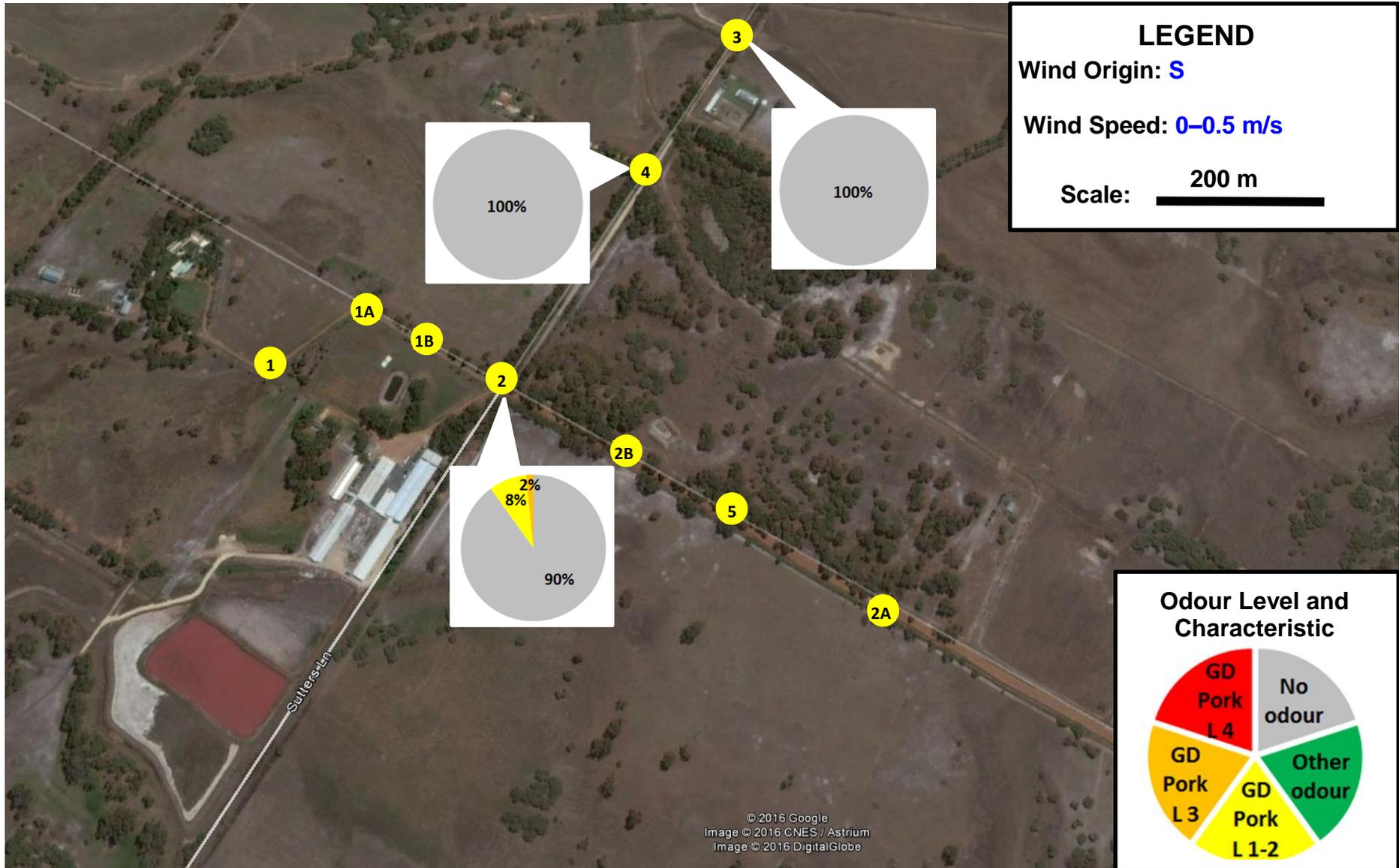
Survey 4: 21 October 2015 – Single measurement **2** (5pm–5.10pm)



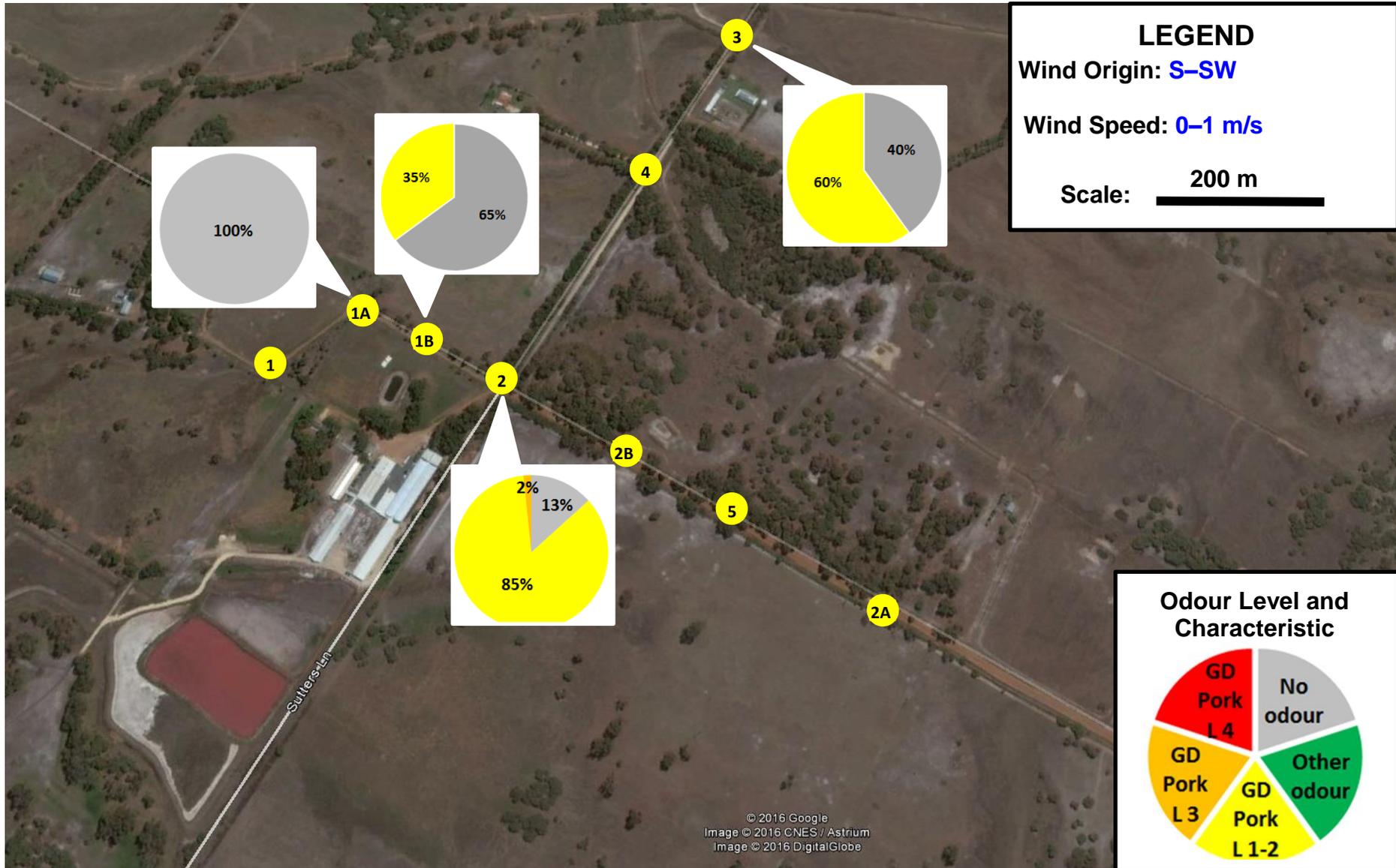
