LEGISLATIVE COUNCIL
Question On Notice

Tuesday, 15 August 2023

1530. Hon Ben Dawkins to the Parliamentary Secretary to the Minister for Water

(1) how many odour studies have been undertaken relating to the Water Corporation's wastewater treatment plant in Dalyellup?
(2) what dates were these odour studies completed?
(3) can the Minister table these odour studies?
(4) if no to (3), why not?

Answers from Water Corporation

1. Two.
2. June 2004 and September 2007.

3-4. Please refer to Tabled Paper (XXX). For the September 2007 report, please refer to Tabled Paper 1365.

Water Corporation

Report on Buffer Zone for Bunbury Wastewater Treatment Plant

June 2004

Consulting Environmental Engineers

Buffer Zone for Bunbury Wastewater Treatment Plant

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1. Scope of Work

The Bunbury WWTP is on the coast to the south of Bunbury and provides wastewater treatment for the whole of the urban area of Bunbury, as well as residential developments to the south (eg, Dwellingup). The plant is hidden in the sand dunes with an extensive area of land zoned for utilities, recreation and conservation.

The Water Corporation has installed a wind and meteorological monitoring station at the plant to provide an understanding of wind and dispersion patterns, and hence the zone that may be affected by odours. Monitoring commenced in August 2003 and a full year of data will be available at the end of August 2004. In the interim, the Water Corporation has requested CEE to provide an indication of the likely extent of the land required for a permanent buffer zone.

The existing treatment plant has a capacity of 7 ML/d, and is now at almost full load. The current treatment processes involve screening, primary sedimentation, secondary treatment (in trickling filters and sequential reactors) with polishing of the effluent in two large lagoons (surface area of 3 ha). The solids removed in treatment are digested, dewatered using a centrifuge and then air-dried in large beds open to the sun.

The plant will be expanded to a projected capacity of 16 ML/d over the next 20 years. With further growth, the final capacity of the plant is expected to be 24 ML/d (sufficient to treat wastewater from an estimated 100,000 persons).

A high quality effluent is produced, which is available for reuse locally. At present, the effluent is released to the ocean through an outfall that discharges 1.7 km from shore through a 120 m long diffuser on the seabed at 10 m depth. The stabilised and dried sludge (biosolids) is available for use as a soil conditioner.

The Water Corporation requested Consulting Environmental Engineers (CEE) to carry out odour modelling for the proposed new wastewater treatment plant (WWTP) at Bunbury to assess the potential odours from the plant and to define a buffer zone to protect sensitive land uses from odour impacts.

The scope of work for this assignment was set out by the Water Corporation and involved the following tasks:

1. Develop estimates of odour emissions for the existing and ultimate plant layouts as provided by the Water Corporation;
2. Review wind and dispersion conditions and develop files for modelling purposes to represent meteorological conditions at the site;
3. Establish an appropriate odour objective for the proposed WWTP, taking into account EPA odour criteria (Guidance Statement No. 47);
4. Undertake *Ausplume* modelling of odour from the plant to predict odour contours; and
5. Advise on the location and size of the buffer zone based on this odour study and appropriate odour management measures.

2. Bunbury Wastewater Treatment Plant

The layout of the existing Bunbury WWTP, which forms the basis of the odour modelling, is shown in Figure 1. The existing plant comprises the following:

- An inlet channel;
- One submerged drum screen;
- Two primary sedimentation tanks;
- A flow splitting tank;
- Two trickling filter;
- Two humus tanks (to remove solids from the trickling filters);
- A sequencing batch reactor (divided into two by partitions, with each side having an anoxic tank at the front followed by intermittently aerated tanks);
- Two anaerobic sludge digestion tanks;
- One open secondary sludge digestion tank;
- A sludge dewatering building containing a centrifuge;
- An associated dewatered sludge storage building (mostly open);
- Seventeen sludge drying beds in an area of 80 m by 70 m;
- Sludge and effluent pumping stations; and
- Two large effluent polishing lagoons.

The existing treatment plant has a capacity of 7 ML/d, and is now approaching full load. The treatment processes include screening and primary sedimentation. The primary effluent is then divided between two parallel secondary treatment processes – trickling filtration and intermittently decanted aeration.

The future plant will involve the construction of a further three sequencing batch reactors (each divided into two by partitions, as with the existing sequencing batch reactor) possibly with larger anoxic/anaerobic areas at the front of the tanks to increase nitrogen removal.

The trickling filters and humus processes will be closed, and the tanks converted to other uses, possible dewatering of secondary sludge.

Three new large anaerobic digesters will be constructed, and the two small existing anaerobic digesters will be closed. Most of the sludge drying beds will be closed, and a new sludge dewatering building with new dewatering equipment will be constructed.

The inlet and preliminary treatment area will be relocated and new screens (and possibly a grit removal tank) will be constructed.

Odour control works in the new plant will comprise covering the inlet and preliminary treatment area, and collecting and treating the odourous air in a soil bed filter or a trickling biofilter. In addition, air from the sludge dewatering building will be collected and scrubbed before release to the atmosphere.

3. Odour Emission Rates

Odour emission rates were estimated for the existing and the proposed plant based on odour emission measurements made at the existing Mandurah, Albany, Broome, Geraldton, Woodman Point and Subiaco treatment plants in 2002/04. The estimates of odour emission rates and the odour emissions from the **existing plant** are summarised in Table 1.

Table 1. Odour Emission Rates from Existing Treatment Plant

Treatment Unit	Unit emission rate, OU/m^2/s	Total odour emission, OU/s
Inlet Area	64 - 100	2,600
Primary treatment	3	700
Trickling filtration	3	800
SBR	4 - 12	9,900
Sludge digestion	6 – 12	4,900
Sludge dewatering	-	8,000
Sludge drying	1	18,600
Rest of plant	1 – 2	800
Total for plant	**-**	**46,300**

As can be seen in Table 1, many areas of the plant emit odours. The sludge drying area is the greatest odour source, as a large area of sludge is exposed to the atmosphere. This is a dilemma typical of environmental situations, where a benefit in one area (solar drying, saving energy) leads to a counterbalancing problem in another area (release of odours).

Using the emissions for the various treatment units listed in Table 1, the total odour emission rate from the **existing Bunbury WWTP is estimated to be 46,300 OU/s**.

The estimates of odour emission rates and the odour emissions from the **future plant** are summarised in Table 2. Using these emission rates, the total odour emission rate from the future Bunbury WWTP is estimated to be 65,200 OU/s.

Despite the almost four-fold increase in the plant capacity (from 7 ML/d to 24 ML/d) the proportional increase in odour emissions is much less. This is because of the application of odour controls for the inlet and sludge processing areas of the plant, and phasing out the more odourous processes (such as trickling filters and sludge drying).

Table 2. Odour Emission Rates from Future Treatment Plant

Treatment Unit	Unit emission rate, OU/m²/s	Total odour emission, OU/s
Inlet Area	20.6	5,100
SBR	0.2	37,500
Sludge digestion	7.7	4,800
Sludge dewatering	0.1	12,000
Sludge drying		600
Rest of plant	1 - 2	5,200
Total for plant	-	**65,200**

As a basis for comparison, the odour emissions from the future Bunbury plant correspond to approximately 2,700 OU/s per ML/d. This is well below the rate applying to the major metropolitan plants of 6,000 OU/s per ML/d and slightly below the typical rate for country plants of 3,000 OU/s per ML/d. Thus the odour estimates for Bunbury are considered to be comparable to other country plants and represent a reasonable level of future odour control.

