Strategic advice on the proposed buffer for the Woodman Point Wastewater Treatment Plant

Section 16(e) report and recommendations of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 1240
November 2006

Strategic Advice Timelines

Date	Progress stages
8 March 2004	**Request for advice from Minister for the Environment**
2 September 2005	**Water Corporation SER document received by EPA**
27 September 2005	**SER document released for 12 weeks public comment**
20 December 2005	**Close of public comment period**
7 June 2006	**Proponent's response to submissions**
20 November 2006	**EPA section 16(e) advice released**

Report Released:
20 November 2006
There is no appeal period on s16(e) advice.

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Executive Summary

Introduction

The Environmental Protection Authority (EPA) has been requested by the Minister for the Environment to provide advice under section 16(e) of the *Environmental Protection Act 1986* on the buffer requirements for the Water Corporation's Woodman Point Wastewater Treatment Plant. The request arises out of community concerns regarding the extent of the odour buffer from the Plant.

For the purposes of providing advice, this report considers:

1. the technical accuracy of Water Corporation's odour sampling and modelling;
2. the nature and extent of the buffer required for the Plant, taking into account relevant odour standards;
3. the adequacy of the Water Corporation's approach to odour management; and
4. the development of an appropriate long-term buffer and land use outcome for the Plant and adjacent landholdings.

Advice

(a) There are significant issues with the technical accuracy of Water Corporation's odour sampling and modelling;

(b) Current odour management is not adequate and fails to meet the goal of no impact at odour sensitive premises;

(c) The current proposed buffer should be retained until after the implementation of Stage 1 measures, which are to achieve a 50% odour reduction, after which further emissions estimates, modelling and ground-truthing should be undertaken to determine the extent of odour impact and a long term buffer reconsidered;

(d) Further odour reduction measures beyond the 50% reduction are likely to be necessary to meet the goal of no impact on odour sensitive premises at residential areas;

(e) The Woodman Point Holiday Park may still experience occasional odour impact, even after the implementation of all three stages of proposed odour reduction;

(f) The best estimate of the extent of odour impact causing annoyance for this WWTP, on currently available information, will be obtained by modelling odour based on a one hour average and the 99.5^{th} (or lower) percentile;

(g) The EPA cannot recommend an appropriate, technically defensible long term buffer at this stage; and

(h) The EPA recommends the urgent implementation of Stage 1 controls to achieve a reduction of fifty percent of the current odour levels as soon as possible but no later than the end of 2008.

Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

- that the Minister notes that this strategic advice addresses odour issues associated with the Woodman Point Wastewater Treatment Plant;
- that the Minister considers the advice;
- that the EPA recommends the urgent implementation of Stage 1 controls to achieve a reduction of fifty percent of the current odour levels as soon as possible but no later than the end of 2008;
- that the Minister notes that the EPA is of the view that the establishment of a long-term buffer for the plant needs to be reconsidered once a fifty percent reduction in odour is achieved;
- that the current proposed buffer should be retained until after the implementation of Stage 1 measures, which are to achieve a fifty percent odour reduction, after which further emissions estimates, modelling and ground-truthing should be undertaken to determine the extent of odour impact and a long term buffer reconsidered; and
- that further odour reduction measures beyond the fifty percent reduction are likely to be necessary to meet the goal of no impact on odour sensitive premises at residential areas.

Contents

1. Introduction

The Woodman Point Wastewater Treatment Plant (WWTP) is the largest of the three metropolitan WWTPs in Perth. The Plant was first established in the 1960s, and has undergone a number of upgrades as a result of urban growth and development within its catchment. The Plant currently treats approximately 120 million litres (ML) of wastewater per day, and the Water Corporation expects that it will ultimately have a capacity of 320 ML per day.

In 2002 the Woodman Point WWTP was upgraded from a capacity of 125 ML per day to its current nominal capacity of 160 ML per day. The upgrade included treatment to secondary standards and odour reduction. When the upgrade was proposed the expectation was that the reduction in odour emissions would allow for the buffer to be contracted, possibly to the eastern shore of Lake Coogee, allowing land currently zoned as "Urban Deferred" to be rezoned for urban use. In addition the proponent stated the Corporation would rectify significant odour issues to the satisfaction of the Department of Environmental Protection, should monitoring subsequently reveal exceedances of the odour criterion. The criterion was in this case the 5 OU (odour unit) 3-minute average, 99.5th percentile and was assumed to be the distinct odour level at which community annoyance may be triggered. This criterion is different to the 'green light' criterion in EPA Guidance 47 because Water Corporation believes that experience has shown the 5 OU criterion to better present WWTPs than the general criterion in Guidance 47. However, subsequent odour modelling, together with a review of odour complaints and verification from a community annoyance survey, have demonstrated that the Plant is not achieving the level of odour control expected by the community (Market Equity 2003, Water Corporation 2005).

On 8 March 2004, the Minister for the Environment requested that the Environmental Protection Authority (EPA) provide advice under section 16(e) of the *Environmental Protection Act 1986* (EP Act) on the proposed buffer for the WWTP. The Minister requested that the EPA's advice address:

- the technical accuracy of Water Corporation's odour sampling and modelling;
- the nature and extent of the buffer required for the Plant, taking into account relevant odour standards;
- the adequacy of the Water Corporation's approach to odour management; and
- the development of an appropriate long-term buffer and land use outcome for the Plant and adjacent landholdings.

The Water Corporation prepared a Strategic Environmental Review (SER) document, which was submitted to the EPA, addressing these issues. In this SER document, the Water Corporation acknowledged that a further significant reduction in odour emissions from the Plant is required (Water Corporation 2005). A programme of work to upgrade the Plant to Australian best practice in odour control, to be completed by 2015, is proposed.

The EPA released the SER document on 27 September 2005 for a 12 week public comment period. Submissions were received from the Department of Health, local government and members of the public. A total of 21 individual and 89 group submissions were received. A number of issues were raised in submissions including

the 2002 upgrade, odour control, regulatory controls, land-use, buffer and the Mayor Road pumping station. The EPA has considered these submissions in the formulation of this section 16(e) advice. In addition representatives of the proponent and community addressed the EPA Board at a meeting. The EPA also obtained independent advice on the technical accuracy of the odour sampling and modelling described in the SER and on the adequacy of the described approach to odour management, including the proposed odour control infrastructure.

This report contains the EPA's advice and recommendations regarding odour issues of the Woodman Point WWTP.

2. Background

2.1 Odour measurement and guidelines

The odour threshold is the concentration of odour necessary for detection by a certain percentage of the population, normally 50%. This concentration is defined as one odour unit (EPA, 2000).

Odour is measured by dynamic olfactometry in which a sample of odorous air is presented to a panel of people in a range of dilutions, and checking whether they can detect the odour. The number of dilutions of an odour sample required to achieve the odour threshold is the number of odour units (OU) for that sample.

Odour intensity is the relative, perceived psychological strength of odour above its threshold. An odour intensity described as "distinct" is usually the intensity at which the odour may be just recognisable. Intensity is related to concentration of the odour but the relationship varies depending on the characteristics of the odour.

In *Interim EPA Guidance Statement 47* (EPA 2005) the EPA provided odour criteria for new proposals and expansions, to assist in determining whether odour impacts are likely to be acceptable. In cases where generic separation distances between industry and sensitive premises are not met, the proponent needs to demonstrate that the ambient odour concentration does not exceed the two-part screening criteria of

(a) 2 OU/m^3 3 min average[a], 99.5th percentile[b]; and
(b) 4 OU/m^3 3 min average, 99.9th percentile

at the nearest sensitive premises.

In cases where these criteria are not met, proposals are assessed on a case by case basis.

[a]3-minute averaging time would capture more fluctuation in measurements than a 1-hour averaging time.

[b]5 OU 99.9th percentile means that 99.9% of the time the odour is less than 5 OU and 0.1% of the time it is greater than 5 OU. The setting of a percentile compliance guideline allows for unusual meteorological conditions or occasional malfunctions at the plant.

2.2 Buffer concept

The EPA does not view buffers as an alternative to providing best practicable emission controls and appropriate management practices. The primary purpose of buffer areas is to provide for contingencies that may arise with typical management practices.

In order to manage industrial emissions, including odour, the EPA's preferred hierarchy is:

- avoidance of discharges;
- minimise the creation and discharge of waste by implementing best practice; or
- ensure environmental impacts from industrial emissions are acceptable and meet the relevant regulations and health criteria beyond the boundary of the site, industrial estate or buffer area. (EPA 2005).

In line with the requirements of the EP Act, it is necessary for individual industrial developers to take all reasonable and practicable measures to prevent or minimize emissions from their premises. Wastewater treatment plants are considered industrial premises in the EPA's buffer guidelines (EPA 2005).

Generally, impacts on the environment decrease with increasing distance from the source of the emission. If the impacts from a particular industry or industrial estate are considered to be unacceptable at the boundary of the site or estate, then there is a need for a buffer area to separate the industrial land and sensitive land use. While not negating the need for best practice approaches to emission management, buffers are an option for achieving an acceptable environmental outcome.

Land uses considered to be potentially sensitive to emissions from industry include residential developments, hospitals, hotels, motels, hostels, caravan parks, schools, nursing homes, child care facilities, shopping centres, playgrounds, and some public buildings.

2.3 Woodman Point WWTP

The Woodman Point WWTP was established in 1966 and constructed on its present site in 1983/4. At that time the land surrounding it was used for industrial and rural activities, including market gardens which were established early in the 20th century. This provided the WWTP with an effective buffer of 1000m to residential zoned land, although residences were present on rural zoned land.

In 1996 odour modelling for the plant was used to establish an informal buffer (set at the 7 OU contour at the 99.8th percentile). This buffer area extended 800m to the north, 700-800m to the west, 700m to the south and 650-800m to the east. This informal buffer included part of the Woodman Point Holiday Park and some residences from 100 to 300m from the eastern shore of Lake Coogee. The Woodman Point Holiday Park is the nearest odour sensitive premises to the WWTP and according to odour modelling the most impacted residential premises. The park was established by 1987 and has 40% of its occupancy (approximately 200 people) as permanent residents. The park is administered by Department of Environment and Conservation and is currently leased to 2024. This informal buffer was not formally

proclaimed but was acknowledged by the City of Cockburn in zoning the area to the east of Lake Coogee as Urban Deferred.

In 1997/8 it was proposed to expand the plant to 160 ML/day and add secondary treatment capability. At that time the Water Corporation indicated that the odour estimations for the upgraded plant would meet the 5 OU (99.5^{th} percentile, 3minute average) at the nearest odour sensitive premises and they expected that this would allow the buffer to be contracted and, on the eastern side of the plant, to be moved to the edge of Lake Coogee (Water Corporation 8/5/98 and SKM 1999). The project was redesigned and engineered during 1999/2000. In 2005 a tanker receival facility for septage and oily wastes was added to the existing plant. Figure 1 shows the location of the Woodman Point WWTP and Figure 2 the current plant layout.

In the 2005 SER document the Water Corporation submitted that a buffer area similar to the one proposed in 1996, but adjusted to cadastral boundaries and of slightly lesser extent to the south of the WWTP, is required for the WWTP. This was based on re-estimation of odour emissions and remodelling of odour and plans for future expansion activities.

At present, the land to the south and west of the Woodman Point WWTP is zoned industrial, and has been developed for a range of medium and heavy industrial purposes. Within the current proposed buffer, land north of the plant is zoned public conservation, and to the northwest is Park and Recreation Reserve. Residential development reaches the northern edge of the current proposed buffer, and there is pressure for residential development to the east of the plant (Figure 3).

2.4 Wastewater Treatment Plant Buffers and odour controls

Comparison with Subiaco and Beenyup WWTPs

Water Corporation currently operate three major WWTPs in Western Australia: Subiaco, Beenyup and Woodman Point, with a fourth plant proposed at Alkimos. The Subiaco and Beenyup WWTP odour controls have been upgraded recently to best practice standards. This involved additional odour control to inlet works, primary sedimentation tanks, feed channels and effluent channels, anoxic and aerobic zones of the aeration tanks and miscellaneous pen stocks. In addition both plants have upstream oxygen injection and pre-chlorination. The Subiaco and Beenyup plants have informal odour buffers of 600m and 150m respectively to the nearest residences.

The Water Corporation has proposed the 5 OU 1-hour average 99.9^{th} percentile as the "distinct" odour level for Woodman Point based on odour complaints, perceptions and modelling undertaken for the Subiaco and Beenyup WWTPs. The independent reviewer noted that the modelling for Subiaco and Beenyup may be inaccurate as the meteorological data used was not recorded at the Subiaco and Beenyup sites.

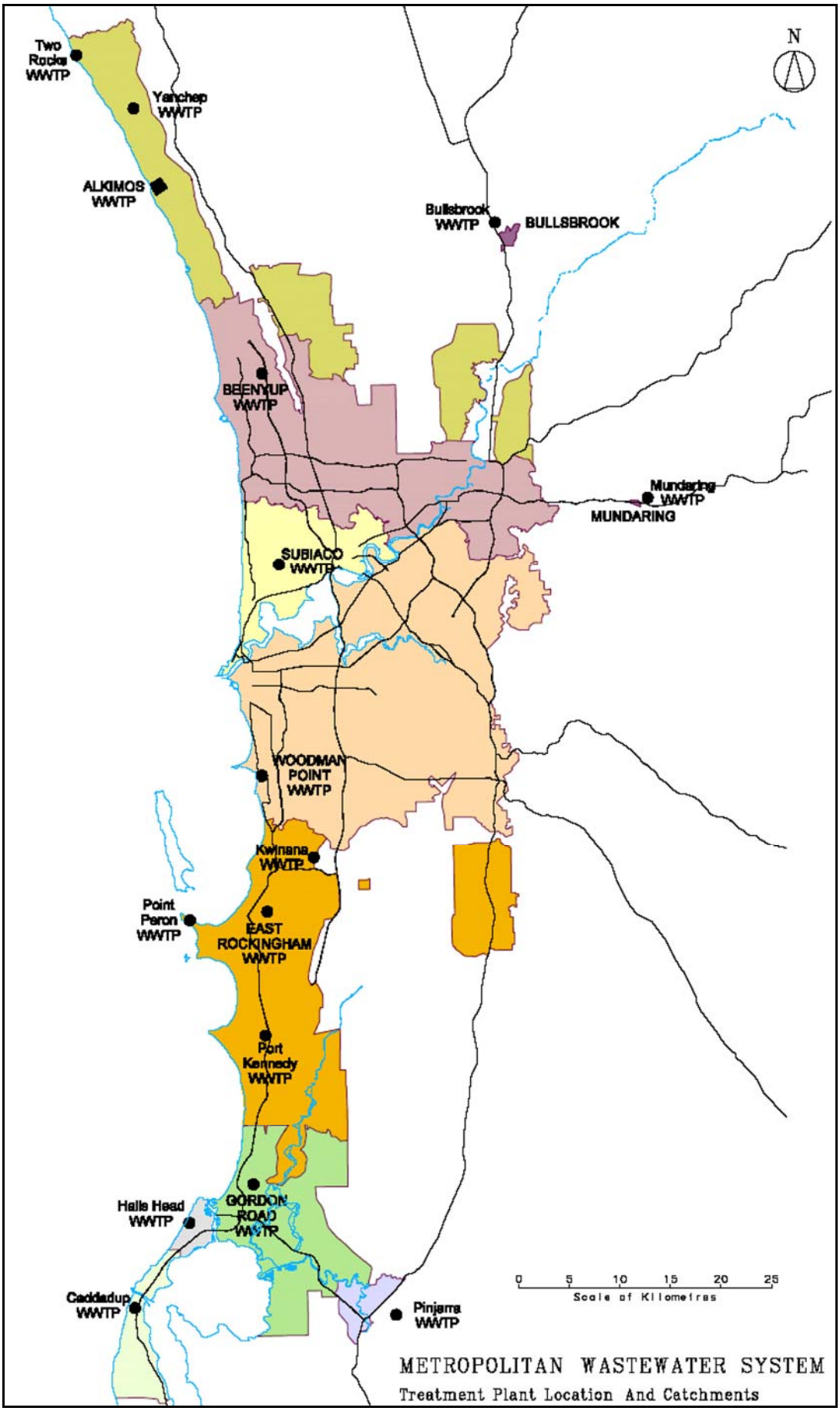

Figure 1: Location of the Woodman Point Wastewater Treatment Plant

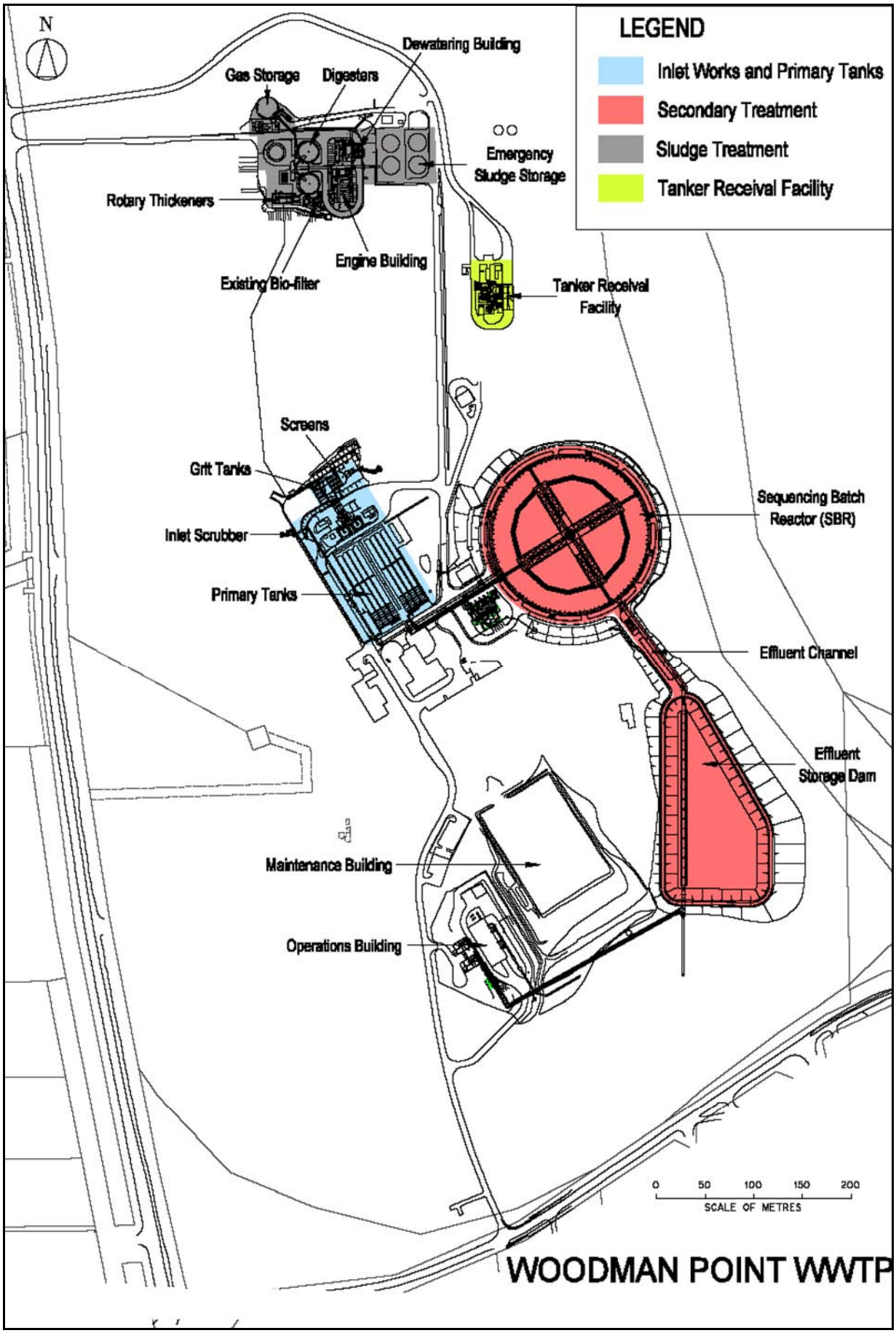

Figure 2: Layout of the Woodman Point Wastewater Treatment Plant

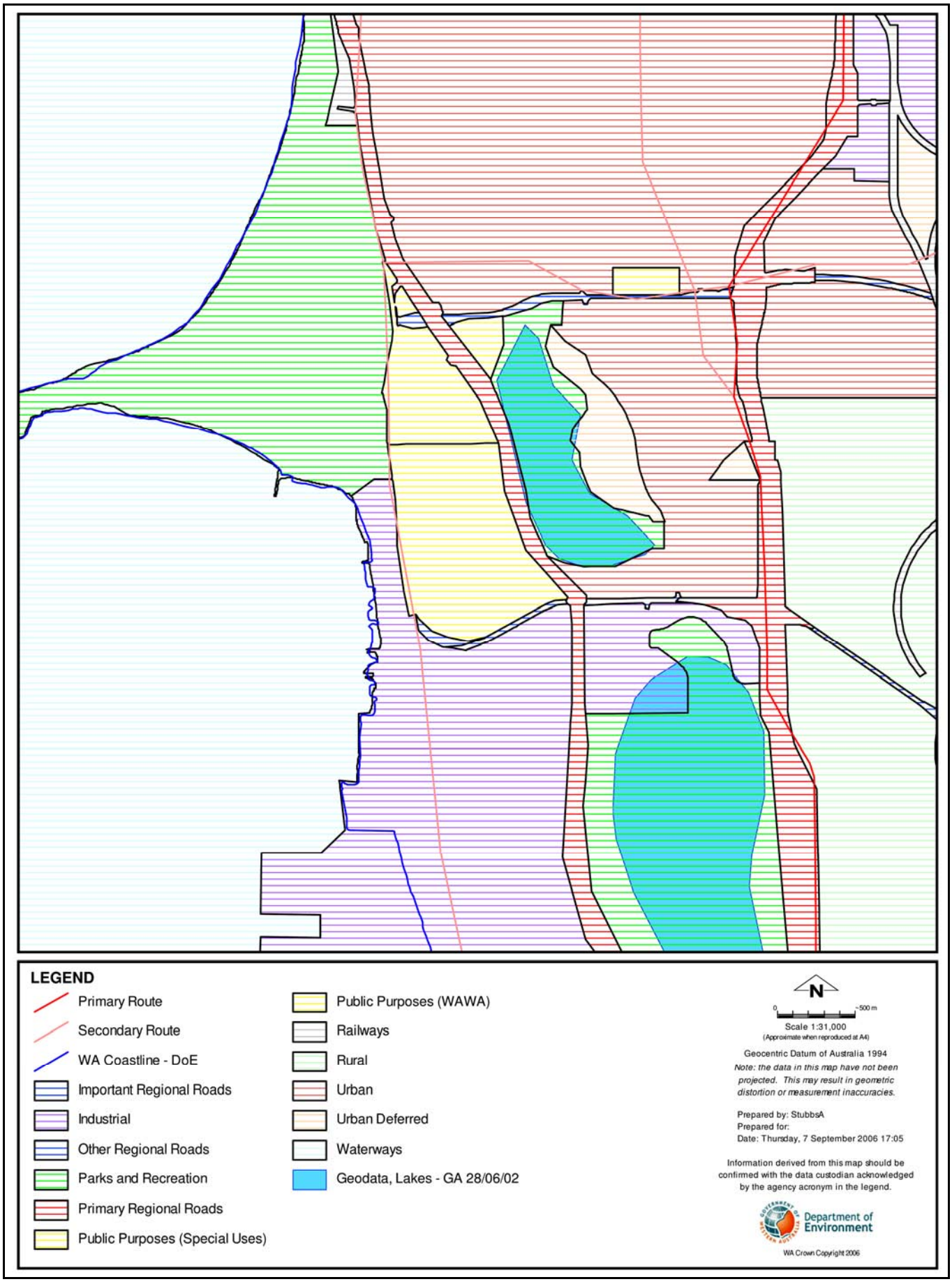

Figure 3: Land Use Zoning – Lake Coogee

Comparison with other WWTPs

The SER document presents some comparisons with odour controls at other Australian WWTPs. It should be noted that not all the relevant information is provided in the SER document in order to make a meaningful comparison. For example, Malabar and North Head plants discharge primary treated sewage through ocean outfalls and do not have secondary treatment. Malabar has all tanks covered within a building and North Head is mostly underground. Eastern WWTP in Victoria has some odour issues and is currently making improvements to odour controls through an environment improvement plan. The requirement of the EPA Victoria licence for this plant is for no objectionable odour at the plant boundary. Pre-treatment of sewage, time for sewage delivery, plant capacity, meteorological conditions, landform and distances to nearby odour sensitive premises are also relevant to the extent of odour controls required at WWTPs.

A survey of WWTP plants where world's best practice has been applied was undertaken for the Water Corporation by URS (URS 2001). In Singapore and Japan the need to control odour has been driven by a lack of land and these plants show how much odour can be reduced. The study reported that full odour containment and emissions reduction was applied to inlet screens and grit removal, primary tanks, secondary anoxic and aeration tanks and in some cases, secondary clarifiers, and all solids treatment areas. The nearest odour receptors for the surveyed plants varied from 150m to 1000m.

Odour controls

There are various options to reduce odours from WWTPs. Odour can be reduced at source by oxygenation in the catchment and chlorination pre-treatment. Sewage arriving at the Woodman Point WWTP has a high degree of septicity due to length of time that the sewage spends in the pipelines. Chlorination of sewage pre-treatment was carried out at Woodman Point previously, but is no longer done.

Another option for odour reduction is to enclose odour sources with the captured air being treated via a scrubber or other means prior to release to atmosphere. The choice of odour reduction methods to be applied at Woodman Point is the responsibility of the Water Corporation.

3. Public Consultation

In 2003 the Water Corporation undertook a telephone survey of residents in the vicinity of the WWTP. The areas surveyed were Coogee, South Coogee and east of the WWTP. The survey found that most residents of these areas had noticed odours and that approximately 50% attributed the odours to the WWTP. Other sources of odour such as industry and Lake Coogee were also thought to contribute to odours in the area. Odours attributed to the WWTP were identified by residents up to 2.8 km north of the plant and 2.2km north-east of the plant. The EPA notes that the area to the east of Stock Road was not surveyed as the Water Corporation, due to lack of complaints, did not consider that there was an odour problem to the east of the plant.

As a result of the SER published in 2005, the EPA received 21 submissions from the public and agencies and a group submission signed by 89 people. Matters raised in submissions included:

- proposed staged odour control works;
- provision of funding for the works;
- performance criteria/standards for odour control works;
- regulation to control odour;
- 2002 expansion of the plant;
- the buffer;
- land uses within the buffer;
- compensation for land in the buffer;
- odour modelling;
- odour survey and complaints;
- use of Mayor Road pump station overflow basin;
- maintenance at the plant;
- on-going community consultation; and
- health effects of odour emissions.

The Water Corporation's response to these submissions is contained in Appendix 6.

4. The technical accuracy of the Water Corporation's odour sampling and modelling

Major sources of odorous emissions (SER) from the WWTP are:

- the anoxic selector tanks of the Sequencing Batch Reactor (SBR) unit;
- the aerobic tanks of the SBR unit;
- sludge digester outlet;
- biofilter outlet;
- Primary Sedimentation Tank (PST) scrubber; and
- fugitive emissions from the primary tanks.

The independent review identified a number of issues with current and previous odour sampling and emission estimates (Appendix 3). These concerns will need to be addressed in future odour sampling and emissions estimates. However, not withstanding the deficiencies, the EPA considers that current sampling and emissions estimate are the best available for the modelling.

The independent reviewer made a number of recommendations which should be taken into account in future modelling (Appendix 4). One of the main concerns is the lack of modelling for "upset" conditions, since these "upset" occurrences may be related to the instances of off-site complaints. Another major deficiency is the use of "sigma theta" instead of "Pasquil Gifford" dispersion curves for the modelling in the SER. This has been subsequently corrected by the Water Corporation.

The reviewer also found that the modelling for odour emissions from Lake Coogee was indicative only and is likely to overstate the impact in the middle of the eastern boundary while understating the impact at the southern end of the Lake. While this may not relate directly to the buffer of the WWTP, odour from the Lake will need be

considered should future residential development be planned on the eastern edge of the Lake.

5. The adequacy of the Water Corporation's approach to odour management at Woodman Point WWTP

It is evident from the odour modelling presented and the complaints/survey data that odours from the WWTP are impacting residential properties far beyond the boundaries of the current proposed buffer. The Water Corporation has not met its stated aim for the most recent expansion of ensuring that 5 OU was not exceeded at odour sensitive premises (commitment P2 of SKM 1999). In addition it is also evident that the standard of odour controls at the Woodman Point WWTP falls short of those at Beenyup and Subiaco, and in comparison to world's best practice.

