Western Sydney Regional Odour Assessment

Prepared for the NSW Environment Protection Authority

Eastern Creek, Kemps Creek & Erskine Park, NSW

Volume 1 - Main Report

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1 INTRODUCTION

In August 2012, NSW Environment Protection Authority (NSW EPA) engaged The Odour Unit Pty Ltd (TOU) to conduct a baseline regional odour assessment covering the Eastern Creek, Erskine Park and Kemps Creek Precincts of Western Sydney. The request for this assessment was in response to community odour complaints and concerns in recent times regarding the level of odours suspected to be originating from the activities undertaken at ten waste management and composting facilities (the facilities) within these Precincts. The facilities covered in this assessment included:

- Eastern Creek Precinct:
  - Global Renewables Resource Recovery Facility (UR-3R Facility);
  - Australian Native Landscapes (Eastern Creek);
  - Waste Assets Management Corporation (WAMC) Landfill; and
  - Veolia Environmental Services (Horsley Park) Landfill.
- Kemps Creek Precinct:
  - SITA SAWT Facility (Kemps Creek Landfill);
  - Australian Native Landscapes (Badgerys Creek);
  - Brandown Resource Recycling Facility and Landfill; and
  - NSW Investments Landfill.
- Erskine Park Precinct (includes St Clair, Colyton and Minchinbury areas):
  - Dial-a-dump (Genesis) Landfill; and
  - Transpacific Industries Landfill (Enviroguard).

The assessment commenced by the undertaking of a reconnaissance visit to all the facilities on 30 August 2012 by TOU assessors, in order to become familiar with the on-site processes and evaluating the potential odours that could be generated at the facilities. The reconnaissance visit was followed by a series of Field Ambient Odour Assessment (FAOA) surveys over a two week period, namely 3 - 12 September 2012, covering morning, afternoon and evening periods.

The objective of the FAOA surveys was to develop a baseline assessment and evaluate the extent of odour detectable beyond the site boundary of the facilities that

have the potential to adversely impact on sensitive receptors. The techniques employed in the surveys were able to quantify and / or qualify the odour intensity, odour character, extent of odour plume and the likely source of odours detected near and far-field from the facilities. TOU understands that NSW EPA will use the information generated in this assessment in ongoing community and industry consultation, and to assist in prioritising odour mitigation efforts at those facilities where the need for improvement is identified. The results presented in this study reflect the state of the facilities during the undertaking of the FAOA surveys, and it should not be presumed that they would prevail under similar conditions at any other time.

The following odour assessment report summarises the results from the FAOA surveys conducted at the facilities in the Eastern Creek, Erskine Park and Kemps Creek Precincts of Western Sydney.

2 ASSESSMENT PHILOSOPHY

2.1 ASSESSMENT PROGRAMME

The project was divided into eight major components as follows:

1. Preliminary review of complaints history logged by the NSW EPA and any relevant background material to the assessment that assisted in the undertaking of the FAOA surveys;
2. Reconnaissance visit on 30 August 2012 by TOU assessors in order to become familiar with on-site processes and the potential odours that could be generated at the facilities;
3. Undertaking of FAOA Surveys between 3 – 12 September 2012;
4. Local Media field briefing on 10 September 2012 by NSW EPA and Terry Schulz
5. Preliminary data entry and analysis;
6. Licensee consultation meeting on 17 September 2012 to discuss preliminary results;
7. Community consultation meeting on 20 September 2012 to discuss preliminary results; and
8. Final data entry and analysis plus reporting.

The schedule for the project has been summarised in **Table 2.1**. In total, 11 surveys were carried out over the survey assessment period.

Table 2.1 – Assessment programme August 2012 - January 2013			
Date	**FAOA Survey No.**	**Time (hrs)**	**Assessors**
30 August	Reconnaissance visit by TOU assessors		
3 September	1	0600 – 1200	Team 1
	2	1700 - 0000	Teams 2 & 3
4 September	3	0600 – 1300	Team 1
	4	1630 - 2330	Teams 2 & 3
5 September	5	0600 – 1310	Team 1
	6	1700 - 2200	Teams 2 & 3
6 September	7	0600 – 1200	Team 1
	8	1700 – 2300	Teams 2 & 3
10 September	Local Media briefing by NSW EPA and Terry Schulz		
10 September	9	1900 - 0000	Team 1, 2 & 3
11 September	10	1900 - 0015	Team 1, 2 & 3
12 September	11	1330 – 1830	Team 1, 2 & 3
17 September 2012	Licensee consultation meeting		
20 September 2012	Community consultation meeting		
October 2012 – January 2013	Reporting		

2.2 WASTE MANAGEMENT AND COMPOSTING FACILITIES

2.2.1 Locations

The facilities that were assessed are spread over a large geographical area in the Eastern Creek, Kemps Creek and Erskine Park Precincts. **Figure 2.1** below illustrates the nominal location of the facilities at these Precincts.

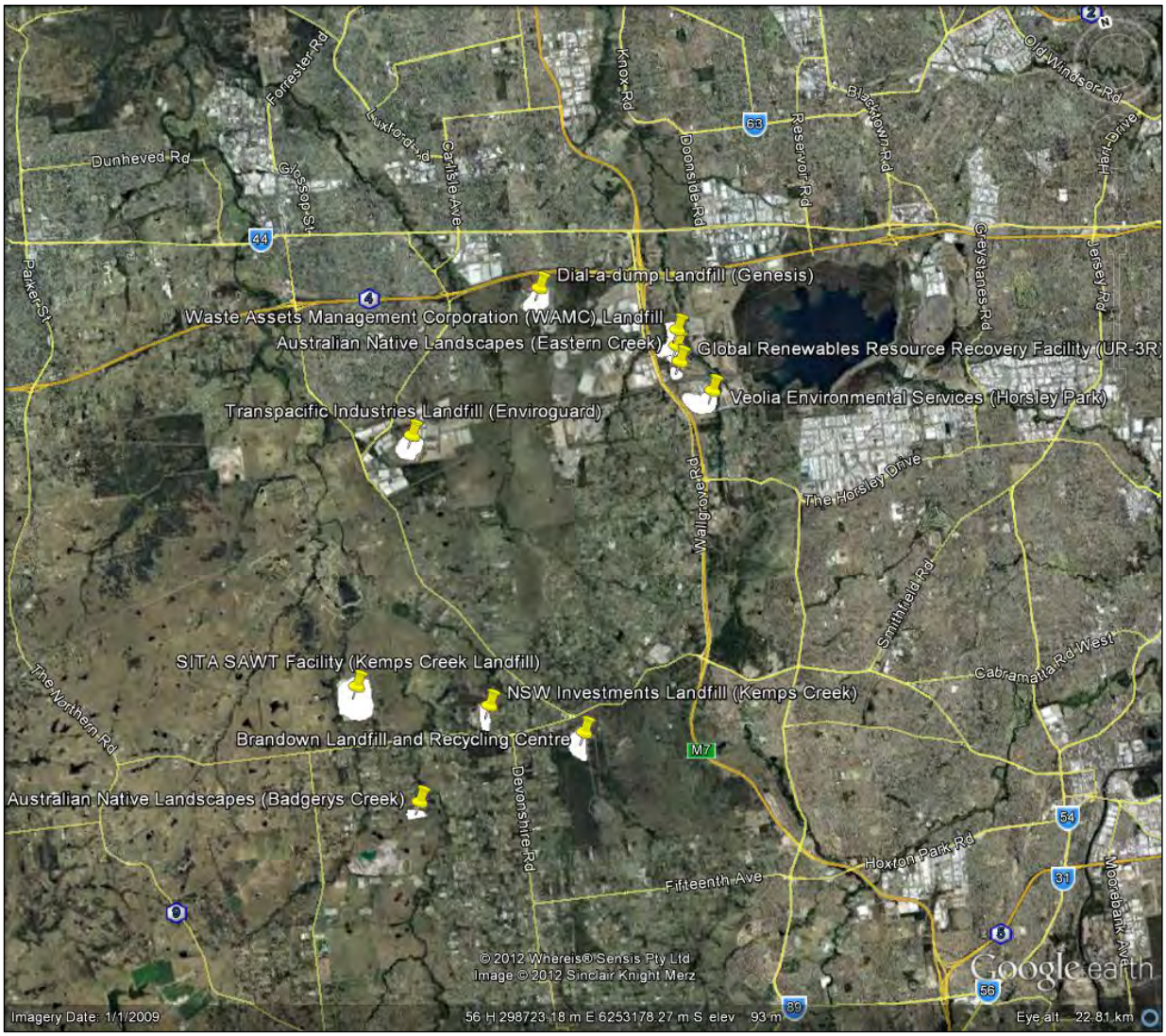

Figure 2.1 –Overview Map: Western Sydney Waste & Composting Facilities

(Map source: Google Earth Maps)

2.2.2 Principal operations

The principal activities that occur at the facilities are briefly described below in **Table 2.2.**

Table 2.2 – Principal activities at the facilities to date (October 2012)

Facility	Principal Activities
Eastern Creek Precinct	
Global Renewables Resource Recovery Facility (UR-3R Facility)	Solid waste (putrescible and non-putrescible) receival, processing and composting
Australian Native Landscapes (Eastern Creek)	Composting and organic materials handling
Waste Assets Management Corporation (WAMC) Landfill	Solid waste (putrescible) landfill with bioreactor capabilities for electricity generation
Veolia Environmental Services (Horsley Park) Landfill	Non-putrescible Landfill with bioreactor capabilities for electricity generation
Kemps Creek Precinct	
SITA SAWT Facility (Kemps Creek Landfill)	Solid waste (putrescible and non-putrescible) receival, processing and composting
Australian Native Landscapes (Badgerys Creek)	Composting and organic materials handling
Brandown Resource Recycling Facility and Landfill	Waste (non-putrescible) landfill and material recycling
NSW Investments Landfill (Kemps Creek)	Non-putrescible Landfill
Erskine Park Precinct	
Dial-a-dump Genesis Xero Waste Facility	Not in operation. To be a recycling and landfill based facility
Transpacific Industries Landfill (Enviroguard)	Non-putrescible Landfill

2.3 COMPLAINTS HISTORY

The complaints history can provide valuable information about the odours being experienced by the complainants. For the purposes of this study, complaints were used as a means of mapping locations where incidences of odour complaints had been logged, in order to ensure that the coverage of the surveys addressed those areas experiencing adverse odour impact. According to data supplied by NSW EPA, there have been over 400 formal odour complaints logged between November 2011 and August 2012 within the Eastern Creek, Kemps Creek and Erskine Park Precincts. **Figure 2.2** illustrates the coverage of formal complaints logged to the NSW EPA EnviroLine Department Service. The colour-coding of each complaint point in **Table 2.3** below refers to the complainant's opinion on the source of the odour/s detected.

