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Planit Consulting Pty Ltd

Kings Forest WWTP - Odour and Noise Assessments

Odour Assessment

70Q-17-0005-TRP-541352-0

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Report Title: Odour Assessment **Job Title: Kings Forest WWTP - Odour and Noise Assessments**		
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EXECUTIVE SUMMARY

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Planit Consulting Pty Ltd to carry out an odour impact assessment of the proposed Waste Water Treatment Plant (WWTP) on Pine Ridge Road within the Kings Forest Development, Tweed Shire, Northern NSW.

The purpose of this assessment is to determine the potential odour impacts associated with the proposed WWTP on sensitive receptors located in the surrounding area. Odour impacts have been assessed in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Department of Environment and Conservation, 2005).

The odour impact assessment has been carried out as follows:

- An emissions inventory of odour emissions for the proposed WWTP was compiled using data supplied by Planit and information derived from published maximum SOERs from Sydney Water for individual activities with the plant operating continuously and with carbon filtration mitigation
- Estimated emissions data was used as input for air dispersion modelling. The modelling techniques were based on a combination of The Air Pollution Model (TAPM) prognostic meteorological model (developed by CSIRO), and the CALMET model suite used to generate a three dimensional meteorological dataset for use in the CALPUFF dispersion model.
- The atmospheric dispersion modelling results were assessed by comparison with the odour assessment criteria described in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*.

Overall, the modelling results indicate that the proposed WWTP would meet the odour performance criteria at the modelled existing and future sensitive receptors.

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1 INTRODUCTION

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Planit Consulting Pty Ltd to carry out an odour impact assessment of the proposed Waste Water Treatment Plant (WWTP) on Pine Ridge Road within the Kings Forest Development, Tweed Shire, Northern NSW.

The purpose of this assessment is to determine the potential odour impacts associated with the proposed WWTP on sensitive receptors located in the surrounding area. Odour impacts have been assessed in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Department of Environment and Conservation, 2005).

2 TECHNICAL OVERVIEW

In the context of environmental annoyance and nuisance, it is vital to address the response of individuals to the odour stimulus and the variance in this response across populations. Apart from the response to the physical characteristics of an odour if an individual believes that a specific odour has potential negative health implications, they are more likely to appraise that odour negatively.

The annoyance of an odour is a function of the FIDOL factors, which are Frequency, Intensity, Duration, Offensiveness and Location. The FIDOL factors can be used as a basic means of assessing the potential odour impact of proposed developments.

- Frequency indicates how often a person is exposed to an odour. Even an odour with pleasant hedonic tone can be perceived as a nuisance if exposure is too frequent. At low concentrations a rapidly fluctuating odour is more noticeable than a steady background odour; therefore a high frequency is an aggravating factor.
- Intensity indicates the strength of the odour; it is proportional to the $\log_{10}$ of the odour concentration (Steven's law).
- Duration indicates the time length of an odour episode, i.e. how long the concentration remains consecutively above the odour threshold.
- Offensiveness is a mixture of odour character and hedonic tone at a given odour concentration. Some odours are universally considered offensive, such as decaying animal matter or rotten eggs. Other odours may be offensive only to those who suffer unwanted exposure in the residential intimacy, for example coffee roasting odour.
- Location indicates the type of land use and nature of human activities in the vicinity of an odour source. Particular attention must be paid to sensitive receptors, which include housing, schools, hospitals, commercial premises (such as restaurants, offices, shops etc.) and outdoor recreational space.

3 ODOUR PERFORMANCE CRITERION

Odour performance goals are designed to take into account the range in sensitivities to odours within the community and provide additional protection for individuals with a heightened response to odours, using a statistical approach which depends on the size of the affected population. As the affected population size increases, the number of sensitive individuals is also likely to increase, which suggests that more stringent goals are necessary in these situations. The *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* include odour assessment criteria as shown in Table 3-1.

Table 3-1: Assessment Criteria for Odour (1 Second Average, 99th Percentile)

Population of Affected Community	Assessment Criteria for Complex Mixtures of Odours (OU)
Urban (>2000) and/or schools and hospitals	2
~500	3
~125	4
~30	5
~10	6
Single rural residence (<2)	7

An odour assessment criterion of 3 OU (peak 1-second average, 99th percentile) would appropriately assess the odour performance of the WWTP for existing and a 2 OU criterion would assess any future sensitive receptors.

4 PROJECT DESCRIPTION

The proposed WWTP will be built inside the Kings Forest Development and will incorporate 3 stages of Membrane Bio Reactor with UV disinfection, a 2ML Permeate Storage Tank for Class A treated effluent to provide feed water to an advanced water treatment plant (AWTP). The 2ML Storage Tank is for storage of excess permeates during wet weather events.

The AWTP incorporates an Ultra Filtration Membrane system, UV disinfection and Chlorine contact tank with transfer pumps to transfer the Class A+ treated effluent to the storage reservoirs. There are also three 2ML tanks for Drinking Water to provide for four days of storage.

The proposed configuration of the WWTP is shown in Figure 4-1.