The EPA recommends that the Water Corporation begin their program of odour reduction immediately with the aim of completing all three stages, or alternative measures to reduce odours, in the shortest time feasible. Of particular concern, is the reviewer's advice that based on the current emission estimates and modelling, "acceptable" odour levels will probably not be achieved at South Coogee until Stage 3 (odour control) is implemented. Even after Stage 3 at an inflow rate of 240ML/day, further controls are necessary to achieve "acceptable" odour level at the Woodman Point Holiday Park. Stage 3 is not scheduled for completion until 2015 in the Water Corporation's proposed timetable and the EPA considers it unacceptable that a residential area should continue to be affected by odour for another nine years. The Holiday Park with 200 permanent residents and another potential 300 temporary occupants should have the same criteria applied to it as to residential premises. The EPA recognises that the current modelling data is predicting that this objective is going to be difficult to achieve. Should the prediction be correct, transient residents may be willing to continue to use the Park despite intermittent odour impacts which will be substantially reduced from the current levels. The Department of Environment and Conservation, as the custodians of the Park, would need to ensure that leasing arrangements made permanent residents aware of the potential for occasional odour impact before settling in the Park.

The EPA recommends that the odour reduction measures be commenced immediately. It is noted that the Water Corporation is required by its licence under Part V of the *Environmental Protection Act 1986* to have an odour improvement plan by October 2006. The aim of this plan is to achieve a reduction in odour of 50% within three years, to achieve an "acceptable" level of odour (defined as 5 OU) at odour sensitive premises and to develop strategies to resolve any land-use conflicts surrounding the plant if an "acceptable" level of odour cannot be attained. It is logical that the largest and most offensive odour sources that can be practicably reduced are addressed in the first instance.

In the SER the Water Corporation proposes a first stage of odour reduction:

- cover the anaerobic and anoxic zones on the Sequencing Batch Reactor (SBR);

- replace the existing Primary Sedimentation Tank (PST)/inlet scrubber with a new centralised scrubber;
- seal the inlet works waste receival pit;
- implement odour control at sludge treatment; and
- remedy odour issues due to mechanical problems at the Tanker Receival Facility (TRF).

Stage	**Action**	**Timing**
Stage 1	• Cover SBR selectors • Upgrade odour control in sludge area (for 4 ESDs) • Construct new chemical scrubbing system	End 2008
Stage 2	• Improve sealing and air abstraction rates under covers of Plant inlet and primary works • Upgrade 2 ESDs to operate as TPAD process	2010 2012
	• Odour sampling, modelling and community surveys to verify odour reduction achieved in Stages 1 & 2 works • Scope any additional odour control works as necessary	2011 2011
Stage 3	• Construct additional aeration treatment tanks (80ML) • Cover SBR (aeration tanks and connect to scrubbing system • Other odour control works	2015

The EPA notes that since the SBR anoxic area is the largest odour source, odour control in this area will substantially reduce emissions. This is also consistent with the expectation of odour control presented in 1999. The new scrubber system for the primary/inlet area is necessary due to the current system being undersized and lacking redundant capacity. The planned odour controls in the sludge treatment area, (including the sludge truck loading area) which may be the source of large intermittent odour emissions, are appropriate.

However, despite the primary/inlet area improvements proposed, the SER predicts odour emissions from this area will increase as the volume of in-flow increases. Odour from the primary/inlet area is still a substantial proportion of the total odour emissions. This is of concern as odour from this area is more offensive in nature to most people than odour from aerobic treatment areas.

As presented in the SER the proposed stage one controls would not deliver the 50% odour reduction in the next three years as required by licence conditions. However, the EPA notes the Water Corporation has now stated (in its response to submissions)

that it is revising its approach to the odour control works in order to attain the 50% reduction by the end of 2008. The Water Corporation now estimate that the Stage 1 works will achieve a 52% reduction in odour.

With respect to the proposed odour improvements the following should be noted:

- covering and odour extraction from the PST should be designed so that maintenance on one PST does not affect the efficiency of odour control on other PSTs;
- in general odour controls should be designed to allow for maintenance with the least escape of odour;
- the option of a taller stack for discharge of emissions from scrubbers should be evaluated to ensure that this does not result in higher odour further from the WWTP site; and
- the maximum odour and frequency of maxima from any point sources at the WWTP should be considered.

After the implementation of the Stage 1 controls to achieve 50% odour reduction, the emissions estimates should be updated and remodelled taking into account recommendations made in this advice (Appendices 3 and 4) in order to obtain a more accurate representation of expected odour impacts. This should be confirmed by ground-truthing and possibly a further telephone survey of affected residential areas. As it is likely that all three stages of odour reduction, as outlined in the SER, will be necessary, odour assessment after completion of the first three years of work should not delay the continuing implementation of further work.

The Water Corporation has argued that to cover the aerobic areas of the SBR will require the construction of an additional secondary treatment tank which will not be required until 2016. The Water Corporation should give consideration to how the covering of the SBR can be brought forward. Possible options could be innovative engineering solutions such as prefabricated cover sections that could be installed without ceasing operations or staging the construction of more secondary treatment units so that sufficient capacity can be constructed earlier than 2015 to allow one SBR quadrant to be taken off-line at a time.

In the investigation of odour emissions a number of deficiencies in the current odour controls and maintenance were also identified. Where possible these deficiencies should be rectified as a matter of priority. Other problems such as lack of redundancy in the system and undersizing of scrubbers should be addressed in the design of upgraded systems.

In regard to malfunctions and accidental releases of odour, the independent reviewer noted that the Stage 1 odour control improvements should also reduce the frequency of upset emissions. The reviewer recommends, and the EPA concurs, that targets that specify the frequency of upset conditions are needed. These could be included in licence conditions for the WWTP.

6. Relevant odour standards

The independent reviewer noted that the northern-most complaints/survey data was omitted in the SER. With the inclusion of these data points, the Woodman Point meteorological data and the correct dispersion curves for modelling, the reviewer found that the 5 OU 1-hour average 99.9 percentile contour, while providing a good fit with data in the north, over-predicted the area with odour complaints/issues to the east by 1 to 1.5km. The reviewer found that the 99.5th (or lower) percentile contour shape provided a better match with the data. The reason for this is that the 99.5th percentile better reflects the frequency of light winds and stable conditions (Pacific Air & Environment, 2005).

The EPA notes that the shape of the modelled odour contours is influenced by the meteorological conditions at the site, the landform and the position and characteristics of the odour sources. Therefore it does not necessarily follow that because the 99.9th percentile contours modelled by AUSPLUME are appropriate at another site, they will be appropriate at the Woodman Point WWTP. The EPA further notes the information contained in the Pacific Air & Environment report (Pacific Air and Environment, 2005) concerning the choice of percentiles for modelling and agrees with the reviewer's conclusion that the 99.5th (or lower) percentile would be appropriate for modelling the expected extent of odour impact at the Woodman Point WWTP.

A one hour average is recommended if AUSPLUME is used as meteorological data are in this format and AUSPLUME currently does not accurately convert this data to shorter averaging times. However, the EPA notes that a 3-minute averaging time would pick up short term meteorological variations and hence odour fluctuations better.

It should be noted that since modelling is a mathematical exercise (that depends on input data), different odour levels can be predicted at the same point on the map. Therefore it is difficult to assign a "distinct" odour level through modelling. The distinct level is best defined through dynamic olfactometry and it is based on average perception of odour. It does not take into account odour sensitive individuals. In areas of higher density population there will be a greater probability of finding odour sensitive individuals.

The value assigned to an odour contour during modelling will also be dependent on the emissions estimation and source parameters of which there is some uncertainty at the moment. Therefore no odour unit value is recommended at this time.

Subsequent to the independent review, further complaints data have become available. The independent reviewer did not have the opportunity to examine this data. Therefore the EPA's conclusions are based on the data provided in the SER. The EPA recommends that the Water Corporation continue to provide a complaints line to further delineate the area of impact. On receipt of a complaint, the complaint should be verified and it should be confirmed that the odour source is the Woodman Point WWTP. A complaints register should be maintained and a summary of complaints data published on the Water Corporation's website every three months.

7. The nature and extent of the buffer required for the plant and the development of an appropriate long-term buffer and land-use outcome for the plant and adjacent landholdings

The independent reviewer concluded that due to issues in relation to the modelling and with the emissions inventory, the predictions from the current modelling cannot be used to define the requirement of the WWTP odour buffer.

The EPA considers that there are further odour controls that can be practicably implemented to reduce odour emissions from the WWTP. Until this is done, an appropriate buffer cannot be determined.

The EPA emphasises that a buffer area is not a substitute for best practicable emission control and good environmental management. Nevertheless an odour buffer should be maintained to cater for unusual meteorological occurrences and short-term WWTP malfunctions.

The EPA recommends the urgent implementation of Stage 1 controls to achieve a reduction of fifty percent of the current odour levels as soon as possible. The Water Corporation should then re-measure odour emissions, remodel to predict ground level odour contours (including worst case contours and expected frequency), carry out ground-truthing and survey residential areas to determine the remaining level of odour impact. Once this has been completed the issue of an appropriate permanent buffer can be reconsidered. Until this has occurred the current proposed buffer should be retained.

At this time, the EPA discourages the development of odour sensitive premises within the proposed buffer as it is evident that properties within this area would be impacted by odour. The EPA notes that even when a new odour buffer for the WWTP has been finalised, the issues of odour from Lake Coogee, a midge buffer, the Kwinana Air Quality Buffer and a wetlands buffer will need to be addressed before further residential development is considered.

Within an odour buffer, acceptable land uses are those where people voluntarily elect to be in the buffer or those which do not require the presence of people for long periods of time. Such uses may be flora and fauna reserves, parks and public recreation facilities or agricultural uses such as grazing, forestry or nurseries or road reserves or storage facilities. It is the EPA's preference that land within a buffer area is owned by the industry requiring the buffer, where practicable. The alternative is for the zoning of the land to reflect its restricted uses. Where conflict occurs between land-owners in a designated buffer and the industry requiring the buffer, the industry is encouraged to liaise with landowners to resolve conflict.

8. Other Advice

It is not realistic for the EPA to consider the upgrade to 320ML/d at this time. This capacity will not be needed until 2045 and:

1) technology/odour controls could change; and

2) water reuse and recycling may make it advantageous to construct new treatment plants at alternative locations rather than expand existing plants.

Although not part of the Woodman Point WWTP, the EPA notes that the Water Corporation uses the Mayor Road pumping station to hold raw sewage in case of emergency. This is a significant source of odour. Raw sewage is held in open ponds approximately two hundred metres from residences. The EPA recommends the Water Corporation either provides emergency storage which will not impact odour sensitive premises or ensures that adequate back-up systems are available so that the situation does not occur.

9. Conclusions

(a) There are significant issues with the technical accuracy of Water Corporation's odour sampling and modelling;

(b) Current odour management is not adequate and fails to meet the goal of no impact at odour sensitive premises;

(c) The current proposed buffer should be retained until after the implementation of Stage 1 measures, which are to achieve a 50% odour reduction, after which further emissions estimates, modelling and ground-truthing should be undertaken to determine the extent of odour impact and a long term buffer reconsidered;

(d) Further odour reduction measures beyond the 50% reduction are likely to be necessary to meet the goal of no impact on odour sensitive premises at residential areas;

(e) The Woodman Point Holiday Park may still experience occasional odour impact, even after the implementation of all three stages of proposed odour reduction;

(f) The best estimate of the extent of odour impact causing annoyance for this WWTP, on currently available information, will be obtained by modelling odour based on a one hour average and the 99.5^{th} (or lower) percentile;

(g) The EPA cannot recommend an appropriate, technically defensible long term buffer at this stage; and

(h) The EPA recommends the urgent implementation of Stage 1 controls to achieve a reduction of fifty percent of the current odour levels no as soon as possible but later than the end of 2008.

10. Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

- that the Minister notes that this strategic advice addresses the buffer requirements for the Woodman Point Wastewater Treatment Plant;
- that the Minister considers the advice;
- that the EPA recommends the urgent implementation of Stage 1 controls to achieve a reduction of fifty percent of the current odour levels as soon as possible but no later than the end of 2008;

- that the Minister notes that the EPA is of the view that the establishment of a long-term buffer for the plant needs to be reconsidered once a fifty percent reduction in odour is achieved;
- that the current proposed buffer should be retained until after the implementation of Stage 1 measures, which are to achieve a fifty percent odour reduction, after which further emissions estimates, modelling and ground-truthing should be undertaken to determine the extent of odour impact and a long term buffer reconsidered; and
- that further odour reduction measures beyond the fifty percent reduction are likely to be necessary to meet the goal of no impact on odour sensitive premises at residential areas.

Appendix 1

References

EPA 2005, *Guidance for the Assessment of Environmental Factors: Separation Distances between Industrial and Sensitive Land Uses*, No 3. June 2005, Perth, Western Australia.

EPA 2000, *Guidance for the Assessment of Environmental Factors: Assessment of Odour Impacts*, No 47 (Draft, withdrawn), April 2000, Perth, Western Australia.

Market Equity 2003, *Woodman Point Odour Modelling Study*, September 2003.

Pacific Air and Environment, 2005, *Technical Paper on the Methodology to Define Odour Buffers for Inclusion Within Proposed Environmental Protection Policy to Establish Odour Buffers for Water and Wastewater Treatment Plants*, Report for WA Department of Environment, November 2005.

SKM 1999, *Environmental Assessment and Management Plan*, Sinclair Knight Mertz, in association with DA Lord and Associates, January, 1999

URS 2001, *Worldwide Review of Odour Control at wastewater treatment plants*, URS, prepared for Water Corporation, October 2001

Water Corporation 8/5/98, *fax from Water Corporation* to Tony Ingrilli, Leanne Hay

Appendix 2

List of Submitters

Organisations:
Department of Health
City of Cockburn

Individuals:

19 individual submissions
89 signatures on group submission

Appendix 3

Recommendations for emission estimates

Recommendations for Odour sampling and Emission Estimates

1. Comparable methods of sampling should be used for comparison of different studies. The latest area source emissions were determined with a flux hood. This method or one that is directly comparable with this method should be used in future studies.
2. Emissions should be measured in summer to provide worst case operating peak rates.
3. Worst case operating emission estimates should be made i.e. all feasible equipment/facilities in operation at the same time.
4. When estimating sample decay rates from measured rates, a percentage rate of change should be applied.
5. A better estimate of emissions from the egg shaped sludge digesters is needed.
6. Emission estimates from the sludge area needs to take into account peak loads and less than optimal operation of the thickening process to obtain worst case emissions.
7. Additional odour sampling in the sludge dewatering building and energy recovery building is needed. Air exchange rate of the building at the time of sampling needs to be taken into account. A worst case emission estimate should be used.
8. The waste gas flare emission is considered an overestimate as it is based on the odour concentration to the flare and assumes no odour destruction.
9. The emission rate from the PST scrubber was calculated from a weighted average of emissions for the time it was on-line and off-line. As such it is neither a maximum nor typical operating emission. Upset emissions should be modelled separately to normal operating emissions.
10. Emissions rates when there is scrubber break through should be taken into account.
11. Better estimation of emission rates from the PST and inlet areas is needed. A worst case value should be determined for the maximum number of covers off at any one time, the extraction rate of the fan and wind conditions.
12. Fugitive emissions estimation from the inlet/PST area should take into account the decreasing air flow rate and the decrease in air extraction when the covers are off a tank.
13. Emission estimates from sludge truck loading needs to be better quantified.
14. More data is needed on the range and frequency of emissions from the tanker receival facility.
15. Emissions also do not take into account diurnal variations which are large. Worst case peak emissions for normal operation should be modelled.
16. Ground truthing of emissions is recommended.
17. Assumptions upon which future emission are based should be explained for any projected modelling.

Some of the above recommendations may not be relevant following the upgrade of odour controls at the WWTP.

Appendix 4

Recommendations for modelling

Recommendations for modelling

1. The meteorological site and data are suitable for odour modelling.
2. Wind direction errors detected for a number of days should be corrected.
3. More detail should be provided on the derivation and analysis of the stability.
4. For comparison purposes, different scenarios should be run using the same model setup. In the current modelling roughness length and wind files were changed between scenarios and therefore the affect of the predicted change in emissions cannot be assessed.
5. Pasquil Gifford dispersion curves are preferred for vertical and horizontal dispersion.
6. Emission parameters used for modelling, e.g. stack heights, diameters, exit velocity and temperature, are inaccurate or incorrect. These should be corrected. Justification should be given where source heights are modified.
7. Building downwash should be included. Downwash due to the digesters should be considered.
8. Variation in emissions should be accounted for. “Upset” conditions should be treated separately.
9. AUSPLUME has limitations in modelling light winds below 1m/s. AUSPLUME also has limitations in modelling variable roughness. Different roughness lengths cannot be used for different directions in one model run. AUSPLUME is also not accurate for airflow from higher to lower terrain. To overcome these problems other models such as TAPM or CALPUFF should be considered.
10. If odours from Lake Coogee are to be considered in future modelling for the WWTP, better emission estimates are required.

Appendix 5

Independent review report and Proponent's response to the independent review

Woodman Point WWTP - Strategic Environmental Review
Independent Peer Review

Prepared for the

Western Australian EPA

By

Air Assessments

March 2006

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Status	**Version**	**Prepared by**	**Reviewed by**	**Submitted to Client**	
				Copies	Date
Draft Report	A	Owen Pitts	David Pitt Environmental Alliances	Email pdf	22 February 2006
Final Report	1	Owen Pitts	Ray Claudius EPA Service Unit	Email pdf	16 March 2006

Table of Contents

1 Introduction

The Water Corporation have submitted a Strategic Environmental Review (SER) of the odour impacts from the Woodman Point WWTP setting out the Corporation's odour reduction program and intentions in relation to the exiting odour buffer. As part of their deliberations, the Environmental Protection Authority (EPA) have sought an independent review of the technical adequacy and accuracy of the SER.

As requested by the EPA service unit, the following scope of work was required:

(1) Meet with a number of community members who made written submissions to the EPA, in order to provide an opportunity for issues to be raised with the peer reviewer, and subsequently considered in the review;
(2) Undertake a brief site visit of WWTP and confirm the appropriateness of the weather station;
(3) Provide comment on the technical accuracy of the odour sampling and modelling described, including the validation of modelling and use of both complaint data and the Market Equity phone survey;
(4) Provide comment on the adequacy of the described approach to odour management, including the proposed odour control infrastructure; and
(5) Provide comment on any other matters that the reviewer considers relevant.

To fulfil the objectives, a site visit and meetings/telephone conversations were had with three individuals and one small group. Additionally, a series of questions were raised with Water Corporation for clarification on matters regarding odour control and modelling. Of these queries, the majority were answered by Water Corporation as best they could, though there were a few queries unanswered.

During the review, it became apparent that a number of the issues involved where much more complex than envisaged. Though the review of the emissions and modelling are considered to be reasonably comprehensive, there are a number of other issues where time constraints prevented a more in-depth review.

The review is structured with:

2 Review of the Accuracy and Adequacy of Odour Modelling in the SER

2.1 Modelling Odours at Woodman Point

Odour modelling at Woodman Point WWTP have been undertaken in the following studies:

- The assessment of odour in mid 1990's using indicative odour emissions and Hope Valley wind data that was used to define the original odour buffer;
- Modelling as presented in CH2Mhill (1999) and SKM (1999) based on onsite odour measurements of sources at the time in 1998 by CH2Mhill (1999). This modelling was undertaken to determine the expected odour levels resulting from the amplification of the plant to 160 Ml/d and associated odour control work;
- Odour emission monitoring conducted in April to June 2003 as a fulfilment of the Works Approval conditions for the amplification (TOU, 2003). These were used to predict the resultant odours from the amplification and to predict future odours for a number of odour control options as reported in GHD (2003) and CEE (2003); and
- Odour modelling using the emissions of 2003, slightly modified with revised model setup and onsite data for the 2005 SER which is the subject of this review.

Further details on the odour modelling and relation to licence conditions are provided in **Appendix B**.

For determining odour impacts the following key steps are required:

- Estimation of odour emissions;
- Consideration of other sources;
- Development of a meteorological file for the area;
- Determination of appropriate odour criteria; and
- Prediction of odour levels using a dispersion model and comparison of the odour levels against the adopted criteria.

An analysis of these steps for the SER modelling is presented in the following sections.

2.2 Odour Criterion Use in the 2005 SER

In the SER, CEE (a Water Corporation consultant) and the Water Corporation adopt the odour criterion of 5 ou, 1-hour 99.9th percentile to define unacceptable odour impacts to residential areas. This was based on the following rationale:

- There is good comparison between odour complaint and phone survey data at Woodman Point and the predicted 5 OU, 99.9th percentile 1 hour average (SER, Annexure G, figure 6);

- Good agreement between complaint data/phone surveys and this modelled criteria at other sites (e.g. Subiaco, Beenyup etc), from which "*the corporation has confirmed that the distinct level of odour corresponds to the predicted 5 ou level … " (SER, page 27); and*

- *"The 99.9 percentile odour criteria provides a high level of protection to the community against odour nuisance, as this percentile limit allows exceedance of the odour criterion for only 8 hours per year. In contrast, a 99.5 percentile limit would permit exceedance of the odour criteria at each site in the area around the plant for 44 hours per year"* (CEE, 2005a) page 4, SER, page 27).

This justification for the adopted criteria is, however, considered weak as:

- The agreement between the above criteria and the complaint data at Woodman Point is not good (see Figure 6, Annexure G) with the contour extending 1km further than the data in the east direction and a good 0.5 km east of Rockingham and Stock roads where no complaints were plotted. This agreement becomes even weaker when it is noted that incorrect plots were presented in the SER, being based inadvertently on sigma theta dispersion and not Pasquill Gifford (PG) dispersion curves as intended (CEE, 2005b). With the use of the PG dispersion curves, the contours extend further (see **Figure 2.1**). The "good" agreement only occurred in the 2003 modelling (see Figure 4 of CEE (2003)) and the accompanying text when using both the Hope Valley wind data and incorrectly using measured standard deviation of wind direction for dispersion (see **Section 2.7** for more details).

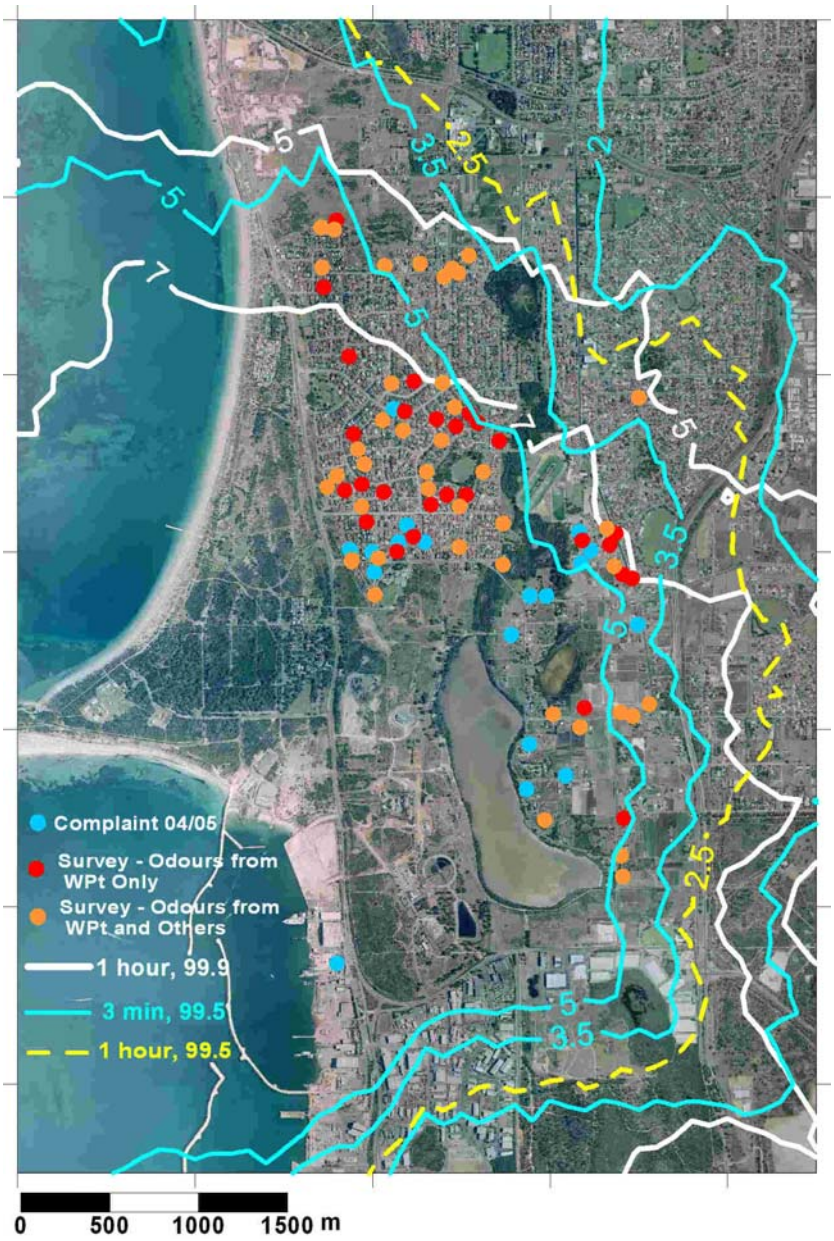

Figure 2.1 Predicted odour contours for the existing (nominally 120 Ml/day) WWTP using the model setup from CEE (2005a). All odour survey points included.

Also this "good" agreement in CEE (2003) was due to the omission of the northern-most odour survey data. Comparison of the survey data (last page of Annexure C in the SER) with that used in the model validation exercise (Figure 6, in Annexure G of the SER), indicates that all data points north of Amity Boulevard were excluded (the top 14 points in **Figure 2.1**). Inclusion of these points and modelling with the correct PG curves (see **Figure 2.1**), indicates that the 5ou 1-hour 99.9th percentile provides a good fit (encompasses) the data to the north, but over-predicts the area with complaints to the east by 1 to 1.5 km.

Instead of the 99.9th percentile contour shape providing the best agreement, the 99.5th percentile provides a better fit as seen in **Figure 2.1**. For this percentile and averaging period, the 3.5 ou level shows a good fit just encompassing the survey data to the north and east. The 5 ou, 3 minute 99.5 criteria, which was in the original commitment and licence condition (see **Appendix B**), slightly under-predicts the "affected" area from the survey, but is a better predictor than the 5 ou, 1 hour 99.9 percentile. That the 99.5 percentile is a better fit to the survey data is due to it better reflecting the frequency of light wind, stable conditions. Use of a higher percentile (eg 99.9 percentile) will tend to provide a more circular contour. PAE in the WWTP odour buffer review (PAE, 2005a) conclude that a 99.5 percentile is better than the 99.9 percentile and that a lower percentile such as the 98th to 99th percentile is probably optimum in matching odour annoyance.

For comparison to the above criteria, the 2.5 ou, 99.5th 1-hour contour from the Queensland EPA criteria (QEPA, 2004) is also presented as it is a guideline that the DoE have recently used in the interim for assessing odour. This indicates that this guideline may be slightly conservative. The previous odour guidelines were withdrawn on 1st August 2005 due to perceived technical issues with the adoption of the "distinct" level and 3 minute averaging.

- The other studies referenced by Water Corporation, in which the 5 ou, 1-hour 99.5th percentile was found to provide a good fit (eg Subiaco and Beenyup) used coastal wind data from small hills (Subiaco using Hope Valley and Beenyup using Hope Valley and Swanbourne data) where the wind data does not reflect the local wind conditions. Therefore, they suffer from the same problem as in using the Hope Valley data at Woodman Point. Additionally, these studies are primarily internal reports for the Water Corporation and to the author's knowledge have not been subject to independent peer review.

- The statement that *"a 99.9 percentile odour criteria provides a high level of protection to the community against odour nuisance than a 99.5 percentile"* is debatable as it ignores the fact that a percentile is only one component of the criteria, with the other two being the odour level and the averaging period. For the above criteria compared by Water Corporation, the averaging periods are different (3-minute versus 1-hour average). Additionally, the odour concentrations for the same averaging time using the 99.5 percentile can/should be lower than for a 99.9 percentile to ensure the same level of protection. It is also noted that as well as the above three criteria, the criterion should also define the emission estimation method, whether the emissions are average emissions or maximums, whether "upset emissions" are included and importantly to ensure that local wind data representative of the are being affected is used.

- Limitations in using odour complaint data to determine the odour impact area and concerns regarding the representativeness of the complaint data, as discussed later in **Section 4**. Also the odour survey areas were limited with many areas where no odour being reported in Figure 6 (Annexure G of the SER), actually just being areas that were not surveyed. See **Section 4** for more details.

For comparison to the above criteria, the criteria specified in the Woodman Point WWTP licence (from July 2001 to July 2004), a 5 ou, 99.5th 3-minute limit and a 2 ou, 99.5th 3 minute goal is also presented

in **Figure 2.1**. As a 3.5ou, 99.5th 3minute level provides a good fit to the data, they indicate that this initial limit and goal were probably realistic values.