Survey 4: 21 October 2015 – Single measurement 3 (5.20pm–5.30pm)



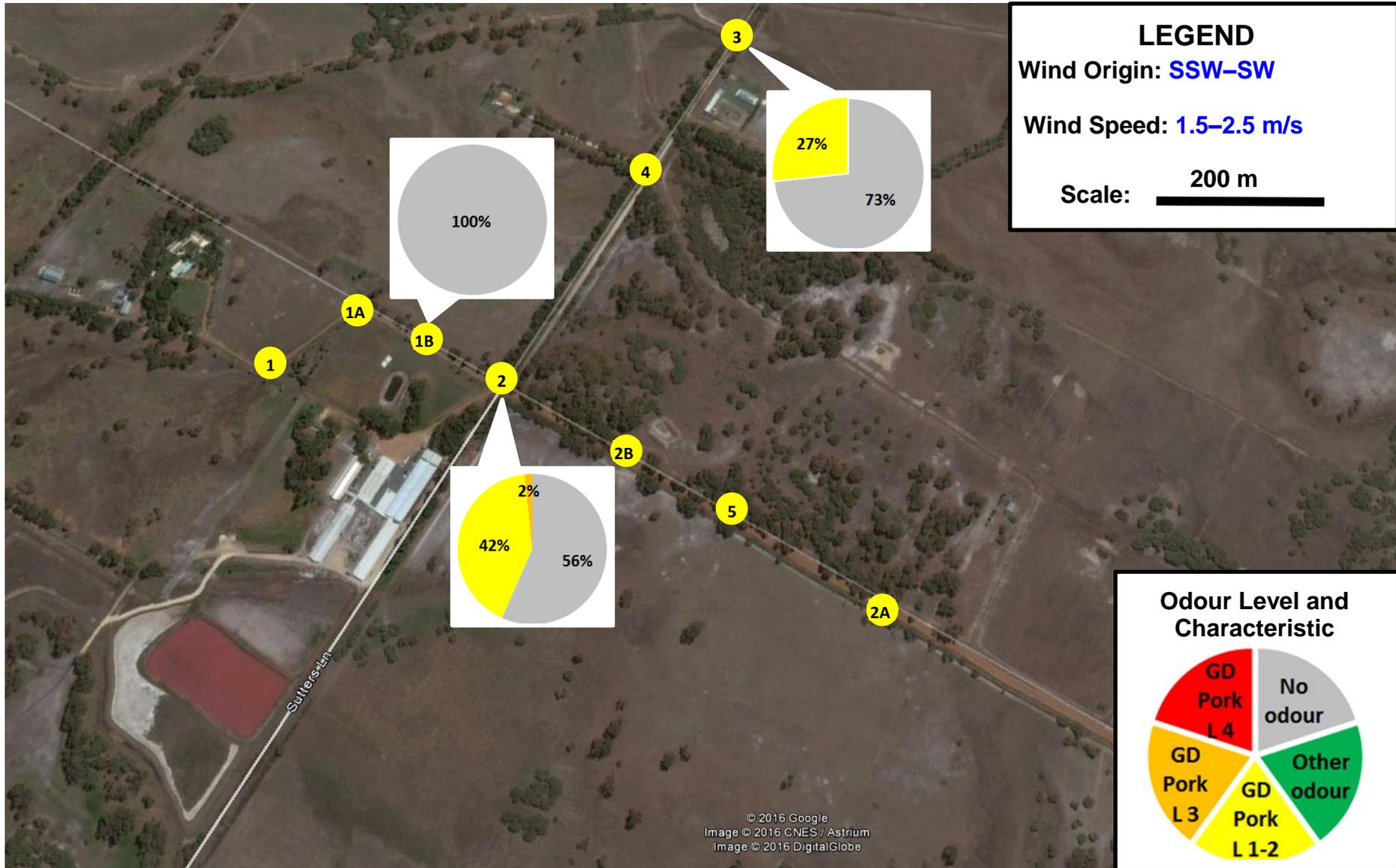
Survey 4: 21 October 2015 – Single