Table 2.3 – Colour scheme for logged odour complaints

Label Colour	Source
Blue	SITA Eastern Creek ^
Light blue	Genesis Dial-A-Dump
Green	Erskine Park Landfill
Yellow	SITA Kemps Creek
Red	Australian Native Landscapes
White	No source given
^ presumably referring to the Waste Assets Management Corporation Landfill	

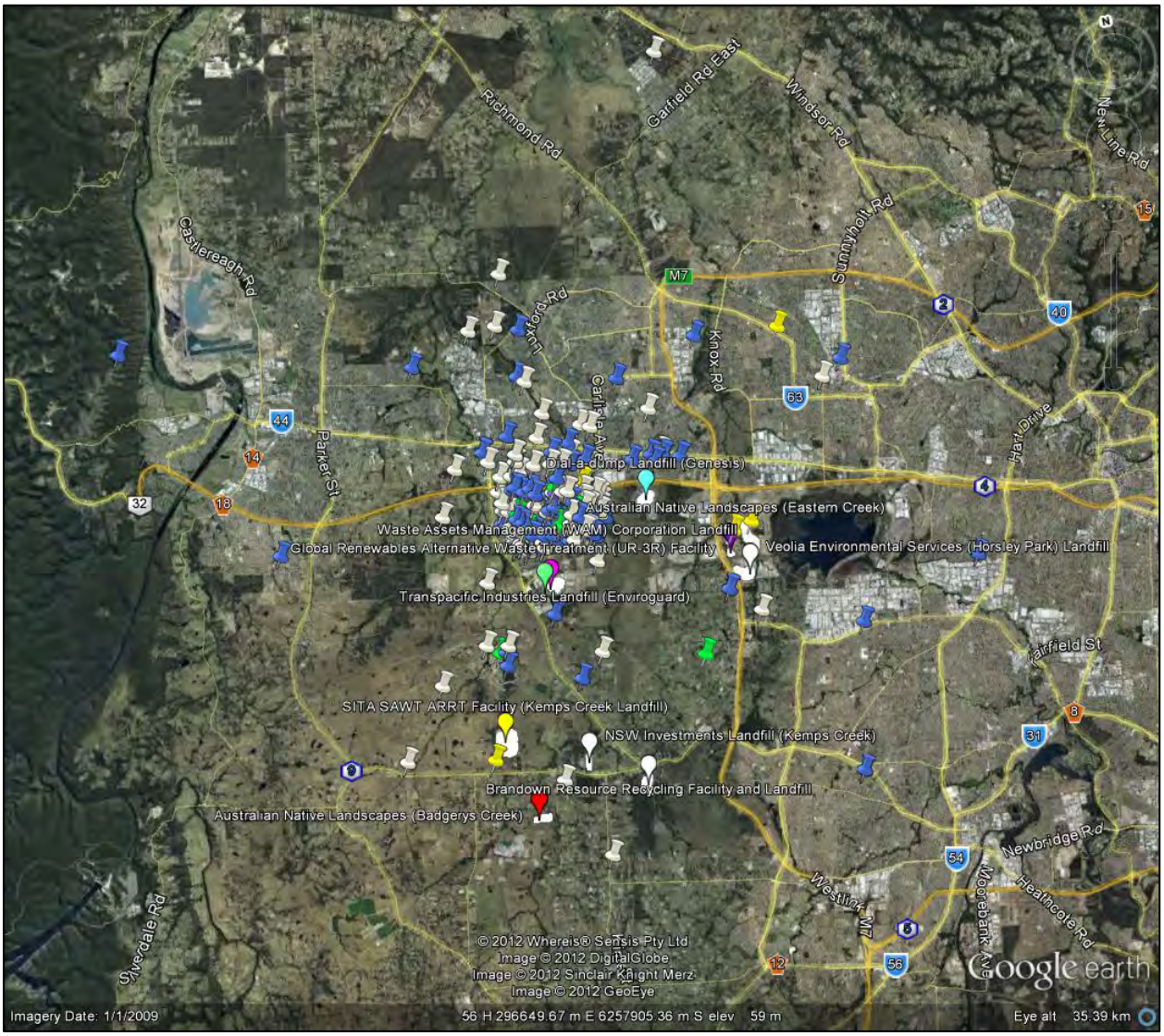

Figure 2.2- Odour Complaints November 2011 to August 2012
(Map source: Google Earth Maps)

3 FIELD AMBIENT ODOUR ASSESSMENT METHODOLOGY

Given the large geographical coverage in which the assessment had to span (see **Section 2: Figure 2.1**), the surveys were conducted by three teams, with each team consisting of two odour assessors. Each odour assessor was fully calibrated and trained, with between 1 and 10 years of experience. Initially, each team was directed to carry out a survey in either the morning, afternoon or evening periods, with each covering a different area. The first four morning surveys were carried out by one team, with the late afternoon / evening surveys carried out by the other two teams. This technique was modified after the first week of assessments, such that all three teams conducted evening surveys simultaneously across the entire assessment area. Based on complaint data, the most frequent time complaints are lodged in the evenings. In an effort to coincide the surveys with stronger wind conditions an afternoon session was carried out on the final day of the fieldwork (see **Assessment program Section 2: Table 2.1**).

The following section details the FAOA survey methodology utilised for this assessment.

3.1 PREAMBLE

The undertaking of a FAOA survey by TOU is based on the German Standard VDI 3940 *"Measurement of Odour Impact by Field Inspection".* This standard prescribes the methods by which field technicians (assessors) determine, define and document observed ground level odours and the manner in which the determination of these odours is defined in relation to odour character, frequency of odours observed and the odour intensity of those individual observations as a quantitative scale of measure.

With this method, a panel of calibrated and experienced assessors conduct a single measurement(s) at discrete measurement points (a grid defined within the surveyed odour plume) within a pre-determined assessment area downwind of the odour source(s). For this assessment, the Eastern Creek, Kemps Creek and Erskine Park Precincts where divided into 8 separate (but conjoined) map areas. These map areas

and corresponding grid reference points were used as map templates to guide the assessors strategically upwind and downwind of the facilities, according to the prevailing wind condition at the time of undertaking the survey. Put simply, each assessment area was selected on the basis of the prevailing wind condition as it related to the odour source being assessed.

Figures 3.1-3.8 present the map templates for each assessment area and highlight the facilities existing within that region.

3.2 FAOA SURVEYS OBJECTIVE

In general, the objective of a survey was to determine the 'decay' or loss of intensity of odours observed downwind of the odour source/s, thus defining the actual odour impact and the impact range. Within the impact range the magnitude of the potential odour impact can be defined by determining the maximum distance at which the clearly recognisable odour is detectable. It is important to understand that it was not necessary for the odour to be present at problematic odour levels at either the assessment point or in neighbouring residential areas during the surveys for the assessment procedure to be successful, since the primary objective of the project was to identify those waste facilities with the potential to be a cause of a portion of the odour complaints received. As it happened, the relatively light winds encountered during the surveys resulted in clear indications of air and odour movement from several facilities into the community, due to the sensitivity of the assessment methodology, and despite a general finding of relatively low levels of waste-based odour beyond the plant boundaries. It is reasonable to qualitatively extrapolate survey findings under light wind conditions to winds of stronger intensity, as it is to project what is likely to happen if odour emission rates from the waste facility sources were to be greater than those prevailing during the survey period.