Further to the above comments, it is noted that in the independent review of the SER by PAE (2005b), a large part of the conclusions that: *"the final recommendations are, in our opinion, reasonable and provide a useful basis for planning"*, are based on the view that the 5 ou, 1-hour 99.5 percentile contour provided a good match of the model's performance. As stated by PAE:

"Whilst there are aspects of the assessment that could be open to criticism (e.g., the use of fixed odour emission rates and the use of a dispersion model that tends to perform poorly in critical light wind conditions), a very important point is made at the end of page 12. 'For the combination of the Ausplume odour model, local wind file, 99.9 percentile frequency, 1-hour averaging and on-site emission measurements, the 5 OU contour provides a good representation of the 'distinct' level of odour and the outer extent of odour annoyance'. <u>This is a critical point</u>: the combined elements of the assessment provide what appears to be a reasonably well integrated approach that goes a long way to deflecting criticism about specific elements of the assessment methodology that could in themselves be regarded as less than ideal: the important point is how the elements combine to provide a reasonable indication of odour extent to guide buffer delineation. This is demonstrated primarily through the matching of odour model results with community odour survey and complaint information. <u>Without this empirical evidence the assessment would be considerably less robust</u>". (Underline added)

<u>Conclusion 1</u>

It is considered that for the Woodman Point WWTP, using emission data from a flux hood and local wind data, the 5ou, 1-hour 99.9th percentile criteria significantly overestimates the area affected to the east of the plant. The good agreement with the survey data cited in earlier studies in 2003 was due to the use of Hope Valley wind data (which is not representative of the area), incorrect use of sigma theta dispersion and the omission of odour survey data points to the north of the WWTP. Instead it is considered that a criteria based on the 99.5th percentile (or perhaps lower percentile) better reflects the dispersion and complaint/survey data. Based on the comparison presented here, the 3.5 ou, 3-min 99.5th percentile or 3 ou, 1-hour 99.5th percentile may be suitable for criteria for the WWTP in assessing the buffer requirements.

2.3 Odour Sensitive Premises Considered

The study omits to identify the Woodman Point Holiday Park as an odour sensitive premises as per the DoE definition of odour sensitive premises (EPA, 2002). This holiday park extends 300m inside the buffer zone (**see Figure 2.2** for the location), with 200 <u>permanent</u> residents and up to another 200 visitors in peak times (pers com, Park Manager). According to **Figure 2.2,** this area of residences would be more affected by odours than the two locations which are discussed as the worst affected areas with residences (South Coogee and the area to the east of Lake Coogee). For example, at the south east corner of the holiday park, the existing 99.5th percentile 3 minute average odour level is 27 ou compared to a predicted 15 ou at the southern-most residence in South Coogee and the east edge of Lake Coogee.

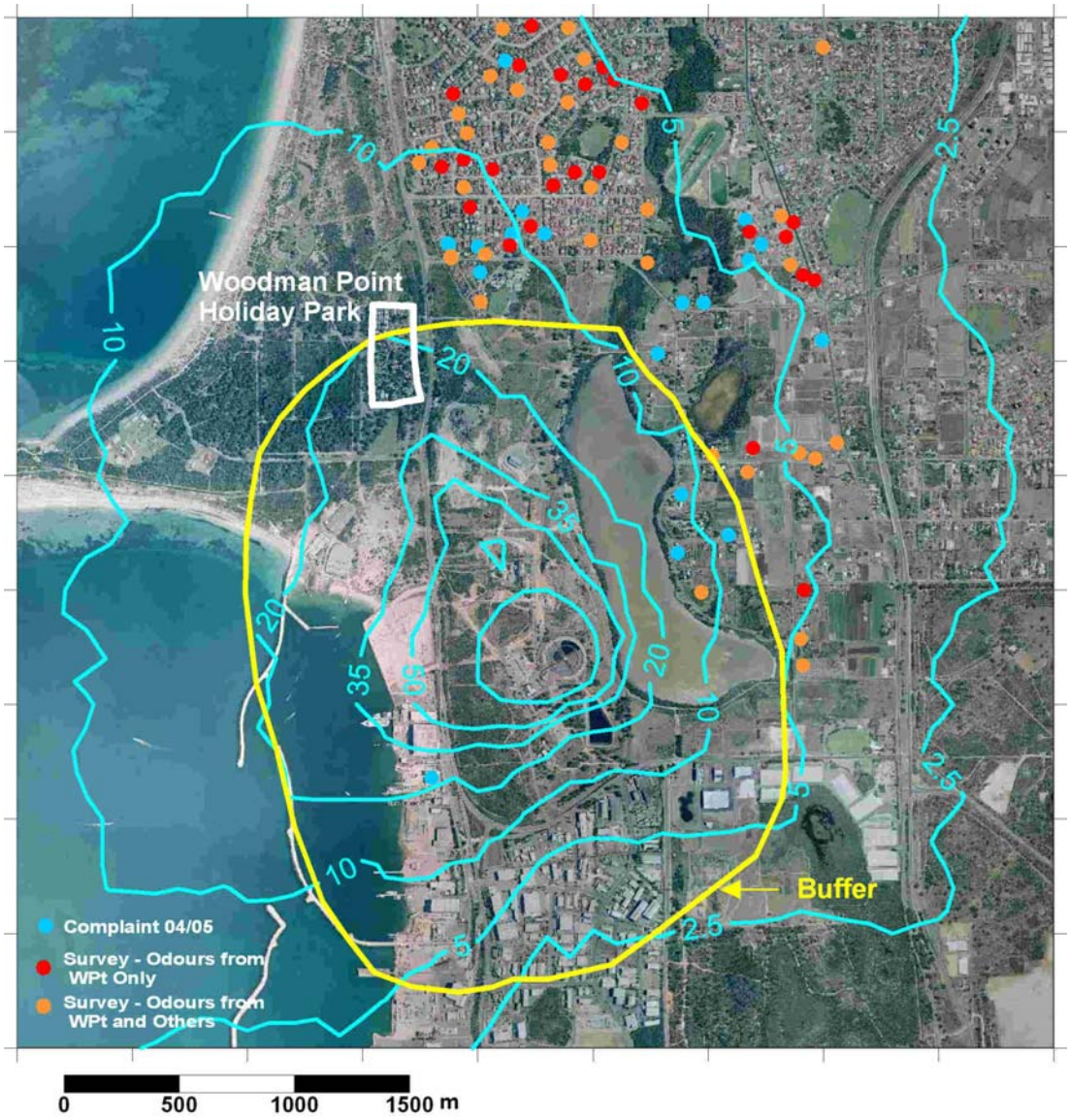

Figure 2.2 Predicted 3 minute 99.5th percentile odour levels (ou) from the existing Woodman Pt WWTP

As this holiday park is the most impacted odour sensitive premises, it should be the focus of the report and how the odour management plan will reduce odours to acceptable levels there. This area was not included in the odour survey and according to the SER did not register any odour complaints in the reporting period. However, in a petition circulated around June 2004 by Robyn O'Brien and sent to the Chair of the EPA, there were 41 signatories from the park's residents who had "experienced odours from the WWTP" and "requested" Water Corporation to reduce the odour buffer". Also, it was reported that during the gathering of signatories that several of the residents noted that they had made complaints in the past about the odour there (Murray O'Brien, pers comm., 2006). These complaints may not have been sent to the Water Corporation or perhaps were outside the period that Water Corporation used for the complaint data in **Figure 2.2**.

Further to the omission of these residences, the report does not identify other areas and groups of people affected by the odours including the nearby shipyards to the east and also the public area of the dog beach, boat ramp and Cockburn sea rescue.

The workers at the Austal shipyard, though not an odour-sensitive premises, appear to be affected by the odours. On the petition, 61 signatories were from this location. Of these, some of the workers reported that at times, other fellow workers had been so affected by the odour that they had to leave work for the day (R O'Brien, pers comm., 2006). This area and the future undeveloped land just north of Austal has the highest predicted offsite odour levels (see **Figure 2.2**). As this is an area where the odour impacts are considered by some as unacceptable and causing health complaints, it should also be identified and addressed in the SER. It is noted that the WA odour guidelines do not have criteria for other work sites, though, for example, the Netherlands has a WWTP criteria 3 to 3.5 times higher than that for residential areas and the Brisbane City Plan have a value twice that for odour sensitive areas (Ormerod, 2006).

The area at the boat ramp, beach and Cockburn sea rescue reported 2 odour complaints in 2002/2003 and 7 odour complaints in 2003/2004 as notified to Water Corporation and presented on annual complaint plots. These were not included in the complaint plot in the model validation in Figure 6 of Annexure G, though the text in Annexure G notes that the complaint data are from the last four years. Water Corporation (2006) have confirmed that the data in Figure 6 is actually only for 2004/2005. As such, as this is a public area and is similar to those categorised as "Sensitive Land Uses" by the EPA (2002) including "play grounds, recreational centres etc", it should also be mentioned regards odour amenity.

Conclusion 2

The SER omits any mention of the Woodman Point Holiday Park as an odour sensitive premise. As this is located primarily within the buffer, has 200 permanent residents and up to another 200 visitors, and is predicted to be the "residential" area most affected by the odour, it should be a major focus of the discussion on odour controls and compliance with odour criteria.

2.4 Emission Estimates

The emissions for the existing WWTP case were estimated by the following historical sequence:

- A survey undertaken by The Odour Unit (TOU) with odour samples collected from 2 April to 13 June 2003 at the treatment plant, with some additional samples in late June on Lake Coogee (TOU, 2003). Based on the survey, TOU estimated total emissions from the WWTP at 263,000 ou/s.

- Subsequent reviews based on site visits by Ian Wallis (CEE) with:

    - A review undertaken in 2003 (as indicated in CEE, 2005a) with the addition of some sources identified by CEE that were not included in the TOU survey and the reduction of some emissions considered to be overestimates (see Section 5.2, TOU, 2003, eg the emissions from the balancing dam were reduced). This modified inventory was used in

the 2003 modelling (GHD, 2003 and CEE, 2003) having a total emissions of 271,300 ou/s.

- Following a site visit in December 2004, additional sources such as from the TRF facility and inlet works constructed after the previous review (from tankers unloading and also from fugitive sources) were added. Total emissions were estimated at 356,000 ou/s and were used in the value management strategy (VMS) in January 2005 as the basis of the odour control strategy (see Annexure F in the SER and the VMS workshop summary, Botica, 2005).

- Subsequent to this workshop, the values were revised downward to the 293,000 ou/s as used in the SER modelling and presented in the SER (Annexure G, Table 1, CEE, 2005b). The most noticeable revisions were the revision downward of the emissions estimates from the TRF and gas engine exhausts.

It is noted that this review process in deriving emission estimates is common practice as more information and understanding of the processes is gained. As such, the revisions do not necessarily imply an uncertainty or bias in the estimates, but can result from a greater understanding over time. These changes with time however, with the different odour emissions presented (such as in the various sections of the SER appendices) have led to some confusion with the public as to the reasons for the changes and omission of various sources.

2.4.1 Existing Emissions

Key aspects of the emission inventory used in the SER are:

- Area source emissions were determined using an isolation flux hood (IFH). The 1998 study (CH2MHill, 1999) by comparison used a wind tunnel to sample the area sources. These two methods provide significantly different emission rates with wind tunnels providing higher emission estimates (see **Section 5.1**). As such, the emission rates from the two methods are not directly comparable;

- The samples were undertaken from April to June 2003 (not as indicated in the SER from March to June, SER, page 35). The 1998 samples on the other hand were taken in mid-January, at midday, specifically as these conditions correspond to when *"odours from the WWTPS are expected to be generated to a maximum level"*. As such, the 2003 measurements are not maximum emission rates and may tend to underestimate the peak emission rates in summer, whilst overstating the late winter emission rates;

- The samples were taken for normal operating conditions, with most of the emissions derived from the 75 percentile of the odour estimates to allow for some conservatism. Emissions using the average emission rate include the TEQ Biofilter. The 1999 emissions were determined as "worst case" estimates in regards to the number of odour sources, eg drying beds available and in the time of emissions – midday during mid-summer.

- As the concentrations measured from the sample bags decay with time, the sampled concentrations and therefore emissions were corrected to a standard time of 3-hours after sampling. The previous CH2Mhill sampling in 1998 were not corrected and therefore may report substantially lower emission rates. The corrections used by TOU (2003) were derived for four sources and estimated the rate of change of odour concentrations per hour. Other samples which were not tested for odour decay were determined based on the rate of change of the most similar source. This method may be appropriate if the concentrations and rate of change per concentration are similar, but for samples with markedly different concentrations, could lead to erroneous results. Instead a percentage rate of change should be used. For example the decay of the samples to the inlet PST scrubbers were based on the decay from the sludge digester sample. The decay of the sludge samples was estimated at 211 ou/hour, though as a percentage it is 1.67 %/hour. For the very high concentration from the PST, with an odour level of 306,000 ou measured 21 hours after sampling, using the change per hour conversion resulted in a concentration of 310,000 ou (TOU, 2003). However, if the more correct percentage rate of change was used, the concentration would be corrected to a much higher value of 398,000 ou. Therefore, for the very high concentrations recorded at the inlet to the PST scrubber, the samples have most likely been under stated by between 20 to 30%.

- Of the emission estimates, the SBR was extensively sampled with 68 samples, with what is considered to be a robust method to determine the overall emission rate. Other emissions estimates from a number of sources however are considered reasonably uncertain. These include the:

    - Bell mouth opening at the top of the egg shaped sludge digesters. The estimate from this source is considered quite uncertain as evidenced by the factor of over 200 variation between the maximum and minimum concentrations recorded. The emission rate derived as the product of this concentration (75^{th} percentile) and volume is also considered poor due to the reliance on a very low wind speed "measurement" of 0.035 m/s used to estimate the wind flow up the "well" for all samples. It is considered that as there is no real movement in the level of the liquid surface in the well, that the odour is being swept out by wind gusts occasionally sweeping down into the well. As such, there will be some area of the well with downdraft and some with updraft and that the volume of area swept out will be a function of the prevailing wind. It is noted that TOU (2003) state that this estimate has *"intrinsic difficulties in sampling"* (page 3) and *"Of all the sources sampled at the plant this source was the most difficult from which to collect a representative sample and gauge an odour emission rate. The method employed relied upon an assessment of ventilation rate of the bell mouth chambers" (page 19).* As a comparison using the emission rate derived of 25,700 ou/s and area of $25m^2$ (assuming the area of the well is equal to the liquid surface) a SOER of 1028 $ou/m^2/s$ is derived, which is an extremely high emission rate - well above that measured at other sources. As such, it is considered that the emissions from this source may easily be a factor of 2 lower, though there is the possibility that the emission could be higher.

    - The emissions from the Sludge Area are considered to be reasonably variable as noted in the odour management planning review (SKM, 2005). This is due to the digesters

being at or near capacity such that residence times of the sludge in the digesters are approaching the minimum times. *"When presented with peak loads, or when the thickening process is not operating as designed, less than optimal digestion can produce bio-solids that are more odorous"* (Annexure E, SER).

- Sludge dewatering building and energy recovery building. These estimates are very uncertain derived from a one point sample in each building, of which their representativeness of the air inside the buildings is not known. Additionally, the air exchange rate of the building is very much an estimate and probably wind speed dependent and may not relate to the period when the sample was taken as indicated in TOU (2003). As such, both measurements are considered quite uncertain.

- The waste gas flare emission is considered an overestimate as it is based on the odour concentration to the flare and assuming no odour destruction.

- Emissions from the PST scrubber. During normal operation, the 75 percentile emission rate was estimated at 1,250 ou/s. However, as the scrubber was estimated to be off-line for around 5% of the time, TOU (2003) argued that a weighted average emission rate of the emissions when on line and off line should be used. Using an estimated emission rate when off line of 422,500 ou/s (estimated as the product of the 75^{th} percentile concentration to the scrubber of 195,000 ou/s by 7800 m^3/hr), a weighted average of approximately 20,000 ou/s was derived. This estimate however, neither reflects the maximum or the typical emission rate from the scrubber and does not lead to an accurate prediction of the ground level impacts of the emissions. In modelling abnormal/upset emissions, the maximum should be used (see **Section 2.7**). Additionally, the 5% of time off line does not include the time when there is breakthrough in the PST scrubbers, i.e. times when the scrubbers are operating (on line), but are operating with emissions much higher than normal.

- Fugitive emissions from the PST and inlet areas of 20,000 and 6000 ou/s each. These are estimates based on an estimated 5% fugitive emission from the PST covers and was subjectively assessed from the 2003 survey visit. These again could easily be higher or lower with the actual value being quite dependent on the number of covers that are off the PST tanks, the extraction rate of the scrubber fan at the time and wind conditions. It is noted that the extraction air to the PST has been decreasing with time (see **Figure 2.3**) and as such, the fugitive emissions from this area may be generally increasing.

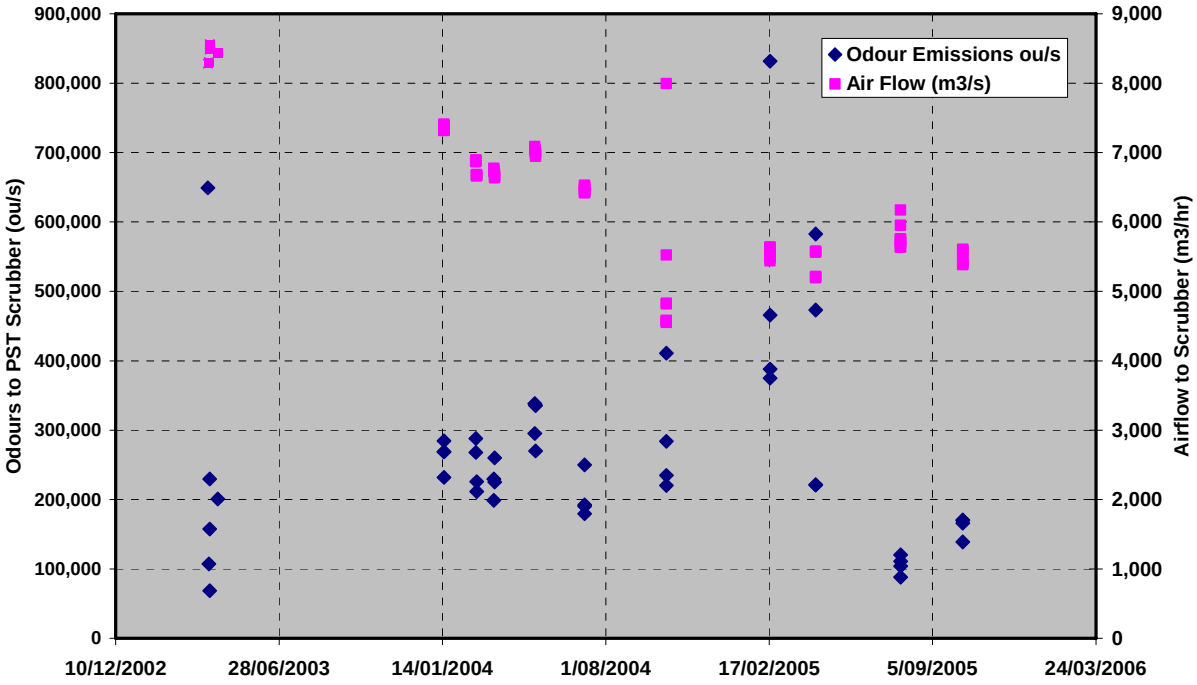

Figure 2.3 Odour and Flow Rates to the PST/Inlet Scrubber

The inlet/PST area was designed for three air exchangers per hour (reported as 23,400 m^3/hr in the VMS, (Botica 2005) but around half this at 12,000 m^3/hr in the SER Annexure D). In the 2003 test work, this flow was measured at substantially less than the design flow rate at around 7,800 m^3/hr. Sampling over the last 2 years is also presented in **Figure 2.3** indicating an overall decline since then, with flow rates now of 5,000 to 6,000 m^3/hr. Therefore, with the lower flow rates there is probably more leakage of odour under normal conditions. During maintenance on a PST when the covers are off, as the four tanks can not be isolated, the additional ingress air lowers the volume of air extracted from the other three tanks therefore likely increasing their fugitive emissions (SKM, 2005).

- Sludge Truck Loading. This value used of 2050 ou/s appears to be very uncertain and probably underestimates the magnitude of the short term peaks. It is based on an estimate by CEE (2005a), from testing of a similar facility in Brisbane that has then been adjusted upward to better fit with expectations. It is noted the actual sample from Woodman Point was discounted as being too high. In a review of the odour issues, Water Corporation state:

  "*The sludge truck loading is known to cause large intermittent odour release. This loading operation is known to be a significant contributor to odour release from the plant. The estimated odour release is possibly an underestimation. This is a difficult source to quantify because of its intermittent nature (approx. 30 minutes per load out). Anecdotal evidence indicates that the peak short term odour release from this source may be much higher than the estimate*". (Annexure D, SER).

- Tanker Receival Facility (TRF). It is noted in CEE (2005a) that emissions from this facility *"are difficult to estimate"*, with estimates of 2,400 ou/s and 2,000 ou/s given "*based on measurements of odour emissions from similar processes in Beenyup and Warriewood"* (page 7, CEE, 2005a). CEE (2005a) note rendering wastes can be *"particularly odourous and will cause large odour releases with any spills…. The exhaust gases from vacuum tankers can be a major source (complaints have been received from as far as Rockingham Road) about this odour"*. As such, the values used in the SER appear to be low and are for typical emissions (probably the 75th percentile), but still significantly understate the magnitude of the infrequent odour emissions that occur due to spills, and maintenance, which cause the complaints. Based on complaints being received several kilometres away, peak odour emissions would be at least in the high tens of thousands of ou/s. It is noted that in the VMS the emissions were originally estimated at 10,000 and 12,000 ou/s (Table 1, Annexure F), but were revised downwards without supporting justification for the SER and modelling study. As such, more data is needed on the range and frequency of odour emissions. It is also noted that the TRF is operating at above its design capacity of 150 m^3/d and of early 2005 was receiving 190 to 220 m^3/day (SKM, 2005).

Therefore, apart from the SBR, it is considered that a significant proportion of the emissions are to a degree uncertain. Further, the emissions do no take into account any diurnal variation. This is considered to be a major issue with WWTP odour modelling as there can be up to a factor of 10 variation in the emissions from some sources as shown in the study by GHD (2002). This is primarily a function of the variation of flows, with low flows and low emissions early in the morning, rising and peaking by early afternoon and then a general slow decrease into early evening. This variation is generally not accounted in this inventory, with all samples irrespective of time grouped together. Therefore, WWTP emissions and modelling is an inexact science, this being one of the reasons ground truthing of odours is useful.

2.4.2 Recent Odour Samples Since 2003

Since the inventory in April to June 2003, there have been ongoing testing of the odour scrubber systems at Woodman point. The data indicates that:

- PST/inlet Scrubber. The odour concentrations and emissions to the scrubber are quite variable **Figure 2.3** with estimated emissions ranging from 88,000 to 830,000 ou/s with a 75th percentile emission of 290,000 ou/s (note no odour decay corrections have been applied). The PST/Inlet scrubber outlet emissions have ranged from 490 to 22,000 ou/s with a 75th percentile of 3,400 ou/s. The outlet measurements indicate agreement with the 20,000 ou/s assumed in the monitoring, but it appears that there has been no monitoring during an event with H_2S breakthrough. For this, a continuous H_2S monitor is required; and

- The clean TEQ bio-filter record much lower odour emissions than sampled in 2003, with the emissions ranging from 190 to 450 ou/s with a 75th percentile odour emission of 380 ou/s. The 2003 samples used in the modelling resulted in an odour emission rate of 22,300 ou/s, indicating

that the bio-filter's performance has significantly improved. It is considered that with consistent emissions now being monitored, the lower odour emission rate should be used.

2.4.3 Future Emissions

Future emissions were estimated by assuming the emissions before any controls were generally proportional to the incoming waste water flow rates, with for sources with odour control, the fugitive emission estimated based on an assumed control efficiency/capture rate. In general, there is little detail on how the control efficiencies were derived. For example, the fugitive emissions from the anoxic tanks after being covered in Stage 1 are around 9,610 ou/s, which assume that around 13% of the present emissions are not captured. Similarly for the PST and inlet areas, 8,000 ou/s is assumed as a fugitive release, whilst for the digester outlet, 5830 ou/s or around (22%) is assumed to be not captured. It is considered that as the digester bell mouth opening, has only a small area (around 12 m^2 each), with little air flow it should be easily covered with capture of approximately 100%. The uncertainty and subjectivity of these estimates is also noted in the PAE review *"Future emission estimates are significantly affected by assumptions about leakage from covers and the efficiency of scrubbers and other controls"* (PAE, 2005b, page 3).

Therefore the fugitive estimates and percentages appear to be based on the current inadequate control of the present system due primarily to poor sealing and inadequate flow rates. As such, it is recommended that the assumptions for the future fugitive estimates needs to be more transparent, with the rationale provided on why a relative high percentage of the emissions will not be captured with the new air extraction systems with high air exchange rates. An independent review or derivation of these assumptions and emissions is recommended.

Conclusion 3

Odour emissions from the SBR appear to be reasonably well determined. However emissions from the fugitive sources are not well quantified (PST tank leakage, digester bell mouth, TRF facility) with there being possibly large, intermittent emissions when the PST scrubber is offline or when there is scrubber breakthrough. The emissions as an average of April to June measurements may underestimate peak summer and overestimate winter emissions. This combined with the seasonality in wind patterns may result in biases in the extent in odour contours in the different directions. Also, the daily variation in emissions though shown to be large is not accounted for. As such, there is a degree of uncertainty in the base case emission inventory.

It is therefore recommended that the number of odour sources listed need to be better quantified with the variability in the emissions due to plant failures, abnormal conditions at the PST area and TRF better defined. It is recommended that downwind assessments by those with experience in the area should be conducted to ground truth the ambient odours using VDI (1993) and provide an independent measure of the plant's emissions.

Future estimates are noted very dependent on the assumptions made regarding the effectiveness of the air capturing system and the scrubber. These assumptions are not provided in the SER and it is

considered that these may be understated resulting in larger future emission estimates. Much greater detail on the rationale is needed, preferably with these estimated from an independent source.

2.5 Other Odour Sources

With regard to the other odour sources, it is understood that there are at least six other major odour sources in the region. These are:

- Old Munster (Mayor Road) No 2. pumping station. This open pond at this facility was used twice in 2005 (as reported from communication with local residents) as an emergency storage area for raw sewerage. On each event, significant odours were reported by nearby residents (some who live within 50m of the ponds), with strong odours reported at least to the Coogee Primary School, 1 km to the west for the April 2005 event. According to the discussions with the community, this emergency storage was seen as a major odour issue (see **Appendix B** on the community's view), with the community having an expectation that Water Corporation had previously intended to decommission this facility.

  Therefore, it is considered that as this is a Water Corporation facility linked to the overall disposal of waste in the area and as a significant local source, the SER should detail how the upgrade will affect the emergency use of the pond and how the Water Corporation intend to manage this issue. Alternatively, if this facility is not to be closed down, then possibly this facility should be modelled using a 'worst case' modeling approach.

- Watsons Foods in Spearwood (approximately 4 km to the north). This plant is a clear odour source in the northern area of the phone survey undertaken for Water Corporation in 2003 and should be reflected in the data there. It is understood that since then, Watsons have reduced odour emissions with a relocation of the major odour source (abattoir) out of the region. The plant has undergone an emission sampling program with the extent of odours modelled as reported in Environmental Alliances (2004).

- Lake Coogee. In summer the exposed mud areas at the edge of the Lake is a significant odour source. This is measured and modelled in the SER and is discussed further in **Section 2.7.2**.

- Bradken foundry situated around 600m to the SSE of the WWTP SBR. On the site visit undertaken by the author, the fume-like odours were quite distinct 1 km down wind of this source.

- Cockburn Cement. This source is approximately 2.5 km to the ESE of the Woodman Point WWTP. The plant has been subject to a detailed odour study and development of an odour management plan based on odour emission testing and modelling (ERM, 2004). ERM (2004) present an analysis of odour complaints indicating several verified odour complaints from this plant in the Coogee and Munster area; and

- Other industries in the Kwinana industrial strip, notably the Alcoa Alumina Refinery, which is approximately 5.4 km to the south. The odours from this plant have been modelled as detailed in SKM (2004).

In the SER, no mention is made of the other sources, excepting Lake Coogee and the possible combined affects. The combined effects is not just in terms of any possible additive affects for any given hour if they are considered "like" odours, but to the cumulative odour problem in the area of the different sources impacting on different days. In terms of additive effects of the plumes at any one moment, the SER does discuss the potential that Lake Coogee under westerlies may line up with the WWTP plant odours, resulting in addition of similar odours. These sources are not modelled together in the SER but treated separately, though it is argued in the SER that their odours are similar. For sources such as Bradkens and Alcoa to south, there is the potential for the plumes may overlap with those from the WWTP under a southerly, such that the source of the odour may be confused with that from the WWTP. From the communication with nearby residents to the east and north who made public submissions, they were strongly of the opinion that the WWTP was the major source of odour in their localities.

Conclusion 4
The report should undertake a greater discussion/analysis of other odour sources in the area and should include details of the old Mayor road pumping station and how the upgrades will minimise/eliminate the usage of this as a receival area for emergency storage of raw sewerage.