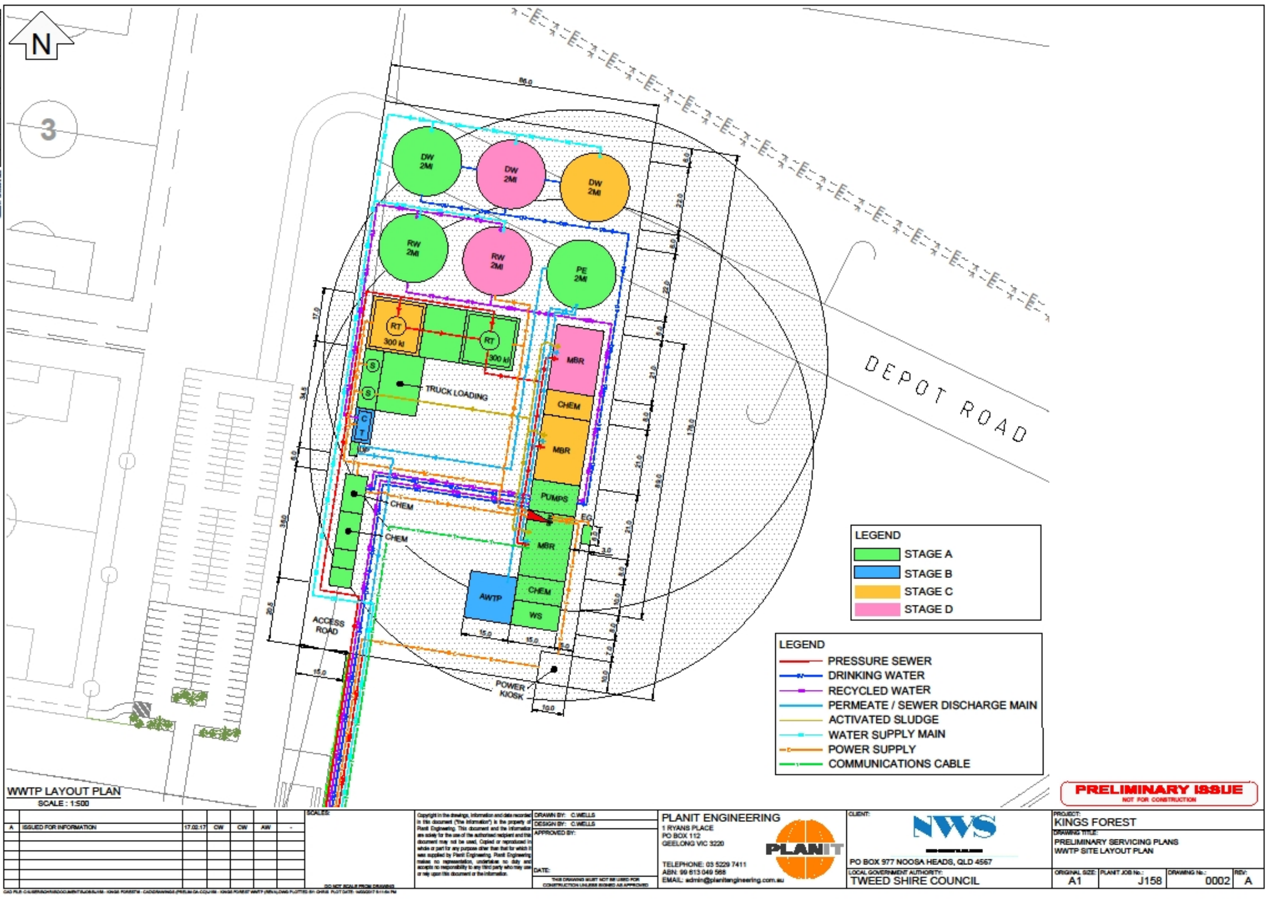


Figure 4-1: *Proposed WWTP Configuration*

5 EXISTING ENVIRONMENT

5.1 LOCAL SETTING

The proposed WWTP is to be located at on Pine Ridge Road within the Kings Forest Development and is adjacent to the Casuarina/SALT development, Kingscliff. The Kings Forest Development will ultimately comprise of:

- 4,509 Residential type dwellings;
- Local commercial areas totalling 12.3 hectares;
- Community areas totalling 14 hectares; and
- 94.9 hectares of Open Space and Sports Fields.

The existing land use in the vicinity of the proposed WWTP is predominantly agricultural with some forested areas. There are a few existing scattered residential and farm buildings.

The location of the proposed WWTP is illustrated in Figure 5-1.

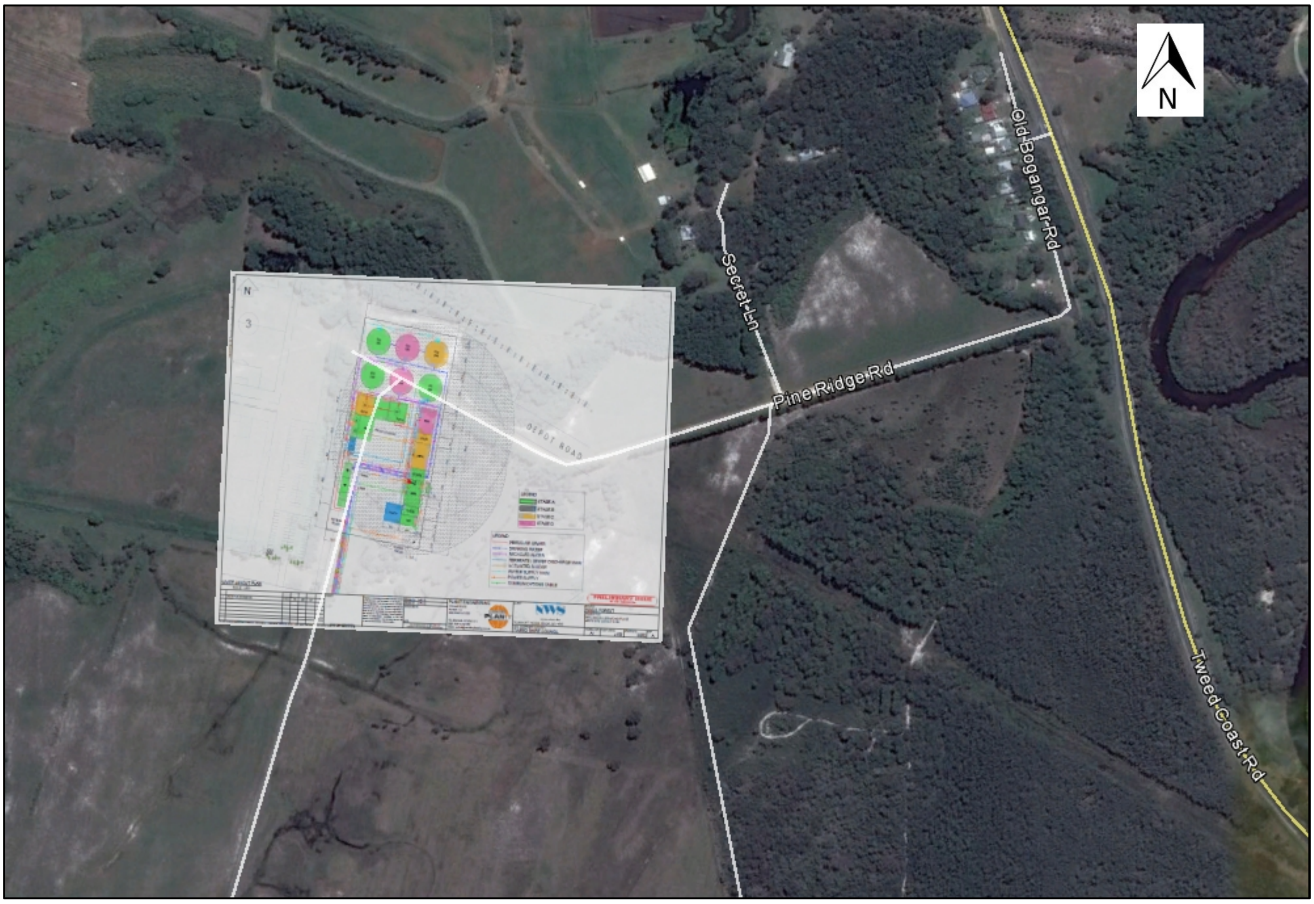


Figure 5-1: Proposed WWTP Location [Google Earth, 2016]

5.2 SENSITIVE RECEPTORS

The nearest existing sensitive receptors were identified from a review of aerial imagery and during a site visit undertaken by Vipac staff on 8/03/17. The nearest future sensitive receptors were identified from a review of the development plan for the area closest to the project site. A list of the nearest potentially affected sensitive receptors to the proposed WWTP site is provided in Appendix A and displayed in Figure 5-2. Green circles identify the existing sensitive receptor locations and yellow the nearest future sensitive receptor locations.