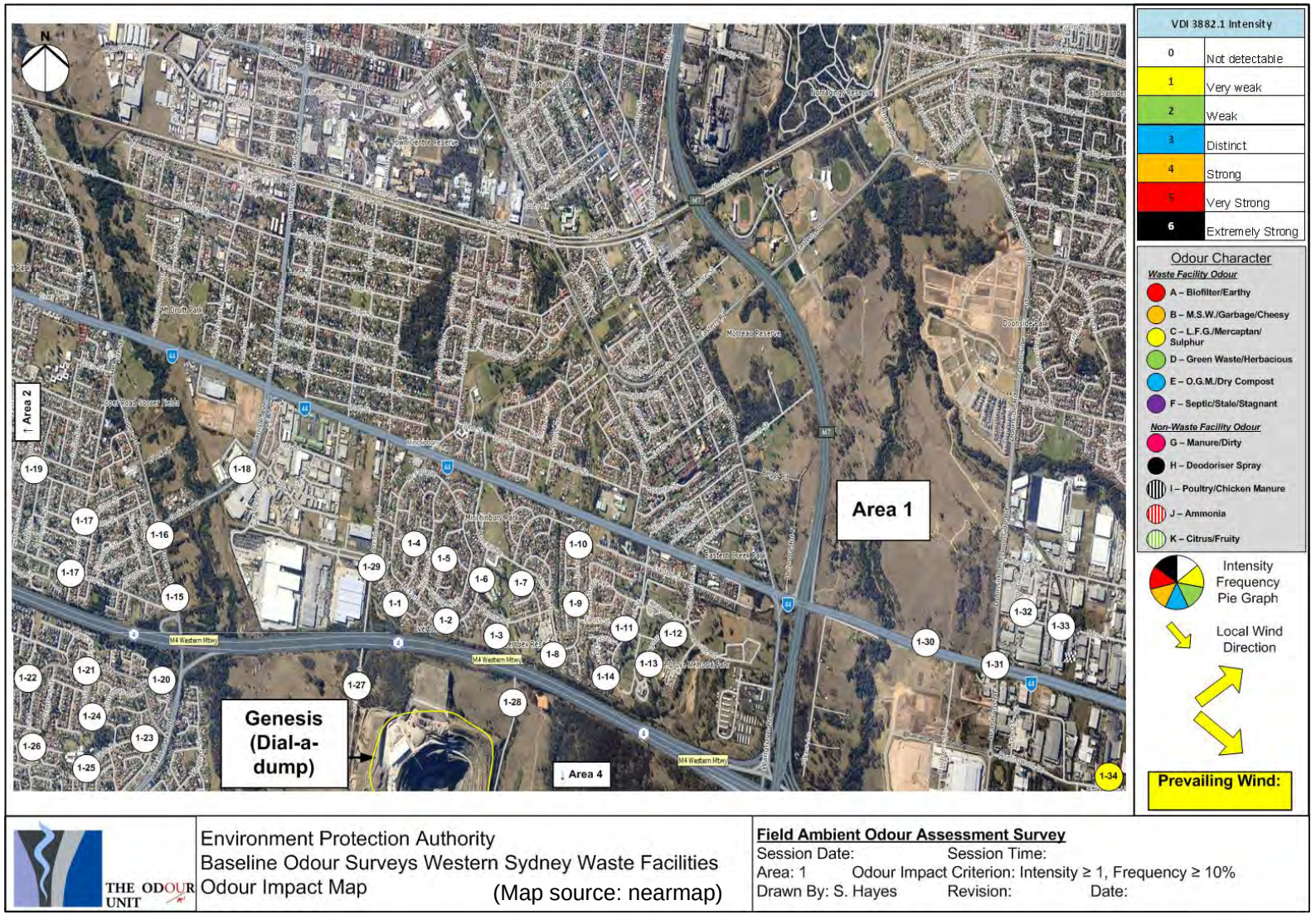

Figure 3.1 – Area 1 FAOA Survey Map Template

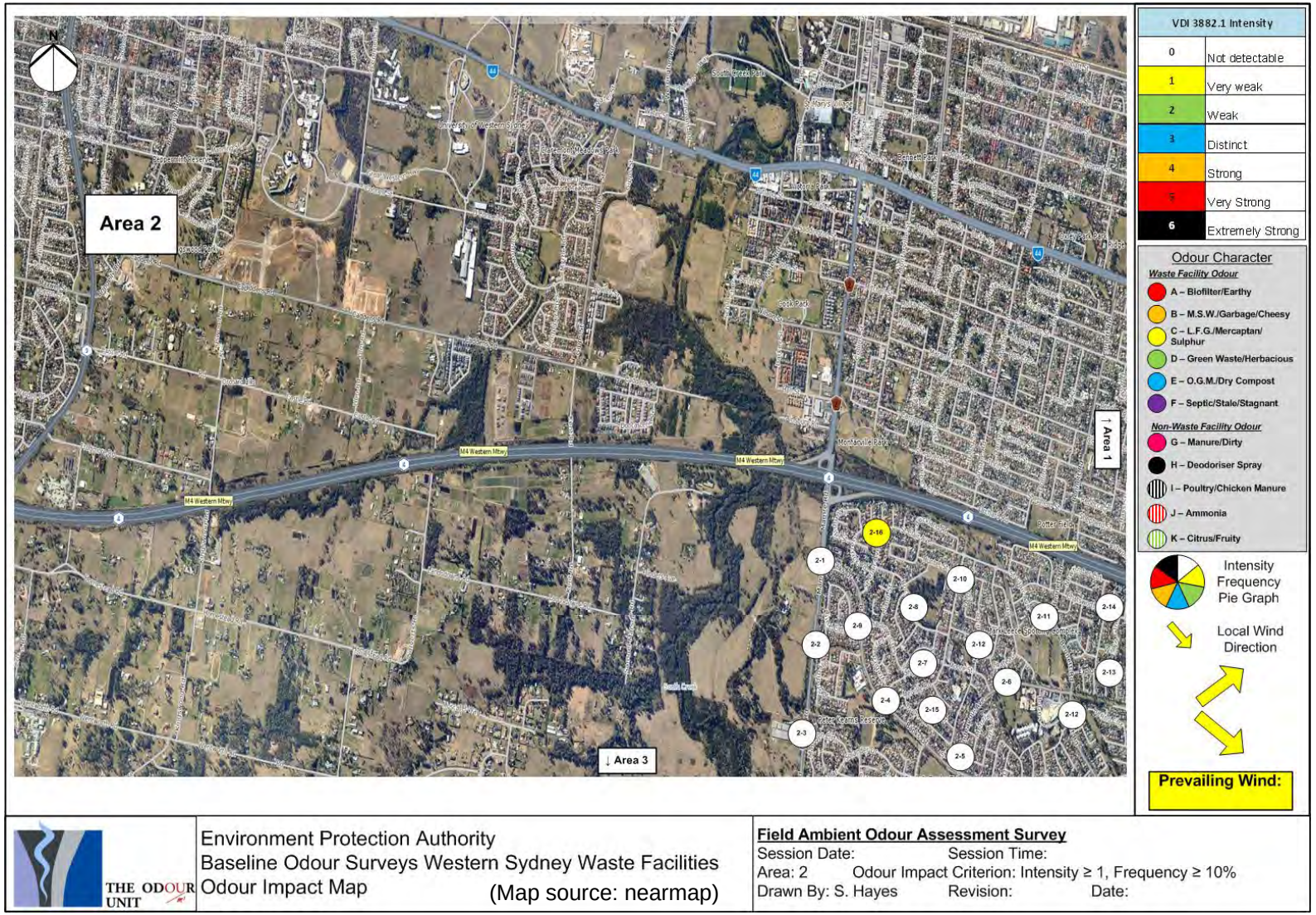

Figure 3.2 – Area 2 FAOA Survey Map Template

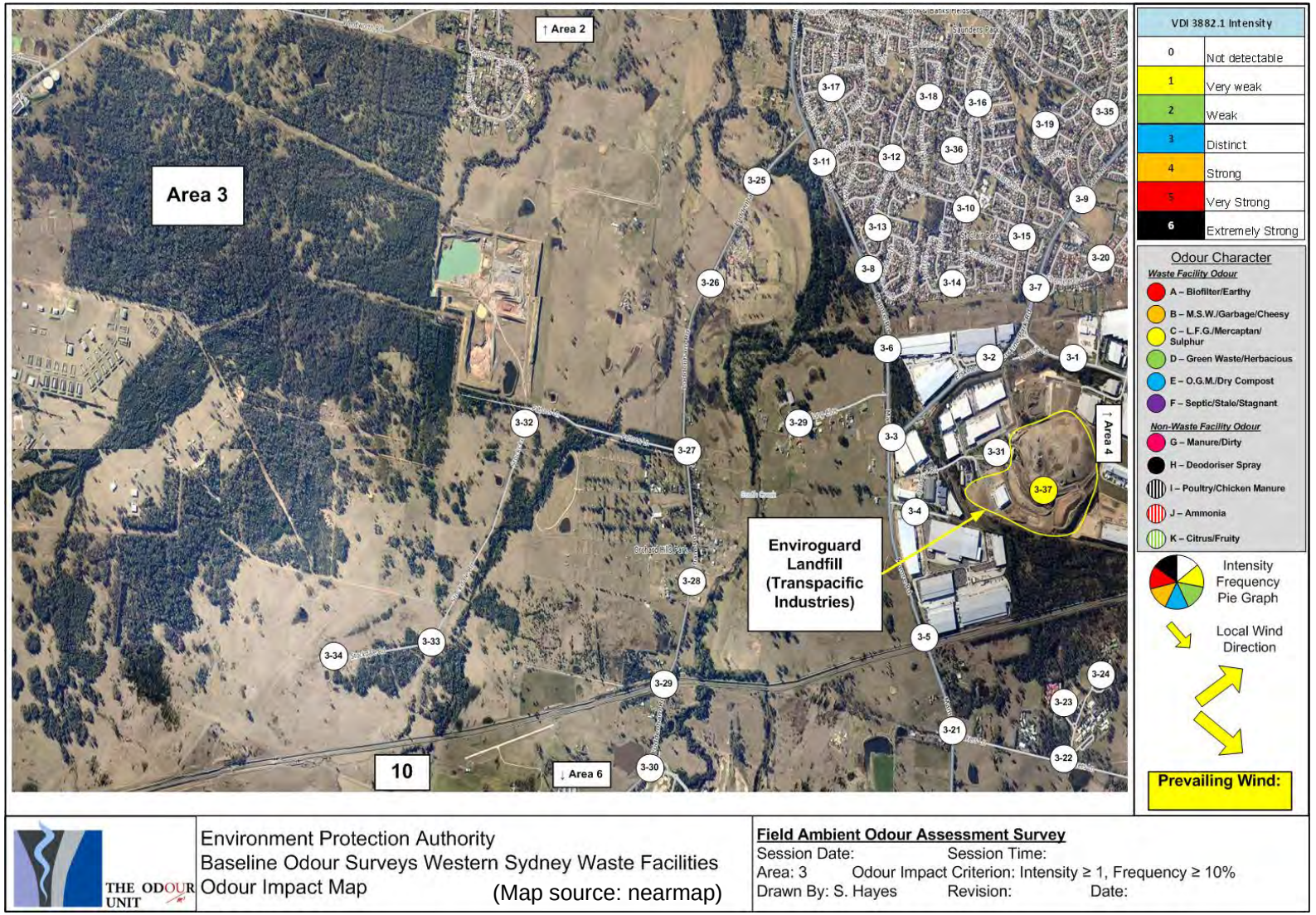

Figure 3.3 – Area 3 FAOA Survey Map Template

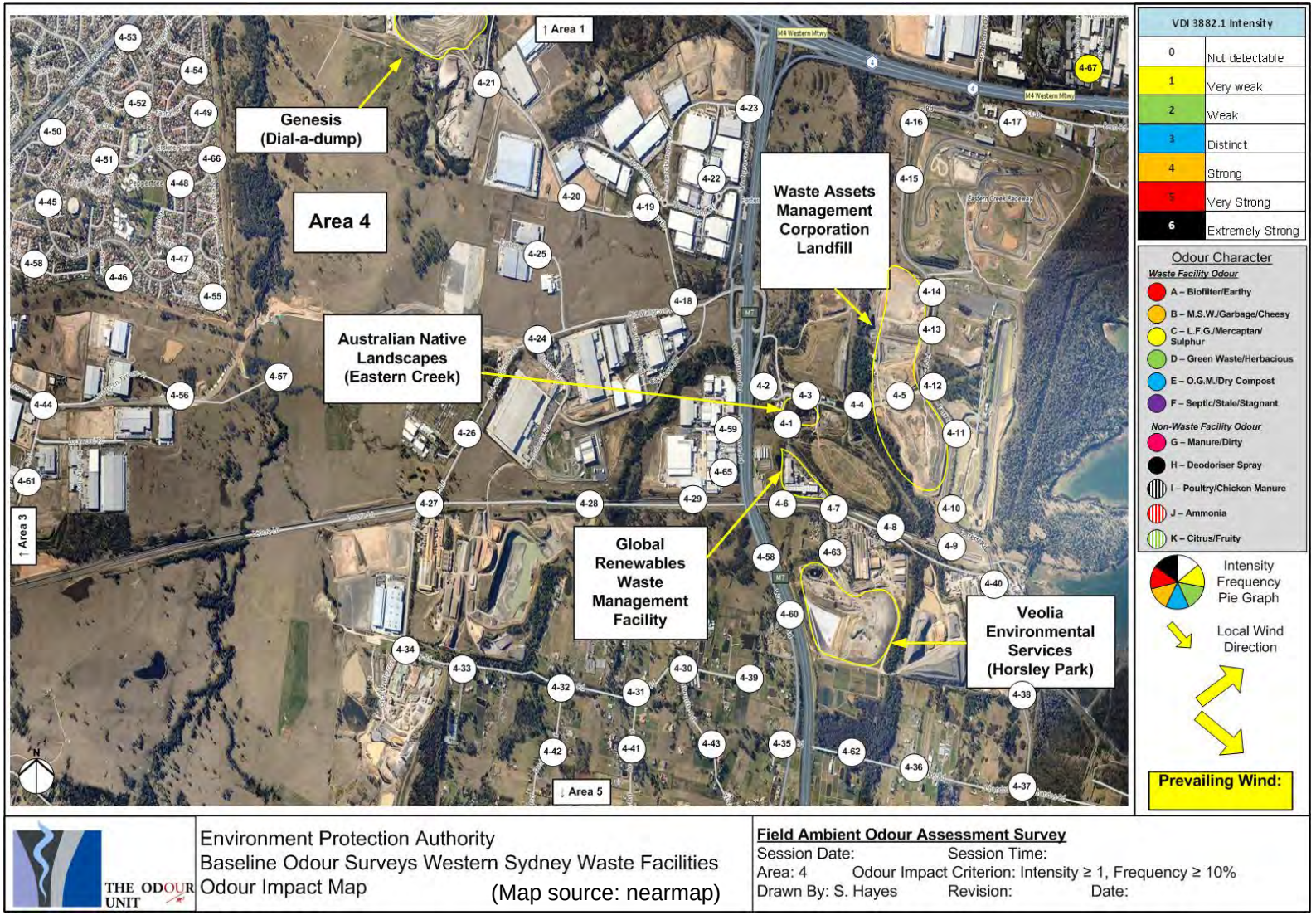

Figure 3.4 – Area 4 FAOA Survey Map Template

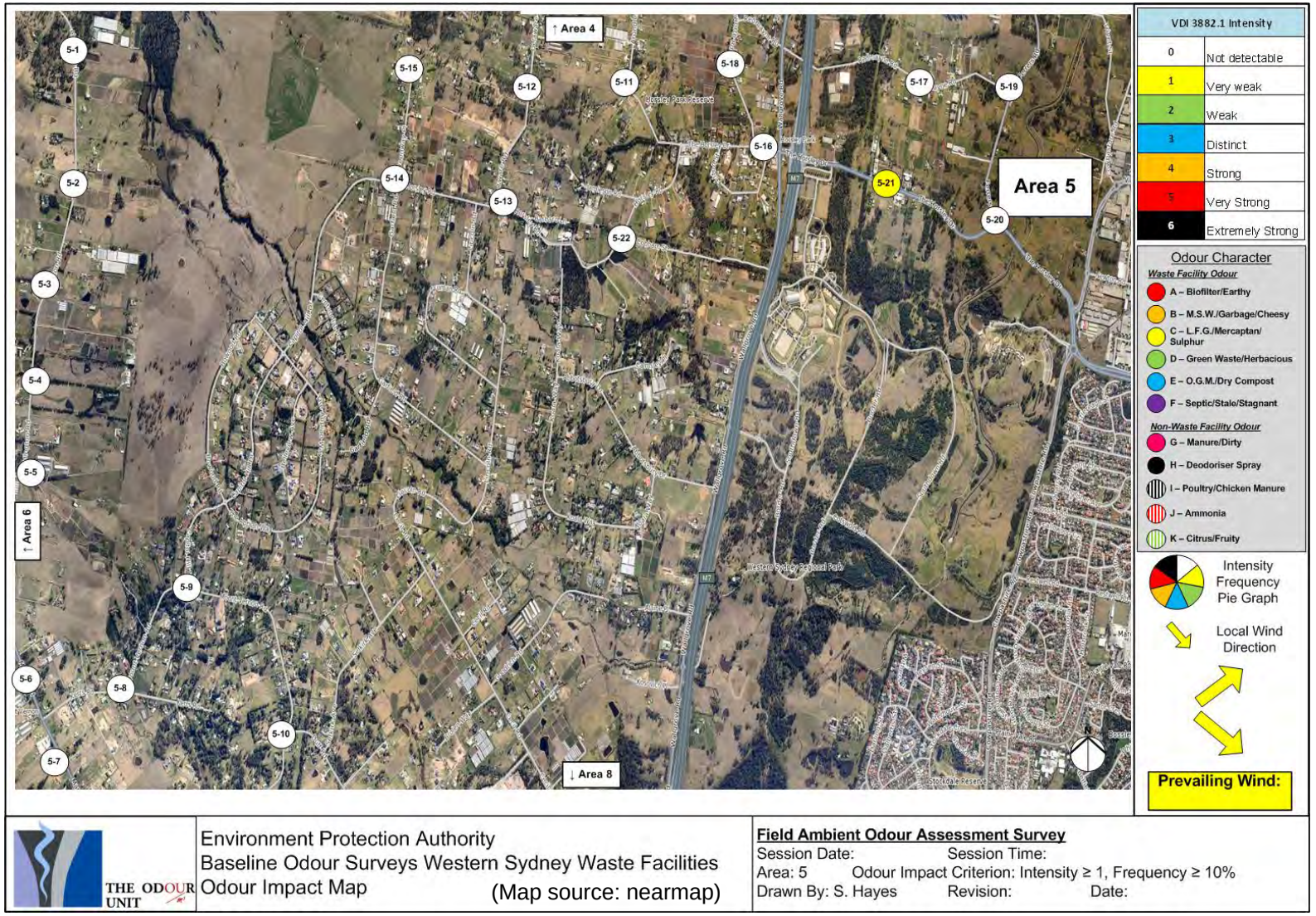

Figure 3.5 – Area 5 FAOA Survey Map Template

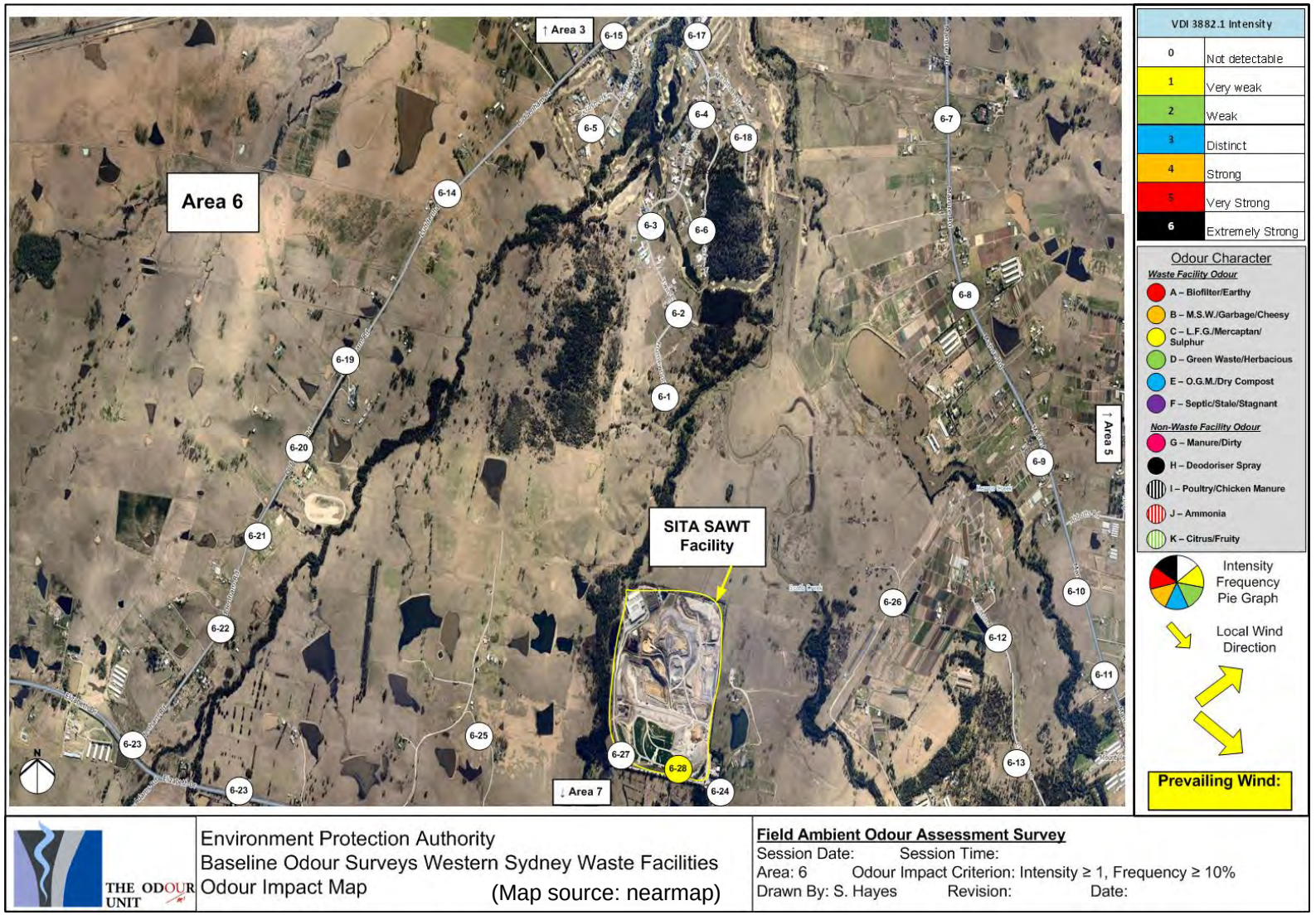

Figure 3.6 – Area 6 FAOA Survey Map Template

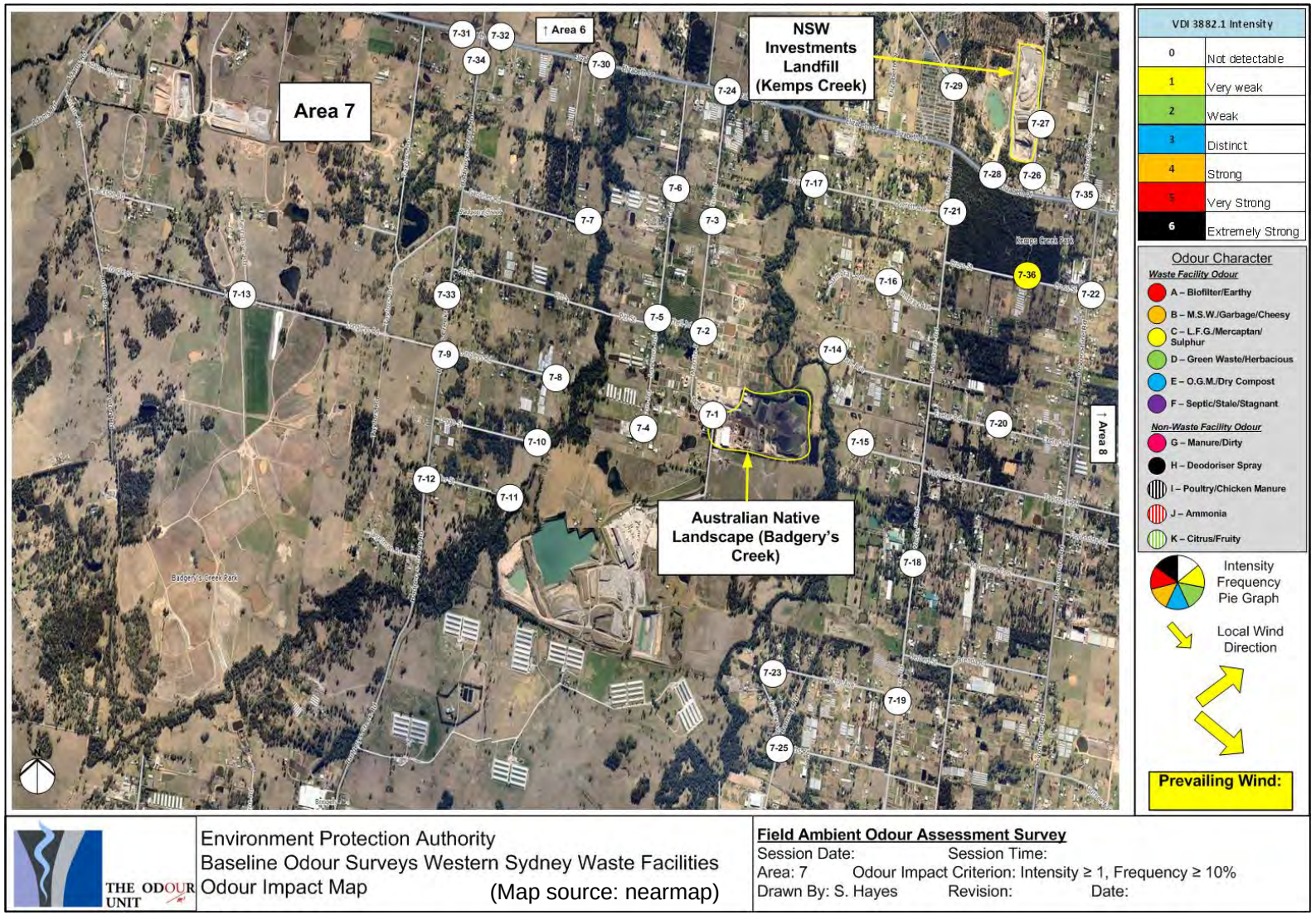

Figure 3.7 – Area 7 FAOA Survey Map Template

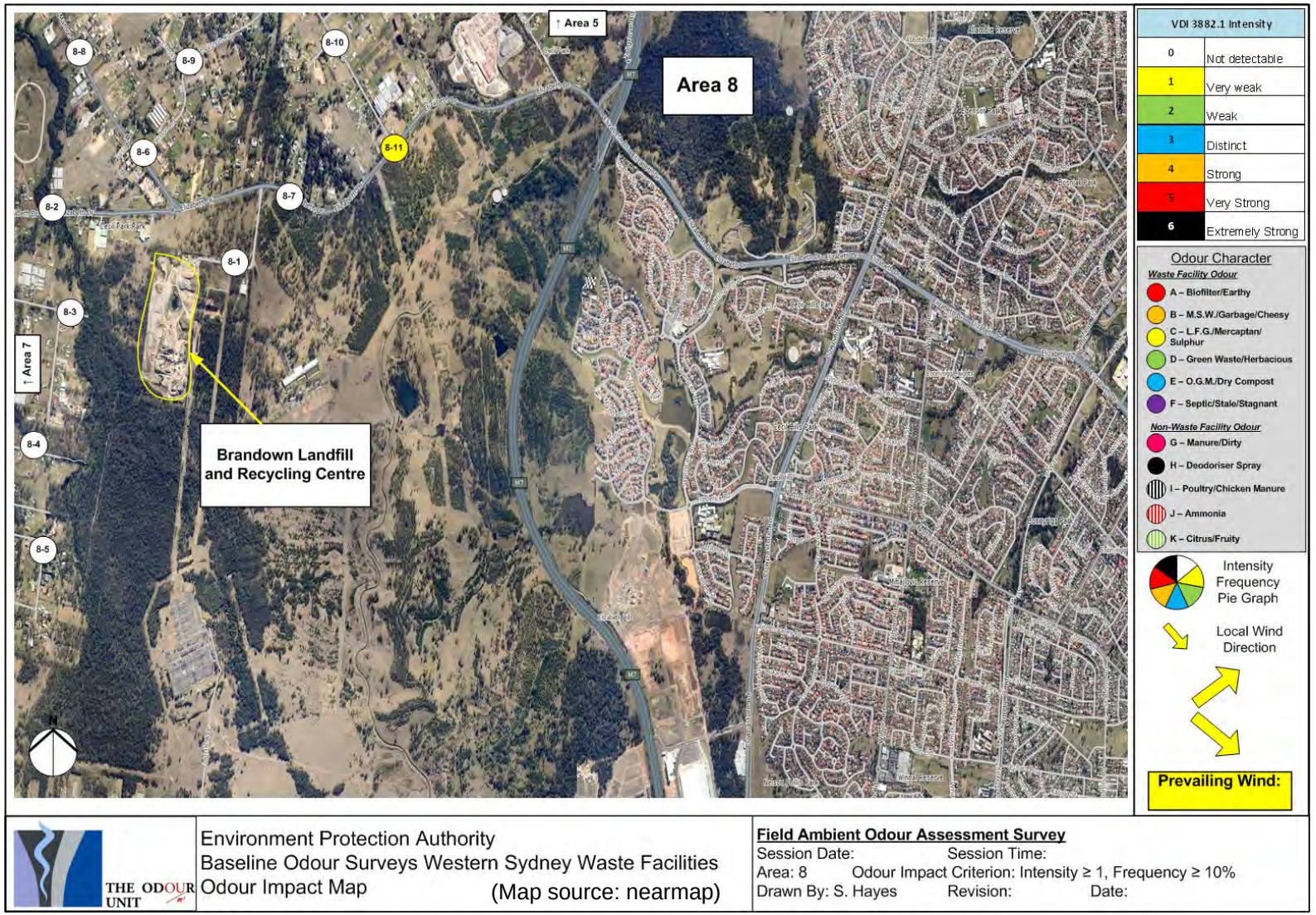

Figure 3.8 – Area 8 FAOA Survey Map Template

3.3 FAOA SURVEY MEASUREMENTS METHODOLOGY

Each measurement cycle comprised 60 individual 'grab' assessments of odour every 10 seconds for a single measurement cycle of 10 minutes. When plotted each grab measurement resulted in a single data point. Where no odours were detectable within 5 minutes of the assessment, the measurement cycle was truncated to 30 grab measurements over the 5-minute period. This truncation was necessary to cover a reasonable amount of ground, given the extent of survey coverage, and focus mainly on those locations where odour was most likely to be prevalent.