measurement 4 (5.40pm–5.50pm)



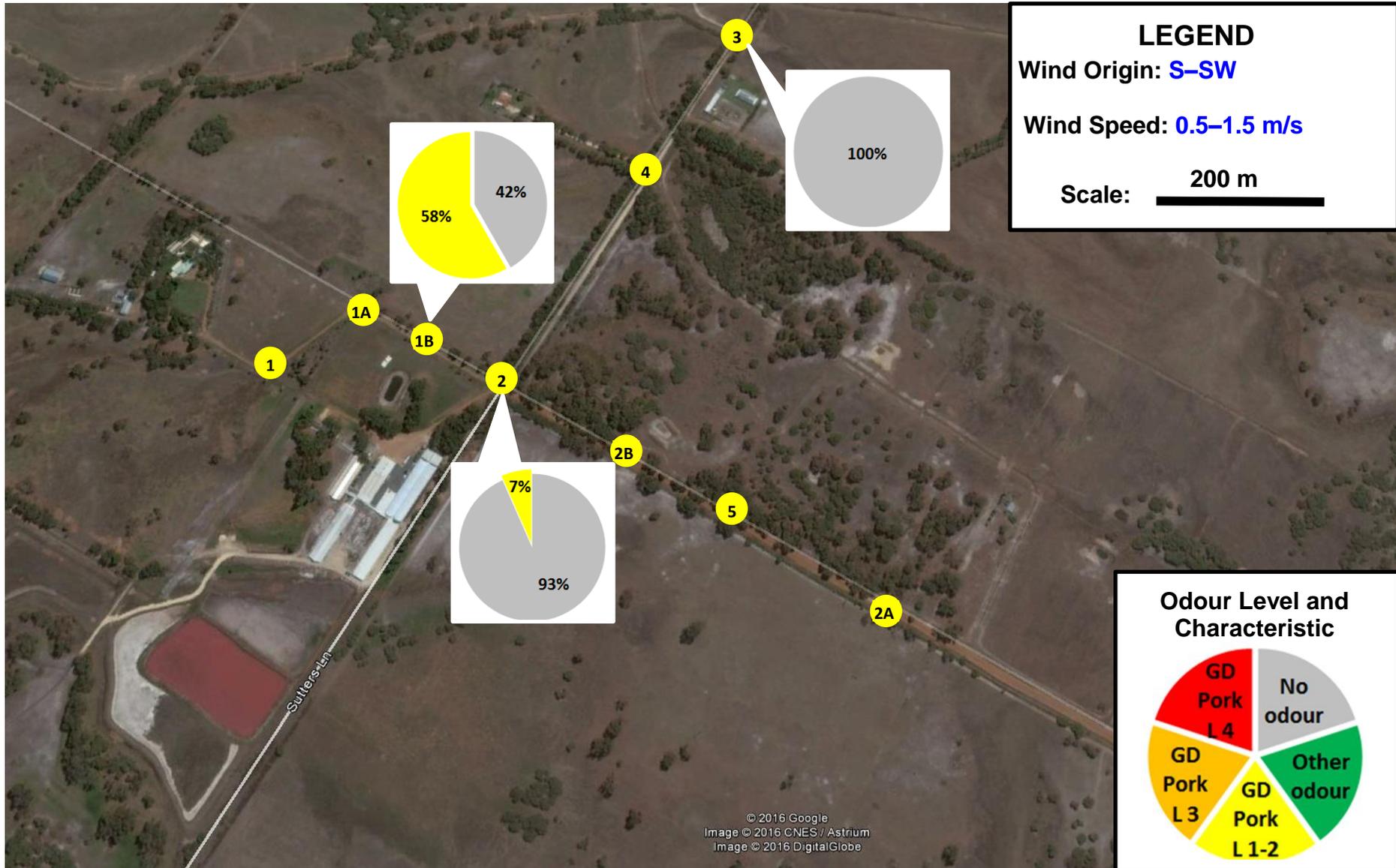
Survey 4: 21 October 2015 – Single measurement 5 (6.05pm–6.15pm)