2.6 Meteorological Data Used

Meteorological data used for the modelling was obtained from on-site weather data, which was processed into a format suitable for AUSPLUME. With respect to the data, the following are concluded:

- As 23 months of onsite wind data are used (2 March 2003 to 1 February 2005), one month February is only represented once in the two years of data. This data set with a summer month "missing" will slightly bias the winds towards an overall winter pattern, though this should be a fairly minor affect. As such, with two years of on-site data, the data set is considered reasonably representative of the conditions at the site;

- The siting of the meteorological station is good for winds in the important quadrant for winds to the north through east and to the south. For winds from the south-east however, the site does not meet the requirements of the relevant Australian standard with an approximate 6.5m building only 50m away. This appears to lead to some reduction in the wind speed for this direction (see **Appendix A**). Additionally, for northerly winds, there is also an apparent reduction which may be due to the hill in that direction or another small building. However, as these obstacles are not in the direction of importance for odour impacts it is considered that the siting is suitable for odour modelling;

- Comparison of the wind data to another nearby site (Hope Valley) indicates that the wind direction sensor has an apparent wind direction offset of around 20 to 25 degrees for the period 1 December 2003 to 14 May 2004 (see **Appendix A**). Additionally, there are three and possibly four days when the wind directions are clearly in error. The wind direction shift as only around 20 degrees for a subset of the data set, should not affect the conclusions greatly, though it is recommended that the data identified be corrected;

- Stability estimates used in the dispersion modelling were estimated using a standard USEPA method utilising solar radiation and the temperature difference measurements between 2 and 10m. The resultant stability data appears to be of reasonable quality;

- Mixing heights were determined using the NSW EPA screening approach. This is noted is a fairly approximate method, but should have negligible affect on predicted ground level concentrations from surface releases. Even for the future modelling scenario with a 40m stack and low plume rise this approach should provide satisfactory results, though it would be beneficial to see a more rigorous approach used; and

- The level of reporting on the derivation and analysis of the stability is considered inadequate. For a modelling assessment of this significance, it would be expected that a greater level of detail should be provided.

Conclusion 5

The meteorological data base appears to be suitable, comprising nearly two years of on-site meteorological data. There are some concerns with some of the wind direction data with an apparent small (20 to 25) degree offset in the winds and 3 to 4 days with incorrect wind data and some small shielding for south easterly and possibly northerly winds. These, however, are considered to have only a small affect overall, but nevertheless should be rectified as soon as practicable. The methods for estimating stability appear sound though the method for estimating mixing height is approximate with the data set only suitable for surface releases of short stacks with low final plume heights.

2.7 Modelling Methodology

2.7.1 Overview

The Dispersion processes considered important for this assessment are:

1) Modelling surfaces releases, emissions from buildings and short stacks sited near buildings;
2) Modelling for dispersion under light wind conditions,
3) Accounting for varying roughness such as for suburban areas and Lake Coogee; and
4) Possibly accounting for the affects of terrain changes such as the North-South ridge and depression around Lake Coogee.

In this assessment of the Woodman Pt WWTP, the Victorian EPA model AUSPLUME (v6) was used. This model is widely used within Australia for modelling WWTPs and is ideally suited for modelling the source characteristics encountered. For modelling light winds below 1 m/s, there is some concern as plume models are not really appropriate due to neglecting along-wind dispersion. However, though this is an acknowledged issue, AUSPLUME is still regularly used throughout Australia for wind speeds below 1 m/s.

For point 3, the varying roughness will affect the rate of dispersion in different directions with the dispersion across Lake Coogee being less than across suburban areas. That this is an issue that needs to be addressed was acknowledged in the assessment with a statement that different roughness lengths

were used for "different directions". However this can not be done within one model run and it is considered that the statement (see **Section 2.7.2**) is incorrect. For the affect of terrain, AUSPLUME has a simplistic treatment which is more appropriate for air flow up and around elevated terrain. For airflow from higher to lower terrain it does not produce the correct concentrations or in ponding situations. To model these effects, other models such as TAPM and CALPUFF would be preferred.

Therefore for issues 2 to 4, AUSPLUME has some limitations and may result in less accurate predictions than some other models.

2.7.2 Detailed Comments

Roughness lengths
The Ausplume model runs were conducted for two roughness lengths, 0.4m and 0.1m. The choice of 0.4m is considered on the high side for the area within the buffer to the north and east (the critical directions), which consists mainly of cleared areas, wooded areas and Lake Coogee, with a value somewhat around 0.25m probably being more appropriate. A value of 0.25m was used in the 1999 modelling. The second choice of 0.1m is a compromise intended to be representative over water, though the over-water roughness length is below 0.01m.

Though two roughness lengths are used in the modelling, they are not used as implied for different directions ("*note that the odour contours are based on a general ground surface roughness of 0.4 m for land conditions and 0.1m for dispersion across Lake Coogee"* page 13, Annexure G). AUSPLUME however, can only use one roughness length for the entire model domain. Instead the different roughness lengths were used to model different WWTP scenarios, with 0.1m used for the 240 ML/d runs and 0.4m for other runs. Therefore, due to the change in roughness assumptions, there is no way to assess the affect of the change to the WWTP scenario as the model parameters were also changed. This change in roughness length is considered inappropriate as the change is only really noted in the corner of the figures. Also, it is noted that besides changing the roughness lengths between runs, changes in wind files used were used. Again there is no good reason to change meteorological files between different scenarios as it confuses the interpretation of the results. As such, for any meaningful interpretation of results, all the different scenarios need to be re run using the same model set up.

Dispersion parameters
Dispersion of the plumes was determined using Pasquil Gifford dispersion curves for vertical dispersion and the standard deviation of the wind variation (sigma theta) for the horizontal dispersion. The use of sigma theta was an error acknowledged by CEE, (2005b) with the revised plots sent to the DoE in December 2005. The use of sigma theta in this case is not the preferred modelling method by the DoE as it has lead to anomalous results, primarily as two different methods are used for the vertical and horizontal dispersion. It was also applied incorrectly in this case, as the measured sigma theta value at the observing site was not properly adjusted to the roughness assumed for the model domain. For the 2005 modelling, this resulted in increasing the measured sigma theta values slightly (site roughness 0.3m and model domain roughness of 0.4m). In the 2003 modelling it was incorrect as the roughness of the Hope Valley site (used for the met data) was set to 0.4m, when the roughness of the area there is

considered by the DoE to be much less at 0.1m. Therefore, the sigma theta measurements should have actually been increased for use at the rougher area.

Source Parameters

Emission parameters used were very approximate and often incorrect. For example the stack height of the PST scrubber was set to 5m as obtained from the 2003 modelling (GHD, 2003), when the actual stack height is 15m. The gas engine exhausts were modelled with a diameter of 4.06 m , velocity of 1.1 m/s and temperature of 20 degrees. In practice the diameter of each of the three exhausts is 0.35m, with a velocity 10.5 m/s and temperature expected to be around 300 degrees C. The flare stack is also assumed to have the flow rate of the gas vented to it with a temperature of 300 degrees C. In this case, this will likely understate the real buoyancy of the flare.

Building downwash is not considered for the vents and stacks. This is a significant omission for all vents apart from the PST stack which should be not affected. Other stacks and vents will probably be downwashed which may change the contours that are predicted. Additionally the egg shaped digesters were modelled as an elevated area source. It is considered that as the emissions should be caught in the lee eddy behind the structure, the plumes will probably be downwashed and have increased dispersion. As such, modelling the digester emissions as an area source with no initial vertical dispersion will likely overstate their impact.

The heights of the sources in the sludge handling area are inconsistent. The digester emissions are released from the top of the digester which is 38m tall. These have been assumed as 5m above ground level, presumably to account that the digesters are in a quarry and the top of the digester is somewhat reduced from the surrounding terrain (see **Figure 2.1**), though it is considered that the height of the digester top is higher than 5m above the surrounding area. If this is the reasoning, then the gas engine exhausts should also be reduced, but this does not appear to have been done. The TRF vent stack is modelled as an area source at height 0m which is another significant rough approximation. Therefore there are inconsistencies with the heights used in the modelling, with importantly no detail provided on why the various adjustments were made.

Figure 2.4 Looking south towards the Woodman Pt Egg Shaped Digesters

Variable emissions

A major concern with the modelling is that the variability in emissions has not been adequately addressed. This primarily relates to the PST scrubber. This was estimated as being offline for 5% in 2003. This estimate has now been verified with "*The Corporation has undertaken a reliability analysis of the scrubbers in November 2005, which indicates that the expected system outage is 40 events in one year, and the theoretical system availability is 96%. The confidence levels of the failure rates are estimated at approximately 60%, which gives the Corporation confidence that the adopted value of 95% represents an appropriate, slightly more conservative value for modelling purposes"* (Water Corporation, 2006). Note the above estimates equates to 3.3 outage events per month, with each being on average 8.8 hours duration.

Additional to this estimate of availability, as the scrubbers are sometimes reported to have H_2S breakthrough, it is considered that there may be a percentage of time that the scrubber is not working to design, which is not included in the above emission estimate. Additionally, other sources such as fugitive emissions from the PST and inlet area are considered to have a significant variation due to the performance of the scrubbers and the maintenance operations that are occurring. Other sources with large variations are the TRF and to a lesser degree, sludge loading (see **Section 2.4**).

For such variable sources, the modelling approach using constant (75^{th} percentile) emission rates will most likely not reflect accurately the true impact of the WWTP. Instead the "upset or failure conditions should be modelled explicitly. The EPA (2002) odour assessment guidelines state:

"For source that are intermittent in nature, and emit odour for only a fraction of the hours per year, proponents should advise of these emissions to allow development of a criterion which is applicable for that source. By way of indication, the criterion would be likely to retain an intensity of "distinct" averaged over three minutes, but with a higher percentile to reflect the degree of intermittency. Such an approach would give a level of protection against the highest events in the year from intermittent sources similar to that given by the above criterion for continuous emissions" (EPA, 2002).

The DoE modelling guidelines also state:
"In the experience of the DEP, intermittent emissions (plant start-ups, plant upsets, etc) result in more pollution complaints than normal emissions from operating industries. The modelling must properly assess both emissions which are continuous in nature and emissions which are intermittent. Intermittent emissions which are insignificant in magnitude and/or very improbable in the lifetime of the plant may be screened out; the remaining emissions should be modelled together on a probabilistic basis to estimate the total plant impact" (DEP, 2000, page 2).

The Queensland odour impact assessment guidelines for these states *"If these emissions are significantly higher than those for normal operations, it will be necessary to evaluate the worst case odour impact, as a separate exercise to determine whether the planned buffer(s) between the facility and neighbouring sensitive receptors will be adequate"* (QEPA, 2004, page 12).

As such, the SER modelling assessment is lacking in that the "upset" conditions although reasonably frequent, are not considered. It is considered that these upsets and large variations may be causing a substantial percentage off the offsite complaints and odour issues. Therefore, correlating odour complaint data with modelled concentrations based on normal (or 75th percentile) emissions may lead to incorrect criteria being developed. Additionally, this point indicates that the analysis of the complaint data should have been more comprehensive to determine if there were relationships between the complaint data and plant operating conditions.

Modelling of Lake Coogee

Modelling of Lake Coogee is considered only very preliminary and likely overstates the extent of the buffer in the middle section of the predominantly north south lake. Details of the modelling were not presented in the SER, but have been obtained from Water Corporation as summarised in CEE (2004). Of relevance are the following:

- A "representative" emission rate of 6 ou/m^2/s from the ten mud/crust samples obtained in March 2004 was used. The measured samples were taken from several identified transects across the mud/crust and on differing looking surface types with the emission rates varying between 3.7 ou/m^2/s and 54.9 ou/m^2/s with an average of all measurements of 17.6 ou/m^2/s (CEE, 2004). To determine an average for the area, the representativeness of each surface is required to weight the odour emission rates, which was not done. In any event the choice of 6 ou/m^2/s is rather arbitrary and well below the arithmetic mean of all measurements. It is also noted that the above data does not accord with that stated in Annexure G of the SER, page 16, that the 6 ou/m^2/s was based on the average of 6 to 8 ou/m^2/s;

- The exposed area was modelled as a series of 20m squares generally spaced 20m apart. That is, in effect a 10m wide strip down the eastern edge, which for the 45 small areas used gives a total

area of 10.8 ha and a total emission of 108,000 ou/s. This assumed constant width of the mud area along the eastern edge of the lake is considered to be a poor reflection of the mud distribution as for a large section of the eastern shore the width is no more than 3 to 5m, with the greatest extent of mud area near the south, and to a lesser degree at the western edge of west Churchill road and north end of the lake. Therefore, assuming a constant width will overstate the impact adjacent to the areas with narrow sections and understate the area affected near the larger expanses of mud; and

- Constant emission rates throughout the day for the months of January to March. The variability in emission rates by month and by time of day needs to be determined.

Therefore, due to these factors it is considered that the Lake Coogee odour modelling can be only taken as preliminary and indicative and most likely overstates the impact in the middle of the eastern boundary due to the narrower width of the mud, whilst towards the south the odours may have a greater extent than modelled. This change in odour along the lake is noted by the locals and was evident to the reviewer in site visits in January and February with the southern end being very odourous, whilst the odours from the middle section were barely noticeable.

Conclusion 6

The modelling methodology in the SER is considered to have significant deficiencies, these being;

- Inadequate treatment of variable emissions particularly from the PST scrubber, with the significant 4% downtime of the PST scrubber. Therefore "upset" conditions need to be modelled explicitly as per the DEP modelling and odour guidelines. It is considered that these "upset" conditions may be leading to a substantial percentage of offsite complaints and odour issues;
- Use of sigma theta instead of PG dispersion curves;
- Very approximate and sometimes incorrect source parameters used (stack heights, diameters etc);
- Limitations of AUSPLUME of not being able to model the variable roughness which are a feature of the area, especially to the area of concern to the east of the WWTP; and
- Lake Coogee odour modelling is seen as providing indicative results only, requiring refinements in the emission estimates and the areas used to better predict the odour impacts from this lake.

3 Review of Present and Proposed Odour Controls

3.1 Comments on the Design and Maintenance of Odour Controls

From a review of the SER and other documentation, the following comments are made on the odour controls at the Woodman Point WWTP:

- The air extraction systems appear to be inadequately designed in terms of air exchange rates with the PST/inlet areas designed for only three air exchangers per hour. In comparison, the Subiaco and Beenyup plants were designed with between 12 to 25 per air exchanges per hour;
- The air extraction rates of the PST/Inlet scrubber have degraded substantially over time, with exchange rates below 1 at the inlet works and around 1.5 at the PST at the time of testing in January 2005 (Botica, 2005). According to the flow rate data presented in **Figure 2.3**, the exchange rates may be slowly decreasing and at present may be even lower;
- The scrubbers were undersized and/or the forecast loads in the waste water were lower than actually occured, eg *"Inlet sulphides are now more than double the design estimates, putting additional load on the scrubbers which must be both fully operational to effectively reduce emissions (the scrubbers are too small to provide a full duty/standby arrangement)."* (SER, Annexure D, page 3);
- There is no redundancy in the system, such that no or little odour control is afforded when maintenance of the scrubber system is required, with the result being the scrubber being off-line for 4 to 5% of the time;
- The appearance that maintenance of the odour controls is not optimum. Eg. SKM (2005) refer to:
    - At the sludge digesters *"The original design was to withdraw sludge via the telescopic valve however this is not done at present due to the unreliability of the level control within the digester. Discharge via the scum shovel is a more odorous method of operation as the discharge is more turbulent"* (page 15);
    - *"A chlorination system was previously installed to dose the influent to help control odours but this is not currently operated*" (page 9). Note, the reason for the chlorination system not being operational and the time that it has operated were requested from Water Corporation, who did not respond. The timing of the changes may help explain some of the discrepancies between the 1999 and 2003 odour emission rates between the inlet and PST areas (see **Section 5.1**); and
    - The deterioration of the scrubber airflow to the PST/Inlet to well below design flow rates. The reason for this decrease was not determined.

This perceived lack of maintenance, therefore may result or explain the relative high outages/upsets (an example being the use of Major road twice in 2005 for emergency sewerage storage) and the lower performance in control equipment. As a result the odour emissions from the WWTP may be quite variable with occurrence of high emissions due to control equipment being off-line or performing below specification or due to maintenance.

3.2 Comments on the Proposed Odour Control

Proposed odour control for the WWTP are:

- Stage1 - Cover the anaerobic and anoxic zones on the SBR. Replacing the existing PST/Inlet scrubber with a new centralised scrubber, implement odour control at sludge treatment. Fixing odour issues due to mechanical problems at the TRF. The estimated average odour reduction is 41% from 2004 levels;
- Stage 2 - Increasing extraction rates to inlet works and PSTs, installation of additional scrubbers and installation of a 50m (or 40m?) high discharge stack. The estimated odour reduction is 48% of 2004 levels; and
- Stage 3 - Covering the aerated section of the SBR, with a new covered SBR constructed. Estimated odour reduction to 76% of 2004 levels

From this review of the emission and modelling (see **Section 2**), it is concluded that the predicted benefits in terms of odour levels are uncertain and need to be re-estimated following improvements to the issues identified. However, though the actual benefits and relative changes may be subject to some questions, it is considered that the sequence in staging is sound.

It is considered that Stage 1, with the estimated 41% reduction from 2003 emissions should be implemented as soon as practicable, as it is considered that this addresses issues that were in the indicative plans in 1999 (i.e. covering the anaerobic and anoxic zones of the SBR - see **Appendix B**) and also implements a scrubber that is more appropriate than the existing undersized scrubber with no in-built redundancy and current poor extraction rates. It is understood that the extraction rate and redundancy issues are being addressed in Stage 1.

As the emission inventory is to a degree uncertain and considered may understate emissions at the sludge area the odour works may result in a larger reduction than estimated. It is also noted that this stage deals with most of the upset emissions, eg PST/Inlet down times, peak emissions from the TRF due to mechanical problems (note the TRF is not listed for odour control in the main texts, though listed in Appendix B of Annexure G). More details are needed to ensure that this intermittent significant source at the TRF is being addressed. As it is the reviewers view that the upsets may be causing many of the offsite odour issues, the proposed odour control may be more effective than indicated by just assessing the change in the typical odour emissions. This highlights a key point in that the focus on future odour control is not just on how the average emissions will change, but also how the frequency of peak emissions will change. It is recommended that firm commitments/targets (possibly licence conditions as per in the Subiaco WWTP licence) are needed regarding the frequency of upset conditions. This was an area in which detail was lacking in the SER.

For Stage 2, improving the extraction rates and replacing or sealing the covers at the PST/Inlet area will reduce the amount of fugitive odours and possibly the frequency of higher emissions as these appear to be dependent on maintenance e.g. lifting covers in the area. This also requires that extraction be more modular such that maintenance on one PST does not affect the performance of the extraction on the others as noted by SKM (2005). The requirement for the taller 40 or 50m stack compared to the present 15m stack is not presented or discussed in the SER. It is considered that this option should be more

fully evaluated to ensure that this does not create additional problems, as argued by some is the case with the new tall stack at Wagerup transferring the problem to the far field. Also more details on the likely maximum odours and the frequency of these from the present and future scrubbers are required, as high odours from a point source can lead to significant offsite impacts.

For Stage 3, the odour emissions are predicted to decrease from 48% to 76% for the 2003 values. It is suggested that as the emission inventory for the sources is to some degree uncertain, that the offsite impacts may be driven more by "upset" conditions which hopefully are addressed in Stages 1 and 2, that the benefits of Stage 3 may be less. As such, it is recommended that an ongoing inventory, analysis of complaint data and important odour ground truthing according to VDI (1993) with updated modelling is required at the end of each stage to assess the level of improvement against predictions.

For comparison to the odour contours presented in the SER and the argument that the buffer needs to be retained, **Figure 3.1** presents the predicted odours at 240ML/d but for the 3 minute 99.5 percentile criteria.

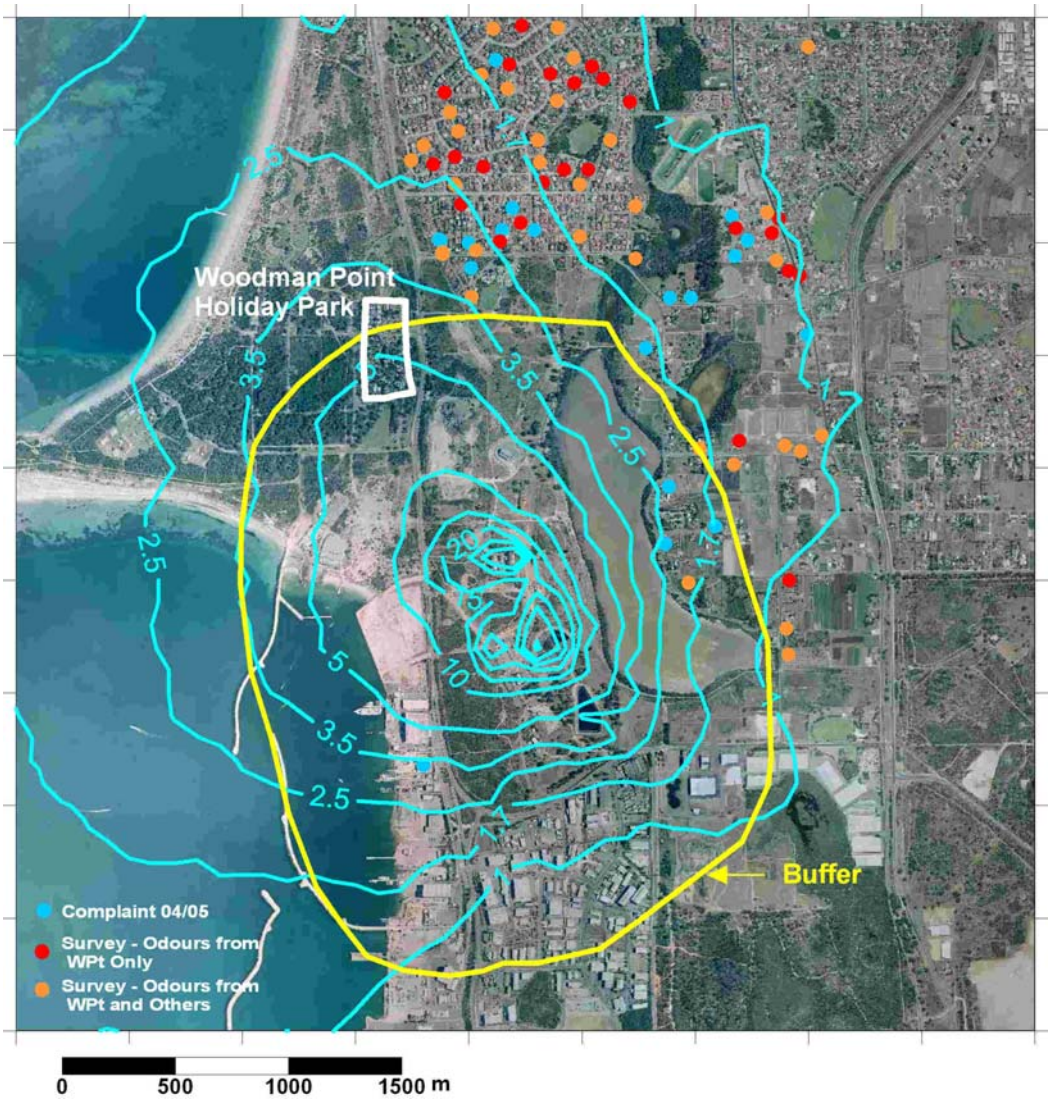

Figure 3.1 Predicted 3 minute 99.5th percentile odour levels (ou) for the 240 ML/d Woodman Pt WWTP

Using the 3.5 ou as presented in **Figure 2.2** as a good measure of the extent of odour complaints/annoyance, at 240 Ml/day, the 3.5 ou level is just achieved at South Coogee with the contour not extending to the eastern edge of Lake Coogee, though with concentrations above this throughout the entire Woodman Point Caravan Park. Noting there are concerns with the emissions, modelling assumption and neglect of intermittent emissions, the results in **Figure 3.1**:

- Do not support the view presented in the SER that a 750m buffer is required to the east of the WWTP for this future case;
- "Acceptable" odour levels will probably not be achieved at South Coogee until Stage 3 is implemented; and
- Even after Stage 3 at an inflow rate of 240 ML/d, further controls are necessary to achieve an "acceptable" odour level at the Woodman Point Holiday Park.

Conclusion 7

With regard to current and proposed odour controls it is concluded that the present odour controls are not performing as designed and may be a substantial cause of the odour issues from the plant. This may be due to maintenance issues and contributed by the plant nearing or exceeding loading criteria. For future odour control, the proposed controls and staging appears generally sound. It is recommended however, that an independent re-evaluation of the odour emissions and modelling assessment is required to re-estimate the benefits of the controls given the numerous errors and issues identified in the emissions and modelling review (see **Section 2**). This study should also involve ground truthing of the odour levels outside the WWTP using methods such as in VDI (1993). This should be undertaken as soon as practicable to be able to refine the estimates of the future effectiveness of odour controls and should entail an independent re-evaluation of the proposed odour controls effectiveness. This process should then be re-evaluated after each stage is implemented, and especially Stage 1 where the greatest benefits are expected to occur. It is also recommended that in the future, firm commitments/targets (possibly licence conditions) are needed to ensure that the frequency of upset conditions is substantially reduced from the current levels.

4 General Comments on the Adequacy of the SER

The following presents a brief summary of issues with the SER apart from the specific modelling and emission issues identified in **Section 2**.

- The odour survey conducted in 2003 though reasonably comprehensive, was limited in the areas surveyed. As the boundaries were not detailed on the map, the figures appear to indicate the extent of odour impacts, though this is in fact just the boundary of the odour survey. An example of this is the areas bounded to the west of Rockingham road, north of Yangebup road and south of Barrington road with the south area expected to be impacted by the Mayor road pumping station. As such, the odour survey figures should have the survey areas indicated to highlight the areas not covered. A survey in Beeliar (east of Stock Road) would also be very useful to confirm whether there are odours here, which is indicated by the 99.9 percentile plots in the SER, but is not supported by the reported complaint data or 99.5 percentile contours.
- The analysis of the complaint data is minimal. Analysis is needed to confirm whether there is a relationship to plant operating conditions and to distinguish between complaints due to normal operating conditions and due to plant upsets. Also, as per the odour survey, the complaint data set is incomplete. The text in Annexure G states that 4 years of complaint data, up to the time of the report were used in the plot in Figure 6, Annexure G. However, advice from Water Corporation (Water Corporation, 2006), indicates that only 2004/2005 data was used. As such, information on complaints in Beeliar and at the boat ramp, beach area have been omitted, which may (as per occurred for the odour survey data), effect the interpretation of the selection of the appropriate criteria. Additionally, complaint data to the DoE or City of Cockburn is not included. It is recommended that at the least, the SER should contain the number of complaints that have been reported by all sources, those attributable to Water Corporation and those which could not be determined. For comparison of model predictions from the WWTP to the criteria, it is recommended other sources such as odour events due to Mayor road pumping station also be removed.

  It is also noted that complaint data is often not an accurate indication of the odour impact and that careful analysis at the least is needed. Preferably other methods such as ground truthing using the method in VDI (1993) are preferred or used in conjunction with complaint data.
- Annexure A is the wrong report with the modelling report presented, whilst this should be the emission survey report by TOU as referred to in page 6 of the SER.
- There is a lot of additional material in the appendices which appears to be of little relevance. This material should have been better summarised in the main report or summarised in the appendices.
- There is a lack of detail given on the present adequacy and performance of odour controls. Issues include the chlorine dosing undertaken to reduce odours in the inlet which has stopped. The SER should also include data on the performance of the scrubbers etc. This data should have been provided in a summary format, showing the results from stack testing as per that presented here in **Figure 2.3**. This is considered standard practice in any impact assessment report relating to expansion of an existing plant. Data on the availability/downtime of the key odour control equipment (e.g. the PST scrubber should be provided on a yearly basis) as this is

considered to be one of the critical statistics measuring the plants odour control performance and how it may be affecting nearby residents.