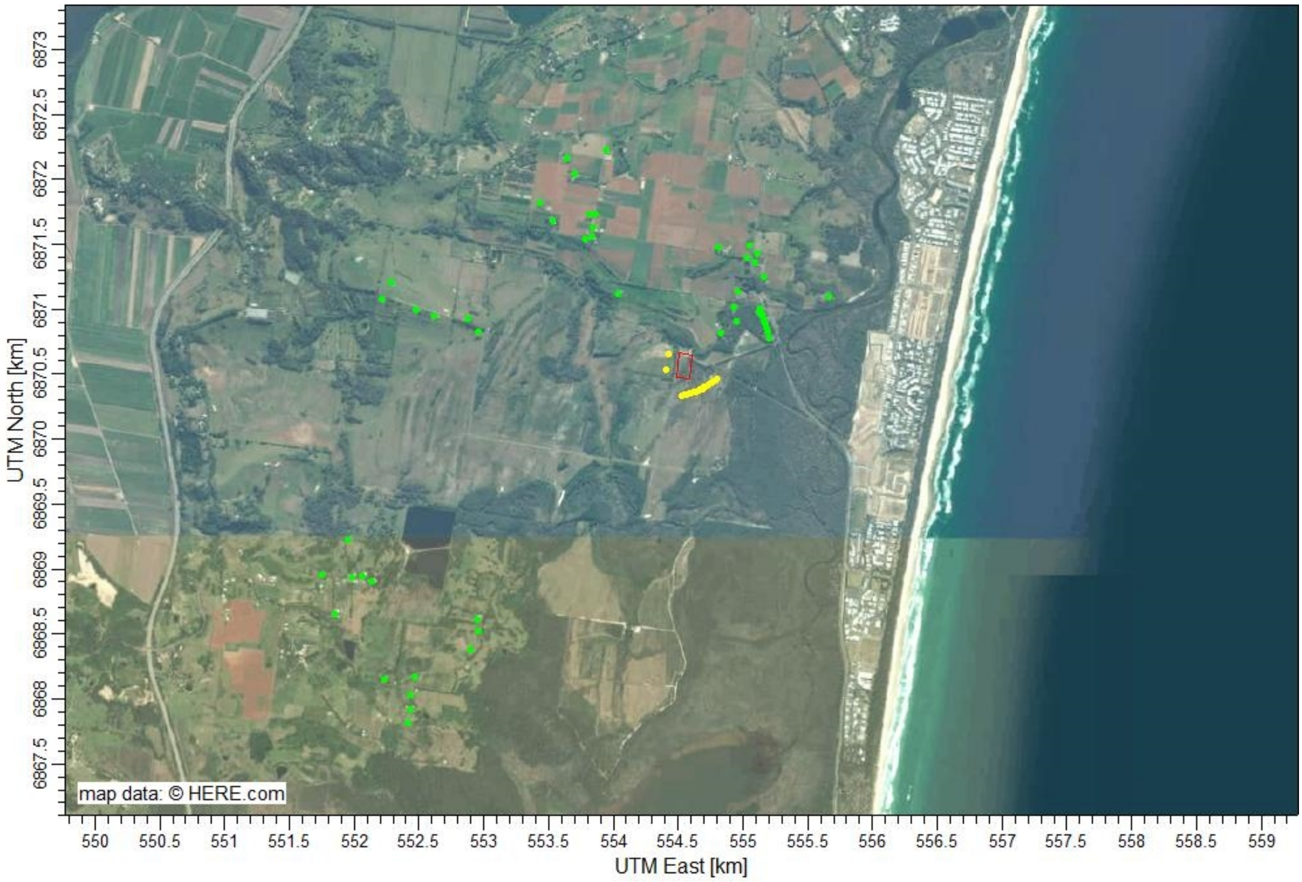


Figure 5-2: Sensitive Receptor Locations and the WWTP Boundary (green circles identify the existing receptor locations and yellow the nearest future receptor locations modelled)

5.3 TERRAIN

The terrain surrounding the proposed WWTP is predominantly flat with AHD of approximately 9m. The terrain data captured from NASA's Shuttle Radar Topography Mission (SRTM) at approximately 90m resolution (3-arc seconds).

5.4 DISPERSION METEOROLOGY

5.4.1 REGIONAL METEOROLOGY

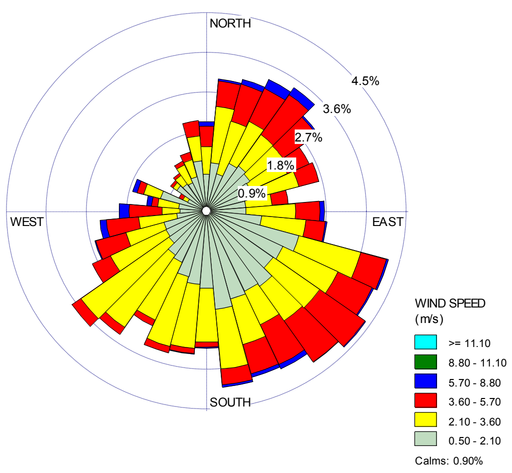
Data recorded by the nearest Bureau of Meteorology (BoM) long term weather station at Coolangatta Airport (located approximately 14km north of the WWTP) was reviewed to describe the meteorological and climatic influences in the region. Long term weather data obtained from the BOM weather station at Coolangatta Airport as presented in Table 5-1. The mean temperature range is between 20.5°C and 28.3°C with the coldest month being July and the hottest, January. The rainfall in the region is variable, with most rainfall in the warmer months. On average, most of the annual rainfall is received between January and April. Rainfall is lowest between July and October. The mean annual rainfall is 1,525 mm.

The annual wind rose recorded at the Coolangatta station in 2014 is provided in Figure 5-3. Winds are shown to be primarily light or gentle (i.e. less than 5 m/s) and from all direction with the exception of north west winds, which are uncommon.

The region experiences a humid subtropical climate with hot and humid summers and mild to warm winters with cool overnight temperatures.