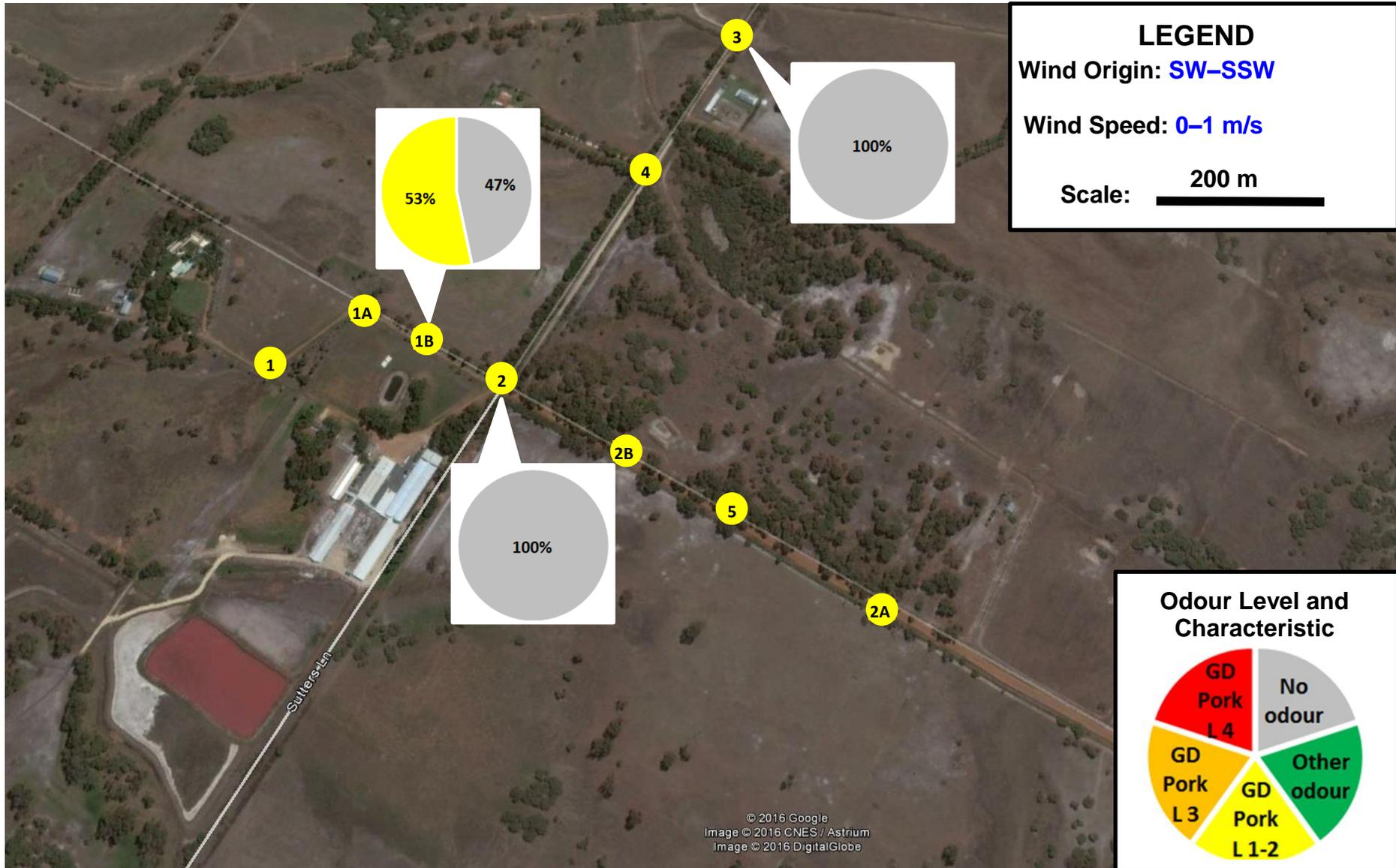
Survey 4: 21 October 2015 – Single measurement 6 (6.25pm–6.35pm)



Survey 4: 21 October 2015 – Single measurement 7 (7.10pm–7.20pm)