4. Odour Objective

In March 2002, the WA EPA issued a revised Guidance Statement on the Assessment of Odour Impacts (Guidance Statement No 47) to define odour objectives. The Guidance Statement set out a staged procedure for the assessment of odours from new facilities in the following terms:

> *"If generic buffer distances are met and the proposed facility is designed for 'best practice' emission control then no further assessment of odour is required.*
>
> *If the generic separation distance is not met, the proponent needs to undertake an odour impact assessment using computer odour modelling to demonstrate compliance with the following default compliance criteria. The default odour criteria are:*
>
> *2 OU at 99.5 percentile at 3 minute averaging period; and*
> *4 OU at 99.9 percentile at 3 minute averaging period."*
>
> *For proposals that do not meet the screening criteria, proponents may undertake an odour intensity study which allows a less conservative odour criteria to be used. The study is to define the "distinct" level of odour*

The 99.9 percentile odour frequency level is used in this assessment (rather than 99.5 percentile frequency) as it provides a high level of protection to the community against odour nuisance. This percentile limit allows exceedence of the odour limit for only 8 hours per year.

In contrast, the 99.5 percentile limit would permit the odour limit to be exceeded at each site around the plant for 44 hours per year.

Based on correlation of odour complaints and odour modelling around the existing Subiaco, Mandurah, Woodman Point and Beenyup WWTP's, the Corporation has ascertained that the **distinct** level of odour corresponds to the predicted **5 OU** level, at 99.9 percentile frequency over a 60 minute averaging period.

Thus in this report, the buffer zone is based on the 5 OU contour at 99.9 percentile over a 60 minute averaging period. Application of the EPA default odour criteria of 4 OU, as listed above, would result in a larger buffer zone than what is required for the 5 OU level, corresponding to the distinct level of odour from this type of plant.

5. Wind Conditions

Meteorological conditions for predicting odour levels in the area surrounding the Bunbury WWTP were based on wind measurements at the site. The Water Corporation has installed a meteorological station adjacent to the entrance to the treatment plant that measures the following parameters every 10 minutes:

- Wind speed at 10 m above the ground
- Wind direction at 10 m above the ground
- Air temperature at 2 m above the ground
- Air temperature at 10 m above the ground
- Net solar radiation
- Solar radiation
- Humidity
- Rainfall.

From these parameters, the wind speed and wind direction over each hour was calculated, together with stability classification (a dispersion parameter) calculated from the solar radiation during the day and from the vertical temperature profile at night. At the time this report was prepared, measurements from the new station were available from 7 August 2003 to 4 March 2004, a period of 7 months.

The wind rose for the new station is shown in Figure 2. The narrow bars near the centre of the wind rose represent the low speed winds (less than 2 m/s). The wider bars represent stronger winds.

Weak winds come mostly from the southeast, although there is a significant frequency of weak winds from the east and south directions. However there are a small number of weak winds recorded from all directions of the compass.

The most common wind direction is from the southeast, and these are mostly light to moderate winds, with speeds of 2 to 5 m/s (7 to 18 km/hr). Strong winds (more than 5 m/s) mostly come from the west.

The wind roses show a very small frequency of winds from the north, northeast and southwest. There are large sand dunes in these directions (relative to the location of the anemometer) and these probably shelter the anemometer from winds from those directions. The effect of shadowing must be kept in mind in evaluating the predicted odour contours and determining the size of the buffer zone.

To examine the likely full spectrum of wind directions, the winds measured on the sand dune next to the Bunbury treatment plant in 1999 were extracted. This anemometer was sited above all nearby dunes, and thus not subject to shadowing for some wind directions. The more exposed location and higher anemometer elevation of the 1999 wind measurements also is reflected in a greater median wind speed. For the 1999 measurements, the median wind speed was 4.2 m/s whereas for the 2003/04 measurements the median wind speed was 3.0 m/s.

As there were no solar radiation or vertical temperature profile measurements made in 1999, the stability classification for day hours was based on the wind speed, time of sunrise and time of sunset (a classification scheme published by the Victorian EPA) and for night hours was based on wind speed, where all hours with speeds of 0.5 to 2.5 m/s were designated Class F, those with speeds of 2.6 to 3.5 m/s were designated Class E and the remainder (with high wind speeds) were designated Class D.

The wind rose for the 1999 station is shown in Figure 3. As before, the narrow bars near the centre of the wind rose represent the low speed winds (less than 2 m/s). There were few low speed winds recorded in 1999, although they do come from all sectors of the compass, with slightly more from the southeast direction (the same as for the lower level anemometer).

The dominant wind directions were southeast (often night and morning winds) and southwest (often day and evening winds). Winds from the west and southwest were generally stronger than those from the east and southeast.

The principal benefit of using the 1999 wind measurements is that the effects of a full range of wind directions (particularly winds from the north) on the shape of the predicted odour contours can be examined. However it should be kept in mind that the wind speeds at 10 m above the top of the dune are higher than expected at ground level across the treatment units.

Table 3 lists the 10 percentile, median and 90 percentile wind speed for the two meteorological files used in the Bunbury odour study. It can be seen that the wind speeds in 1999 always exceeded those measured in 2003/04 (reflecting the more exposed site of the 1999 measurements). To compensate for this difference, the anemometer for the 1999 measurements was set at a nominal height of 30 m above the plant level in the odour modelling.

Another interesting feature is that the wind speeds during the night at the 1999 site were much the same as during the day at that site. However the night wind speeds at the 2003/04 site were 25 to 45 per cent lower that the speeds during the day at that site.

Table 3. Frequency of Wind Speed (in m/s) Classifications in Bunbury

Wind Condition / Classification	Percentage of Hourly Winds in Classification (% of year)			
	1999		2003/04	
	Day	Night	Day	Night
10 percentile wind speed	2.3 m/s	2.4 m/s	2.0 m/s	1.1 m/s
Median wind speed	4.4 m/s	4.1 m/s	3.7m/s	2.4 m/s
90 percentile wind speed	9.4 m/s	9.1 m/s	6.1 m/s	4.5 m/s

Overall, the wind speed records, for both sites, show that the Bunbury WWTP is in a site that generally is mostly exposed to moderate winds, with high speeds (particularly from the west and southwest) occurring at times, and low speeds occurring on some nights.

6. Odour Modelling

Odour modelling for this assessment has been carried out using the following procedure:

- Ausplume Model version 5.4 as issued by the Victorian EPA;
- Odour emission rates as listed in Tables 1 and 2;
- Terrain on a 100 m square grid, determined from a topographic map of the region;
- 60-minute averaging times and CEN odours, as defined by the WA EPA;
- Meteorological files for 2003/04 and 1999 as described above;
- WWTP geometry from plans of the site; and
- Other model parameters (eg, roughness) to best suit the Bunbury WWTP area.

The odour model has been used to predict 99.9 percentile odour contours in the vicinity of the proposed WWTP. As explained above, the 99.9 percentile predictions represent the odour level that is exceeded 8 hours per year at each location, corresponding to 0.1 per cent of the 8760 hours per year.

7. Odour Predictions

Figures 4 to 10 show the predicted odour contours for the proposed plant for the available meteorological files. There are three sets of odour contours for the existing treatment plant and four sets for the future plant.