By its nature, a FAOA survey result comprises the individual discrete assessment results for each assessor at each location tested, as well as the combined results for each member of the three teams of two, across the selected assessment area. This technique generated a large database of results; in this case approximately 30,000 individual 'sniffs' by the assessors.

Overall, each survey utilised a panel of six assessors, divided in teams of two, with each assessor undertaking 6-15 single measurement sets over the assessment areas. Given the size of the raw data set for this project it was determined that the data would best be interpreted by a visual-based method whereby each team assessment finding would be plotted and colour-coded over an aerial photo of the assessment area.

For every single measurement the panel assesses the presence, character and intensity of any observed odours, and records the prevailing wind direction and speed. Each survey was designed to collect a multitude of single measurements per measurement day, over a 5-6 hour period, and interpret those results in an easily-understood manner.

The study was less about finding adverse odour impacts and more about determining the source of odours present in the community.

An example of how the results are presented in this assessment is shown in **Figure 3.9**; which represents survey results on the evening of 4 September 2012 at Assessment Area 4 between 1630hrs to 2330hrs. In this instance, the survey was conducted by recording 2 single measurement sets (i.e. 1 per assessor) at 11 discrete measurement points within the assessment area. The outcome of that survey provided a dataset of 22 single measurement sets over the assessment area on that measurement day. For each measurement point, the odour intensity, character and likely source was determined.

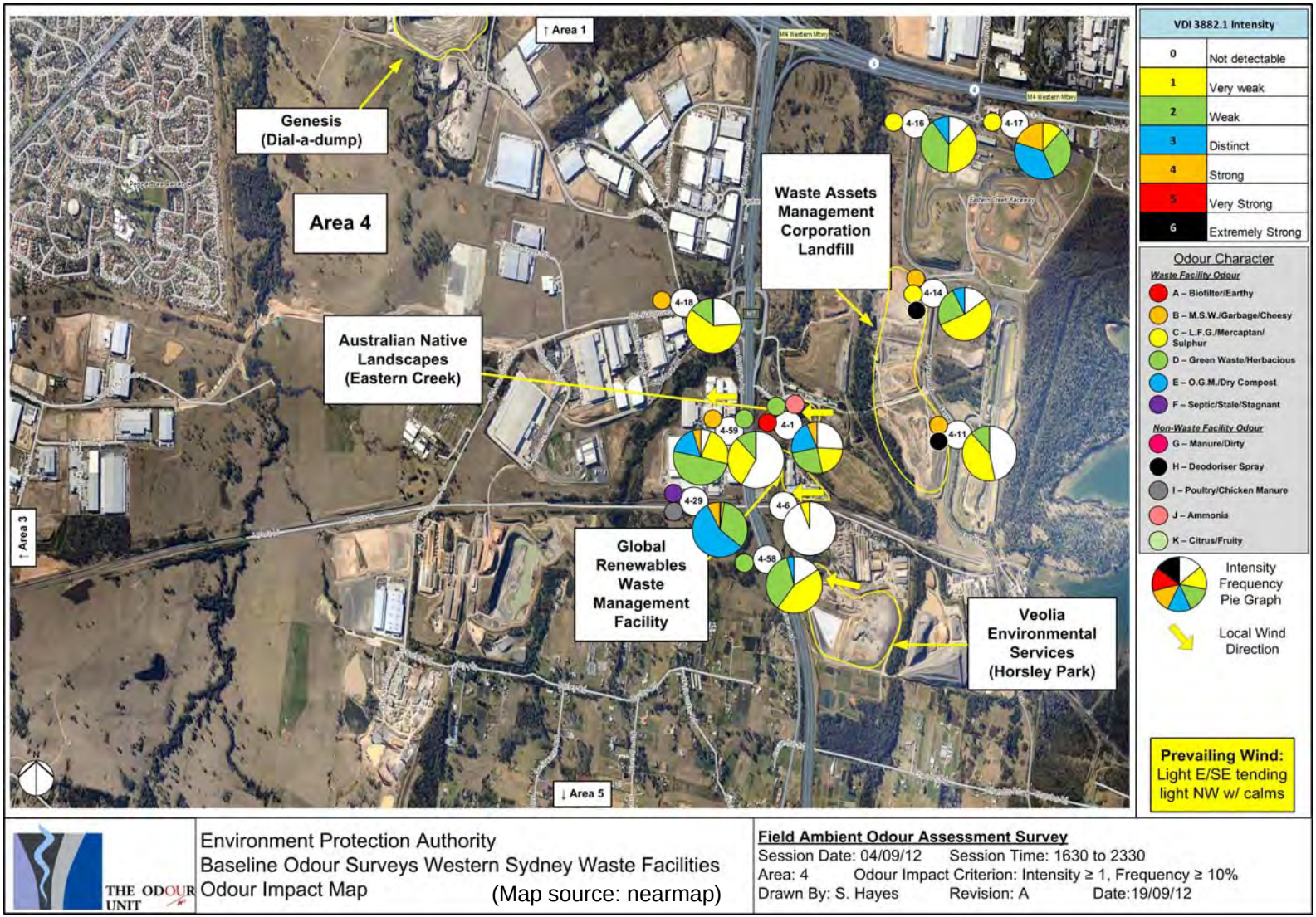

Figure 3.9 – An example of a survey map plot result showing 11 discrete measurements in Assessment Area 4

3.4 SURVEYS ASSESSMENT PERIOD

The surveys periods were selected after consultation with the NSW EPA. This resulted in the need to complete the field work for the project in a relatively short period of time, prior to the planned second public meeting in late September 2012. As a result the surveys were carried out from 3 - 12 September 2012.

3.5 SURVEYS METEOROLOGICAL CONDITIONS

Ideally, FAOA surveys should be carried out over a range of meteorological conditions, from near-calm to moderate to strong wind speeds, and under differing wind directions. The result of each FAOA survey would then determine the impact range within that assessment area for that survey, and the overall finding represent a broader picture of possible adverse odour impacts.

Unfortunately, the relatively short duration of the project coincided with a relatively narrow range of wind speeds, although there was a reasonable range of wind directions available for assessment. The findings of this project are therefore restricted to the wind and weather conditions prevailing at the time of the assessment, and the nature and condition of the various processes and activities carried out at each of the ten waste facilities under investigation.

3.6 FAOA ODOUR KEY DESCRIPTORS

The odour sources at the facilities have their origins from the processes occurring at each individual facility. Based on TOU's experience, the reconnaissance visit and early FAOA fieldwork, key odour descriptors were allocated, as shown **Figure 3.10.**

The odour characters were divided into two categories, namely:

1. **Waste facility odour:** odour likely to be generated from the facilities; and
2. **Non-waste facility odour:** odour generated from other non-waste facility based sources such as poultry farms, piggeries, animal manures, and

deodoriser sprays (used along the boundary fences on some of the waste facilities).