Table 5-1: Mean Long-term Weather Data for Coolangatta [BOM 1982-2016]

Month	Mean Temperature		Rainfall (mm)	9 am Conditions			3 pm Conditions		
	Max (°C)	Min (°C)		Temp (°C)	RH (%)	Wind Speed (km/h)	Temp (°C)	Mean RH (%)	Wind Speed (km/h)
Jan	28.3	20.9	165.0	25.7	70.0	18.1	26.6	69.0	22.9
Feb	28.2	20.8	174.5	25.4	72.0	17.1	26.5	69.0	21.8
Mar	27.3	19.7	176.0	24.3	72.0	17.4	25.4	67.0	22.3
Apr	25.4	17.0	169.9	22.1	71.0	16.1	23.7	64.0	20.0
May	23.2	13.9	138.7	19.5	70.0	14.9	21.6	62.0	18.3
Jun	21.0	11.3	139.8	17.0	71.0	13.4	19.7	60.0	16.8
Jul	20.5	10.1	72.5	16.4	67.0	13.5	19.4	56.0	18.3
Aug	21.4	10.5	60.6	17.8	61.0	15.2	20.0	56.0	20.4
Sep	23.3	13.3	40.9	20.2	62.0	17.8	21.4	61.0	22.2
Oct	24.5	15.9	88.6	22.0	65.0	19.0	22.5	66.0	23.1
Nov	25.9	18.1	126.1	23.3	68.0	19.4	23.8	68.0	22.5
Dec	27.2	19.7	154.9	24.7	68.0	18.6	25.3	68.0	22.7
Annual	24.7	15.9	1525.3	21.5	68.0	16.7	23.0	64.0	20.9



Location: Coolangatta BoM Station	**Data Period:** Jan 2014 – Dec 2014	**Data Type:** Measured Data

Figure 5-3: Annual Wind Rose for Coolangatta Weather Station (2014)

5.5 LOCAL METEOROLOGY

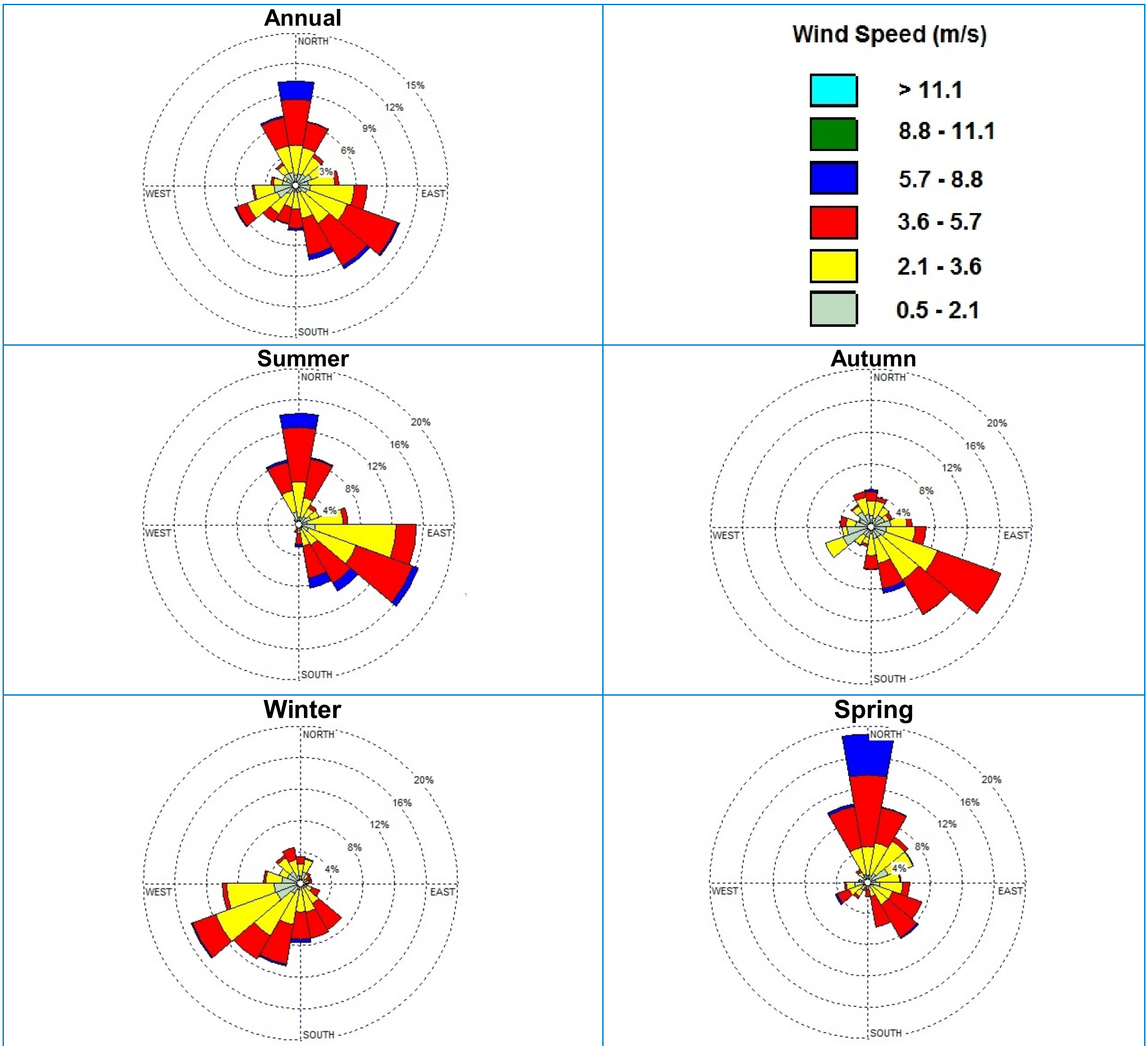
5.5.1 INTRODUCTION

A three dimensional meteorological field was required for the air dispersion modelling that includes a wind field generator accounting for slope flows, terrain effects and terrain blocking effects. The Air Pollution Model, or TAPM, is a three-dimensional meteorological and air pollution model developed by the CSIRO Division of Atmospheric Research and can be used as a precursor to CALMET which produces fields of wind components, air temperature, relative humidity, mixing height and other micro-meteorological variables for each hour of the modelling period. The TAPM-CALMET derived dataset for 12 continuous months of hourly data from the year 2014 and approximately centred at the proposed WWTP has been used to provide further information on the local meteorological influences. Details of the modelling approach are provided in Section 6.