Figure 4 shows the predicted odour contours for the existing plant using the 1999 wind file (on the dune). For convenience in evaluation, the zone between the predicted 5 OU and 6 OU odour contours is coloured green in the plot. It can be seen that the predicted 5 OU contours extends more than a kilometre to the west (out to sea). There also is a large extension of more than 1 km to the south, in a narrow zone just inshore from the ocean. The 5 OU contour extends about 800 m to the north and only 400 m to the east, with a small extension to the northeast.

Figure 5 shows the predicted odour contours for the existing plant using the 2000 wind file (on the dune). These odour contours are more contained that the 1999 predictions, and are considered to be more realistic. The predicted 5 OU contour extends about 800 m to the west (out to sea). The 5 OU contour extends about 800 m north of the plant boundary, 500 m to the east and 700 m to the south, with the largest extension on the foreshore close to the ocean.

Figure 6 shows the predicted odour contours for the existing plant using the 2003/04 wind file (adjacent to the plant). These odour contours are generally similar to the 2000 predictions. The predicted 5 OU contour extends almost 1000 m to the west (out to sea). The 5 OU contour extends about 700 m north of the plant boundary, 600 m to the east and 700 m to the south, with the largest distance being on the foreshore close to the ocean.

Figure 7 shows the predicted odour contours for the future plant using the 1999 wind file (on the dune). The predicted 5 OU contour extends about 1500 m to the west (out to sea). There also is a large extension of about 1200 m to the south, in a narrow zone just inshore from the ocean (similar to the contour pattern in Figure 4). The 5 OU contour extends about 900 m to the north and 500 m to the east, with a small extension to the northeast.

Figure 8 shows the predicted odour contours for the future plant using the 2000 wind file (on the dune). These odour contours are more contained that the 1999 predictions, and are considered to be more realistic. The predicted 5 OU contour extends about 1200 m to the west (out to sea). The 5 OU contour extends about 1100 m north of the plant boundary, 600 m to the east and 900 m to the south, with the largest extension on the foreshore close to the ocean.

Figure 9 shows the predicted odour contours for the future plant using the 2003/04 wind file (adjacent to the plant). These odour contours are generally similar to the 2000 predictions. The predicted 5 OU contours extend about 1500 m to the west (out to sea). The 5 OU contour extends about 1200 m north of the plant boundary, 1000 m to the east and 1200 m to the south, extensions on the foreshore close to the ocean and to the southeast.

Figure 10 shows the predicted odour contours for the future plant using the 2000 wind file (on the dune) and the DEP odour default odour criteria of 4 OU with a 3 minute averaging period. For convenience in evaluation, the zone between the predicted 4 OU and 5 OU odour contours is coloured blue in the plot. It can be seen that the predicted 5 OU contours extends more than 2 km to the west (out to sea). The predicted 5 OU contour extends about 1500 m north of the plant boundary, 500 m to the east and an average of 800 m to the south.

The predicted odour contours for the future plant extend slightly further than those for the existing plant, as there are more odour emissions in the future. The approximate distance to the predicted 5 OU contour (or 4 OU contour in the case of the DEP criterion) from the plant boundary is summarised in Table 4.

Table 4. Distance of Predicted 5 OU Contour from Plant Boundary

Model Scenario	Distance to 5 OU Contour, m		
	North	East	South
Existing plant - 1999	800 m	400 m	1000 m
Existing plant - 2000	800 m	500 m	700 m
Existing plant - 2003/04	700 m	600 m	700 m
Future plant - 1999	900 m	500 m	1200 m
Future plant - 2000	1100 m	600 m	900 m
Future plant - 2003/04	1200 m	1000 m	1200 m
Future plant - 2000-DEP	1500 m	500 m	800 m
Recommended buffer	**800 m**	**550 m**	**650 m**

There are many factors taken into account in recommending an appropriate buffer zone for a treatment plant, including:

- The pattern of winds shown in the wind roses;
- The predictions of the odour model for the various wind files;
- Observations of the treatment plant and an assessment of odour emissions;
- Odour complaint history and the distance to which odour is detectable around the existing plant;
- Local land use and topography;
- Experience at other treatment plants with buffer zones of various sizes;
- The potential for future odour controls as the plan expands from 7 ML/d to 16 ML/d, and then to the ultimate size of 24 ML/d; and
- The time period over which the plant expansion will occur.

The present Bunbury treatment plant is considered to be relatively odourous in comparison to other plants of a similar size. It has a large natural buffer zone comprising heavily vegetated steep sand dunes. Residential areas are 1 km from the plant boundary and there are no reports of odour complaints. This confirms the odour model predictions which indicate that the distinct odour extends about 700 to 800 m from the plant and rarely to 100 m from the plant (the edge of existing residential areas).

Odour emissions from the ultimate future plant (of hydraulic capacity 24 ML/d) are expected to be 41 per cent greater than odour emissions from the existing plant (of hydraulic capacity 7 ML/d). However the odour modelling (see Table 4) predicts a even larger increase in the extent of odour impact. In part, this is due to gaps in the wind files so that the 99.9 percentile prediction corresponds to a relatively small number of events.

From experience with other similar plants, and noting the wind patterns at Bunbury, the adjacent land use and the topography and vegetation in the buffer zone, we consider that the buffer zone for the future plant should not be larger than the present buffer zone.

In our view, the design and operations of the future plant have to be managed to reduce emissions to below those shown in Table 3 for projected future emissions.

The buffer zone recommended for the Bunbury plant is as follows:
- 300 m to the west (all the land to the ocean);
- 800 m to the north;
- 550 m to the east (to the main north/south road); and
- 650 m to the south (excluding a small corner to the southeast).

The recommended buffer zone is shown in Figure 11. The corner to the northeast has been retained in the recommended buffer zone because of the high proportion of sea breezes experienced at Bunbury, which mostly come from the southwest and blow across the plant to the northeast. The risk for odours being detected is in a narrow zone to the south of the plant adjacent to the shore, when there are light breezes in the morning from the north and northeast. This risk could be addressed by appropriate land planning and retaining vegetation in the buffer zone to the south of the plant.

8. Buffer Zone

Wastewater treatment plants receive and must treat all of the liquid wastes discharged by the community to the sewers. A modern wastewater treatment plant has several functions:
- Remove detritus and other solid and gritty objects from the wastewater;
- Remove organic solids and convert into useful products for reuse;
- Remove dissolved constituents to meet water quality standards;
- Remove nitrogen and phosphorus to meet environmental objectives;
- Remove pathogens to protect public health; and
- Produce a reclaimed water stream for subsequent reuse.

Even with good pollution control technology and careful operations, there will be a base level of odour emissions and, at times, higher emissions as a result or the discharge of high contaminant loads to the sewers and/or plant upsets. These events are anticipated in the management of the treatment plant and should be allowed for in land use planning. An adequate buffer zone allows the emissions to dissipate without significant adverse effects on sensitive land uses.

The buffer zone is not, of course, an alternative to 'best practice' operation of a sewerage system, including responsible management of the sewage collection system, treatment system, reuse operations and disposal systems.

Residential areas require higher standards of amenity than industrial or commercial operations and the separation of different land uses is achieved by buffer zones around land uses not compatible with residential areas. The consequences of an inadequate buffer zone are threefold:

- Nuisance and hazard experienced by residents adjacent to the buffer zone;
- Additional cost experienced to ratepayers for sewerage operations;
- Additional energy consumption by the sewerage system; and
- Community annoyance.