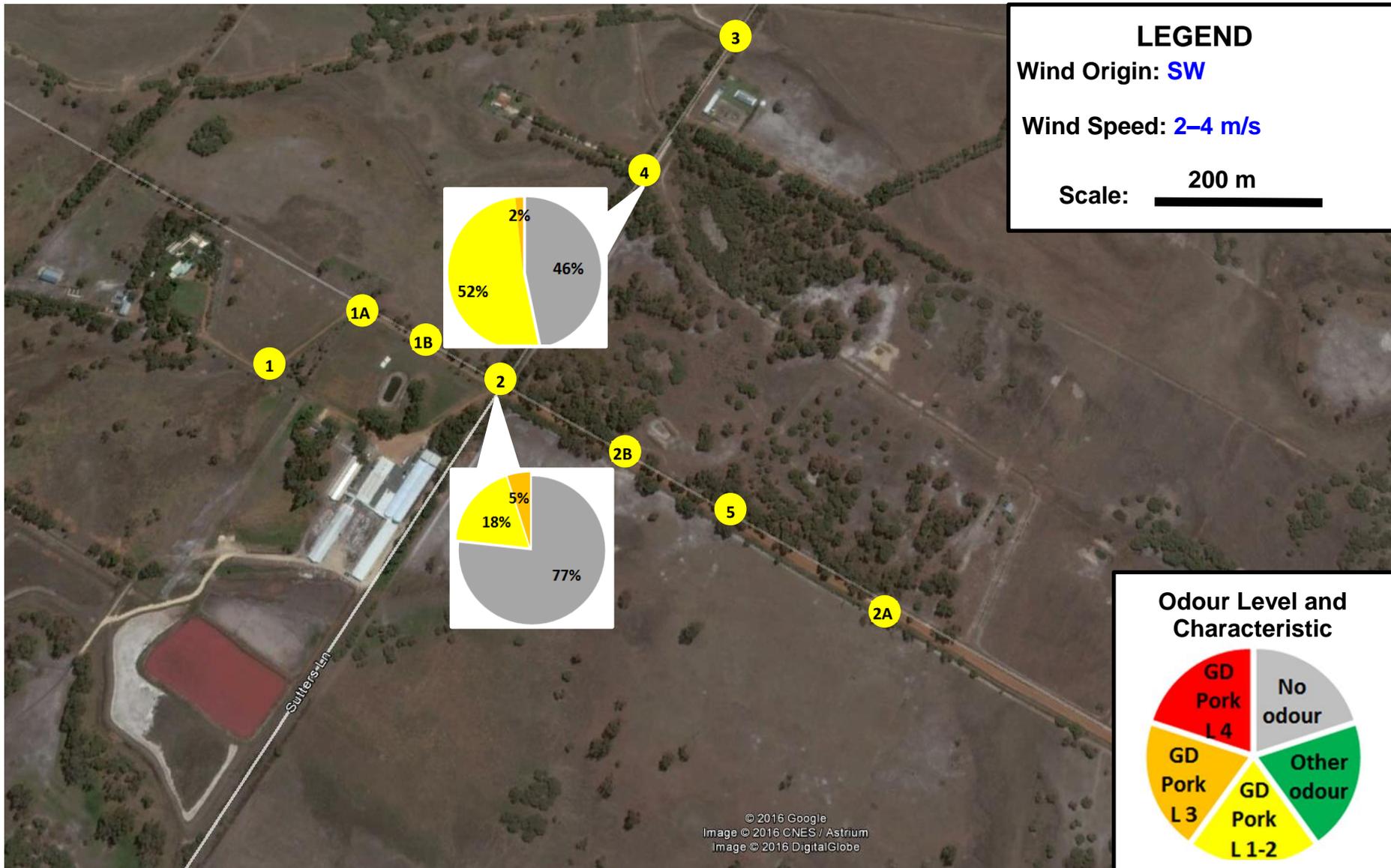


Survey 4: 21 October 2015 – Single measurement 8 (7.30pm–7.40pm)

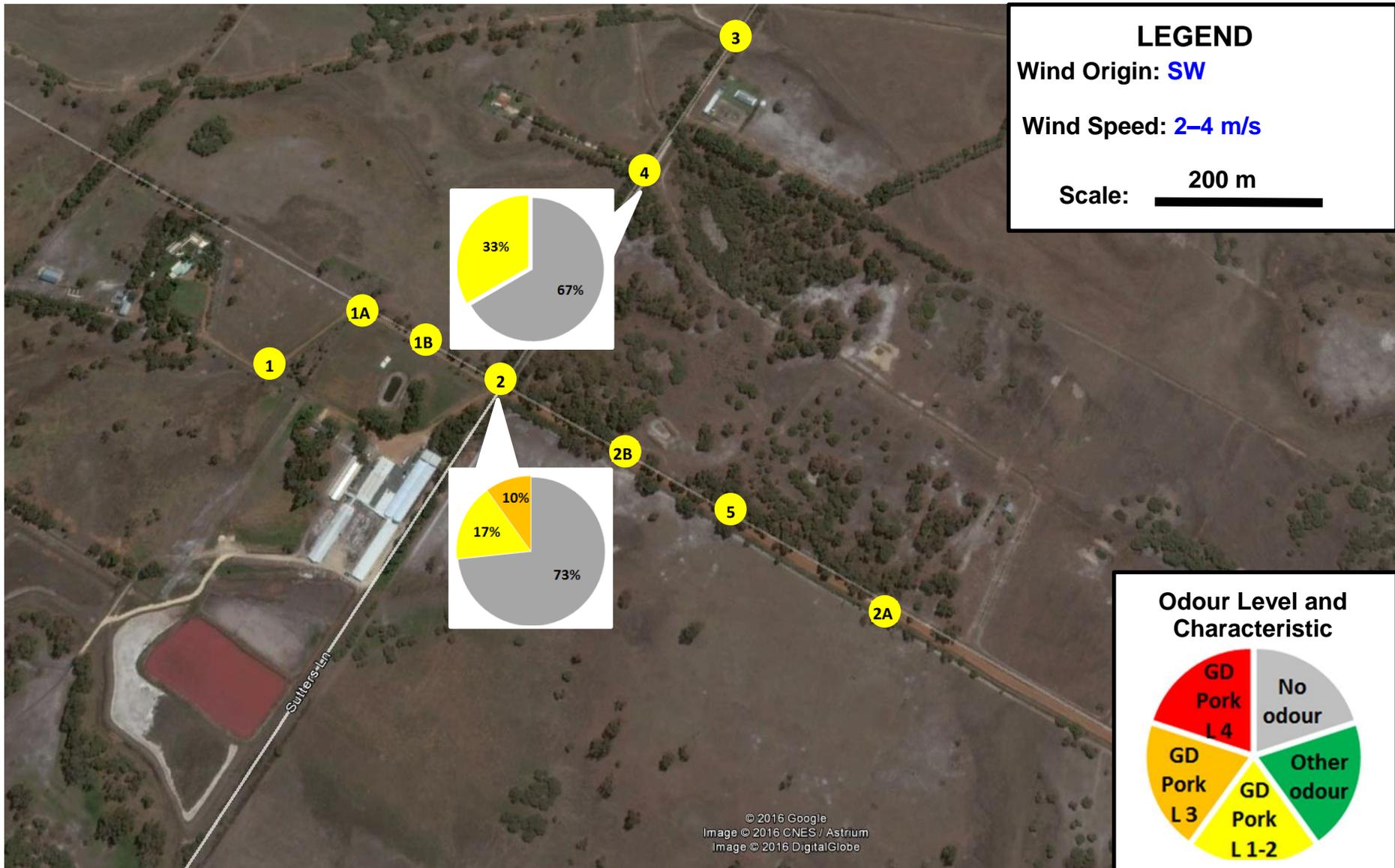


## Appendix G – Maps With Measurements of Survey 5: 11 November 2015

Survey 5: 11 November 2015 – Single measurement **1** (5pm–5.10pm)



Survey 5: 11 November 2015 – Single measurement **2** (5.15pm–5.25pm)



Survey 5: 11 November 2015 – Single measurement **3** (5.30pm–5.40pm)