5.5.2 WIND SPEED AND DIRECTION

Figure 5-4 presents the annual and seasonal wind roses from the TAPM-CALMET derived dataset for the year 2014 at the proposed WWTP location. Key features of the winds are:

- Winds are predominantly from the north or southeast with average wind speed of 3.1 m/s;
- Calm winds (<0.5m/s) are infrequent representing only 0.35% of the winds for the year;
- The strongest winds (>5.7m/s) occur from the north in summer and spring;
- Lighter winds (<5.7m/s) primarily from the southeast and southwest occur in autumn and winter; and
- The annual wind rose for the TAPM-CALMET derived dataset is generally consistent with the measured data from the Coolangatta BoM Weather Station. Although the distance between the two locations (approximately 14km) and some elevated terrain (up to approximately 100m) explains differences between the two wind roses shown.



Location: Site	**Data Period:** Jan 2014 to Dec 2014	**Data Type:** TAPM- CALMET extract

Figure 5-4: Annual and Seasonal Wind Roses for the TAPM-CALMET Derived Dataset, 2014

5.5.3 ATMOSPHERIC STABILITY

The Pasquill-Gifford stability classification scheme denotes stability classes from A to F. Class A is described as highly unstable and occurs in association with strong surface heating and light winds, leading to intense convective turbulence and much enhanced plume dilution. At the other extreme, class F denotes very stable conditions associated with strong temperature inversions and light winds, which commonly occur under clear skies at night and in the early morning. Intermediate stability classes grade from moderately unstable (B), through neutral (D) to slightly stable (E). Whilst classes A and F are strongly associated with clear skies, class D is linked to windy and/or cloudy weather, and short periods around sunset and sunrise when surface heating or cooling is small. Figure 5-5 shows the stability class percentages from the TAPM-CALMET derived meteorological data for the project site. The data identifies that Stability Class D is most common; this stability class is indicative of neutral conditions neither enhancing nor impeding odour dispersion.

As a general rule, unstable (or convective) conditions dominate during the daytime and stable flows are dominant at night. This diurnal pattern is most pronounced when there is relatively little cloud cover and light to moderate winds.

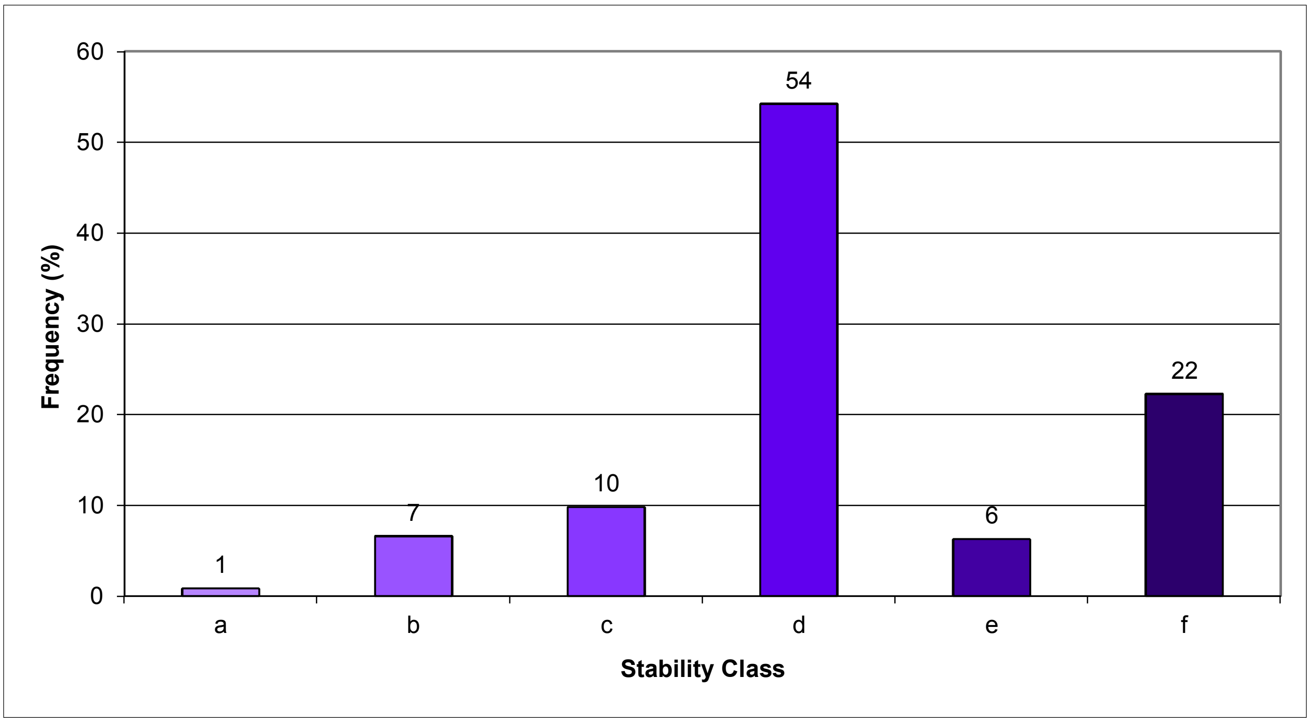


Figure 5-5: Stability Class Percentages for the TAPM-CALMET Derived Data, 2014

5.5.4 MIXING HEIGHT

Mixing height is defined as the height of the layer adjacent to the ground over which an emitted or entrained inert non-buoyant tracer will be mixed (by turbulence) within a time scale of about one hour or less.

Diurnal variations in mixing depths are illustrated in Figure 5-6. As would be expected, an increase in the mixing depth during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and the growth of the convective mixing layer.