Buffer zones are a practical and widely adopted solution to a real planning issue. For example, buffer zones are recognised for:

- Airports;
- Pharmaceutical manufacture;
- Refineries;
- Quarries and mining;
- Animal feedlots;
- Noxious industries;
- Organic chemical industries; and
- Wastewater treatment plants.

From the predicted odour contour patterns shown in Figures 4 to 7, the distance to the 5 OU contour has been extracted and is shown in Table 4 for the various model simulations. From consideration of all results, a recommended buffer zone for the proposed Bunbury treatment plant has been defined.

The recommended buffer zone is shown in Figure 9.

Incompatible land uses, such as residential development, restaurants and similar sensitive land uses should not be permitted within the buffer zone. However there are a wide range of synergistic and/or compatible land uses which can be sited within the buffer zone for a treatment plant (such as, golf courses, playing fields, solid waste transfer stations, recycling facilities, light industry, intensive agriculture, service commercial, community composting area, etc) so that the land can be used effectively for the benefit of the community.

9. Conclusions

The conclusions of this odour modelling study are as follows:

1. The estimated odour emission rate from the existing Bunbury treatment plant is 46,300 OU/s. The odour emission is predicted to increase to 65,200 OU/s for the ultimate plant at Bunbury.
2. Low wind speeds and low rates of atmospheric dispersion occur at times at Bunbury, particularly at night.
3. The distinct odour level is believed to be 5 OU, for a prediction based on 99.9 percentile frequency and 60 minute averaging.
4. The recommended buffer zone, shown in Figure 11, extends for:
   - 300 m to the west (all the land to the ocean);
   - 800 m to the north;
   - 550 m to the east (to the main north/south road); and
   - 650 m to the south (excluding a small corner to the southeast).
5. A larger buffer zone would be required if the EPA default odour limit of 4 OU was used.
6. No residential or restaurant development should be permitted inside the buffer zone but a wide range of compatible land uses would be acceptable (utilities, waste composting, waste recycling, golf course and horticulture).

Figure 1. Layout of Existing Treatment Units at Bunbury WWTP

Figure 2. Wind Rose for Year 2003/04 for Bunbury

Bunbury (Delta T)
All

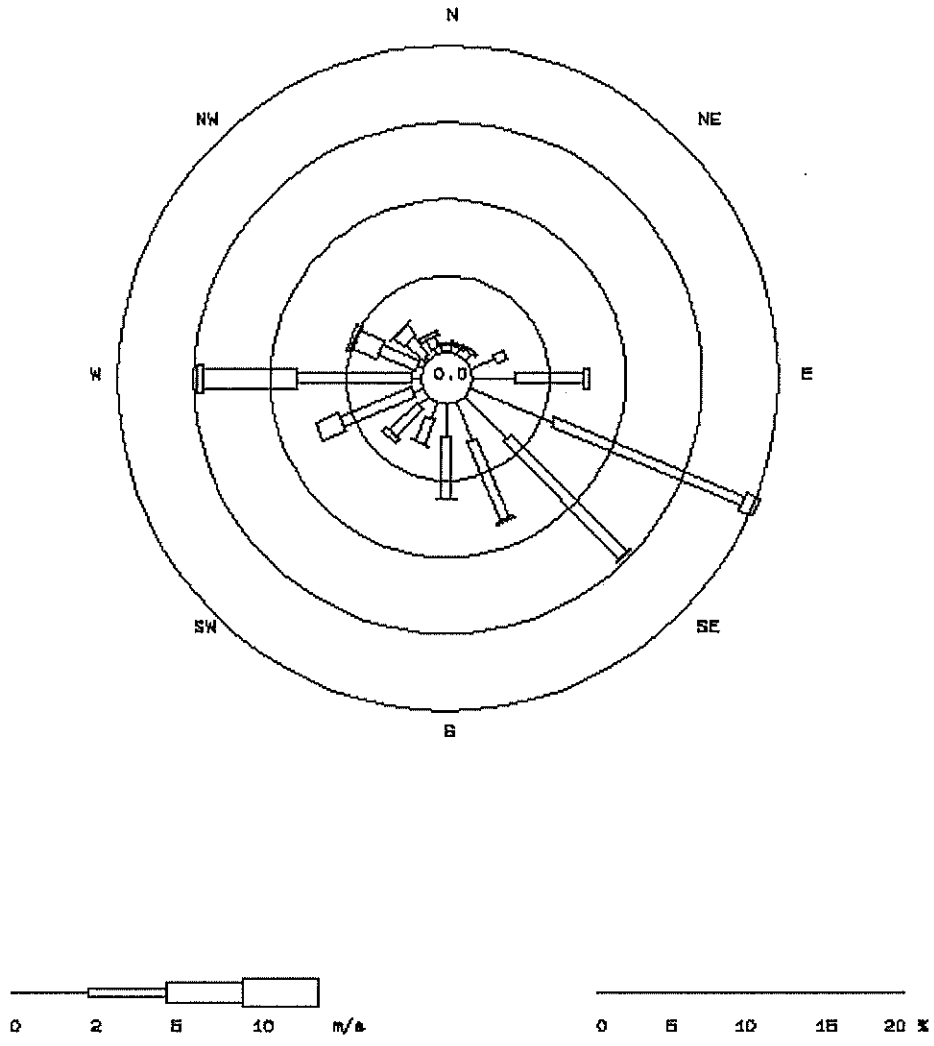

Figure 3. Wind Rose for Year 1999 for Bunbury (temperature)