- There are significant changes in the modelling set ups between 2003 and 2005 which are not presented to the reader. The changes relate primarily to how sources were modelled. These changes should be highlighted to note that the model set-up and emissions used to obtain the "good" agreement with the odour survey data in 2003 and as used as the basis to argue for the buffer has changed.
- The report should have provided more analysis of the odour complaint data and the obvious contradiction in the statement *"Surprisingly, despite the $150 million upgrade to the Woodman Point Wastewater Treatment Plant in 2000/02, odour complaints then increased five-fold to 35 complaints for 2003/04, with the number of complaints again increasing to 65 during 2004/2005"* (page 9 of the SER). This contradiction should be explained as it indicates that the odour emissions did not decrease as claimed with the upgrade, but the odours increased (or perhaps the intensity of peak events increased?). Alternatively the explanation may be that the complaint data has been biased since then, through a greater public knowledge of complaint procedures and heightened awareness of the issues, such as may have arisen from conducting the odour survey in August 2003. This view is supported in that complaints increase around this time (see Figure 4 of the SER). Other factors that may lead to the change is that the sections of the community have been induced/encouraged to complain. Also, that there is a change after the odour survey, may also suggest that the odour survey may now be unrepresentative.
- The SER does not attempt to put into context the 1999 assessment and why the odour levels predicted then and now and the resultant implications for the need for a buffer are so different (An analysis of these issues is presented in **Section 5)**. This issue is noted is one of the main concerns the community has regarding the WWTP and the SER. The way the 2003 and 2005 reports are presented instead tends to ignore the original modelling, the commitments in the 1999 report and the subsequent licence conditions for the upgrade (**Appendix B**, discusses more fully the various commitments in the 1999 report and the subsequent licence conditions).
- There are some statements that appear to misrepresent the publics position such as, *"There was an expectation by some landholders within the buffer area to the east of Lake Coogee that the odour control works undertaken in 2000/02 would reduce the buffer to the eastern margin of the lake enabling development for residential purposes of land currently zoned Urban Deferred"* (page 7, SER). It is not mentioned that this expectation was based on the commitments in the 1999 upgrade report and public statements/position of the Water Corporation up to around 2002 (see the Engineering Excellence Awards, Woodman Alliance, 2002 and **Appendix B**).

5 Comparison of the 1999 and 2003/2005 Studies

One of the major issues the community has with regards to the WWTP are the questions:

- Whether the upgrade in 2000/2002 delivered the benefits claimed and if not, why this was the case; and
- How do modelled odours from the upgraded WWTP compare to the odour conditions in the licences, pre July 2004.

In the SER these questions are not addressed. As such, the following provides a brief analysis of the emissions estimates used in the 1999 work and that estimated following the odour study in 2003.

5.1 Emission Estimates in 1999 and 2003

5.1.1 Base Case (1998-1999) 100 ML/d Emissions

Emission estimates for the WWTP as undertaken in 1998 (reported in January 1999, CH2MHill, 1999 and SKM, 1999) are provided in **Table 5.1** along with the updated estimate made in 2003 as presented in GHD (2003).

Table 5.1 Woodman Point Emission Estimates for 1998 or 1999

Source	**CH2MHILL (1999)**	**SKM (1999)**	**GHD (2003)**	**CH2MHILL (1999)**	**SKM (1999)**
Sampling Method for Areas	***Wind tunnel***	***Wind Tunnel***	***Flux Hood***	***Converted to be equivalent to a Flux Hood***	***Converted to be equivalent to a Flux Hood***
Effluent Pumping Station	14,700	14,700		14,700	14,700
Digesters	22,500	22,500	25,700	22,500	22,500
Waste Gas burner	80	80	7,460	80	80
Screens	64,500	2,000	430,000	64,500	2,000
Grit Tanks	5,072	5,072		2,536	2,536
PSTs	144,418	68,460		72,209	34,230
Sludge Drying Beds	216,450	216,450		108,225	108,225
Sludge Loading			551		
Odour Bed			143		
Sludge Dewatering Building			7,000		
Energy Recovery Building			3,000		
Dewatered Sludge Stockpile	59,020	59,020		29,510	29,510
Effluent Chamber		3,000		0	3,000
Total	**526,740**	**391,282**	**473,854**	**314,260**	**216,781**

Note: The conversion to flux hood for the area measurements were undertaken assuming that wind tunnel measures SOERs twice that as from a flux hood.

Table 5.1 indicates that:

- The CH2MHILL estimates were much greater than provided in SKM due to the SKM report having much lower emissions from the screens and the PST Though both reports were released

in January 1999, it cannot be concluded which report contained the final best estimates (Water Corporation, 2006). The lower PST emissions in SKM is due to the much smaller total area of the PST used, with this area in agreement with the actual size. However, in the estimates, both CH2MHILL and SKM assume that two and not four tanks were operational. The much lower inlet emissions in SKM was due to a much lower specific odour emission rate assumed. Though different odour emissions were predicted, the modelled contours in both reports were reasonably similar.

- The estimates provided in GHD for 1999 are based on assuming no sludge drying beds and stockpiles as were included in the 1999 estimates. In the 1999 estimates, these areas accounted for 275,470 ou/s or 52% and 70% of the two estimates. It is not known when these drying beds ceased being used, but it is considered that this was before 1999, such that the 1999 base case may have been an over-estimate;
- The estimates provided in GHD from the PST inlet area were 430,000 ou/s, which is 91% of the total odour emissions. The 2003 PST/inlet area estimate is therefore 2 and 5.7 times greater than that estimated for this area in 1999 as reported in CH2MHILL and SKM. The 2003 estimate was based on the 75 percentile odour concentration of 8 samples to the inlet and one sample at the outlet when the PST/Inlet scrubber was not working. This appears to overstate the emissions, with the average and 75% of the 2004 and 2005 sampling (without odour decay corrections) being approximately 270,000 and 290,000 ou/s.
- The 1999 area source estimates are based on wind tunnel measurements, whilst the 2003 are based on flux hood estimates. This point is not detailed in the SER and can give a incorrect impression that the estimates are by the same method. Wind tunnels provide higher emission estimates than from an isolation flux hood, due to the much higher air speeds above the surface which helps strip odours. Air Assessments (2005) provides a summary of some comparison studies between the two methods indicating that for WWTP sources, the wind tunnels measurements (standardised to a wind speed of 0.05 m/s at 0.1m above the surface as per the 1999 measurements) are on average between 2 to 7 higher than that from a flux hood. Based on using the lower limit of this rough conversion, **Table 5.1** also presents the estimated emissions with the area emissions "converted" to flux chamber measurements. This indicates that the estimates in 1999 when on a comparable measurement basis, will probably be less than originally stated and as such the reduction in odour emissions between 1999 and 2003 is lower than would first appear. Such statements as
  "There will be some differences in odour measurement techniques between the 1998 assessment of total odour emissions and the 2003 assessment. Nonetheless, both assessments were made by the same laboratory using comparable methods. Thus the substantial reduction in total odour emission rate (from an estimated 536,700 ou/s to an estimated 273,740 ou/s) shows that the upgrade did comply with the Works approval condition to reduce the overall odour impact of the upgraded wastewater treatment plant in comparison with the earlier plant." (SER Annexure B, page 8) are inaccurate as it neglects this change in measurement methods. Instead for comparison, the emissions presented for 1999 in GHD (2003) of 473,865 ou/s may be more realistic, though if the 75 percentile emission from the PST from the much greater number of samples in 2004 and 2005 is used, an estimate of 333,854 ou/s for the 1999 case can be derived. Therefore from 1999 to 2003 there may only be a small decrease in typical emissions. Note the above has not corrected the 2004/2005 for the decay time which will increase the emissions, but

conversely the 2003 measurements should be reduced to account for the lower waste water flows in 1998.

5.1.2 120 ML/d (2003-2005) Emissions

Estimates of the odour emissions after the Upgrade are presented in **Table 5.2**.

Table 5.2 Woodman Point Emission Estimates after the 2000/2002 Upgrade

Source	**CH2MHILL (1999) @ 160 ML/d**	**SKM (1999) @ 160 ML/d**	**SER (2005) @ 120 ML/d**	**CH2MHILL (1999)**	**SKM (1999)**
Sampling Method for Areas	***Wind tunnel***	***Wind Tunnel***	***Flux Hood***	***Converted to a for Flux Hood***	***Converted to for Flux Hood***
Inlet Pit Tankers			1,200		
Inlet Area (fugitive)			6,000		
Grit and Screen bins (fugitive)	48,072	5,072	1,200	24,036	2,536
Primary Tanks (fugitive)	36,326	17,220	20,000	18,163	8,610
PST Scrubber		400	20,000		400
Inlet/ PST Area- Total	***84,398***	***22,692***	***48,400***	***42,199***	***11,546***
Anoxic Tanks	0	0	88,000		0
Aerobic Tanks	89,920	89,920	74,000	44,960	44,960
Aeration walls		0	2,000		0
SBR Area-Total	***89,920***	***89,920***	***164,000***	***44,960***	***44,960***
Effluent Channel		0	550		0
Effluent Dam		0	3,000		0
Tanker		NA	2,400	NA	NA
Tanker Vents		NA	2,000	NA	NA
Sludge Drying Bed #2		43,290	removed		21,645
Sludge Thickener			3,100		
Biofilter Outlet			22,300		
Digester Outlet		133	25,700		67
Sludge Storage Tanks			2,000		
Sludge Dewatering building			7,000		
Biosolids Bin			1,000		
Sludge Truck Loading			2,050		
Odour Bed		50	140		25
Energy Recovery Bld.			3,000		
Gas Engine Exhausts	2,000	160	3,000	2,000	160
Waste Gas Burner (flare)			7,460		
Sludge Area - Total	***2,000***	***43,633***	***76,750***	***2,000***	***21,897***
Total	**176,318**	**156,245**	**297,100**	**89,159**	**78,403**

Notes

1) The 1999 estimates of the SBR emissions have been assumes to be all from aerobic tanks with the anoxic tanks covered and scrubbed as stated in the SER, Annexure B page 7.
2) The conversion to flux hood for the area measurements were undertaken assuming that wind tunnel measures SOER twice that as from a wind tunnel

Table 5.2 indicates that the 1999 estimates after the upgrade are much lower than the 2005 SER estimate, even though they are for 160 Ml/d compared to 120 Ml/d. The differences are due to the 1999 estimates having negligible emissions from the sludge drying area and that emissions from the SBR were around half that estimated now. For the SBR, the 1999 and 2003 estimates of the aerobic emissions are in good agreement (This assumes that the anoxic zones were assumed covered in the 1999

estimates as reported in the SER, Annexure B, page 7). Therefore the much larger emissions from the SBR area may be due to the final design where it was designed with no air extraction from the anoxic tanks, unlike the preliminary design in the EAMP (SKM, 1999) and assessed by the DoE. Alternatively, if the preliminary design considered that none of he SBR was to be covered (unlike that indicated in Annexure B, page 7), the emission estimates for the overall SBR in 1999 were a factor of two too low. Note confirmation was sought on the design of the upgraded plant in the 1999 reports, but no details were provided by Water Corporation.

For comparison to the 2003 and 2005 estimates, the 1999 based wind tunnel emissions have also been "converted" to flux hood which show even lower estimates.

Therefore, the 1999 estimates of the upgrade substantially under-predicted the emissions through not:

- Considering/underestimating emissions from the sludge area; and
- Either were based on the anoxic zones at the SBR being covered or underestimated emissions from the SBR.

The result of both these was that the 1999 upgrade odour contours were much lower from that assessed in 2003 after the upgrade.

5.2 Modelling Assessments in 1999 and 2003

Details on the 1999 modelling are very sketchy with little detail provided in CH2MHill (1999). This review has not attempted to verify the adequacy of the modelling as it considered outside the scope of work. The only comments that can be made are, that as the area source emissions are from wind tunnels they should show larger odour contours than derived from isolation flux hood measurements.

Details on the 2003 modelling were provided in GHD (2003) and have been assessed through the AUSPLUME configuration files and output files as requested from GHD for this review. These files indicate major issues and errors with the modelling. These issues/errors are:

- For estimating the horizontal dispersion of the odour, the modelling used PG dispersion curves for the 3 minute predictions (for assessing against the licence conditions), but used sigma theta measurements for the 1-hour predictions. This change is presumed to have occurred inadvertently as the version of AUSPLUME at the time switched automatically between the two depending on the averaging period, providing only a warning to the user. Therefore, there is no consistent basis for comparing between the two averaging periods and the two odour criteria evaluated. It is noted that the site meteorological roughness length for Hope Valley was assumed to be 0.3m, which is well above that generally assumed for he site of 0.1m as used by the DEP. Therefore the predicted dispersion will most likely be incorrect;
- All stacks except the PST scrubber stack were assumed to have the exit at ground level. That is, no stack at all. The PST scrubber stack was also assumed to be 5m and not 15m (as also carried through in the CEE modelling). These assumptions will most likely result in higher ground level concentrations from these stacks;

- The gas engine exhausts were modelled with a diameter of 4.06 and velocity of 1.1 m/s and temperature of 20 degrees to apparently model the emissions as from a fugitive release from a building (see below);
- Releases from buildings were modelled (approximated) as stacks, eg the sludge building was modelled as a surface stack with a diameter of 2.76m and speed of 0.6 m/s;
- The two egg shaped digesters were modelled as one area, with a length and breadth of 3.71m. This will neglect the probable increased dispersion from the wake of the buildings, that the sources are elevated and that there is an approximate separation of 33m between two sources;
- Sludge loading considered an area of 0.3m length which understates the volume out of which the emissions are initially mixed; and
- The future scenarios at the SBR assumed no additional SBRs, but that the emissions per unit area increase. This neglects that with additional units the emissions will be spread over a wider area which will therefore act to reduce off site concentrations.

As such, with the errors in the modelling set-up it is considered that no conclusions should be made with regards to the 2003 modelling and the requirements for any buffer. Also, as noted before, the meteorological data was not adequate, with the Hope Valley data and only 7 months of on-site data used.

6 Conclusions

This report presents an independent review of Water Corporation's SER - *Management of Odour* at Woodman Point WWTP, which details the Corporation's odour reduction program and intentions in relation to the existing odour buffer.

From the review it is concluded that there are a number of significant issues in relation to the modelling and to a lesser degree with the emission inventory, such that the results can not be used to scientifically define the requirement of the WWTP odour buffer.

These issues are detailed in the conclusions throughout the report, but include:

- Significant errors in the modelling, including the dispersion scheme and source parameters used;
- Omission of a number of odour survey points which have biased the interpretation of the model validation;
- The emission inventory for a number of sources is indicative only, with many of the sources considered to have quite variable, unquantified emissions, eg the PST/inlet area, TRF and sludge area;
- No modelling of upset conditions. These are considered to be very important for this WWTP with a high number of upset conditions that are considered to contribute to the off site odour issues;
- Omission of a key sensitive receptor, the Woodman Point Holiday Homes. This site should be considered and is likely to be the critical odour sensitive premise in determining the degree of odour controls necessary at the plant; and
- Errors in the meteorological file used.

From comparison of the modelling predictions to the survey and complaint data, it is also concluded that instead of the 99.9^{th} criteria proposed, a 99.5^{th} or lower percentage criteria would better fit the data. Use of such a criteria indicates that odour levels at the east edge of Lake Coogee from the WWTP will most probably be similar to that at the south end of Coogee. Therefore, odour control works to protect South Coogee as planned should also protect the area in the Urban deferred zone at the eastern side of Lake Coogee. Note, this conclusion is based on the model as set up in the SER, and may change if as suggested, a model accounting for changes in surface roughness such as CALPUFF is used.

Another significant issue identified was the absence of discussion on the future of the Mayor road pumping station, which is a significant source of odours and complaints in the area.

As such, it is recommended that the issues identified in this review be addressed before a more quantitative assessment for the requirement of a WWTP buffer is undertaken. These issues it is noted may affect somewhat the likely predicted benefit of the controls proposed and the WWTP buffer requirements, but should not hinder the odour emission reduction activities planned by Water Corporation. It is considered that the plans for Stage 1 in particularly should be implemented as soon as practicable. It is also recommended that with such a contentious issue, such as buffer definition, greater independence and transparency is required in the assessment, particularly in collating present emissions and in estimating future control efficiencies and emissions.

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Appendix A Review of Woodman Point Wind Monitoring

Water Corporation installed a weather monitoring station at the south east corner of the primary settling tanks in 2003. The weather station consists of:

- Wind speed and direction measurements at 10m above ground level recorded with a Climatronics F460 wind sensors;
- Air temperature measured at 2 and 10m above ground level;
- Solar radiation;
- Net solar radiation; and
- Relative humidity.

The wind sensors (Climatronics F460) have very low stalling speeds of 0.22 m/s for both the speed and direction sensor and meet the Australian standard for Class 1 Air Quality wind sensors (AS 2923-1987). In terms of siting, the wind station is considered to be reasonably well sited, though it appears to be shielded to some degree for south easterlies by the blower building situated 50m to the SE.

To further ascertain the degree of shielding, the winds were compared to that recorded by the DoE at the Hope Valley weather station (approximately 7 km) to the south. This data was used in the early odour modelling assessments (1999 and 2003), but was discontinued as this site as situated on a small hill does not record very low wind speeds at night.

Selected plots of the comparison between the wind speeds and directions between the two sites are presented in **Figure A.1** to **A.3** indicating:

- Wind speeds recorded at the sites are comparable for stronger winds, though for the lighter winds Woodman Point as expected records lower wind speeds than recorded at Hope Valley;
- The wind directions are in general agreement, apart from the period 1 December 2004 to 14 May 2004 where it was evident that there was a step change in the wind directions measured at Woodman Point, where it records wind directions 20 to 25 degrees lower than reported at Hope Valley. That is the wind from the south (180 degrees) would be reported as from 155 to 160 degrees at Woodman Point.
- Woodman Point measures lower wind speeds for south easterlies and northerlies. The lower south easterlies are probably due to the proximity of the approximately 6.5m tall blower building 50m to the south east. The lower winds from the north are possibly due to the small hill to the north. That the winds may be lower than actual for these wind directions is not critical as areas to the north west and south are not critical areas for determining the extent of buffers. For the other wind directions the wind speeds are generally a bit lighter than recorded at hope Valley as expected due to the more exposed site at Hope Valley.

Other issues with the data are that that are evident from comparison with the Hope Valley data (not shown) are:

- The wind directions for three days are incorrect (midday 14th to 17th May 2004) with the wind directions being reversed around 180 degrees; and
- 1 February 2005 is suspect being the wrong date or bad data.

Therefore, the Woodman point data set looks reasonable for the site, with some under measuring of south easterlies and northerlies which are not critical in terms of determining odour buffers. The data does however, have some issue with a wind direction problem for a period of 5 months which should be corrected and there are 4 days of data with wind direction errors that also should be fixed before other modelling is conducted.

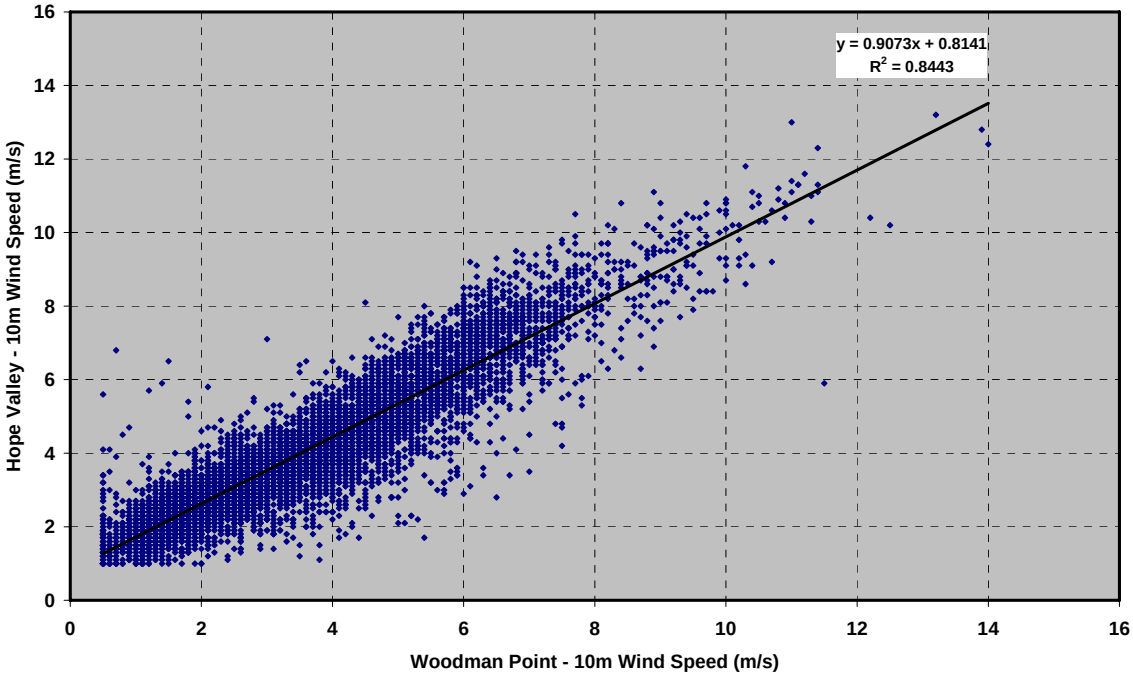

Figure A.1 Scatter plot of Woodman Point versus Hope Valley Wind speeds

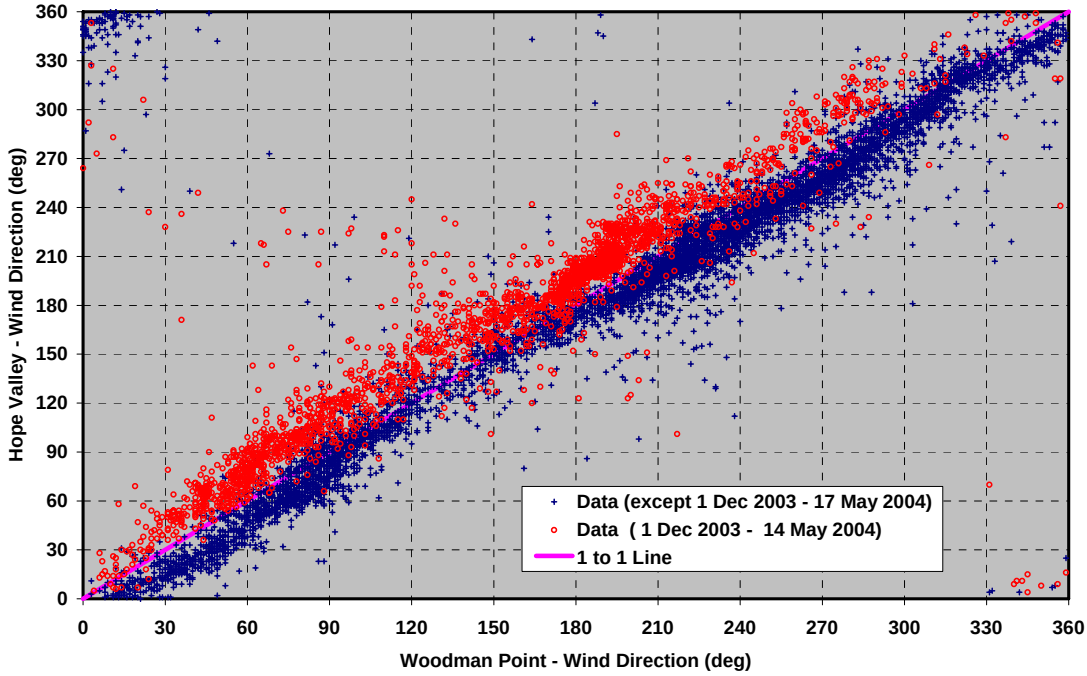

Figure A.2 Scatter plot of Woodman Point versus Hope Valley Wind Directions for wind speeds greater than 3 m/s

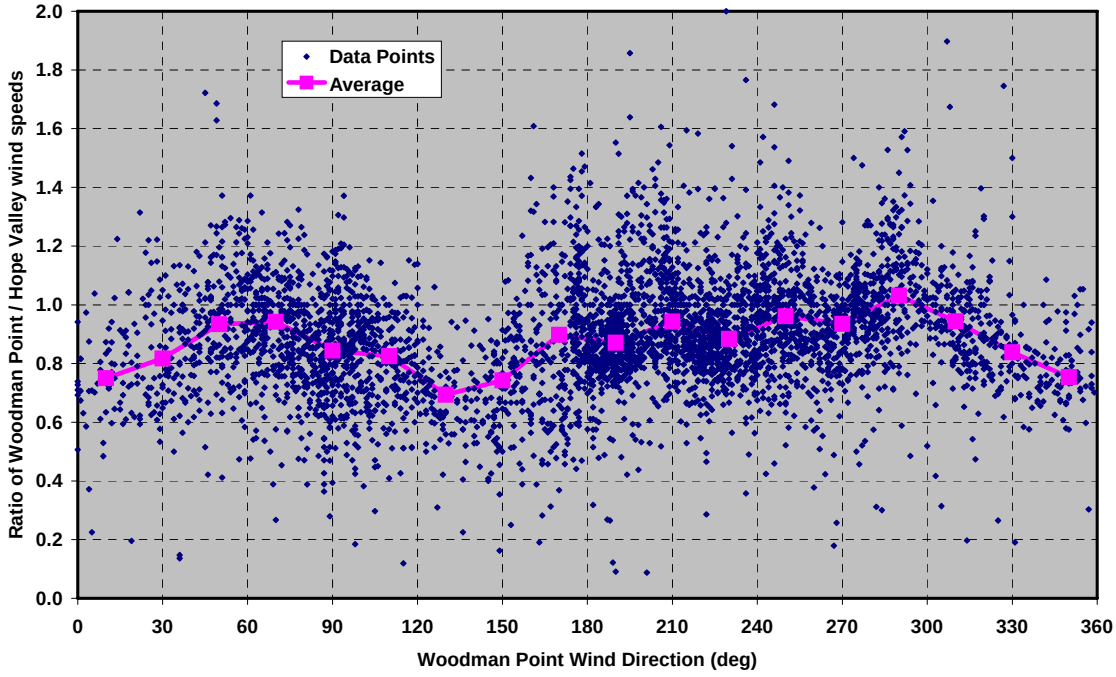

Figure A.3 Scatter plot of Woodman Point versus Hope Valley Wind Directions for wind speeds greater than 3 m/s

Appendix B Summary of Community View

As requested by the EPA brief, a series of informal meetings/dialogues were held with selected people and groups who had made public submissions. A summary of the views and where possible, any supporting documentation behind these views is presented below. It is noted that the views expressed do not necessarily imply the author's agreement.

The "views" are summarised below, generally ranked in order of decreasing importance.

1) With respect to odour impacts of the expanded plant, the Water Corporation has not met its commitments or the licence conditions stipulated by the DoE. Instead of rectifying these when the odour survey and modelling indicated they were not in compliance, the Water Corporation have instead sought to formalise the buffer at 750m to the east of the plant.

The Water Corporation were granted approval to construct the amplification to 160 ML/d on the basis that, at the time, they only had indicative technology and designs available and that the emissions from the proposed plant could only be estimates. As such, the Water Corporation committed to (and subsequent licences stipulated) that they would demonstrate compliance with the projected future odour levels presented in the SER, and if not in compliance with the modelled odour levels, rectify this to achieve these odour levels. The Water Corporation commitments in the 1999 Environmental Assessment and Management Plan (EAMP) were:

"The Water Corporation has therefore committed to undertake sampling and remodelling for the amplified plant after commissioning to confirm the predicted 5 OU contour using emission data from the new plant. Remodelling will be scheduled for completion by mid 2003, allowing for sampling in late summer/autumn following a period of stable operating conditions. This will allow reconsideration of the buffer in the third quarter of 2003. The Corporation will rectify significant odour issues to the satisfaction of the DEP, should monitoring subsequently reveal exceedances of the 5OU criteria at odour sensitive premises (SKM 1999, commitment P2, page 9).

The predicted 5ou contour for the amplified plant extended approximately to the edge of Lake Coogee – about 500m from the Treatment Plant with the contour varying from over Lake Coogee to at its furtherest, 150m to the east of the shoreline.

In the summary of Environmental Factors and Management (page 8), the commitment is summarised differently to the text. Under management objectives, it is stated to *"Meet requirements at the edge of the present buffer zone under normal plant operation"* and under Proposed Management it is stated, *"Cover selected facilities and treat odours to ensure amplified WWTP meets 5ou: 99.5%: 3 minute criteria at edge of buffer zone."*

Therefore, it is critical to note that the commitment in the text is to confirm that the impact of the upgrade scenario was the same as that modelled, to protect odour sensitive premises, which is essentially

to the eastern edge of Lake Coogee, however the summary table had the less stringent requirement to only meet the criteria at the present buffer.

Based on the SER, the Works Approval for the upgrade (1 April 1999) was written with a preamble stating the Water Corporation were seeking the establishment of a formal buffer and that this would require the measurement of actual odour emissions, modelling and provision of summary and detailed technical report. The Department of Environmental Protection will then *"assess the report findings in the context of the Department's odour criteria in recommending the appropriate dimensions of the buffer area. In so doing, there will be a recognition that land to the east has been rezoned to residential to within 750m of the plant"*. The relevant conditions in the Works Approval consisted of:

GENERAL REQUIREMENTS
G1 The works approval holder shall construct the facilities associated with the amplification project in accordance with the following documents:

(i) "Woodman Point Wastewater Treatment Plant Amplification - Environmental Assessment and Management Plan: Sinclair Knight Merz in association with DA Lord and Associates, January 1999.

(ii) Subsequent information supplied on 25 February 1999.

(iii) The environmental management plan and monitoring plan as required by condition G3.

Where there exists contradiction of details, specifications and design, the works approval shall prevail.

WORKS APPROVAL COMPLETION DOCUMENTS
G2 Prior to commencement of operation of the new or upgraded components of the amplification project, the works approval holder shall send completion documents to the Director, certifying compliance with the relevant conditions of the works approval.