NB: MSW = Municipal Solid Waste, **LFG =** Landfill Gas, **OGM =** Organic Growth Medium. It is a specific odour stemming from the Global Renewables Facility only

Figure 3.10 – Key odour descriptors used for the Western Sydney Regional Odour Assessment

The definition for each odour character presented in **Figure 3.10** is as follows:

- **A = Biofilter / Earthy:** refers to any odour generated from Alternative Waste Treatment (AWT) Facilities biofilter-based odour control system (specifically applies to Global Renewables Facility as no biofilter-based odours were found to be within the vicinity of the SITA SAWT Facility and was restricted to the Eastern Creek Precinct);

- **B = MSW / Garbage / Cheesy:** refers to any odour arising from the handling and/or processing of domestic municipal garbage/putrescible waste;
- **C = LFG / Mercaptan / Sulphur**: refers to odour arising from the presence of Landfill Gas and is specific for all active landfills capable of producing biogas;
- **D = Greenwaste / Herbacious:** refers to any odour from the handling and/or processing of municipal greenwaste;
- **E = OGM / Dry Compost:** this odour character refers to two explicitly different types of compost-based odours, that is:

    - OGM – where explicitly stated, it refers to the MSW-derived compost produced by the Global Renewables Facility.
    - Dry Compost – where explicitly stated, it refers to any compost-derived odour/s NOT originating from the MSW-derived compost (i.e. OGM) produced by the GRL Facility. This character includes compost derived odours originating from greenwaste, animal manures, and other compostable material from either waste or non-waste based sources (with the exception of GRL). This is based on TOU assessors over the course of the study identifying that OGM has a unique odour character than other compost based odours originating from other sources detected in this study.

  Both terms are used explicitly in this report unless the assessors determined that they were detecting both types of the above compost odours simultaneously.
- **F = Septic / Stale / Stagnant:** refer to any odours from septic tanks and stale dirty water;
- **G = Manure / Dirty:** refers to odour arising from agricultural activities. It also includes odours from piggery farm operations;
- **H = Deodoriser Spray:** refers to odour arising from the masking agent used in the spray systems around several of the facilities' boundaries. This odour is classified as non-waste facility based as it does not directly arise from processing operations;

- **I = Poultry / Chicken Manure:** refers to odour arising mainly from poultry and chicken farm operations;
- **J = Ammonia:** arising from soil enrichment products used around the farming regions of Badgerys Creek and Kemps Creek region. It also refers an ammonia-based odour generated at the SITA SAWT and Global Renewables Facilities, where applicable; and
- **K = Citrus / Fruity** refers to odour detected that had a pleasant fruity character whose source however could not be determined.

3.7 ODOUR INTENSITY CATEGORIES

The observed off-site odours are quantified according to the German Standard VDI 3882 Part 1. The category scale for judging odour intensity in the field is a quantitative reference scale where assessors award one of the attributes in the **Table 3.1** (below) to the assessor's odour impression.

Table 3.1 - VDI 3882 (Part 1) Odour Intensity Categories

Odour Strength	Intensity Rank (code)	TOU Interpretation (meaning)
Not detectable	0	No odour detected
Very Weak	1	Odour recognised and where possible assigned to the odour source
Weak	2	Odour is weak but not yet distinct
Distinct	3	Odour is clearly distinct
Strong	4	Strong odour detectable
Very Strong	5	Very strong odour detectable
Extremely Strong	6	Extremely strong odour detectable

An odour is clearly recognised (category of intensity 1) when the odour quality can be clearly assigned.

3.8 ODOUR INTENSITY & FREQUENCY CRITERION

Although outside the scope of work for this project, and referring to the Odour Intensity Categories listed and described in **Table 3.1** above, a particular odour intensity level can often be linked to a possible odour impact from the facilities. This criterion, whether it is Category 2 (Weak) or Category 3 (Distinct), will be dependent upon the sensitivity of the receptor areas, the nature / offensiveness of the odours present and the frequency of exposure. Odour Intensity Category 1 (very weak) would rarely, if ever, correspond to adverse odour impacts.

Where more than one assessor has assessed that measurement point within the FAOA survey, the results of the odour results documented are averaged to derive the average frequency of each individually observed odour intensity i.e. for 2 assessors assessing a single measurement point, the assessment is based on 120 individual odour determinations.

3.9 SELECTION OF ASSESSORS

For the selection of assessors, as it relates to the VDI 3940 standard, the most important selection criterion is currently odour sensitivity to n-butanol in nitrogen.

TOU specialises in, and stringently carries out Dynamic Olfactometry according to Australian Standard AS/NZS4323.3:2001. TOU performs assessor n-butanol calibrations before all olfactometry testing sessions in our laboratories, in addition to the required primary calibration where each assessor is calibrated against n-butanol from at least 10 dilution series collected on 3 different, non-consecutive days.

TOU has considerable data history on each panellist for their individual sensitivity to the calibration reference gas n-butanol. Each assessor was selected from TOU's pool of calibrated odour panelists. VDI 3940 additionally recommends assessor calibration data history for the reference gas hydrogen sulphide (H_2S) when assessing hedonic tone in concert with odour intensity. This methodology statement is only for odour intensity determination and, as such, this recommendation is not applicable.

Optional tests, from VDI 3940, are used to determine the assessors' ability to discriminate odours of different intensities. The first test involves ranking 7 flasks of different n-butanol concentrations (derived from VDI 3940). TOU has previously undertaken this optional test on more than one occasion for other FAOA surveys and found the results of this as poor, with only 2 of the panelists ranking them successfully. The assessors considered the solutions 'relatively weak' and 'too similar' to be compared to the VDI intensity scale. As such TOU does not rely on this optional test when selecting assessors.

The second optional test utilises the triangle method where each assessor must discern between 3 bags of odorants, 2 identical and 1 different, to identify the different sample by either intensity or quality. This test is routinely chosen to be performed before each survey when TOU considers that the assessors have been 'out of practice' for undertaking FAOA surveys. The assessors are not aware which bag has the reference gas n-butanol. This method was used for this assessment, where 2 identical bags were filled with pure nitrogen gas (N_2) and 1 with n-butanol gas was used to calibrate each assessor before the commencement of each FAOA survey.

As a general rule, TOU's Sydney office undertakes dynamic olfactometry assessments within the range of 500 – 900 odour tests annually. As a consequence TOU's assessors are highly skilled for olfactory analyses. As part of TOU's laboratory olfactometry analyses, TOU also undertakes laboratory derived intensity assessments on individual odour samples where the assessors are exposed to laboratory conditions of odour intensity determination. Additionally, TOU also undertakes a high volume of FAOA surveys annually which exposes assessors to a variety of odour sources in the field.

3.10 SIZE OF PANEL

According to the German Standard VDI 3940 "*the pool of assessors should consist of four times as many assessors as are needed for one measurement day, and of not less than ten persons. The size of the panel should be chosen appropriate to the objective of the survey*".

Typically, 2 to 3 FAOA assessors per measurement day are required. If for example the plume was considered wide reaching, the objective of the survey may be to observe the entire plume width and intensity and therefore more than 3 persons may be deployed.

TOU utilised 2 assessors as a minimum per FAOA survey, one of which acts as a coordinator for the group of assessors.

3.11 RECORDING OF METEOROLOGICAL CONDITIONS

Meteorological conditions were recorded using a Kestrel 4500 Pock Weather Tracker Anemometer (see **Photo 3.1** for illustration of setup). At each measurement point on the maps, the team would setup the anemometer apparatus enabling for real-time measurement of local temperature, wind speed and direction at a measurement location point (see **Section 4** for details) over each 10-min measurement cycle. This was undertaken during every survey at each measurement point.

Photo 3.1 – Kestrel Anemometer apparatus in operation (Source: The Odour Unit Pty Ltd)

3.11.1 Wind conditions description

The prevailing wind condition presented in each map plot result reflects the wind speed and direction at the time of survey based on local meteorological stations. As mentioned later in **Section 4.2**, there is a range of factors that determine wind direction and speed at a given point in time and therefore the local wind condition experienced at particular MLP may differ slightly from the prevailing winds reported for the survey period. **Figure 3.11** describes how the wind condition labels on the FAOA map plots should be interpreted.