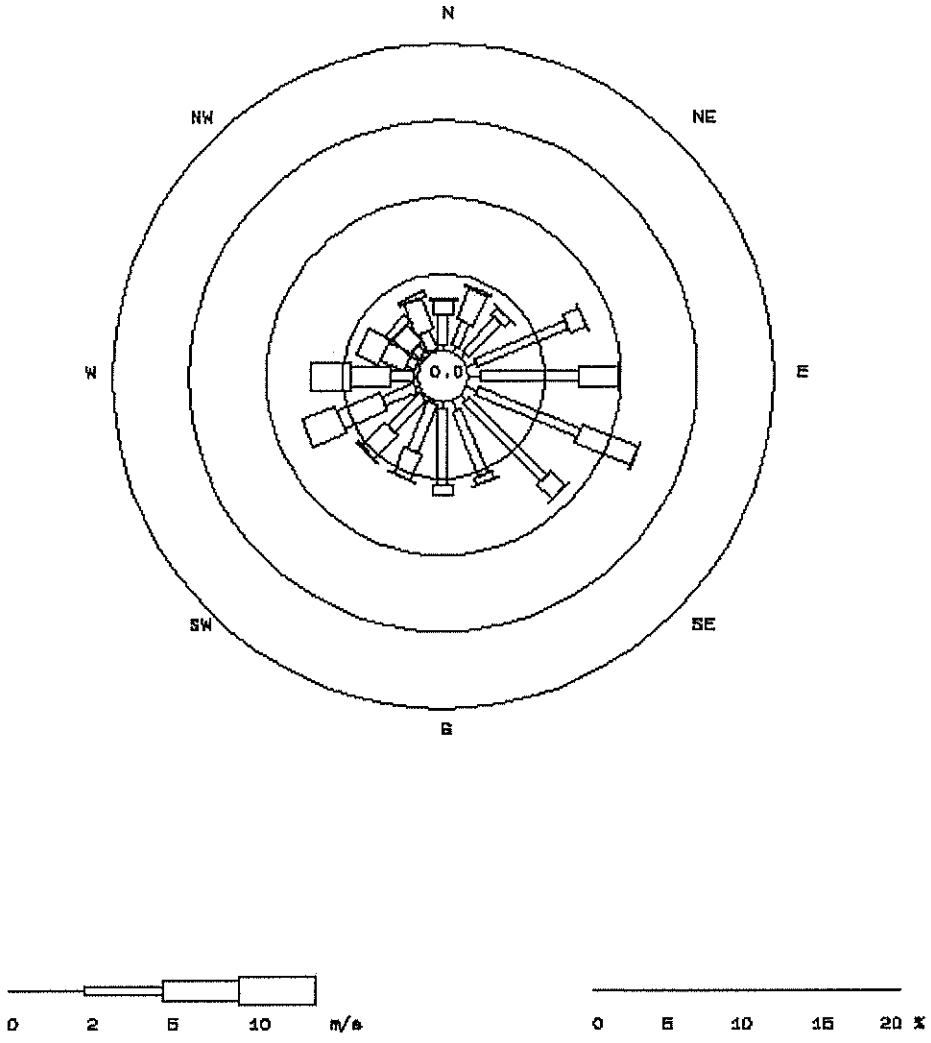

Figure 4. Predicted Odour Contours for Existing Plant Using 1999 Met File

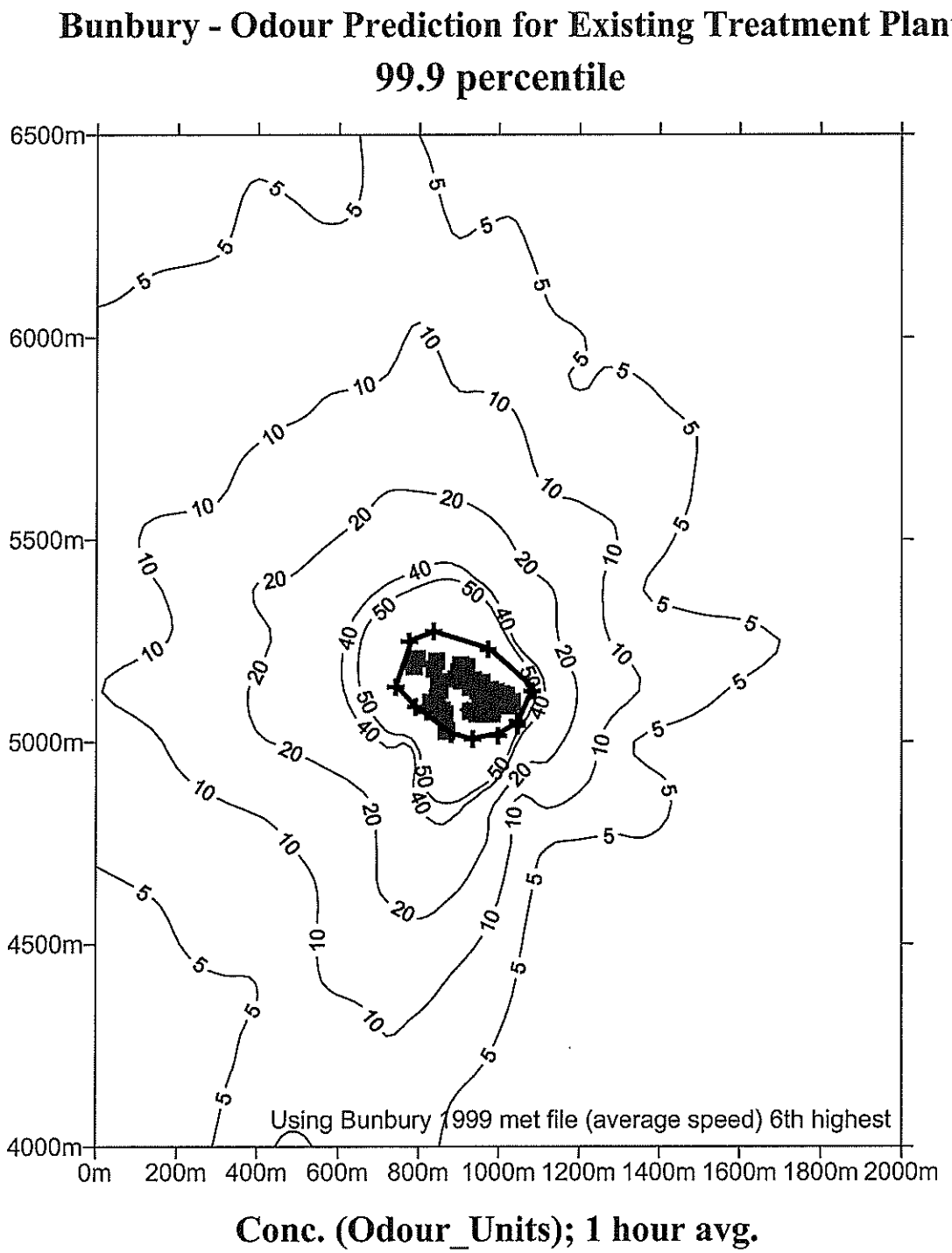

Figure 5. Predicted Odour Contours for Existing Plant Using 2000 Met File

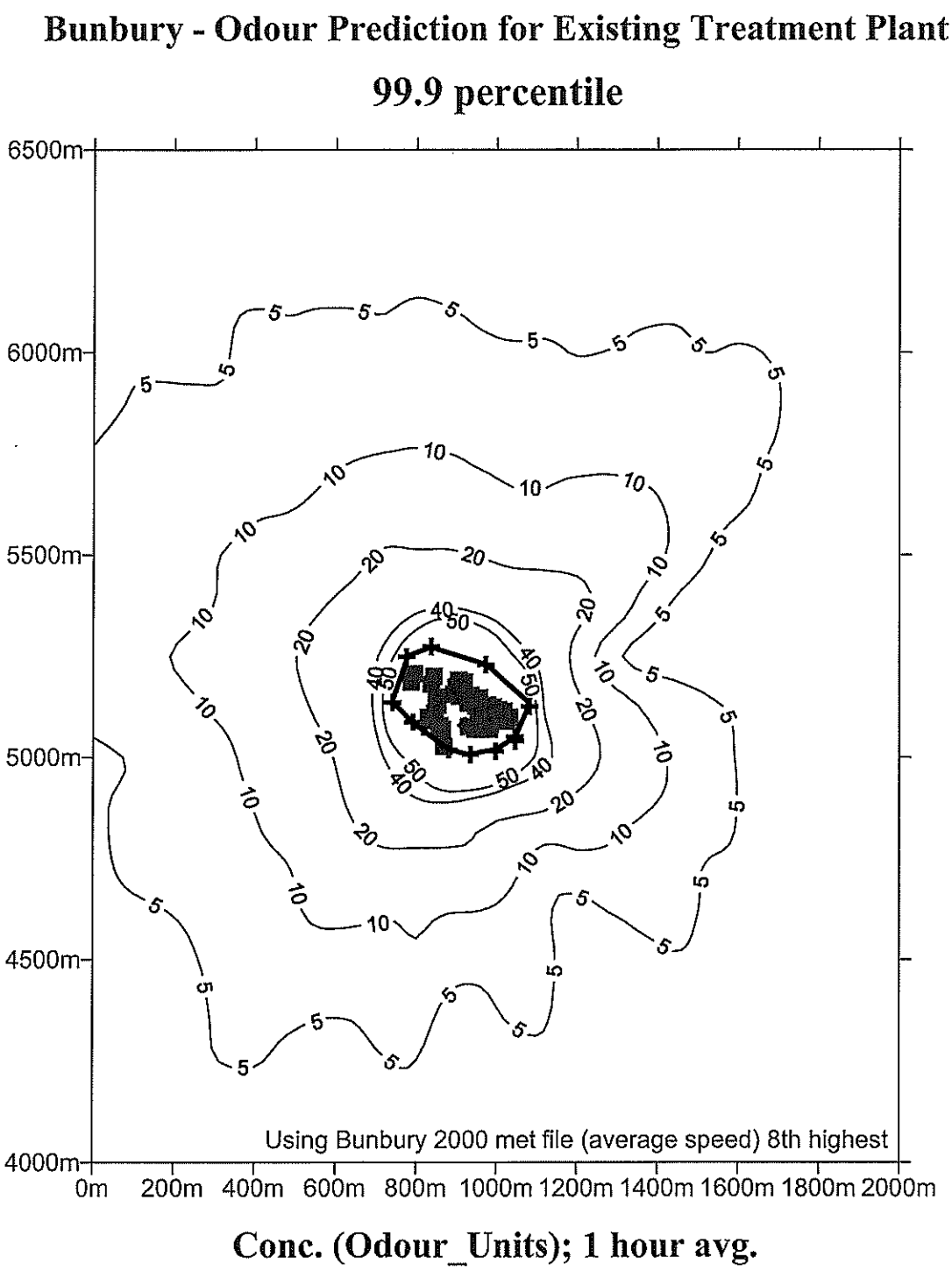