AIR POLLUTION CONTROL CONDITIONS
A1 The works approval holder shall construct the new facilities such that the overall odour impact of the wastewater treatment plant is reduced in comparison with the existing impacts.

The general condition therefore specifies that the plant is to be constructed to the specifications and commitments within the EAMP, which includes the commitment in the text regarding protecting all odour sensitive premises. Note, that that Water Corporation in the 2005 SER, quotes only the Air Pollution Control condition (overall odour impacts to be reduced) and asserts that they complied with this (see page 5 of Annexure B of the SER).

The City of Cockburn on 31 March 1999 wrote to the DEP outlining their concerns with the draft Works Approval, specifically in relation to the buffer, stating:
"As you are aware, a key issue of concern to the City relates to the impact of the amplification on the odour buffer surrounding the plant. The comments in relation to the redefinition of the buffer in the preamble of the Works Approval and requirements of condition A1 are noted. Council's position on the buffer is that it should be reduced to at least the eastern shore of Lake Coogee through technological improvements to the plant. The City therefore seeks a commitment from the Department that the revised

licence for the plant following completion of the amplification will approach the revision of the buffer in line with Council's position" City of Cockburn (1999).

In response, the DEP's Pollution Prevention Division Director Fred Tromp DEP is quoted as writing, "*The DEP shares the City's objective that ultimately the odour buffer should not extend east of Lake Coogee. And further that a odour survey should be done after the upgrade using relevant DEP odour criteria to determine the extent of the buffer, but should the buffer area so determined extend to the east of Lake Coogee, then additional odour control works will be required as a condition of the licence to meet the DEP's objective"* (as cited by R O'Brien, 2006).

In the Best Practice Environmental licence which commenced July 2001 to Dec 2002, a licence condition for odours was introduced in the Woodman Pt WWTP licence.

Odour Management

The licensee shall manage odour emissions such that odour concentrations at the edge of the area to the east of Lake Coogee zoned Urban Deferred do not exceed five odour units for 99.5% of the time (three minute average), with a goal of not exceeding two odour units for 99.5% of the time (three minute average).

This condition was consistent with the 1999 EAMP in that:

1. It was flagged within the EAMP as per the statement. "*The current licence contains general (non measurable) requirements regarding offensive odour emissions"* ….. and that, "*The odour modelling undertaken for this EAMP will allow adoption of a licence condition relating to the predicted (5ou: 99.5%: 3 minute) odour levels around the treatment plant. This will be implemented after a verification period following plant commissioning"*. (SKM, 1999, page 122);
2. The 5 ou, 99.5%, 3-minute average criteria used in the EAMP was proposed by the Water Corporation as the criteria that gave good agreement with complaint data at Subiaco. This criterion was accepted by the DEP for Woodman Point subject to a modelling study using actual emissions from the amplified plant and community survey and that the "*corporation will rectify significant odour issues should monitoring reveal exceedances of the odour criterion beyond the predicted 5 ou criterion"* (SKM, 1999, Appendix C - correspondence Water Corporation/DEP); and.
3. The position of the contour at the eastern edge of Lake Coogee is consistent with the contour presented for the proposed upgrade case (Figure 7.1, SKM, 1999).

[Reviewers note, this transference of proposed concentrations from the proponent's environmental assessments to the licensee is considered a standard practice of the licensing branch, to ensure that the plant as built, conforms to that which was evaluated and accepted by the DoE. Generally in modelling air pollutants, the modelled emission concentrations, (which should be maximums) are transferred into the licence conditions as emission concentration limits. In this case, without emission concentrations given, the resultant ambient odour concentrations were used to set the licence conditions. This use of ambient concentrations was also implemented in the Collie Power station licence of about the same time.]

The licences from (14 Jan 2003 to 1 July 2004), Best Practice Environmental licence added Conditions under Reporting and Audit Management, and clarified the odour management condition A1.

Odour Management

"The licensee shall manage odour emissions such that validated odour modelling of concentrations at the edge of the area to the east of Lake Coogee zoned Urban Deferred will not exceed five odour units for 99.5% of the time (three minute average), with a validated modelling goal of not to exceed two odour units for 99.5% of the time (three minute average). (changes underlined).

After the revised odour modelling results of 2003 (CEE, 2003) showed the 5 ou 99.5 percentile 3-minute average contour extended well past Lake Coogee (ie the extent of the contour was much larger than that predicted in the 1999 EAMP), the licence was altered in the 2 July 2004 to 31 October 2005 licence, removing the previous condition and including four very general conditions (as is cited in the 2005 SER as the licence conditions):

- *The licensee shall maintain covers over the pre-treatment and primary treatment areas of the plant, except during routine maintenance or emergency situations.*
- *The licensee shall maintain a chemical scrubbing system for the removal of odourous compounds from the pre treatment and primary treatment areas of the plant, prior to their emission through the pre-treatment and primary treatment are scrubber stack.*
- *The licensee shall maintain covers over the tanker receival facility, except during maintenance or emergency situations.*
- *The licensee shall maintain a chemical scrubbing system for the removal of odorous compounds from the tanker receival facility, prior to the emission through the tanker receival facility scrubber stack*

This licence was appealed by Water Corporation and a third party. Water Corporation was successful in adding a condition regards ocean discharge limits and amending the third point to state, *"The licensee shall maintain covers on equipment in the Tanker Receival Facility except during routine maintenance or emergency situations"*. However, a third point to delete a sentence in the licence preamble *"These works are designed to minimise odour impacts within the 'Urban Deferred' area to the east of Lake Coogee"* was dismissed as the Committee noted that it was a non binding section of the licence (Ministry for the Environment, 2005).

The third party appeal was summarised as relating *"to the history of odour impacts, the management of odours from the WWTP and previous commitments given by WC in relation to the odour buffer associated wit the WWTP"*. In considering the appeal, the committee summarised Water Corporation's commitment to odour control and the buffer as *"The WC committed to undertake sampling and remodelling for the amplified plant after its commissioning, to confirm the position of the 5OU contour and ensure that it remained within the current zone"*. Note, on this point it is considered by some in the community, that the Appeals Committee incorrectly fail to recognise Water Corporations more stringent commitment given in the EAMP (detailed previously), and neglect to consider the 2001 to 2004 licence conditions in their deliberations.

The Appeals Committee top two conclusions were:

1. *"Odour emissions and/or impacts from the WWTP should be further managed to ensure that unreasonable emissions were not experienced at the nearest odour sensitive premises.*
2. *The committee considered that further work was required of the WC to reduce odours and subsequent impacts on nearby residents. However, the Committee believes that, an annual licence was not the most appropriate mechanism to undertake strategic investigations and reviews for medium to long term outcomes".*

In the final summary it was stated,
" In summary, in terms of the Minister for the Environment; Science determination of the appeals, while the Minister supported the recommendations made by the Committee in relation to the matters concerning conditions relating to odour criteria and community consultation, the Minister allowed Ms O'Brien's appeal to the extent that:

1. *The licence should be amended to include a condition that requires WC to develop, in consultation with the community, an Odour Improvement Plan which aims to initially reduce current odour emissions from the facility by at least 50% within three years, and provide further reductions beyond this, to ultimately achieve an ambient odour level of 5OU (or as otherwise recommended by the EPA) at the nearest odour sensitive premises, or, if this can not be practically achieved, develop strategies to resolve any residual land-use conflicts.*
2. *The WC's commitment to conduct an annual audit of the operational aspects of the odour control devices at the treatment plant should be reflected in the licence, with associated reporting requirements.*
3. *The Minister requested the DoE to investigate the application of limits on the chemical scrubber stacks at the WWTP as a means of controlling emissions from this source.*
4. *The Minister requested the DoE to ensure that it reviews the Woodman Point WWTP licence as appropriate once the Odour Improvement Plan has been developed and approved and the EPA has provided its section 16(e) advice on odours relating to the plant and that consideration be given to the development of an EIP for the Woodman Point WWTP in conjunction with the WC and the community as part of its process".*

Following this "report", the new licence issued in November 2005, valid to October 2010 was substantially revised, with requirement to develop an Odour Improvement Plan in which the Water Corporation,

"should aim to:
(i) Initially reduce Odour Emissions, which are currently modelled to be 297,100 ou/s by at least 50% within three years;
ii) Provide further reductions beyond three years, to ultimately achieve an ambient odour level of 5 odour units (or as otherwise approved by the Director) at the nearest odour sensitive premises"…

Therefore, in summary, the community's view is that Water Corporation have not kept their 1999 commitments, have not met their works approval licence (they have only met one condition in the works approval) or their licence conditions from July 2001 to July 2004. Instead of rectifying the odour impacts to the levels stipulated after the odour study in 2003 "demonstrated" their non compliance, the Water Corporation instead has sought ways to formalise the buffer (see later).

2) The DoE have failed to protect the public and enforce the licence conditions. As such, the licence conditions are *"not worth the paper they are written on".*

The following view is based on the perceived failure of the DoE to act on the works approval and licences with the expectation that Water Corporation were in breach and should have been made to rectify the odour levels to comply with the Works Approval conditions originally imposed for the upgrade (ie construct the facility to meet the odour levels as predicted in the 1999 EAMP) and then in the subsequent plant licenses. Even the new (current) licence is seen to be set up to allow failure to reach the originally predicted odour levels, in that the condition is to aim to reduce odours by 50% within 3 years. As seen in the Water Corporation SER, the current plan does not require achieving even a 48% reduction until 2012.

3) In the final engineering design of the WWTP, due to cost cutting measures, critical odour controls were removed such that the final built plant emissions were above that used to gain approval in the SKM 1999 documentation. As such, the plant was never going to meet the ambient odour criteria in the SERs commitment and works approval.

In the detailed design phase of the plant (The Woodman Alliance, 2002) "*the major role of the Alliance was to carry out front-end engineering design of the multi-million dollar facility and to identify cost savings*" (page 12, underline added). In this process, one of the "innovative ideas" was to combine the four separate secondary treatment ponds into one circular area, thus reducing the amount of concrete needed. In this design the covers to the selectors of the SBR were dropped (as originally specified in the 1999 modelling, see page 7 of CEE, 2003) and therefore it seems probable that the final plant design allowed higher overall odours to be emitted than was presented in the EAMP. As such, the final plant design did not meet the Works Approval requirements. [Note, details on the plant design used in the EAMP modelling was requested from Water Corporation to confirm the above, but were not provided].

4) The Water Corporation and/or parties constructing the upgrades continued to publicly commit to aiming to reduce the odour buffer until around late 2002. This changed however, before the odour study of 2003 was conducted and as such it is considered that:

a) **The Water Corporation may have mislead the public on the likelihood of rezoning the Urban deferred area; and**

b) **As the Water Corporation strongly believed that this area should be a residential exclusion zone before the Odour Study, they may have influenced the Study to meet Water Corporations objectives.**

The Water Corporation through their officers who attended the amplification community reference group indicated to the working group and public that they were working to restrict the buffer to the eastern edge of Lake Coogee. An example of this is the fax from Water Corporation (1998) to community members that,

"*The Water Corporation has almost completed a definition study of the upgrade of Woodman Point WTP. Indications are that as part of the upgrade (completed early 2002) odour control systems installed*

will permit the buffer on the eastern side of the plant to be moved to the edge of the lake. Discussions are underway with the DEP to agree on this - particularly with regards to the acceptable level of odour units that will not lead to odour complaints".

This is also reported in the EAMP, Appendix C, *"Note that the Corporation has undertaken some modelling on this basis for Woodman Point that indicates a reduction in the buffer may be possible. However, the Corporation's position is that the current buffer should not be reduced for at least five years. This will allow odour emissions to be confirmed on site in the 12 months following commissioning of the advanced Secondary Plant."*

Also, this was the position put to the Community Reference Group throughout the construction to the upgrades (2000? to 2002). An example of the public statements from Water Corporation in 2002 are in the application for the 2002 Engineering Excellence awards, where it is stated.
"The existing Wastewater Treatment Plant required an odour buffer that extended into a large area of market gardens on the east side of Lake Coogee. This buffer was subject to development restrictions and caused dissatisfaction among landowners. The decision to cover odourous facilities at the new treatment plant coupled with the extraction and treatment of the captured gases, is expected to result in a significant reduction in the odour buffer zone, possibly enabling new residential development to proceed" page 35 and
"With the covering of the more odourous facilities and the scrubbing of the foul gases, the odour problems for local residents and industry has been reduced dramatically. The reduction of the "odour buffer" around the treatment plant will free real estate for alternative uses previously not permitted" (page 56).

The position of the Water Corporation in this same period as outlined to Governmental departments was however: *"the proposed future residential are, west [presumed east?] of Lake Coogee, falls within the buffer zone of the soon-to be-completed upgrade of Woodman Point Wastewater treatment Plant. The land use recommended contradicts the State Sewerage Buffer Policy and the Water Corporation is <u>strongly opposed</u> to any proposal to rezone this land for residential purposes. This land should retain its Rural Zoning status"*. (Water Corporation, 2000 to City of Cockburn). (Underlined words in the original letter were in italics).

In October 2002, contrary to that given publicly in the Engineering Excellence awards, Water Corporation (2002) in a letter to the WA Planning Commission state,

"The current zoning of the land to the east and north of the plant reflects this constraint with an urban deferred zoning, which effectively means that this area is a Residential Exclusion Area (REA). The Corporation believes it is not a responsible decision by regulatory and planning agencies to give rise to possible expectations of land owners that may not be realised. The Corporation strongly believes that this area should be indicated as an REA reflecting the buffer as it is known to be now. It is speculative to postulate a reduction and sends incorrect signals to landowners…."

This position as such was not in accordance with public statements that Water Corporation itself was making a little earlier and the commitment in the EAMP; *"This will allow reconsideration of the buffer in the third quarter of 2003"* (SKM 1999, commitment P2, page 9).

Those in the general community were not made aware of Water Corporations position until late 2002, at the opening of the new plant, when those in the community reference group (CRG) through informal discussion where informed that Water Corporation's position was that the buffer was required and that Water Corporation would seek to retain it. As such, the CRG was seen as being mislead with information withheld from it, this not according to its working principal that "*CRG members will be promptly notified in the event of any significant development or initiatives in relation to the plant*". Also those on the working group who had reassured the other community members on the progress of the odour reductions, lost face and credibility with the rest of the community.

Therefore, the Water Corporation is seen by some members of the community to have mislead the public regarding the possibility of the area being rezoned when instead, it had a clear goal to retain the buffer before the 2003 study had commenced. As such, the assumptions and independence of the 2003 odour survey are questioned along with the primary conclusion of the study "*In summary the odour model for the year 2020 indicates that the existing buffer zone should not be reduced in size*" CEE (2003).

5) Concern Regards an Equitable and Timely settlement for properties within the buffer

Residents within the eastern buffer (Urban deferred zone) were very concerned that the Water Corporation were attempting to have the land rezoned to parks and open spaces such that less compensation would be paid for the land if the 750m buffer was retained. They see the move by the Water Corporation to have a Section 16E assessment primarily to meet this objective and that under a Section 16E there will be no right of appeal of the decision of the EPA.

6) The Tanker Receival Facility (TRF) was forced onto the Water Corporation, and has added further odours to the existing unacceptable odour impacts

Due to the closure of the Brookdale facilities, it was decided by the Minister for the Environment and Heritage that raw septage and grease trap waste collected by tankers would be primarily sent to Woodman Point WWTP. At the time, due to concern from the community, it was stated by the Minister for the Environment that the TRF would have zero emissions and be enclosed (uncited reference from community). Water Corporation also in their public media release (Water Corporation, 2003) stated:

"Treating septage and grease trap waste at Woodman Point will have minimal impact on the local community.

- *Construction of the new facilities will ensure there is no odour increase and the buffer zone will not alter.*

- *There will be a slight increase in truck traffic - 10-15 trucks per day - along Russell Road."*

This facility however, was not enclosed and can be a large odour source (see comments by CEE, 2005a as reported in **Section 2.4**) with the number of trucks well above this number. Further, the emissions used in the SER are considered to be adjusted to an arbitrarily low number (4,400 ou/s) from the original number used in the VMS (22,000 ou/s - see Annexure F of the SER) so as to appear to meet the commitments given. Additionally, emissions due to the inclusion of the TRF should include the tanker

emissions at the primary inlet (due to the diversion of septage trucks when the queue at the TRF is too long - 1,200 ou/s), which will further increase the additional odours emitted due to the TRF.

7) Though its has been stated that the Mayor Road (No. 2) pumping station would be decommissioned, it is still used for sewerage overflow which can be a significant source of odour and annoyance.

Within the 2002 Engineering Excellence Awards, one of the key points used for the award application was that the Alliance had revised the plan for the No. 2 pumping station:

"The Alliance identified that a significant improvement in asset performance could be realised by building a much larger Munster Pumping station No 3 now, capable of accommodating the full flow. The higher initial capital costs would be more than offset by decommissioning Pumping Station No 2 and liquidating its real estate value much earlier than planned.

Although not part of the original scope, the Alliance team presented a business case to the Water Corporation Board demonstrating whole of life advantages and as a result, a recommendation was accepted and a scope change issued to the Alliance. This strategy also brought great advantage to the local community by enhancing the amenity of the residential area that has progressively engulfed Munster Pumping station No 2 in the eighteen years since its construction. Residents would benefit from the elimination of odour and noise emissions from the facility and reduced visual impact in the neighbourhood." (The Woodman Alliance, 2002, page 14).

However, instead of decommissioning the pumping station, it still exists and in 2005, was used twice for overflow storage of raw sewerage in the outside pond, leading to significant odours (stench).

8) Other issues are:

- The Water Corporation had not been up-front; on one hand conducting an odour study to independently determine the buffer requirements and resolve land use issues, whilst in the background trying to implement rezoning of the land such as seen in plans to develop a golf course.

- Concern that the DoE allowed the 2000/2002 expansion of the WWTP without any public review or environmental report and yet required the much smaller impacts of relocation/expansion of the pumping station under a Public Environmental Review. The Woodman Point WWTP Amplification Project '*Environmental Project Definition Report'* (SKM, 1997) was assessed by the DEP as a Works Approval under Part V of the Environmental Protection Act.

- The Water Corporation in 1999, and again now, are trying to upgrade the plant on the back of so-called "environmental improvement projects".

- Concern that the Water Corporations are not committed to best practice, as best practice even as defined in their best practice licence involved the processes of setting:
    - Environmental performance objectives;

- Continual improvement programs; and
- Environmental management and audit plans.

With regards to these three items, concern is held that Water Corporation did not implement any of these with regards to odours, i.e. setting objectives, measuring against the objectives, developing improvement programs, and having independent audits and such were in breach of their best practice licence.

- The plant even with the proposed odour controls will not have national best practice odour control as claimed in the SER. This is seen in that current WWTP in Australia have lower odour criteria placed on them such as the Melbourne Waters Eastern Treatment Plant with conditions such as *"Odours offensive to the senses of human beings shall not be discharged beyond the boundaries of the premises"*.

- The recent complaint data is skewed in that the residents were informed in mid 2004 that the DoE did not think there was much of an odour issue at Woodman Point given that they had not received many odour complaints. As such, there was a concerted push to register perceived odours at the time.

- Concern that the influence of topography on odour dispersion was excluded in the modelling.

- Odour contours did not match with their experience, in that they perceive odours appear to decrease quickly with distance from the lake.

- Consider that the maintenance of the plant has been sub standard which has contributed to the odour issues.

- The view that lake odours were improving due to the changing nature of the area (market gardening decreasing) and the vegetation improvement plan, and that the results from a survey did not reflect this.

- Combining Lake Coogee odours and the treatment plant odours is not appropriate as they are quite distinct with some residents to the east of the Lake commenting that they did not see the lake odours as offensive;

- Consideration that the digester may be understated as a source of odour.

- Concern that the need for the old emergency pumping station on Mayor Road as a storage area indicates the poor state of Water Corporation's equipment and the reliability of power supply in the area. Concern was also raised as to the reliability and adequacy of the backup emergency generators with the frequent plant shutdowns and corresponding odour releases.

- It is considered that there may be other alternative technologies available to minimise offsite odours and requested an international odour control expert to conduct an <u>independent</u> review of the odour controls and costing proposed.

- Concern that there is a degree of "subjectivity" and bias in the emission estimates and that the discussion on the derivation of the emissions does not tell the entire story. This is seen in that the odour emissions were revised upwards to 356,000 ou/s in January 2005 as reported in Annexure F and as used in the control designs, but then revised downward in the SER modelling to 297,100 ou/s. In the text for the derivation of the final 297,100 ou/s in the SER however, it is stated that these were derived from the 2003 emissions with additions only, with no mention to the higher intermediate January 2005 estimates.

- The security of the plant is sub-standard as evidenced by the fact that two Water Corporation vehicles were set alight at the end of 2005. With this lack of security, concern is raised that the plant or sections of the plant could be disrupted by vandals etc, with corresponding emissions of odour or effluent.

- Sections of the SER are misleading. For example:

    - References to the buffer zone as a defined buffer zone (SER, Annexure B, figures 2 to 7) when no statutory buffer exists; and

    - The statement that for the proposed odour Controls "*Stage 1- provide covers on major identifiable odour sources"* is misleading as the SBR aerobic tanks, which is the second largest source, is not to be covered until Stage 3.

- The SER does not have any detail on specific costs for specific odour controls, but includes the costs with the rest of the upgrade. Therefore a cost benefit analysis can not be undertaken

- Are concerned that the EPP policy for buffers is "on hold" or has "been shelved" with no details on the independent review by PAE released to the community. Concern is raised that this process and report which may have aided in the planning or providing for a solution to the issues, appears to be on hold until after the EPA makes it recommendations. The process appears to be the opposite to open, transparent, policy making.

- Concerned that there is little or no details in the SER on the monitoring that will be undertaken to confirm odour levels off site.

AIR ASSESSMENTS PEER REVIEW OF THE SER

WATER CORPORATION RESPONSE

May 2006

The Water Corporation appreciates the opportunity to respond to and clarify the points raised in Air Assessments' peer review of the Woodman Point Wastewater Treatment Plant Strategic Environmental Review (SER). Many of the points can be explained or addressed by relatively small changes in the input files used for modelling – and the predicted odour contours move only a very small distance as a result – demonstrating that the conclusions from the modelling in the SER are well supported.

A key finding of the peer review is that a different odour criterion (3.5 OU at 99.5 % frequency) provides a better fit to the community survey and complaint data than the odour criterion generally adopted by the Water Corporation and used in the SER (5 OU at 99.9 % frequency). However, when all the community survey and complaint data are plotted on the base plan (as suggested by the reviewer) it is apparent that the 5OU criterion encompasses the community concerns much better than the 3.5 OU criterion. This conclusion is readily seen by inspection of the attached odour contour plots. As a consequence, there is no basis for the suggestion by the reviewer that the proposed odour buffer zone need not extend so far to the east.

The reviewer rightly emphasises the uncertainty in measuring and estimating present odour emissions and the even greater difficulty of estimating future odour emissions. The Water Corporation agrees that these are difficult matters and that there is a large variability in the measured odour emission rate even from a source (for example, the selector zone of the secondary tank) that operates in an apparently consistent manner.

As a result, the Water Corporation considers that a conservative approach must be taken in predicting future outcomes from the proposed odour control works, recognising the uncertainties in predicting the performance of a series of projects that have yet to be designed, constructed, operated and tested. It also is recognised that the previous odour control works implemented as part of the amplification of the Woodman Point Plant in 2002 have not performed as well as the technical specialists had anticipated at that time.

The Water Corporation considers that the reviewer has not taken sufficient account of future uncertainty and the difficulties in operating such a large complex plant and, accordingly, is too optimistic about the likelihood of reducing the buffer zone to the east of the plant.

As set out in Appendix G of the SER, odour modelling is one of a number of considerations in defining the buffer zone for a wastewater treatment plant. These include:

1. Experience at similar plants;
2. Generic buffer distances prescribed for wastewater treatment plants;
3. Local wind conditions and topography;

4. Results of community surveys and odour complaints;
5. Predictions from odour modelling; and
6. Net benefit to the community.

Thus odour modelling is important, but is not the only consideration in defining the buffer zone for the Woodman Point WWTP or any other treatment plant.

The Water Corporation has recently completed major odour upgrades at the Subiaco and Beenyup WWTPs and is monitoring the community reactions to the significantly reduced odour emissions and improved conditions in the region of the plants. There have been major improvements in the amenity of the surrounding areas. Nonetheless, on the basis of the community responses received to date, the Water Corporation believes a 600 m buffer zone is required for the Subiaco plant (which is half the capacity of the Woodman Point plant) and a slightly larger buffer zone is required for the Beenyup plant (which treats approximately the same volume of wastewater as currently treated at the Woodman Point plant). The Woodman Point plant will ultimately be treating a much larger volume of wastewater than the Beenyup Plant and requires a larger buffer again, particularly because of the low rate of odour dispersion across Lake Coogee.

Although it may not be apparent from the text of the peer review, the predicted 5 OU contours (at 99.9 % frequency) calculated by CEE and the reviewer are very similar and both extend along the eastern shore of Lake Coogee. When the uncertainties in future odour emissions are considered, as well as the varying sensitivity of different persons to odour, the buffer zone recommended by the Water Corporation is considered reasonable and appropriate for operation of the State's largest wastewater treatment plant, ultimately serving more than 1 million people. There is a need to retain a factor of safety, commensurate with the DOE's requirements for odour modelling that "uncertainty is balanced by conservatism".

The Water Corporation remains committed to undertaking the odour upgrade of the Woodman Point WWTP as outlined in the SER, and is currently working on the design of those parts of Stages 1 and 2 of the proposed works necessary to deliver a 50% reduction in odour emissions by the end of 2008.

The Water Corporation will undertake a comprehensive program of odour sampling and modelling once these works are implemented, to assess their effectiveness in reducing odour emissions from the plant and in reducing odour impacts in the community; and to determine the extent of additional works that may be needed.

WATER CORPORATION RESPONSE TO ISSUES IN THE SER FOR WOODMAN POINT WWTP RAISED BY AIR ASSESSMENTS

Conclusion 1 – Accuracy and Adequacy of Odour Modelling

The peer review asserts that the 5 OU contour (at 1-hour averaging and 99.9 % frequency) significantly overestimates community response to odour, as determined by complaints and phone surveys, to the east of the plant. Further, the peer review concludes that the "good" agreement only occurred in the 2003 modelling, which used the Hope Valley wind file and sigma-theta dispersion and was thereby deficient.

The peer review asserts that the predicted 3.5 OU contour (at 3-minute averaging and 99.5 % frequency) or the 3 OU contour (at 1 hour averaging and 99.5 % frequency) better reflects the complaint/survey data, and should be used in assessing the buffer requirements for the WWTP. Use of the 99.5 % criterion, from the model as set up in the SER, indicates that odour levels at the east edge of Lake Coogee from the WWTP will most probably be similar to that at the south end of Coogee. Therefore, odour control works to protect South Coogee as planned should also protect the area in the Urban Deferred Zone east of Lake Coogee.

Response by Water Corporation

The Water Corporation considers that the conclusion reached by the reviewer is not based on the correct assessment of the facts, as can be judged by comparing the predicted 3.5 OU and 5 OU contours with all available information on community odour impacts (complaints, phone survey results, and CEE field surveys of ambient odour levels).

Figure 1 shows the **3.5 OU contour, as predicted by the reviewer**, plotted on a plan of the area, together with all known odour complaints from January 2000 to April 2006, all responses from the phone survey in September 2003 and sites recorded in CEE field surveys as having noticeable odour.

It should be noted that the phone survey was limited to the area west of Stock Road, which is why there are no red or orange dots east of Stock Road to check the odour model predictions. Almost all the respondents to the phone survey living between Lake Coogee and Stock Road reported 'strong' odours from the treatment plant; and reported a high level of annoyance by the odours they experienced. The field survey of odour (quoted in the SER on page 10 of Appendix G) reported an elevated odour level of 8 to 9 OU at Stock Road. These results suggest that noticeable odour would extend further east beyond Stock Road.

The two blue dots east of Stock Road on Figure 1 denote formal odour complaints and indicate that an odour level, which some residents consider to be unacceptable, extends east of Stock Road. Based on this evidence, the Water Corporation considers that unacceptable odour impacts are currently experienced by residents east of Stock Road. However the 3.5 OU contour recommended by the reviewer does not extend east of Stock Road.

It can be seen in Figure 1 that the 3.5 OU contour predicted by the reviewer does not encompass 5 sites reporting odour complaints, and excludes any odour impacts east of Stock Road, which is clearly not in accord with the evidence. Thus the Water Corporation considers that the 3.5 OU contour significantly under-estimates the extent of the odour impact experienced by the community.

The alternative odour criterion suggested by the reviewer of 3 OU (at 99.5 % frequency and 1-hour averaging) has the same problem of under-estimating the extent of community odour impact to the east of the plant.