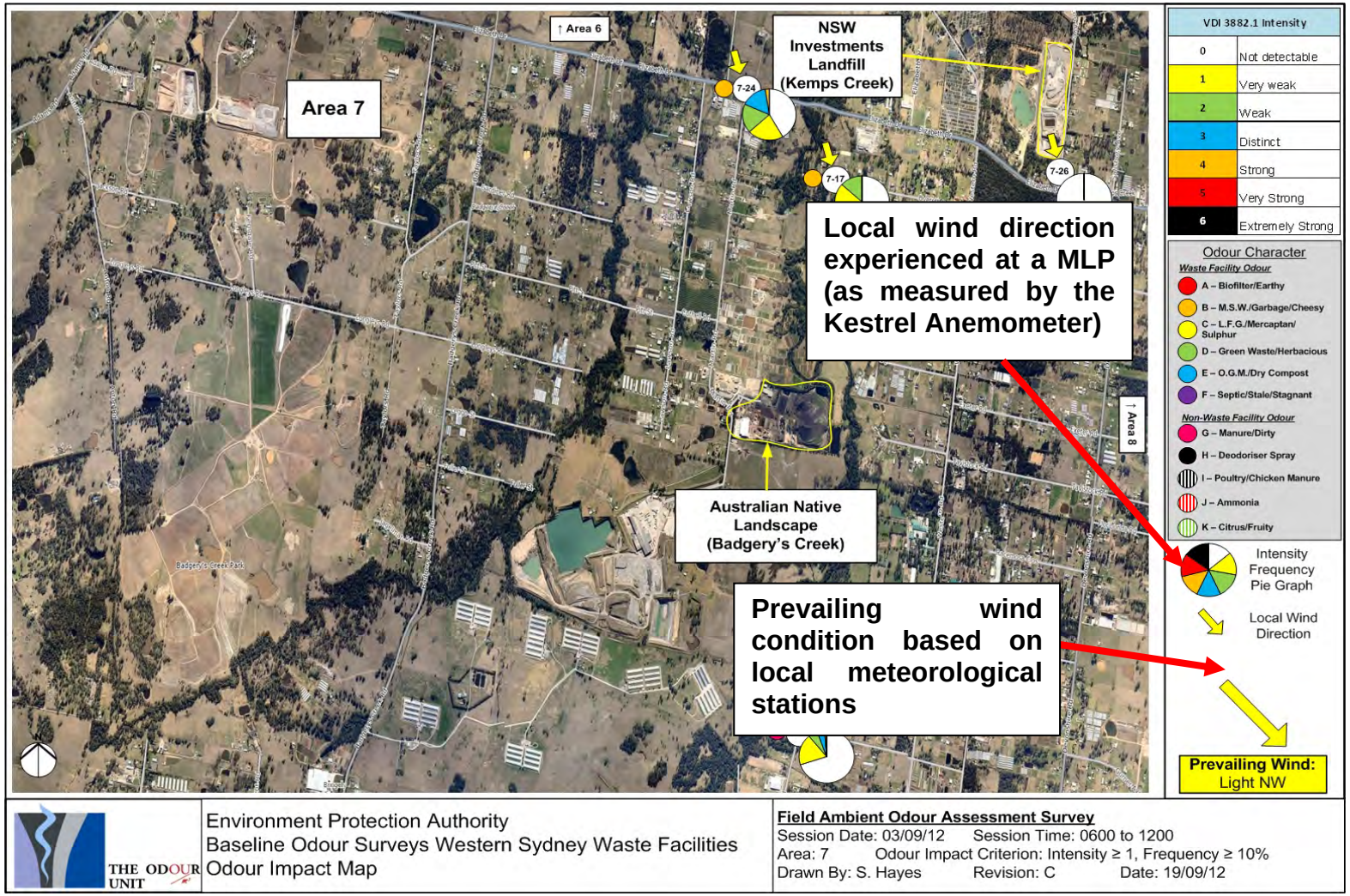

Figure 3.11 – Description of wind conditions on FAOA map plots

3.12 DESCRIPTION OF ASSESSMENT AREAS

Table 3.2 lists the facilities residing in each of the assessment areas. Depending on wind condition, each assessment area enabled an assessor to gauge upwind and downwind impacts from the facilities (where suitable access was available).

Table 3.2 – Description of Assessment Areas

Assessment Area No	Precinct	Facilities within assessment area
1	Erskine Park ^	Dial-a-dump (Genesis) Landfill
2	Erskine Park	n / a
3	Erskine Park^	Transpacific Industries Landfill (Enviroguard)
4	Eastern Creek	Global Renewables Resource Recovery Facility (UR-3R Facility)
		Australian Native Landscapes (Eastern Creek)
		Waste Assets Management Corporation (WAMC) Landfill
		Veolia Environmental Services (Horsley Park) Landfill
5	Kemps Creek	n / a
6	Kemps Creek	SITA SAWT Facility (Kemps Creek Landfill)
7	Kemps Creek	Australian Native Landscapes (Badgerys Creek)
		NSW Investments Landfill
8	Kemps Creek	Brandown Resource Recycling Facility and Landfill

^ as previously mentioned this includes St Clair, Colyton and Minchinbury areas

4 INTERPRETATION OF RESULTS

4.1 FAOA MAP PLOT RESULT

The following section contains the findings of each FAOA Survey conducted over the 7 day assessment period. The logsheets for each FAOA survey, showing the raw field data, have been appended as **Appendix A.**

4.2 INTERPRETATION OF SURVEY FINDINGS

Each map plot result shown consists of several features. These are generally depicted on a pie chart and wind vane indicator on each map plot. The features include:

- **A measurement location point (MLP)**: these are strategic points on the map were designed to enable assessors to pursue upwind and downwind effects from the facilities;
- **Location wind conditions**: the local wind direction and speed at each MLP has been indicated by a yellow arrow. In the event a wind direction has not been indicated, the conditions at the time were calm (i.e. < 1 m/s) and wind direction was unable to be accurately determined. The recorded wind conditions at each MLP varied at time from the prevailing wind conditions (see further details below);
- **Prevailing wind:** this is the wind conditions that existed in the general Sydney precinct at the time of the assessment and has been obtained from the local meteorological stations. Given the complex meteorological dynamics that can occur arising (such as local terrain, topography, katabatic channelling and effects from natural and built environments) affecting wind direction and speed, the local wind conditions experienced at some measurement points varied from the prevailing wind condition; and

- **Odour descriptors:** at each MLP where a measurement cycle was undertaken, key parameters were recorded in the event an odour was detected (methodology for this has been previously described in **Section 3**). The key descriptors shown on the maps includes the intensity of odour (how strong the smell was) based on the VDI 3882 German Odour Intensity Scale. In addition, the odour character was also recorded based on an odour character inventory developed by TOU to describe the range of odours encountered throughout the course of the surveys. These have been categorised as either waste or non-waste facility based odour (i.e. whether the odour detected at a MLP originated from the facilities or others). Where an odour character has not been assigned at a particular MLP, it is representative that the odour detected could not be characterised as either a waste or non-waste facility odour. The occurrences of these events over the course of the study have been summarised in **Section 5: Table 5.1.**

As previously mentioned in **Section 3**, given the large geographic distances between each assessment precinct, the survey maps were divided in eight conjoined assessments areas (i.e. Areas 1 – 8). Each assessment area consists of location points indicating the nominal location where a measurement cycle was undertaken. The location points are uniquely identified by a 3 digit numeric system. The first digit indicates the Assessment Area No. with the subsequent two digits indicating the unique MLP.

An example of a survey map plot result is shown in **Figure 4.1**. In this case, MLP 4-18 indicates that a discrete measurement was carried out at assessment area 4 at location point 18. At each MLP, the Kestrel Anemometer was setup to record important meteorological parameters at that point (see **Section 3.8** for details).

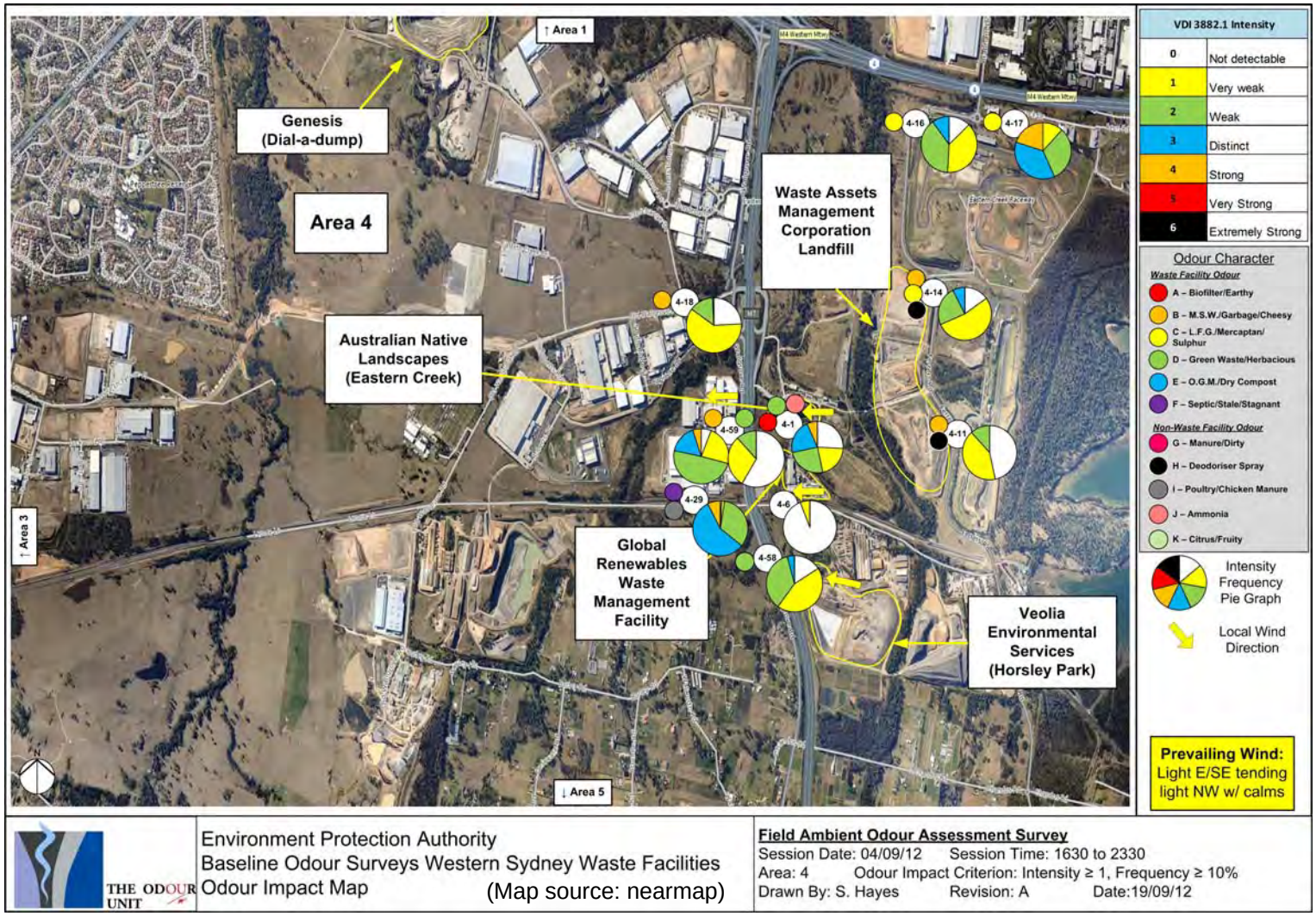

Figure 4.1 – Example of a map plot result