Figure 6. Predicted Odour Contours for Proposed Plant Using 2003/04 Met File

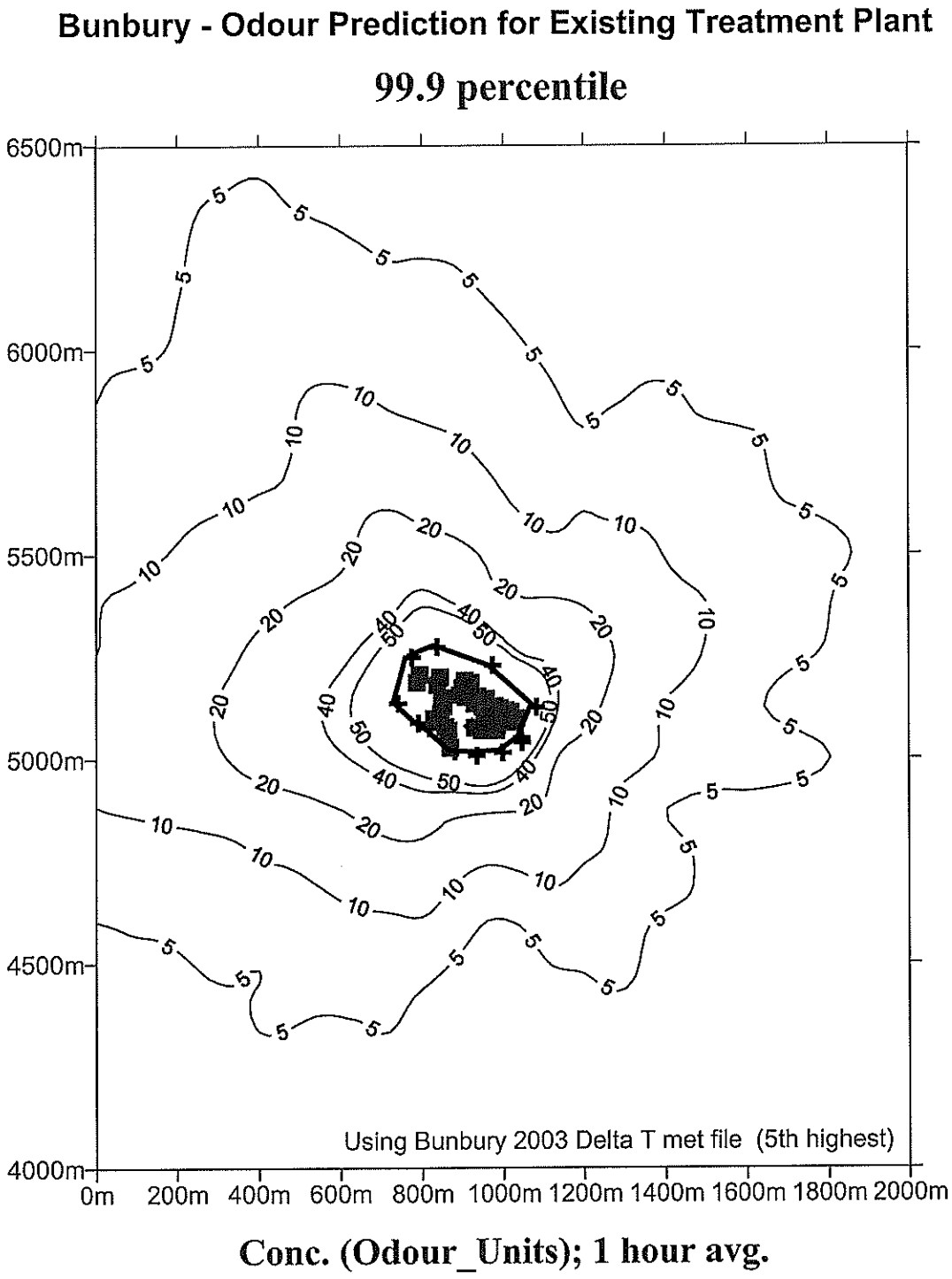

Figure 7. Predicted Odour Contours for Future Plant Using 1999 Met File

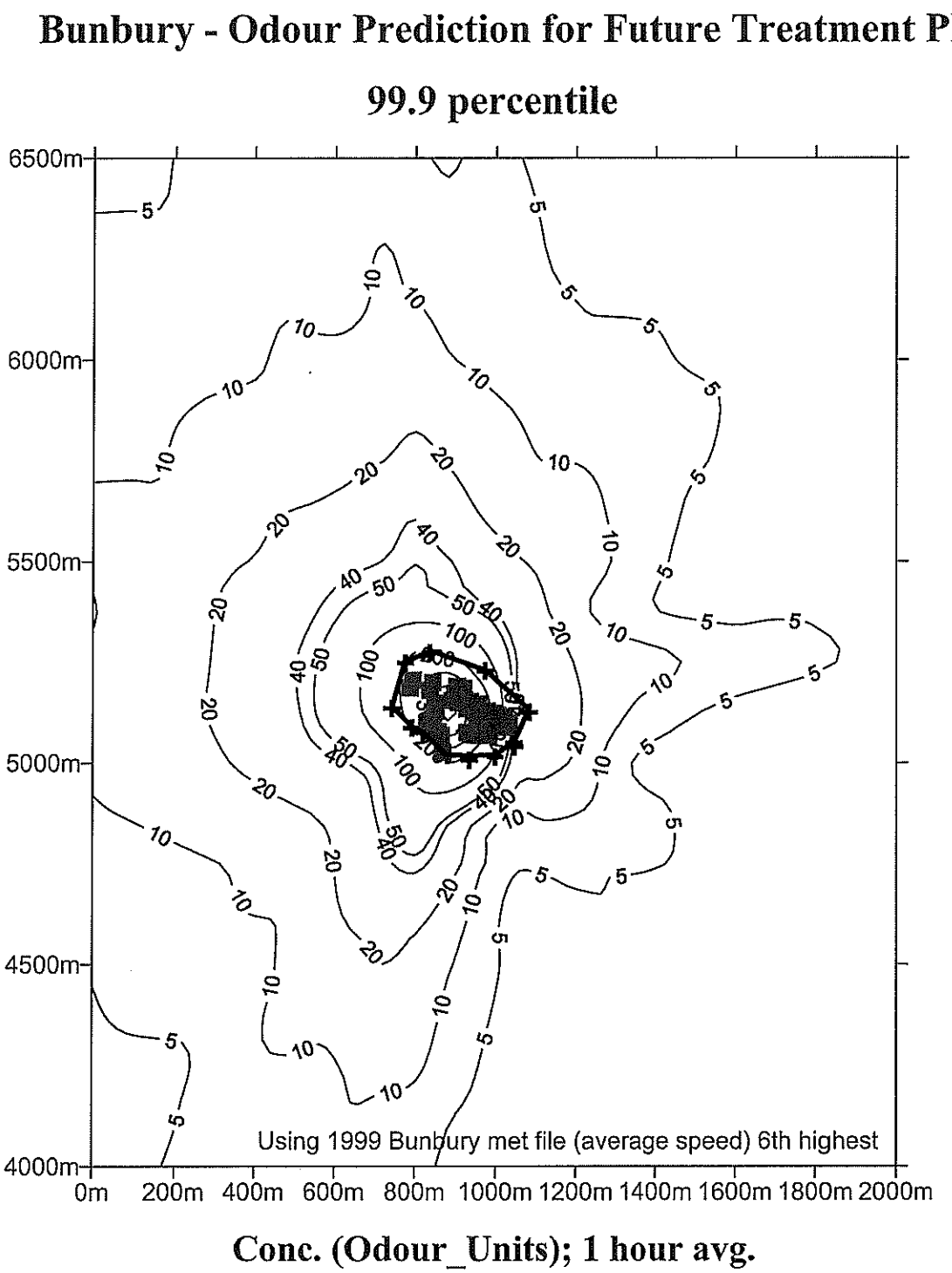

Figure 8. Predicted Odour Contours for Future Plant Using 2000 Met File

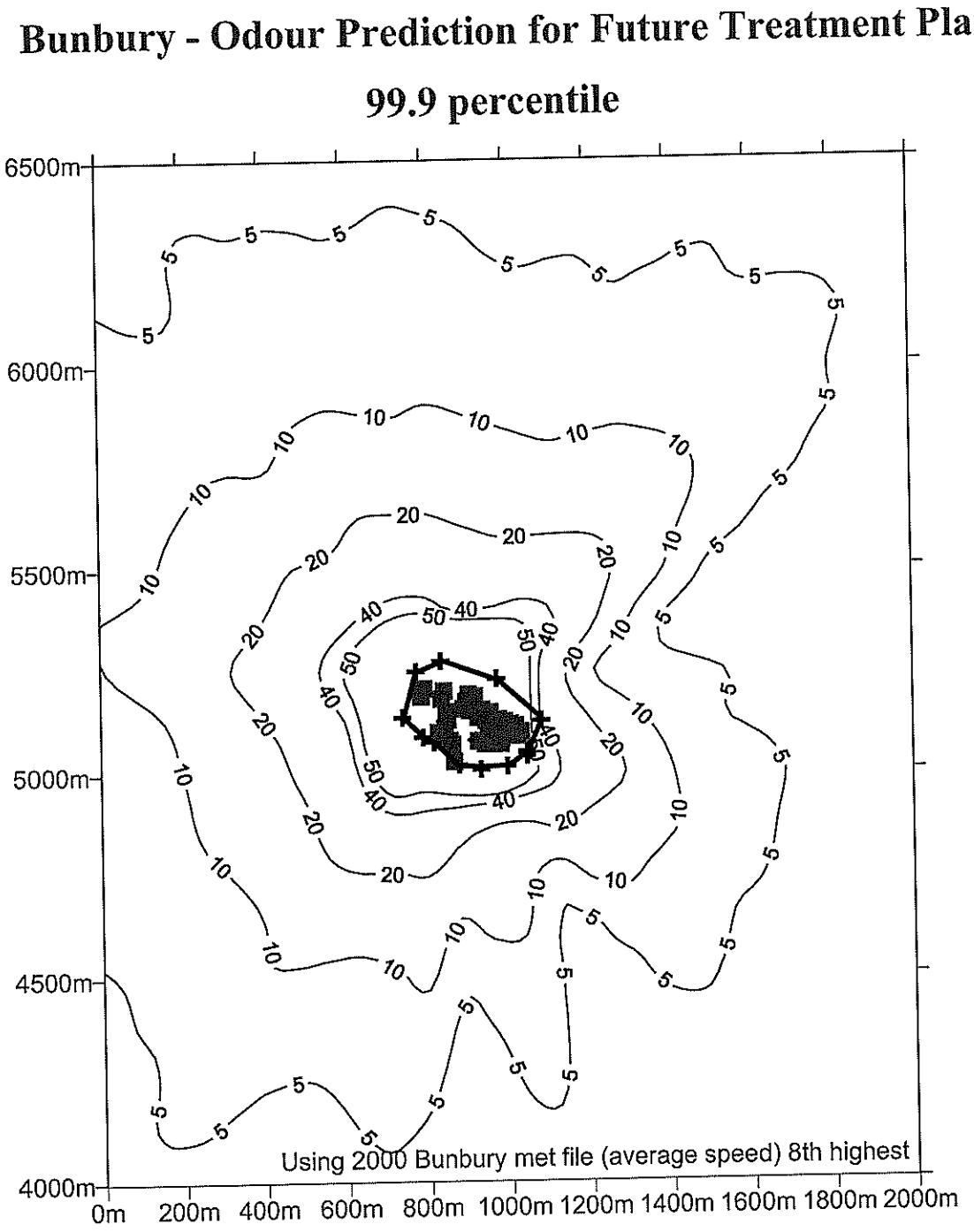