Figure 2 shows the **5 OU contour, as predicted by CEE** (following the minor modifications listed later in this response to satisfy the reviewer's concerns), plotted on a plan of the area, together with odour complaints, responses from the phone survey and CEE's field survey results. It can be seen that the 5 OU contour does encompass all sites reporting complaints and all residents reporting noticeable and annoying odours from the treatment plant in the phone surveys. Thus the Water Corporation considers that the 5 OU contour is a good estimate of the outer extent of the (unacceptable) odour impact as experienced by the community (and much better than 3.5 OU).

As noted above, in interpreting Figure 2, it should be kept in mind that the phone survey did not extend east of Stock Road. The Water Corporation notes that two residents east of Stock Road have complained about odour. Generally when there are residents in an area lodging complaints, there are more residents in the vicinity that are also annoyed by the odour but not to the extent that they do anything about it.

In summary, the Water Corporation considers that there is good justification for using 5 OU (at 99.9 percentile) as the boundary of the zone within which the community experiences odour that would be judged as being generally unacceptable. Consequently, the conclusions in the SER, based on use of the predicted future 5 OU contour to assess the zone likely to be affected by odour in the future, still apply.

A brief response to other comments made by the reviewer on odour modelling is given in the table below.

Review issue	Response by Corporation
Not all complaint data has been plotted in the SER	All odour complaint data and field survey data now plotted in Figures 1 and 2 of this response
Not good agreement between complaints and odour predictions	The predicted 5 OU contour just encompasses the odour complaints and community odour survey results.
Only good agreement in 2003 modelling using Hope Valley wind file	Modelling using Hope Valley wind file was less successful that current (2006) modelling using 2 year Woodman Point wind file
5 OU odour contour over-predicts to the east	Not so – the 5 OU contour just encompasses the odour complaints and survey results (see Fig 2)
3.5 OU or 3 OU odour contour provides a better fit	Not so – the 3.5 OU contour under-predicts the extent of odour (see Fig 1). This is true also for the 3 OU contour
5 OU odour contour for Subiaco used Hope Valley wind file	Not so – the good agreement between the predicted 5 OU contour and odour complaints at Subiaco was obtained using the Swanbourne wind file.

The SER is based on odour modelling specifically undertaken in 2005. The 2003 odour modelling was conducted by GHD and used by CEE (2003) only to decide whether there was justification to reduce the buffer zone. CEE (2003) concluded there was not. The 2003 report claimed only “reasonable agreement” between the model predictions and the community response. The 2005 modelling claimed “good agreement”.

The 2005 odour modelling report stated that “*It should be recognised that the predicted future 5 OU contour should not be interpreted as a ‘line’ but as a band about 200 m wide that is centred on the contour line*”. Use of a band recognizes the difficulties in estimating odour emissions and other uncertainties inherent in odour modelling.

The latest odour model predictions by the Water Corporation (as shown in Figure 2) are considered more accurate, as several changes have been made to the source geometry and wind file in response to comments from the reviewer, and the dispersion is modelled using the Pasquill-Gifford curves rather than sigma-theta (see discussion below). As a matter of interest, the nett effect of all changes is rather minor, as can be seen by comparing the predicted 5 OU contour in the SER for the existing Woodman Point plant (the 2005 modelling) and the latest (2006) modelling (as shown in Figure 3). There is no significant difference between the curves, which demonstrates that the conclusions in the SER still apply.

Conclusion 2

The SER omits any mention of the Woodman Point Holiday Park as an odour sensitive premise. As this is located primarily within the buffer, has 200 permanent residents and up to another 200 visitors, and is predicted to be the "residential" area most affected by the odour, this site should be considered and is likely to be the critical odour sensitive premise in determining the degree of odour controls necessary at the plant; and it should be a major focus of the discussion on odour controls and compliance with odour criteria.

Response by Water Corporation

The Woodman Point Holiday Park was not specifically considered in the SER because it is part of a Nature Reserve, and the focus of the SER was to describe how the Water Corporation would manage odours to achieve a situation of no nuisance odours in all areas currently zoned for residential uses, and as far as reasonably practicable in the Urban Deferred zone to the east of the plant.

The odour predictions for the existing plant indicate that there is likely to be nuisance odours from time to time at the Holiday Park. However, since 2000 the Water Corporation has not recorded any complaints from the Holiday Park in relation to odour from the Woodman Point Plant, and the four (only) complaints in 2000 were attributed to a local industrial source. The odour model predictions in the SER show that most of the Holiday Park will be within the future 5 OU contour.

In the light of the reviewer's comments above, and recognising that complaints are not received from the Holiday Park, CEE has reviewed the modelling inputs based on a site visit to the Park. CEE considers that a higher roughness factor of 0.6 m is appropriate to model the location of the 5 OU contour in the region north-west of the Plant, to account for the rougher terrain and elevated limestone ridge between the Plant and the Holiday Park, and the tall trees in and around the Holiday Park. On this basis, the predicted future 5 OU contour extends only across the lower south-east corner of the Holiday Park.

The Water Corporation will assess odour impacts in this area following implementation of the works designed to reduce odour impacts from the plant by 50% within three years. These works include upgrading odour control in the sludge treatment area, important to reducing odour levels in the vicinity of the Holiday Park.

In terms of odour impacts in non-residential, lower amenity areas the Water Corporation does not consider that there will be unacceptable levels of odour at the dog beach and boat ramp after the odour upgrade. There may be slightly elevated odours at the industrial zone immediately to the west of the plant in the early morning, but the situation will be greatly improved from the present situation.

The recommendation of the SER to maintain an appropriate buffer zone to the east of the plant will avoid repeating the mistakes of the past, by not allowing more residences within a zone where odour is predicted to be generally unacceptable.

Conclusion 3

Odour emissions from the SBR appear to be reasonably well determined. However, emissions from the fugitive sources are not well quantified (PST tank leakage, digester bell mouth, TRF facility) with there being possibly large, intermittent emissions when the PST scrubber is offline or when there is scrubber breakthrough.

The emissions as an average of April to June measurements may underestimate peak summer and overestimate winter emissions. This combined with the seasonality in wind patterns may result in biases in the extent in odour contours in the different directions. Also, the daily variation in emissions though shown to be large is not accounted for.

As such, there is a degree of uncertainty in the base case emission inventory. It is recommended that downwind assessments by those with experience in the area should be conducted to ground truth the ambient odours using VDI (1993) and provide an independent measure of the plant's emissions.

Future estimates are noted very dependent on the assumptions made regarding the effectiveness of the air capturing system and the scrubber. These assumptions are not provided in the SER and it is considered that these may be understated resulting in larger future emission estimates. Much greater detail on the rationale is needed, preferably with these estimated from an independent source.

Response by Water Corporation

It is agreed that there is a degree of uncertainty in the base case emission inventory. This is a consequence of the variability in odour emission rates, as explained below.

It is apparent that there is also a degree of uncertainty in the future emission inventory, (albeit that the odour control works are aimed at providing a high degree of odour control) as this involves projections about the effectiveness of covers and related odour control equipment that has yet to be designed, installed, operated and tested. This is why the Water Corporation has taken a conservative position in assessing the need for a buffer zone in the future.

While the reviewer considers that odour emissions from the SBR have been reasonably well determined, it should be noted that the coefficient of variation of the SBR odour emission rates vary over a wide range (see Table 1) with a coefficient of variation (standard deviation divided by the mean) ranging from 55 % to 90 %. The number of odour measurements and the range of odour emissions from the digesters were of the same order as from the SBR.

Table 1. Summary of Measured Odour Emission rates in SBR and Digester

Woodman Point WWTP - Odour Emission Rates (SOER for SBR; OU/s for digester)								
Odour sources are listed across the top of columns; Odour emission rates are sorted; Statistical data are listed for each source	**Select-1**	**Select-2**	**Select-3**	**Anoxic**	**Transition**	**Aeration**	**Settling**	**Digester**
	4	8	8	0.4	7	0.5	0.21	262
	11	20	23	0.7	9	0.6	0.22	2,065
	13	21	24	0.9	32	0.8	0.23	2,555
	19	27	38	8	33	0.9	0.30	10,238
	30	55	74	10		1.3	0.37	11,988
	51	55		15		2.2	0.38	14,350
	55	60		16		2.6	0.39	20,125
	64	65		17		2.6	0.40	20,650
	65			24		2.9	0.60	21,000
	68			25		2.9	0.94	30,975
	71			31				41,213
	77			44				56,788
	78			59				
	109							
Mean	51	39	33	19	20	1.7	0.4	19,351
Geom mean	59	41	24	16	21	1.7	0.4	17,238
75 percentile	70	56	38	25	33	2.6	0.4	23,494
75 %/mean	1.4	1.4	1.1	1.3	1.6	1.5	1.0	1.2
Standard Deviation	31	22	25	17	15	1.0	0.2	16,861
Coeff Variation	61%	57%	75%	90%	72%	58%	55%	87%

The method used by the Water Corporation to represent the variability in emissions is to use the 75 % emission rate for each source when developing the emission inventory. As shown in Table 1, this corresponds to using a 20 % higher odour emission level (on average) compared to the mean of the results.

The Water Corporation is still exploring methods to account for the daily variability in odour emission rates. Given the high variability (as illustrated in Table 1) it will be appreciated that this is a very difficult task as the variability is not explained (so far) by plant flows, time of day or other recorded factors. Information from studies at the Beenyup plant indicates that the highest odour levels occur in the evenings, which supports the conservative approach of using 75 %ile emission rates.

The PST leakage was estimated by assuming a leakage factor of 5 %. This results in a diffuse odour emission rate of 20,000 OU/s. An alternative approach is to use the measured downwind odour levels (250 OU) and multiply it by the width of the primary tanks (60 m), mean wind speed during sampling of 0.8 m/s and plume depth of 2 m, to obtain a downwind estimate of fugitive odour emissions from the PST of 24,000 OU/s. This is similar to the estimate obtained from the assumed 5 % leakage.

The Water Corporation has employed specialist odour consultants to undertake ambient odour surveys using *VDI (1993)* elsewhere and, so far, has found the technique of limited applicability. The Water Corporation does not consider that it is appropriate or useful to delay implementing the proposed odour control works in order to undertake field surveys to review the base case odour emissions inventory.

It is the Water Corporation's preference to continue to rely on complaints, phone surveys and other methods of recording the responses of residents who live in the area of influence of the plant as the primary sources of information to verify odour modelling. The Water Corporation considers that the work it has undertaken in this regard has provided good correlation between community odour impacts and current emissions from the plant, and provided good justification for the use of the 5 OU contour for assessing odour control works and future buffer requirements.

A brief response to other comments on odour modelling is given in the table below.

Review issue	Response by Corporation
Flux hood and wind tunnel estimates of odour emission rates not comparable	Agree
Odour testing in autumn may under-estimate peak summer odour emission rate	Agree
Correction of odour emission rates to 3 hours is satisfactory	Agree
Understated emissions from PST scrubber	Probably so – see discussion
Fugitive emissions from PST area may be increasing	Agree
Odour emissions from sludge truck loading may be under-estimated by TOU	Very likely (as stated in SER)
More information needed on odour emissions from tanker receival facility	Agree
Overall, "a significant proportion of the emissions are to a degree uncertain"	Agree
Should reduce odour from biofilter	The biofilter is not included as a source in modelling following the odour control works to be implemented within the next 3 years
Assumptions about future emissions need to be more transparent	Not so - estimated future odour emissions have been provided to the community
Fugitive estimates based on inadequate controls and sealing	Not so. Estimates for fugitive emissions are based on effective sealing and a high level of odour control.

In summary, as shown in Table 1, there is an inherent variability in odour emission rates which limits the accuracy that can practically be achieved in measuring odour emission rates. In addition, fugitive emissions and episodic emissions are particularly difficult to measure and to model.

As a consequence, there is an inherent uncertainty in odour model predictions that must be recognized in the interpretation of odour modelling, and a reasonable factor of safety must be retained, commensurate with the DOE's requirements for odour modelling that "uncertainty is balanced by conservatism".

Conclusion 4

The report should undertake a greater discussion/analysis of other odour sources in the area and should include details of the old Mayor Road pumping station and how the upgrades will minimise/eliminate the usage of this as a receival area for emergency storage of raw sewage.

Response by Water Corporation

The overflow basin at the Mayor Road (old Munster) pump station is not part of the Woodman Point WWTP site and does not form part of the SER proposals.

The overflow basin is an important 'backup' for the Water Corporation's wastewater conveyance system, which allows for controlled temporary storage into a concrete lined basin during power outages and other emergency situations, rather than accepting raw wastewater backing up in peoples' houses or uncontrolled discharge into the environment. The Water Corporation endeavours to limit the period of storage to the absolute minimum, and keeps local residents informed about each event and the clean up process.

Overflows of raw wastewater into the emergency storage facility occur very infrequently (for example only twice in 2006). However the Water Corporation understands the concerns of local residents living in close proximity to the facility, and is considering options to mitigate this situation.

Conclusion 5

The meteorological data base appears to be suitable, comprising nearly two years of on-site meteorological data. There are some concerns with some of the wind direction data with an apparent small (20 to 25) degree offset in the winds and 3 to 4 days with incorrect wind data and some small shielding for south easterly and possibly northerly winds. These, however, are considered to have only a small affect overall, but nevertheless should be rectified as soon as practicable. The methods for estimating stability appear sound though the method for estimating mixing height is approximate with the data set only suitable for surface releases of short stacks with low final plume heights.

Response by Water Corporation

The Water Corporation agrees that the existing on-site wind and meteorological monitoring system provides high quality data suitable for odour modelling. The Water Corporation considers that the method used to calculate mixing height is appropriate for modelling odours from surface sources and short stacks.

The suggestion of the reviewer to delete four days of data has been accepted, although the field logs do not provide support for deletion of the four days. It should be noted that the four days in question had low wind speeds, and the effect of deleting them is to bring the predicted odour contours closer to the plant. A further day has been deleted on the basis of field notes raising a question about the recorded wind speeds over a seven hour period.

The field personnel report that they checked the wind directions at the Woodman Point site every four to six weeks and the direction shown by the sensor when set at 90°, 180°, 270° and 360° was within 2° of the true direction. Thus the field checks provide no support for the suggested 20 to 25 degrees offset in wind direction.

An additional 20 days of meteorological data has been added to the file used for odour modelling to make a near-complete two year file. The 5 OU contour shown in Figure 2 has been developed using this amended Woodman Point wind file. The Water Corporation notes that the odour predictions using the amended and extended wind and input files are essentially the same as obtained in the SER using the original wind file (as shown in Figure 3).

Conclusion 6

The modelling methodology in the SER is considered to have significant deficiencies, these being;

1. *Inadequate treatment of variable emissions particularly from the PST scrubber, with the significant 4 % downtime of the PST scrubber. Therefore "upset" conditions need to be modelled explicitly as per the DEP modelling and odour guidelines. It is considered that these "upset" conditions may be leading to a substantial percentage of offsite complaints and odour issues;*
2. *Use of sigma theta instead of PG dispersion curves;*
3. *Very approximate and sometimes incorrect source parameters used (stack heights, diameters etc);*
4. *Limitations of AUSPLUME of not being able to model the variable roughness which are a feature of the area, especially to the area of concern to the east of the WWTP; and*
5. *Lake Coogee odour modelling is seen as providing indicative results only, requiring refinements in the emission estimates and the areas used to better predict the odour impacts from this lake.*

Response by Water Corporation

1. The Water Corporation agrees that odour "events", meaning releases of odours at higher rates due to plant upset conditions or major maintenance conditions, are a significant consideration. Unfortunately it is very difficult to predict the timing and duration of odour events, or the odour emission rates during these events. It is noted that neither the reviewer, nor the PAE (2005) review, presented any suggestions on how to measure or predict episodic odour events, or any example of where it has been done for wastewater treatment plants.

   The Water Corporation is continuing to explore methods to predict and describe odour events. In the future, when the odour upgrade has been completed, such events will become a major proportion of total odour emissions and therefore critical with respect to offsite impacts.

   It is unfortunate that the total downtime of the PST scrubber has been found in practice to be much greater than expected at the time it was installed. The number, type and duration of scrubber failures could not have been predicted in advance. The Water Corporation is confident, based on experiences with the new odour scrubbing systems installed at the Subiaco and Beenyup plants, that the new odour scrubbing system for the Woodman Point plant will also operate reliably and to a high level.

It is also agreed that the method used to represent scrubber failures in the odour inventory is relatively coarse. In terms of odour emissions, the scrubber failures that have occurred can be summarised into three groups:

a. Scrubber not operating due to blockages, major equipment failure or power failure (diffuse emissions from the PST area will increase from the estimated 20,000 OU/s to 40,000 OU/s).
b. Scrubber operating, but odour capture less than design requirements of 99 % odour removal. In such events, there will be a gradual reduction in odour capture over time, so odour emission from the scrubber increase from about 1,250 OU/s to 20,000 OU/s to 100,000 OU/s up to, eventually, 195,000 OU/s. For many short term failures it is believed that the odour emission rate may not rise much beyond 20,000 OU/s.
c. Scrubber chemicals are exhausted but fans operating so there is minimal removal of odours.

The Water Corporation did not model the various situations that could occur, as this would require a very extensive review of operating history, and matching emission rates to wind conditions. The Water Corporation does not consider this would be a useful exercise as it was proposed in the SER that the existing scrubber would be totally replaced as part of the odour control works, with a duplicate scrubbing system, which will operate with very low downtime risk level.

2. Sigma theta was used by GHD in their 2003 odour model and was inadvertently continued in CEE's 2005 modelling because the same input file, with sigma theta set as the default, was used to maintain consistency in the odour modelling. It should be noted that CEE provided updated odour predictions using Pasquill-Gifford curves as soon as it was identified that sigma theta had been used. This correction was made before the review commenced.

3. It is agreed that the GHD input file did have some inappropriate stack dimensions and that these should have been picked up and changed in subsequent modelling. However the stack dimensions adopted by GHD were conservative and an attempt to reflect the complex site topography in the description of the sources.

   For example, the gas engine stacks extend only about 2 m above the roof of the building, but actually discharge about 15 m below the rim of the quarry. Because the building is in the quarry, use of the building downwash option is not appropriate. Thus GHD adopted a solution that described the engine exhausts in the model as a large diameter short stack with a low discharge velocity.

It is agreed that the height of the PST scrubber stack is not 5 m as defined by GHD; (nor is it 15 m as suggested by the reviewer); it is 22 m. However the stack is adjacent to a vegetated ridge and the stack extends 5 m above the vegetation, which may have influenced GHD to adopt 5 m as the stack height. Hence use of a 22 m high stack in the model may under-estimate concentrations.

4. It is agreed that the surface roughness is different in different directions from the treatment plant. Lake Coogee, to the east, has a very low roughness, while the limestone ridge, vegetation and industries to the west and northwest have a much higher roughness.

   As Ausplume can handle only one roughness at a time, the procedure followed in modelling was to do the base runs with a roughness of 0.4 m and then do sensitivity runs for a lower roughness of 0.1 m (to judge the buffer zone to the east) and for a higher roughness of 0.6 m (to judge the effects to the northwest of the plant).

   A composite roughness of 0.1 m is considered appropriate to the east of the plant, as this path combines vegetated land down the eastern slope of the ridge (with a roughness of about 0.4 m), the lake itself (with a roughness of about 0.01 m) and then the land to the east of the lake (with a roughness of about 0.3 m).

   It is agreed that a model which allows for a different roughness in different areas would be a good alternative method of predicting odour contours, however this was not available when the SER was prepared, nor is it available now.

5. It is agreed that the modelling of odour emissions associated with Lake Coogee provides indicative results only, as odour emission areas and rates appear to vary on a week-by-week basis, in response to climatic factors, extent and degree of desiccation of the exposed marginal mud flats, and wind patterns.

   When the reviewer visited the Lake, the southern section appeared to generate most of the odour. However, other observers have reported that, at times, the central section or the northern section produces more odour, presumably as a consequence of wind and other factors. As a result, CEE used the same odour emission rate along the whole eastern shore, but reduced the emission rate to correspond to the rates most commonly measured in the two surveys of odour emanating from the mudflats undertaken by TOU using an isolation flux hood (ie, 6 to 8 $OU/m^2/s$).

It is recognised that this rate is below the arithmetic average of all odour emission measurements from the Lake's marginal mud flats. CEE was mindful that using a higher emission rate would have substantially increased the area to the east of the lake margin unacceptably impacted by offensive, sulphidic odours.

It was not the purpose of the SER to provide a definitive prediction of the effects of odours associated with the Lake based on weekly (or hourly) odour testing. The purpose was to demonstrate that the Lake odours impact on residential amenity for several hundred metres east of the Lake during the important summer and autumn months when residents are more likely to be outdoors, and that the Lake odours impact on an area greater than the width of the buffer zone. Any further, more detailed, assessment of Lake odours and their zone of impact is considered to be the responsibility of the environment, health, and planning authorities and not the Water Corporation.

Conclusion 7

With regard to current and proposed odour controls the reviewer has concluded that the present odour controls are not performing as designed and may be a substantial cause of the odour issues from the plant. This may be due to maintenance issues and contributed by the plant nearing or exceeding loading criteria.

For future odour control, the proposed controls and staging appears generally sound. It is recommended however, that an independent re-evaluation of the odour emissions and modelling assessment is required to re-estimate the benefits of the controls given the numerous errors and issues identified in the emissions and modelling review. This study should also involve ground truthing of the odour levels outside the WWTP using methods such as in VDI (1993). This should be undertaken as soon as practicable to be able to refine the estimates of the future effectiveness of odour controls and should entail an independent re-evaluation of the proposed odour controls effectiveness.

This process should then be re-evaluated after each stage is implemented, and especially Stage 1 where the greatest benefits are expected to occur.

It is also recommended that in the future, firm commitments/targets (possibly licence conditions) are needed to ensure that the frequency of upset conditions is substantially reduced from the current levels.

Response by Water Corporation

The Water Corporation agrees that the odour controls installed in 2002 as part of the major amplification of the plant are not performing as well as predicted by the external experts employed by the Water Corporation at that time; that is one of the key reasons for the proposed odour upgrade as set out in the SER.

The reviewer implies that poor maintenance may be contributing to the odour events at the plant. This is not the case: the Water Corporation pays careful attention to maintenance, particularly in terms of the existing odour control equipment, at the plant. Maintenance is undertaken on a planned basis and plant operators and the laboratory staff at the plant have a close working relationship to ensure the optimum operation of the equipment.

The odour problems at the plant are due to a combination of design problems associated with key treatment and odour control facilities; and amongst other things, the sludge treatment facility nearing its capacity. These problems have been identified and form the major parts of Stages 1 and 2 of the odour upgrade proposed in the SER.

The Water Corporation notes that the reviewer concludes that the proposed odour upgrade and staging are sound; the proposals have resulted from a great deal of

technical input and expertise. The benefits of the proposed odour control works at the Woodman Point WWTP will be substantially reduced odour emissions and significantly improved community amenity in existing residential areas.

The Water Corporation has undertaken a considerable amount of work since 2000 which has placed it at the forefront of odour management for wastewater treatment in Australia, in terms of understanding odour emissions from its wastewater treatment plants, obtaining good quality data for modelling purposes, understanding community reactions to odour emissions, and building and operating wastewater treatment plants with very high levels of odour control. All this knowledge and expertise is being used to ensure that the odour upgrade proposed in the SER performs to a high level.

As explained above, the Water Corporation does not consider it is reasonable or useful to delay designing and implementing the odour upgrade works as proposed in the SER. The Water Corporation has done considerable work to better understand the causes of the odour problems at the plant, and obtaining more data, will not improve the accuracy or reduce the variability of the odour emissions data. Also, the future plant is yet to be designed and constructed, so projections of future fugitive odour emission rates must necessarily be “estimates”, albeit they are based on the knowledge of what has occurred with the odour upgrades at Subiaco and Beenyup.

It is noted that incorporation of all the amendments suggested by the reviewer on odour source geometry, wind data and dispersion parameters lead to a 5 OU contour which is not significantly different from that presented in the SER. Repeating the odour modelling is expected to provide further refinement but no significant change in predicted odour outcomes.

The external odour management consultants currently undertaking the preliminary design for the odour control upgrades to achieve a 50 % reduction in odour emissions are basing their recommended designs on conservative values for the key design parameters (loading rates, air flow rates, etc) based on the Water Corporation experiences at the Subiaco and Beenyup plants.

The Water Corporation will carry out detailed odour emission testing and modelling and community odour surveys after the completion of the works proposed to reduce plant emissions by 50%, to assess the actual performance of the works in significantly reducing community odour impacts.

The Water Corporation works diligently to minimise odour events, but they are an inevitable consequence of operating a sophisticated treatment plant at the end of a very large public sewerage catchment. The Water Corporation uses as a target for

operations “less than 8 hours of high odour emissions per year” which translates to the odour criterion of remaining below 5 OU for 99.9 % of the time.

A buffer zone has been recommended which incorporates a number of relevant local factors, including the local topography to the east of the plant, as well as using the results of odour modelling and community surveys of odour annoyance. The Water Corporation does not consider it prudent to minimise the buffer zone on the basis of over-optimistic projections of the possible performance of odour management for a future expanded treatment plant.

Overall Conclusions of the Review

From the review it is concluded that there are a number of significant issues in relation to the modelling and to a lesser degree with the emission inventory, such that the results can not be used to scientifically define the requirement of the WWTP odour buffer. As such, it is recommended that the issues identified in this review be addressed before a more quantitative assessment for the requirement of a WWTP buffer is undertaken.

It is also recommended that with such a contentious issue, such as buffer definition, greater independence and transparency is required in the assessment, particularly in collating present emissions and in estimating future control efficiencies and emissions.

Response by Water Corporation

The Water Corporation agrees that the buffer zone will never be "scientifically" defined as it requires consideration of many issues (discussed previously) and judgment to select a buffer zone that provides optimal community benefit. The Water Corporation has developed skills and expertise in this regard, and employs skilled external consultants for specific requirements, in order to establish as accurately as possible 'workable' buffers which provide optimal community benefit.

Guidance Statement 3 indicates that it is the role of the EPA to independently assess the Water Corporation's recommended revised buffer for the Woodman Point Plant. In fulfilling this requirement, the Water Corporation recognises that the EPA will review the emission estimates and odour modelling, and establish the community consultation processes appropriate for each situation.

The Water Corporation has been very open in its dealings with the local community in relation to the proposals in the SER, including providing a detailed report, all measurements and a full set of modelling files to the public and for this review. The Water Corporation has also funded the reviewer's assessment of the SER for the EPA, and funded an Australia-wide review of odour sampling, modelling and buffer determination (carried out by PAE (2005) for the EPA).

The Water Corporation has supported a Community Reference Group for the Woodman Point WWTP since 2000, and this group has had numerous briefings on the existing odour problems at the plant and the predictions of odour modelling. A new Community Reference Group is being currently formed to broaden its representation of the community and key stakeholders, and to make it more independent of the Water Corporation. The new group will be involved in monitoring the odour improvement works at the plant as they proceed.

Appendix 6

Proponent's response to submissions

STRATEGIC ENVIRONMENTAL REVIEW: ODOUR MANAGEMENT
WOODMAN POINT WASTEWATER TREATMENT PLANT

RESPONSE TO PUBLIC SUBMISSIONS

WATER CORPORATION
May 2006

1. INTRODUCTION

The Environmental Protection Authority forwarded 20 submissions on the Strategic Environmental Review in full (bar any identifying information), and provided a summary of the issues for one confidential submission where the submittee was unwilling for the Water Corporation to have access to the whole document. The Water Corporation has provided detailed responses to these submissions herein.

This response to submissions is in four parts:

- Part 1 sets out relevant background information to this response and provides additional information relevant to the Water Corporation's response;

- Part 2 comprises the Water Corporation's summary of the 20 full submissions into the issues and concerns to which the Water Corporation has responded in Parts 3 and 4. The Water Corporation's summary of the 20 submissions was reviewed and accepted by the EPA Service Unit prior to the Water Corporation commencing its response;

- Part 3 comprises the Water Corporation's detailed response to the environmental and social issues and concerns raised in submissions under a number of headings; and

- Part 4 comprises the Water Corporation's detailed response to other issues and concerns raised in the submissions but which we understand are not directly relevant to the Environmental Protection Authority in forming its advice to the Minister.

In addition to providing advice to the EPA on issues and concerns raised in public submissions, the Water Corporation also provided detailed advice in a separate report to the EPA on issues and recommendations raised in a technical peer review of the SER for the EPA carried out by Air Assessments in January to March 2006.

Since submitting the SER to the EPA in early September 2005, the new Annual DOE Licence for the Woodman Point Wastewater Treatment Plant has been issued commencing on 1 November 2005. The new Licence contains a new Condition relating to odour management at the Plant requiring the development of an odour improvement plan which should:

1. Initially reduce odour emissions, which are currently modelled to be 297,100 OU/s, by at least 50% within three years;

2. Provide further reductions beyond three years, to ultimately achieve an ambient odour level of 5 odour units (or as otherwise approved by the Director) at the nearest odour sensitive premises; and

3. Develop strategies to resolve any residual land use conflicts surrounding the Premises in the event that (2) cannot be achieved.