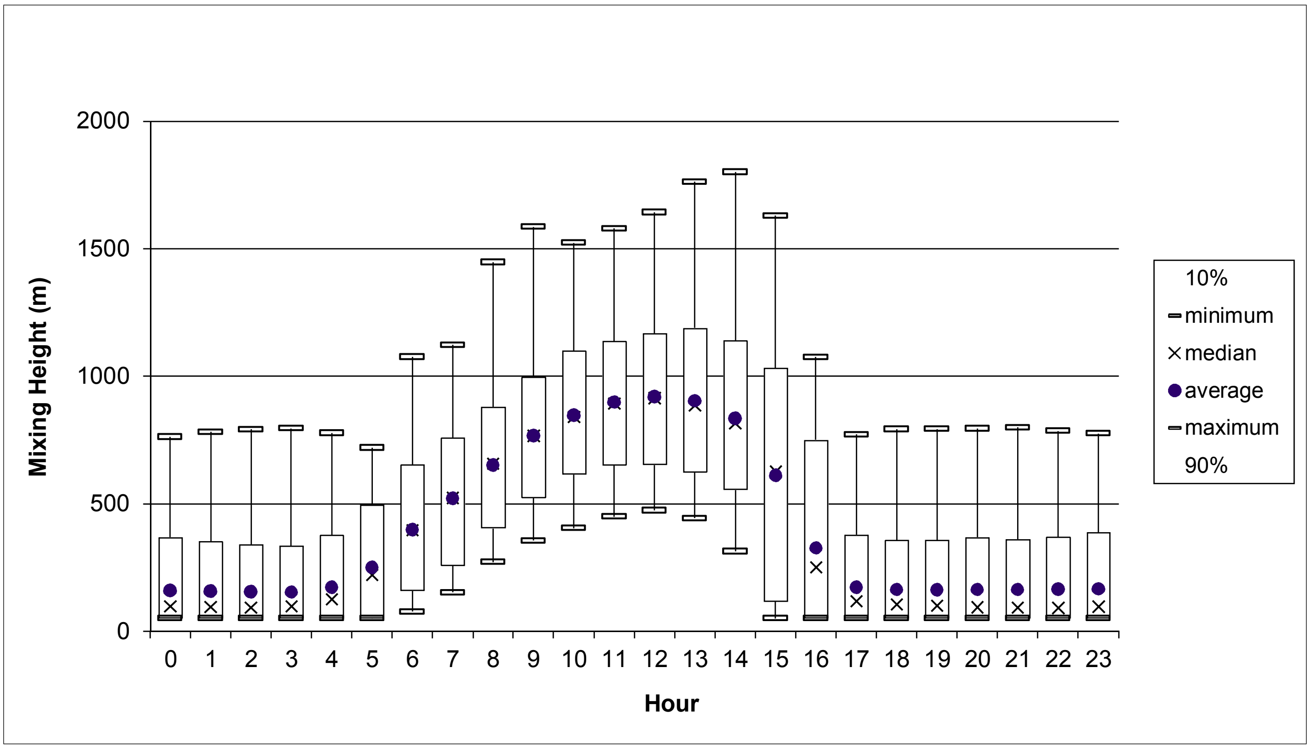


Figure 5-6: Mixing Height of the TAPM-CALMET Derived Data, 2014

6 ASSESSMENT METHODOLOGY

6.1 OVERVIEW

The overall approach to the assessment follows the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Department of Environment & Conservation, 2005) and the CALPUFF modelling guidance for NSW (Barclay & Scire, 2011) as recommended in the *Atmospheric Dispersion Modelling Guidelines*.

The odour impact assessment has been carried out as follows:

- An emissions inventory of odour emissions for the proposed WWTP was compiled using data supplied by Planit and information derived from measured data at similar facilities (outlined in Section 6.2).
- Estimated emissions data was used as input for air dispersion modelling. The modelling techniques were based on a combination of The Air Pollution Model (TAPM) prognostic meteorological model (developed by CSIRO), and the CALMET model suite used to generate a three dimensional meteorological dataset for use in the CALPUFF dispersion model (Section 0).
- The atmospheric dispersion modelling results were assessed by comparison with the odour assessment criteria described in Section 3.

6.2 EMISSIONS ESTIMATION

6.2.1 EMISSIONS SCENARIOS

Estimation of odour emissions from the proposed WWTP were developed for an emissions scenario with all stages of the WWTP completed. This represents maximum (or worst-case) operation.

6.2.2 PEAK-TO-MEAN RATIOS

For odour modelling in NSW a peak-to-mean ratio (P/M ratio) must be applied to odour emission rates to take into account peak odour levels. Whilst CALPUFF is capable of predicting impacts for averaging times ranging from one-hour to years, the human nose is capable of responding to odours over much shorter periods, often in the range of one second. In order to allow CALPUFF to predict odour impacts in the range of 1-second, peak-to-mean ratios are applied.

The use of peak-to-mean ratios is discussed in the Approved Methods (Department of Environment & Conservation, 2005). Peak-to-mean ratios are effectively scaling factors that allow one-hour average odour emission rates to be scaled so that the predicted odour impacts are expressed in terms of one-second values.

The peak-to-mean ratios are dependent on the type of odour emission source, the atmospheric stability class, the distance between the odour source and the sensitive receptor. The odour sources for this assessment are classed as near-field as the NSW Department of Environment & Conservation (NSW DEC) advises that near-field peak-to-mean factors are to be used when sensitive land use is located within 10 times the largest source dimension. The applicable peak-to-mean ratio for each source type is presented in Table 6-1.

Table 6-1: Peak-to-mean Ratios [DEC, 2005]

Source Type	Pasquill-Gifford Stability Class	Far-field Ratio (P/M60)
Area	A, B, C, D	2.5
	E, F	2.3
Wake Affected point	A-F	2.3
Volume	A-F	2.3

All odour sources in this assessment have a P/M ratio of 2.3 for most stability classes, with the exception of an area source during neutral and convective weather conditions (stability classes A, B, C and D), when the ratio is 2.5. A ratio of 2.5 has been applied to all model input data in order to predict the worst-case one-second odour concentration.

6.2.3 Estimated Emissions

Odour source emission inputs for the proposed WWTP are listed in Table 6-2. The odour emission sources are based on the following assumptions:

- There will be four MBR areas after the final stage of the proposed WWTP. Each MBR will house the following:
  - 1x Screening bin;
  - 1x influent tank;
  - 2x anaerobic tanks;
  - 2x Aeration tanks; and
  - 2x MBR tanks.
- Odour emission data in Table 6-2 was derived from the maximum value listed in the Sydney Water Database (McDonald, Cesca, Witherspoon, Mackenzie, & Barbu, No Date);
- A constant emission rate was assumed for all odour sources for the duration of the year which is conservative;
- Surface areas for area sources were taken from proposed site layout, process-specific drawings, and other information provided by Northern Water Solutions (NWS);
- Near-field peak-to-mean ratios were applied to emission rates based on the type of source configuration, as described in Section 6.2.2. As all sources were scaled using a peak-to-mean ratio of 2.5, the ratios have not been included in the SOER and OER values in Table 6-2.

The WWTP will be located within a passively ventilated shed. The building ventilation modelling is based on the following assumptions:

- The emissions from each MRB area will exit through vents with carbon filters. For each MBR there are four vents; two single vents with carbon filters and two double vents with carbon filters (six carbon filters in total). The carbon filter will be McBerns VF300 which has a H_2S removal efficiency of 99.9%. However for this assessment the H_2S removal has been modelled as 99% to present a conservative assessment;
- The MBR building will be passively ventilated with low level vents in the façade of the building. It should be noted that a passively vented building relies on thermal buoyancy to allow air to pass through the carbon filter;
- A constant emission rate was assumed for all odour sources for the duration of the year. It is acknowledged that external ambient temperatures and wind conditions around the building may affect the discharge rate of the vents, however this assessment is based on the maximum allowable air flow through the carbon filters;
- Each MBR was modelled with an OER of 0.413 $OU.m^3/s$, based on the following assumptions:
  - Total odour within each MBR building: 33,852 OU;
  - An estimated air flow of 72 m^3/h;
  - A stack diameter of 0.3 m to achieve an exit velocity of 0.28 m/s based on the air flow above; and
  - A 5.4 m stack height.