Figure 9. Predicted Odour Contours for Future Plant Using 2003/04 Met File

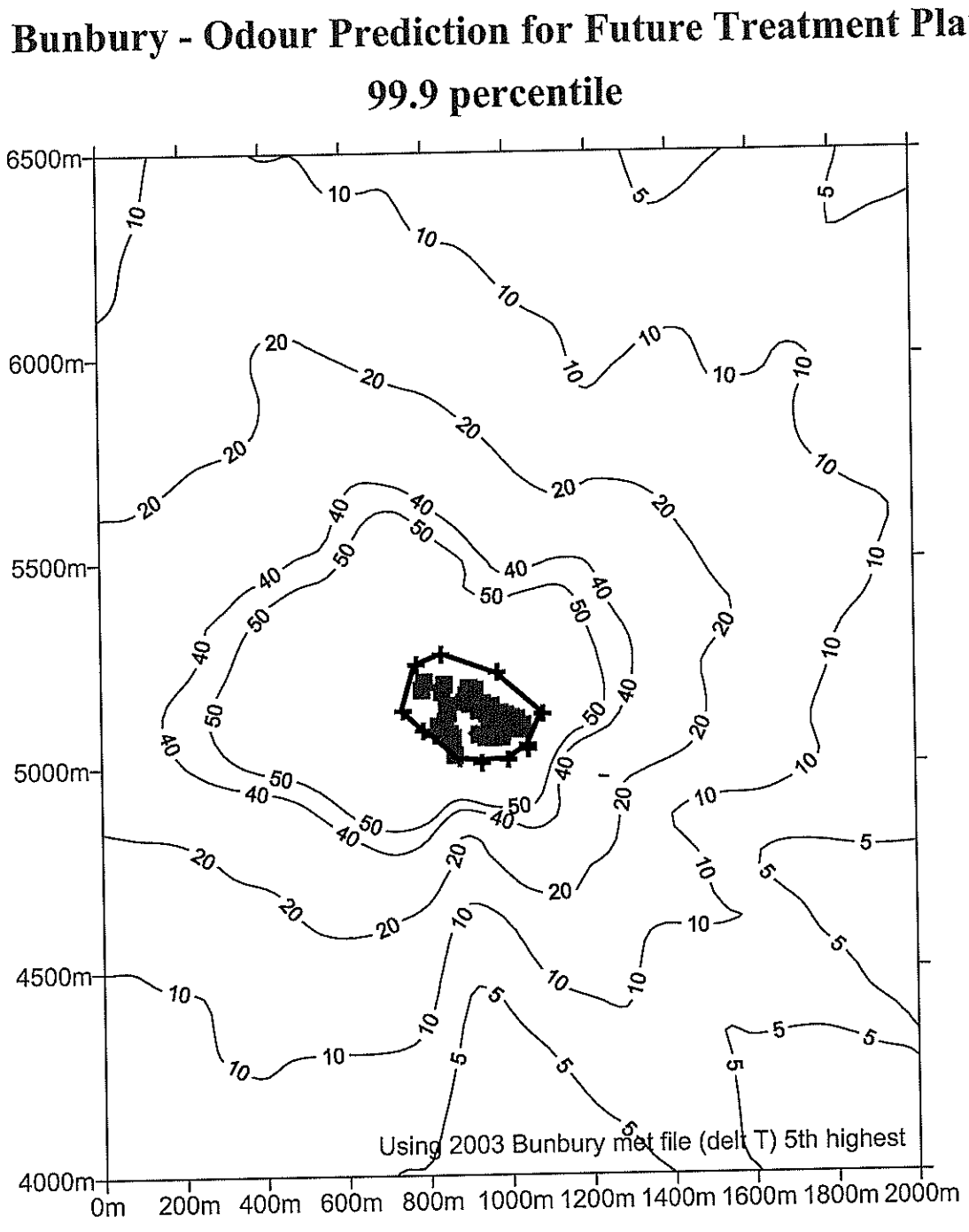

Figure 10. Predicted Odour Contours for Future Plant Using DEP Criteria

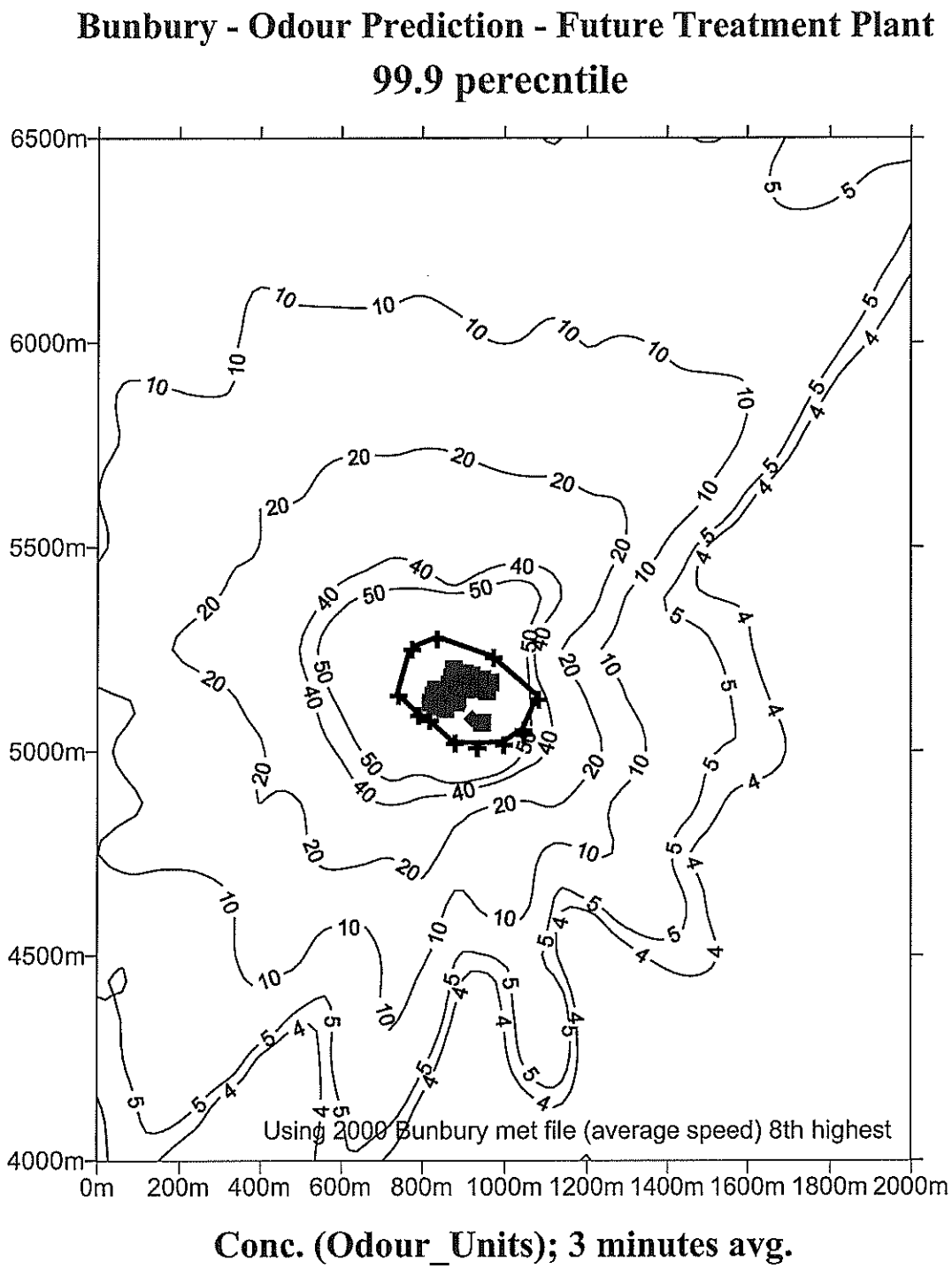

Figure 11. Recommended Buffer Zone for Bunbury WWTP

THE INFORMATION CONTAINED HEREIN IS SUBJECT TO ONGOING REVIEW AND AMENDMENTS AND SHOULD BE READ IN CONJUNCTION WITH THE ASSOCIATED REPORT.

DESIGN FILE:...\wwtp bunbury.dgn

PCID:PC4677

WATER CORPORATION

PROJECT N°: buffer DATE: 20/02/2001

WASTEWATER TREATMENT PLANTS

Figure 1: BUNBURY WWTP

Figure 3.17