Table 6-2: Odour Sources

Location	Process Unit	Type of Source	Covered or Ventilated	Capture Rate	Estimated SOER (OU.m/s)	Modelled SOER (OU.m/s)	Surface Area (m^2)	OER ($OU.m^3/s$)
MBR / Room (Quantity = 3)	Screening Bin x1	Point	Yes	99%	5.64	0.06	2.0	0.11
	Influent Tank x1		Yes	99%	5.64	0.06	10.2	0.57
	Anaerobic Tank x2		Yes	99%	2.73	0.03	6.3	0.34
	Anoxic Tank x2		Yes	99%	1.38	0.01	9.1	0.25
	Aeration Tank x2		Yes	99%	0.83	0.01	20.4	0.34
	MBR Tank x2		Yes	99%	0.08	0.00	17.1	0.03
Redundancy Tank	Redundancy Tank x2	Area	Yes	99%	5.64	0.06	56.81	3.20
Truck Loading	Sludge Truck Loading	Area	No	0	5.64	5.64	0.79	4.43
Activated Sludge	Activated Sludge	Area	No	0	5.64	5.64	12.58	70.95

6.3 MODELLING METHODOLOGY

6.3.1 TAPM

The Air Pollution Model, or TAPM, is a three-dimensional meteorological and air pollution model developed by the CSIRO Division of Atmospheric Research. TAPM solves the fundamental fluid dynamics and scalar transport equations to predict meteorology and (optionally) pollutant concentrations. It consists of coupled prognostic meteorological and air pollution concentration components. The model predicts airflow important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analyses.

TAPM was configured as follows:

- Centre coordinates – 28˚ 17.500 S, 153˚ 33.500 E;
- Dates modelled – 30 December 2013 to 1 January 2015 (2 start-up days);
- Four nested grid domains of 30 km, 10 km, 3 km and 1 km;
- 41 x 41 grid points for all modelling domains;
- 25 vertical levels from 10 m to an altitude of 8000 m above sea level;
- data assimilation mode with data hourly average data incorporated for the measurement data collected at the Bureau of Meteorology Coolangatta Weather Station for 2014; and
- The default TAPM databases for terrain, land use and meteorology were used in the model.

6.3.2 CALMET

CALMET is the meteorological pre-processor to CALPUFF and includes a wind field generator containing objective analysis and parameterised treatments of slope flows, terrain effects, and terrain blocking effects. The pre-processor uses the meteorological inputs in combination with land use and geophysical information for the modelling domain to predict a gridded three dimensional meteorological field (containing data on wind components, air temperature, relative humidity, mixing height, and other micro meteorological variables) for the domain used in the CALPUFF dispersion model.

CALMET uses the meteorological data input in combination with land use and geophysical information to predict a gridded meteorological field for the modelling domain.

Vipac adopted the no observation approach for this site which uses prognostic data generated using TAPM nudged with observational data for the assessment. The CALMET modelling setup is presented in Table 6-3.

Table 6-3: CALMET Setup Parameters

Parameter	Setting
Meteorological grid domain	10km x 10km (100 x 100 x 10 grid dimensions)
Meteorological grid resolution	0.1km
Surface meteorological stations	None
Upper air meteorological station	None
3D Wind field	3D wind fields from TAPM (1km resolution) input as an initial guess to CALMET

6.3.3 CALPUFF

CALPUFF is a non-steady-state Lagrangian Gaussian puff model. CALPUFF employs the three-dimensional meteorological fields generated from the CALMET model by simulating the effects of time and space varying meteorological conditions on pollutant transport, transformation and removal.

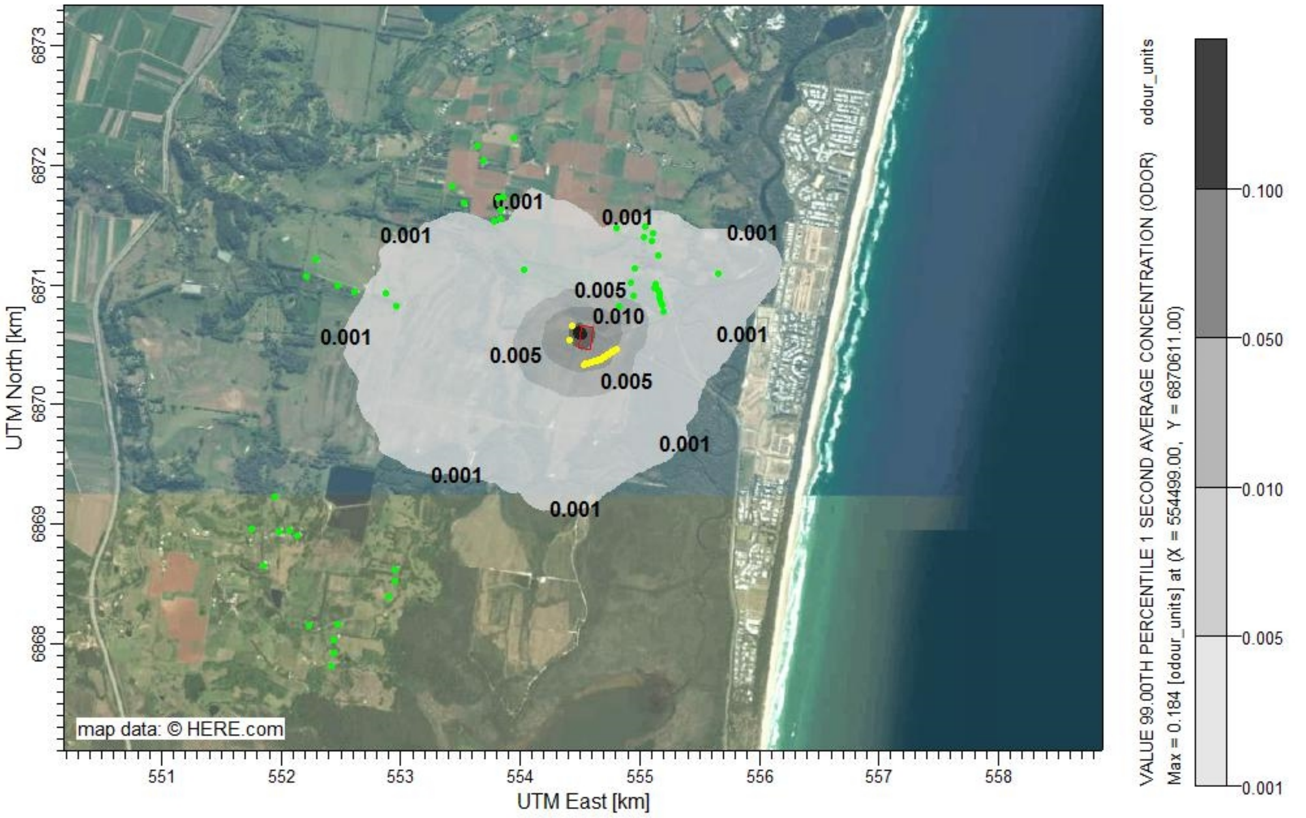
The odour emissions from the proposed WWTP have been modelled using CALPUFF using the following key inputs:

- meteorological dataset for 1/1/14 to 01/01/2015 generated in CALMET;
- 100 x 100 grid with a grid spacing 100 m;
- terrain data from Geoscience Australia Digital Elevation Model;
- emission rates and source configurations as presented in Table 6-2;
- partial plume adjustment for terrain influences;
- a radius of terrain feature set to 5km and minimum radius of influence to 0.1km.

7 RESULTS

This section presents the results of the odour impact assessment. Contour plots illustrate the spatial distribution of ground-level concentrations across the modelling domain.

Figure 7-1 presents the dispersion plot of the predicted odour impact for the proposed WWTP and Table 7-1 provides the predicted 99th percentile odour concentrations at the worst affected existing and future sensitive receptor. The contour lines show the 99th percentile, 1-second average ground-level odour concentrations. The model predicts that the odour impact from the proposed WWTP is well below the 3 OU, 99th percentile criterion and 2 OU, 99th percentile criterion at all existing and future sensitive receptors, respectively.



Pollutant:	Averaging Period:	Percentile:	Criteria:
Odour	1-Second	99th	Existing receptors - 3 OU Future receptors – 2 OU

Legend
- Existing sensitive receptor locations modelled as listed in Appendix A
- Nearest future sensitive receptor locations modelled
- Proposed WWTP location

Figure 7-1: 99th Percentile Predicted 1 Second Average Odour Concentrations from the Proposed WWTP

Table 7-1: Predicted 99th percentile 1 second average odour concentration at the worst affected sensitive receptors

Worst affected sensitive receptor	Universal Transverse Mercator Location (m)		Predicted 99th Percentile Odour Concentration (OU)	Assessment Criteria (OU)
	X	Y		
existing residence	554831	6870820	0.014	3
future sporting field	554409	6870535	0.05	2

8 MITIGATION

The proposed WWTP has been assessed based on the use of McBerns carbon filters which has a H_2S removal efficiency of 99.9%. It is recommended that the manufacturer's maintenance guidelines are adhered to at all times and that the filters are replaced accordingly.

9 CONCLUSIONS

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Planit Consulting Pty Ltd to carry out an odour impact assessment of the proposed Waste Water Treatment Plant (WWTP) on Pine Ridge Road within the Kings Forest Development, Tweed Shire, Northern NSW.

The purpose of this assessment is to determine the potential odour impacts associated with the proposed WWTP on sensitive receptors located in the surrounding area. Odour impacts have been assessed in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Department of Environment and Conservation, 2005).

The odour impact assessment has been carried out as follows:

- An emissions inventory of odour emissions for the proposed WWTP was compiled using data supplied by Planit and information derived from published maximum SOERs from Sydney Water for individual activities with the plant operating continuously and with carbon filtration mitigation
- Estimated emissions data was used as input for air dispersion modelling. The modelling techniques were based on a combination of The Air Pollution Model (TAPM) prognostic meteorological model (developed by CSIRO), and the CALMET model suite used to generate a three dimensional meteorological dataset for use in the CALPUFF dispersion model.
- The atmospheric dispersion modelling results were assessed by comparison with the odour assessment criteria described in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.*

Overall, the modelling results indicate that the proposed WWTP would meet the odour performance criteria at the modelled existing and future sensitive receptors.

Appendix A SENSITIVE RECEPTOR LOCATIONS

ID	Description	Universal Transverse Mercator Location (m)	
		X	Y
1	existing residence	554831	6870820
10	existing residence	555661	6871100
11	existing residence	555157	6871249
12	existing residence	555096	6871363
13	existing residence	555110	6871429
14	existing residence	555030	6871398
15	existing residence	555048	6871491
16	existing residence	554806	6871478
17	existing residence	553836	6871556
18	existing residence	553784	6871535
19	existing residence	553839	6871632
2	existing residence	554950	6870911
20	existing residence	553860	6871736
21	existing residence	553812	6871732
22	existing residence	553941	6872229
23	existing residence	553699	6872043
24	existing residence	553641	6872164
25	existing residence	553530	6871679
26	existing residence	553431	6871824
27	existing residence	552478	6871002
28	existing residence	552214	6871078
29	existing residence	552283	6871213
3	existing residence	554927	6871018
30	existing residence	551643	6869848
31	existing residence	551307	6869803
32	existing residence	551950	6869226
33	existing residence	552138	6868904
34	existing residence	552064	6868945
35	existing residence	551986	6868936
36	existing residence	551751	6868955
37	existing residence	551852	6868656
38	existing residence	552233	6868153
39	existing residence	552468	6868166
4	existing residence	554962	6871136
40	existing residence	552435	6868028
41	existing residence	552440	6867918
42	existing residence	552416	6867817
43	existing residence	552896	6868386
44	existing residence	552957	6868520
45	existing residence	552952	6868616
5a	existing residence	555201	6870781
5b	existing residence	555187	6870829
5c	existing residence	555179	6870854
5d	existing residence	555168	6870885
5e	existing residence	555162	6870909
5f	existing residence	555162	6870929
5g	existing residence	555155	6870949
5h	existing residence	555143	6870966
5i	existing residence	555120	6870976
5j	existing residence	555130	6871003

6	existing residence	554035	6871122
7	existing residence	552960	6870823
8	existing residence	552875	6870928
9	existing residence	552618	6870943
46	future residence	554801	6870460
47	future residence	554786	6870451
48	future residence	554773	6870444
49	future residence	554762	6870435
50	future residence	554742	6870423
51	future residence	554728	6870415
52	future residence	554719	6870407
53	future residence	554703	6870400
54	future residence	554695	6870393
55	future residence	554684	6870387
56	future residence	554670	6870380
57	future residence	554658	6870374
58	future residence	554642	6870367
59	future residence	554629	6870362
60	future residence	554615	6870359
61	future residence	554601	6870354
62	future residence	554585	6870350
63	future residence	554570	6870346
64	future residence	554559	6870346
65	future residence	554547	6870341
66	future residence	554529	6870336
67	future sporting field	554430	6870655
68	future sporting field	554409	6870535