As a result of this requirement, and the short lead time to achieve the significant reduction in odour emissions from the plant, the Water Corporation has revised its planned approach to implementing odour control works at the plant. In essence the Water Corporation is now working to design and construct those parts of Stages 1 and 2 of the works proposed in the SER required to meet the odour outcomes stated in the Licence (ie 50% reduction in odour emissions within three years). The Water Corporation's responses in Part 3 to a number of community issues and concerns relating to the staging of the works outlined in the SER, reflect this changed requirement.

2. SUMMARY OF PUBLIC SUBMISSIONS

Submission	Issues raised
1	• Concerned about the excessive time it will take to implement all stages in odour control • Concerned that the Water Corporation is giving higher priority to other capital works instead of implementing its commitments given for the 2002 upgrade to the plant • Was informed by the Water Corporation that the 750m generic buffer would be contracted to 500m from the plant following the 2002 upgrade • Questions why community odour complaints have come to nothing • Questions discrepancy in SER and GHD value management study in terms of odour emissions from the Tanker Receival facility (4,400 and 32,000 OU) • Requests that increasing air extraction rates from wastewater treatment areas is included in Stage 1 works • Requests that all odour control works proposed in three stages be implemented within 3 years, ie not staged • SER assumes all odours from various sources are additive, including lake odour. This is not the case, odours are not cumulative • Questions the sludge treatment stack emission limit for mercury, and whether there are any treatment processes which could result in heavy metal emissions to the local airshed
2 (DOH)	• Fully supports proposed odour control measures • Fully supports proposed ongoing stakeholder consultation • Recommends a larger buffer than proposed in the SER, being 500m (based on 5 OU, not 10 OU) from the eastern lake margin because of odour from Lake, and at least conservative approach to delineating buffer on cadastral boundaries should be used • Recommends conservative approach to compatible land uses within the buffer to minimise exposure of sensitive receptors • Supports preparation of structure plan to allow community input to land planning
3	• All three stages of proposed odour control measures must be implemented, with guaranteed funding

	• Odour control at the plant should exceed standards implemented at Subiaco WWTP • Odour control measures must be included in DOE Licence • No statutory buffer impacting on any residential property or urban deferred zoned land • Mayor Road PS site should not be used as emergency storage of raw wastewater • What measures does the EPA propose to enforce the reduction in existing odour levels? • A 1800 complaint line should be implemented, managed by the EPA and reported to the Minister
4	• Supports implementation of proposed odour control works as quickly as possible to minimise the extent of the buffer so that it is virtually removed from the Urban Deferred zoned land • Adjustment of the buffer would be supported by the landholder, but only if it were to conform with the wetland/Lake buffer proposed in the structure plan for this area • Any increase in the buffer would be subject to compensation
5	• Stricter and enforceable conditions be placed in the Licence for the plant to manage and regulate odour emissions, protective of sensitive receptors in the local area • Sufficient Government funding be provided to ensure the odour control works are effective long term • Performance standard for the odour control works should be set to limit odour levels to that of the natural background levels of Lake Coogee • The proposed buffer is unacceptable, the maximum buffer should be 50m from the plant's inner boundary, or if not achievable after stage 2, a maximum of 500m • Recommends housing development as the appropriate land use for the area currently within the buffer, specifically for foreign workers and students working/training at the nearby Marine Technology Park
6 (includes copy of proforma as 3 above)	• SER is biased in favour of a statutory buffer rather than controlling odours • All three stages of proposed odour control measures must be implemented, with guaranteed funding • Odour control at the plant should exceed standards implemented at Subiaco WWTP • Odour control measures must be included in DOE Licence • Proposed buffer should not exceed 5 OU at 160ML/d, and should not encompass any residential properties and the Deferred Urban zoned land • Expansion of the plant beyond 160ML/d should contain odours within that buffer • Plant maintenance is inadequate and adding to odour problems

	• Mayor Road PS site should not be used as emergency storage of raw wastewater • What measures does the EPA propose to enforce the reduction in existing odour levels?
7 (proforma as 3 above)	• All three stages of proposed odour control measures must be implemented, with guaranteed funding • Odour control at the plant should exceed standards implemented at Subiaco WWTP • Odour control measures must be included in DOE Licence • No statutory buffer impacting on any residential property or urban deferred zoned land • Mayor Road PS site should not be used as emergency storage of raw wastewater • What measures does the EPA propose to enforce the reduction in existing odour levels? • A 1800 complaint line should be implemented, managed by the EPA and reported to the Minister
8	• Mayor Road PS site should not be used as emergency storage of raw wastewater • The proposed odour control works need to be implemented before any extensions to the plant • 5OU should be included in the Licence for the plant • Concerned that no legally binding conditions will be set to ensure the odour control works are implemented and agreed odour criteria adhered to • There is no formal buffer for the plant, as there are residences within it • No residents should be subject to odours inside or outside of any proposed buffer • The community consultative committee should be reviewed to be made more inclusive of local residents and independent of the Water Corporation, and focus on odour management at the plant • A 1800 complaint line should be implemented, managed by the EPA and reported to the Minister
9	• Supports contraction of the buffer to the eastern margin of Lake Coogee • Opposes industrial and commercial uses of the Urban Deferred zoned area • Supports the need for a comprehensive planning study to examine alternative uses of the Urban Deferred zoned land if the buffer remains unchanged • Concerned that buffer boundary lies along the property boundary such that the owner cannot do anything with the property, whilst the adjoining property is outside the buffer and has no constraints • Seeks compensation for loss resulting from property being entirely contained within the buffer • Supports bringing forward Stage 1 of the odour control works • Concerned that false assurances given by the Water Corporation that the buffer would be contracted

	back to the Lake margin
10	• The Water Corporation should honour its commitment given to residents, City of Cockburn and DOE during the 2002 amplification of the plant, that the buffer would be contracted back to the Lake margin, and odours would be reduced to 5OU • All three stages of proposed odour control measures must be implemented immediately, with guaranteed funding • Odour control at the plant should exceed standards implemented at Subiaco WWTP • Odour control measures must be included in DOE Licence • No statutory buffer impacting on any residential property or urban deferred zoned land • Mayor Road PS site should not be used as emergency storage of raw wastewater • What measures does the EPA propose to enforce the reduction in existing odour levels? • A 1800 complaint line should be implemented, managed by the EPA and reported to the Minister • A transparent and accountable community liaison process be established between the Water Corporation and residents
11 (proforma as at 6 above)	• All three stages of proposed odour control measures must be implemented, with guaranteed funding • Odour control at the plant should exceed standards implemented at Subiaco WWTP • Odour control measures must be included in DOE Licence • Proposed buffer should not exceed 5 OU at 160ML/d, and should not encompass any residential properties and the Deferred Urban zoned land • Expansion of the plant beyond 160ML/d should contain odours within that buffer • Plant maintenance is inadequate and adding to odour problems • Mayor Road PS site should not be used as emergency storage of raw wastewater • What measures does the EPA propose to enforce the reduction in existing odour levels?
12 (proforma as at 6 above)	• All three stages of proposed odour control measures must be implemented, with guaranteed funding • Odour control at the plant should exceed standards implemented at Subiaco WWTP • Odour control measures must be included in DOE Licence • Proposed buffer should not exceed 5 OU at 160ML/d, and should not encompass any residential properties and the Deferred Urban zoned land

	• Expansion of the plant beyond 160ML/d should contain odours within that buffer • Plant maintenance is inadequate and adding to odour problems • Mayor Road PS site should not be used as emergency storage of raw wastewater • What measures does the EPA propose to enforce the reduction in existing odour levels?
13	• Odour problems have become worse at the plant because of lack of ongoing maintenance and the flawed design of the SBR (ie odour control not built in) • No statutory buffer to be established over existing residences and proposed residential areas • New state of the art continuous odour monitoring systems must be installed at the plant • Odour monitoring results to be made public at least quarterly • Odour modelling needs to allow for the height difference of the plant relative to the level of the Lake and adjoining land • The changing weather patterns which increase the odour footprint from the plant need to be considered • Need continuous communication between adjoining residents and the Water Corporation to monitor odour performance and impacts • Expressions of interest should be sought from industry to provide alternative odour control technologies for the plant
14 (City of Cockburn)	• Reconfirms its support for the contraction of the buffer to the eastern margin of Lake Coogee • Opposes industrial and commercial uses of the Urban Deferred zoned area • Supports the need for a comprehensive planning study, initiated by the City, to examine alternative uses of the Urban Deferred zoned land if the buffer remains unchanged • Supports bringing forward Stage 1 of the odour control works
15	• The Water Corporation must institute best practice • Supports the removal of the buffer or contraction back to the Lake margin
16	• Questions the validity of the odour survey undertaken in 2003 including its accuracy, role of the Water Corporation in undertaking the survey, independent verification by EPA/DOE • Questions why the Water Corporation encourages residents to report unacceptable odour emissions as the information was used to support the odour survey results, not to support improved Plant operations • Questions what odour control works have been undertaken at the plant since the 2002 Plant expansion

	• Questions why the proposed odour control works will take so long to be implemented • Questions whether the Water Corporation has breached its Licence • Questions whether EPA/DOE/DOH are aware of any health effects of the odours emitted from the plant
17	• Complements the Water Corporation on the comprehensive analysis of the problem and the 3 stage odour control works to address the problem • Considers Stage 1 works should be completed by the end of 2007 • Strongly supports establishing a permanent buffer around the plant • Private land within the buffer should be purchased by the Water Corporation and rezoned to public purposes (odour buffer) to prevent its use for residential purposes and to also provide a revegetated 100m buffer for the Lake
18	• The Water Corporation should honour the commitments and indications it gave to residents at the time of the 2002 expansion of the plant, to reduce the buffer to the Lake margin • Supports the new conditions of Licence requiring a reduction in odour emissions of 50% within three years and additional works if necessary to contract the buffer boundary back to the Lake margin
19	• Concerned that his property is included in the proposed buffer which will restrict the future development of the property which is why it was purchased • Requests that the property should not be included in the buffer, as it is more than 700m from the nearest odour source and more than 200m from the Lake • Concerned that the WA 21 Alliance raised expectations that the buffer would be contracted to the eastern margin of the Lake • States that the Water Corporation changed its approach from controlling odour to address landholder concerns, to an adversarial approach of achieving odour buffers with compatible landuses • Questions why the Water Corporation was so confident that the 2002 upgrade of the plant would result in the contraction of the buffer, if they knew the modelling was based on inadequate data or inappropriate assumptions • The odour modelling has still not been assessed for its technical veracity • Modelling based on most conservative assessment of each input so that the modelled odour impact zone is grossly exaggerated, including artificially high levels of complaints, and inappropriate inputs to the

	model (dismissing 30m ridge on which the plant is situated, focussing too much on odour impacts during calms rather than under sea breeze conditions, odour sampling carried out when odours known to be at their worst and when there was a pre planned odour event at the plant, fudge factor applied to odour values prior to modelling, including Lake odour inappropriately to add to the odour impact zone, and inadequate sample size to allow validation of odour footprint with residents experiences of odour) • Questions why the Water Corporation proposes to operate the plant to National Best Practice instead of the (higher) International best practice standard (ISO 14000) to reduce the buffer to meet landholders expectations • Proposed buffer zone is an ambit claim by the Water Corporation to minimise the necessary expenditure by the Water Corporation to contain odours within the plant boundary • Plant is considered very poorly managed and maintained, especially relative to the Subiaco Plant, with no continuous improvement plan in place • The Water Corporation should be prosecuted for the high odour levels resulting from deterioration of membrane seals on the primary sedimentation tanks • The Water Corporation has undertaken many modelling runs using different scenarios, but has chosen to present only a near worst case scenario
20	• Seeks compensation for their property which is within the buffer, or approval for subdivision
21	• Concerned about the environmental impacts of substances emitted to air (bio aerosols, heavy metals, VOCs, etc) • Concerned about the Water Corporation willing to reduce odours in existing residential zoned land, but not so for residents in the Urban Deferred zone • Concerned about lack of regulation to require the DOE to take decisive action over odour emissions • Concerned about the Water Corporation committing in its environmental management plan for the 2002 Plant upgrade, to reduce odours to 5OU at 99.5% at the eastern and northern margins of the Lake, and then reneging on this commitment • Seeks the buffer to be contracted to 500m, not 750m (ie to the eastern margin of the Lake)

3. WATER CORPORATION RESPONSE TO ENVIRONMENTAL/SOCIAL ISSUES

3.1 Odour control works

- *What odour control works have been undertaken at the plant since the 2002 Plant expansion?* **16**

Some additional odour control work has been carried out at the plant, not withstanding the fact that the odour control works undertaken as part of the Environmental Enhancement/ Plant Augmentation Project were only commissioned in 2003, ie three years ago.

The Water Corporation has installed a proprietary boundary misting product in the sludge handling area, to reduce periodic but strong odours emissions during loading sludge onto trucks.

- *All three stages of proposed odour control measures must be implemented,* **3, 6, 7, 10, 11, 12**
- *Complements the Water Corporation on the comprehensive analysis of the problem and the 3 stage odour control works to address the problem* **17**
- *The Water Corporation must institute best practice* **15**

The Water Corporation agrees it is highly likely that all three stages will have to be implemented to bring the odour impact from the plant operating at its future ultimate capacity back to the existing buffer. The SER sets out a staged approach to odour control enhancements that aligns with the orderly development of the plant, probable funding availability, and most importantly, achieving the maximum offsite odour benefit as early as possible.

The odour control works proposed for the plant have the benefit of learning from the major odour control projects recently completed at the Water Corporation's other major plants at Subiaco and Beenyup. These two plants are now the only extensively covered plants in Australia, and the works proposed for the Woodman Point Plant will also achieve this very high standard of odour control, which represents national best practice in odour control.

- *Concerned about the excessive time it will take to implement all stages in odour control* **1**
- *Why will the proposed odour control works take so long to be implemented?***16**
- *Requests that all odour control works proposed in three stages be implemented within 3 years, ie not staged* **1**
- *Considers Stage 1 works should be completed by the end of 2007* **17**
- *Supports bringing forward Stage 1 of the odour control works* **9, 14**
- *Supports implementation of proposed odour control works as quickly as possible to minimise the extent of the buffer so that it is virtually removed from the Urban Deferred zoned land* **4**

Completing the design for the proposed works to the level of detail necessary to ensure the works will meet the required environmental outcomes, and for construction purposes, is very time consuming. This is a very large project both in terms of the

capital investment and the scale of the works required, which involves many individual components posing considerable challenges for integrating the new works into a large and complex operating plant.

The Water Corporation has commenced the (early) definition phase of the staged odour control works. A contract to complete the definition studies was awarded in early January 2006. The design phase of the project cannot be further compressed.

The Water Corporation is currently working on the design of those parts of Stages 1 and 2 of the proposed works necessary to deliver a 50% reduction in odour emissions by the end of 2008, a very challenging deadline set by the DOE Licence for the plant.

The allocation of each of the selected odour control measures among the three stages is explained in detail in the SER and was based upon an assessment of the odour reduction achieved vs cost and the existence of critical linkages with other plant upgrades and operational constraints for the existing plant.

The sludge treatment process is close to its design capacity and is already planned to be upgraded over the period 2008-9. Hence it is sensible to implement sludge odour control works during Stage 1.

The SBR bioselectors were included in Stage 1 because they are the greatest odour source on the site and emit from a much smaller area than the SBR aerobic zones. Since the area to be covered is small no major disruption to the secondary process is anticipated and the risk of process failure is manageable for the short duration.

As explained in the SER, the odour control works for the SBR are proposed to be done concurrently with the capacity upgrade of the secondary treatment module, which is currently not scheduled for implementation until 2015.

- *Requests that increasing air extraction rates from wastewater treatment areas is included in Stage 1 works* **1**

See response above. Consideration of increased air extraction rates is being given in the current definition studies for works to meet the 50% reduction in odour emissions stated in the DOE Licence.

- *The proposed odour control works need to be implemented before any extensions to the plant* **8**

See response above. The Water Corporation cannot undertake Stage 3 works without constructing additional secondary treatment capacity, and the Water Corporation cannot justify around $170 million in capital expenditure in the short term where the additional secondary treatment capacity would not be needed for 9 years.

In saying this however, additional odour control will be factored into any significant augmentation/modification to the plant from now on.

- *New state of the art continuous odour monitoring systems must be installed at the plant* **13**

Various monitoring systems will be included in the odour control works including instrumentation to monitor under cover pressures, airflows, odour treatment efficiency, hydrogen sulphide concentrations, etc.

- *Expressions of interest should be sought from industry to provide alternative odour control technologies for the plant* **13**

The technology proposed in the SER is based on that which had been found very reliable and effective at both the Subiaco and Beenyup WWTPs. This technology was selected with input from national and international expertise in odour control. As with the recent Subiaco and Beenyup odour control upgrade projects, the Water Corporation is utilising industry expertise to ensure odour control works meet or exceed those installed at these plants.

The Water Corporation invests significantly in research and technology development, and has trialled a variety of experimental and proprietary technologies for odour control, generally at smaller plants experiencing specific and localised odour problems.

The Water Corporation does not consider it is either necessary or appropriate to risk considering alternative odour control technologies at such a major plant, particularly in terms of its Licence requirement to achieve 50% odour reduction within three years.

3.2 Performance criteria/standards for Staged odour control works

- *Odour control at the plant should exceed standards implemented at Subiaco WWTP* **3, 6, 7, 10, 11, 12**

The proposed odour control works at the plant will be constructed to a high standard and will achieve a very high level of odour control. The works will meet or exceed those at the Subiaco Wastewater Treatment Plant.

However the Woodman Point Plant is the largest wastewater treatment plant in Metropolitan Perth, and within 10 years will be treating 160 ML/day which is 2 1/2 times the volume of wastewater being treated at Subiaco. In the future the Woodman Point Plant will be treating some four to five times the volume of wastewater being treated at Subiaco. The level of residual odours from the Woodman Point Plant (including fugitive odours and odours released when hatches are opened and covers are removed for periodic maintenance) will inevitably be higher than those at Subiaco.

The Water Corporation does not believe it is in the best interests of the broader community to invest in odour control beyond that which is reasonable and practicable for the current environment.

- *Performance standard for the odour control works should be set to limit odour levels to that of the natural background levels of Lake Coogee* **5**

The Water Corporation does not agree with this suggestion. Lake Coogee is very odorous in summer when the lake water levels fall and the exposed organic mud flats dry out and release hydrogen sulphide and other odorous emissions. The Water Corporation has undertaken odour measurements of the Lake margin using Dynamic Olfactometry to the Australian Standard methodology, and has also taken direct hydrogen sulphide measurements. Measured odour concentrations vary from 4 to 55 OU/m2/s, the highest level is similar to that from the plant's bioselectors. Hydrogen sulphide concentrations have been measured as high as 15ppm, which is very high, and potentially of concern from a public health perspective.

Consulting Environmental Engineers modelled the impact of odours from the drying Lake margin, using an average concentration of 7 OU/m2/s. This shows that under calm stable atmospheric conditions, with a gentle westerly breeze, the 5 OU contour would be more than 1 km inland from the Lake's eastern margin and the 10 OU contour would be about 600 m inland. Very strong odours would be experienced up to 200 m inland from the Lake.

In the 'worst case' event of a weak westerly wind of only 0.5 m/s, strong odours would occur up to 1 km from the Lake's eastern margin, and odours would be noticeable up to at least 2 km from the Lake's margin. Conditions within 250 m from the Lake (ie within the buffer) would be obnoxious.

Anecdotal evidence is that strong odours from the Lake are experienced for at least 3 months of the year, and so the Water Corporation cannot agree that the performance criteria for the proposed odour control works be set to the natural background levels of odour from the Lake.

- *States that the Water Corporation changed its approach from controlling odour to address landholder concerns, to an adversarial approach of achieving odour buffers with compatible landuses* **19**

The Water Corporation's approach since commencement in 1997 of planning the development of the new plant has always been to ensure effective management of odours from the plant, through a combination of implementing odour controls at the plant, and maintaining a buffer to allow odours which cannot be contained or eliminated to be dispersed without resulting in odour conflicts. The question at the time of implementing the new plant, was whether the change from a primary to a secondary treatment plant together with the significant changes to the management of sludge/biosolids at the plant, would reduce odour emissions to the extent that the buffer could be reduced to the lake margin.

Clearly the Water Corporation's expectation based on the technical specialist advice provided to it at the time, was that the buffer may have been able to be contracted to the Lake Coogee eastern margin, but only if demonstrated following an assessment of the effectiveness of the works. The odour monitoring and modelling program undertaken for this purpose in 2003 demonstrated that the buffer could not be contracted.

The Water Corporation's conclusion based on modelling of future odour impacts after significant expenditure on the three stages of odour control, combined with greater understanding of the specific needs of operating covered plants and its understanding of community responses to odour, is that the buffer will remain an important component of managing odours from the plant without causing conflicts.

- *Questions why the Water Corporation proposes to operate the plant to National Best Practice instead of the (higher) International best practice standard (ISO 14000) to reduce the buffer to meet landholders expectations* **19**

The Water Corporation will be implementing a very high level of odour controls at the plant which will place it, together with the Water Corporation's Subiaco and Beenyup WWTPs, as a national leader in odour control. ISO 14000, the international standard for environmental management systems, has working to achieve best practice as an underlying goal. The Water Corporation believes its proposals for odour control are entirely in line with the requirements of ISO 14000 in this regard.

- *Concerned about the Water Corporation willing to reduce odours in existing residential zoned land, but not so for residents in the Urban Deferred zone* **21**

The proposed odour control works will substantially reduce odours emanating from the plant, which will substantially reduce the levels of odour experienced by all residents currently impacted by odours from the plant, including those in the Urban Deferred buffer.

3.3 Regulation to ensure effective performance of the works and the Water Corporation

- *Supports the new conditions of Licence requiring a reduction in odour emissions of 50% within three years and additional works if necessary to contract the buffer boundary back to the Lake margin* **18**

The Water Corporation is working to achieve a 50% reduction in odour emissions in accordance with the Licence requirement by the end of 2008. Additional work will be considered following the completion of the works and an assessment of their effectiveness as detailed in the SER.

- *Questions whether the Water Corporation has breached its Licence* **16**

The Water Corporation submits an Annual Report on its performance against the plant Licence each year to the Department of Environment. In addition the Department undertakes routine inspections of the plant to audit Conditions of the Licence and to determine the suitability of the Licence Conditions. The Water Corporation believes it has complied with its Licence.

- *Odour monitoring results to be made public at least quarterly* **13**
- *Odour control measures must be included in DOE Licence* **3, 6, 7, 10, 11, 12**
- *5OU should be included in the Licence for the plant* **8**

- *Concerned about lack of regulation to require the DOE to take decisive action over odour emissions* **21**
- *Stricter and enforceable conditions be placed in the Licence for the plant to manage and regulate odour emissions, protective of sensitive receptors in the local area* **5**

These are matters for the Department of Environment to consider, within the context of the EPA's advice on the SER. However it is generally accepted by industry and environmental regulators in Australia that it is difficult to regulate diffuse odour emissions such as from a WWTP. The DOE and the Water Corporation continue to work in this area to develop a reasonable and practicable approach to odour regulation that is both enforceable and provides protection for sensitive receptors in the context of existing land uses.

- *Concerned that no legally binding conditions will be set to ensure the odour control works are implemented and agreed odour criteria adhered to* **8**
- *What measures does the EPA propose to enforce the reduction in existing odour levels?* **3, 6, 7, 10, 11, 12**

These are matters for the Department of Environment and the EPA to consider.

3.4 Issues associated with the buffer

- *SER is biased in favour of a statutory buffer rather than controlling odours* **6**
- *Proposed buffer zone is an ambit claim by the Water Corporation to minimise the necessary expenditure by the Water Corporation to contain odours within the plant boundary* **19**

The Water Corporation has proposed significant odour control works in three stages estimated to cost in excess of $100 million which will meet what is current National best practice. Even after completion of these works it is likely the residual odour impact will still only just meet the existing buffer. Therefore to confidently ensure future odour conflicts are minimised the Water Corporation believes the existing odour buffer must be retained and structure planning occur within the buffer to ensure future land uses are compatible with the buffer.

- *Strongly supports establishing a permanent buffer around the plant* **17**
- *Recommends a larger buffer than proposed in the SER, being 500m (based on 5 OU, not 10 OU) from the eastern lake margin because of odour from Lake, and at least a conservative approach to delineating buffer on cadastral boundaries should be used* **2**

The Water Corporation believes odour buffers should be utilised when odour controls cannot reasonably and practicably protect potential odour sensitive receptors from unreasonable odour emissions. From experience gained from other plants, the Water Corporation has found that the 5 OU at 99.9%ile, using 1 hour averaging offers good protection from odour in residential areas. For the Woodman Point WWTP this will coincide with the existing buffer once proposed odour controls are completed.

The Water Corporation has modelled the strong odours emitted during summer from the drying mud flats along the Lake's eastern shoreline and has found that the 5OU/s

contour for this source extends a kilometre to the east of the eastern margin of the Lake. The mud flats emit strong odours, at times very strongly sulphidic odours, for at least three months of the year.

The DOE's Air Quality and Air Pollution Modelling Guidance Notes do require that assessments of odour impacts incorporate background (natural and manmade) odour sources to assess cumulative impacts. However there is some evidence in the international literature which suggests that sensitive receptors are likely to be more tolerant of odour if the sources are 'natural'. The Water Corporation does not support a larger buffer based on the Lake's influence, but concurs it supports the need for the existing buffer.

- *There is no formal buffer for the plant, as there are residences within it* **18**

The existing buffer has legal standing and is recognised by the statutory land use planning system in both the Metropolitan Regional Scheme and the City of Cockburn's District Scheme.

The rezoning Amendment of the Metropolitan Region Scheme in 1997 for the area along the eastern margin of Lake Coogee from Rural to Urban Deferred, while the land beyond the buffer was rezoned to Urban/Residential, was to give explicit recognition to the odour-impacted nature of this land.

The rezoning of the buffer to *Urban Deferred* was appealed by the Water Corporation and the City of Cockburn. In not upholding that appeal the then Minister for Planning made the following statement (in correspondence dated 21 January 1997):

> *"It should be noted that the land within the Urban Deferred Zone should not be considered as being suitable for future residential development. Rather, future use is to be compatible with the location of land within the Waste Water Treatment Plant Buffer Zone or the Minister for the Environment's conditions of development as appropriate."*

The buffer is also legally provided for in the City of Cockburn's Town Planning Scheme. The buffer is zoned Development Zone in the City's Scheme and is described as Development Area DA5, which provides under Schedule 11 of the Scheme for residential development except within the buffers of the Woodman Point Wastewater Treatment Plant, the Munster Pump Station and Cockburn Cement.

- *No statutory buffer impacting on any residential property or urban deferred zoned land* **3, 7, 10, 13**
- *Supports contraction of the buffer to the eastern margin of Lake Coogee* **9, 14**
- *Seeks the buffer to be contracted to 500m, not 750m (ie to the eastern margin of the Lake)* **21**
- *Supports the removal of the buffer or contraction back to the Lake margin* **15**
- *Proposed buffer should not exceed 5 OU at 160ML/d, and should not encompass any residential properties and the Deferred Urban zoned land* **6, 11, 12**

- *The proposed buffer is unacceptable, the maximum buffer should be 50m from the plant's inner boundary, or if not achievable after stage 2, a maximum of 500m* **5**

The modelling undertaken for the Water Corporation demonstrates that odour from the plant will extend into the Urban Deferred zoned area even following the completion of Stage 3 odour control works. It is also important to understand that the inherent uncertainties in modelling means that the buffer 'line' is actually a 'band' approximately 200m wide with the modelled line lying along its centre. Therefore it would be inappropriate to contract the buffer back to the Lake's eastern margin.

In the Water Corporation's view the level of odour which will be experienced inside the buffer will be acceptable in terms of land uses such as rural residential/hobby farming and market gardening purposes, and other similar uses such as nurseries, garden centres.

- *Concerned that buffer boundary lies along the property boundary such that the owner cannot do anything with the property, whilst the adjoining property is outside the buffer and has no constraints* **9**
- *Adjustment of the buffer would be supported by the landholder, but only if it were to conform with the wetland/Lake buffer proposed in the structure plan for this area* **4**
- *Concerned that his property is included in the proposed buffer which will restrict the future development of the property which is why it was purchased* **19**
- *Requests that the property should not be included in the buffer, as it is more than 700m from the nearest odour source and more than 200m from the Lake* **19**

The revised buffer for the Woodman Point Wastewater Treatment Plant has been proposed by the Water Corporation following a comprehensive program of odour sampling at the plant and modelling using meteorological data from the weather station installed on the plant site. The data collection and analysis has been undertaken by specialists in their field in accordance with stated/written requirements of the DOE.

The size and shape of the buffer is based on modelled odour impacts, and the actual alignment of the buffer follows, as far as practicable, existing lot boundaries, which is the preferred approach of the Western Australian Planning Commission.

The Water Corporation believes buffers fulfil a necessary role in orderly planning of communities and are in the best interests of the broader community. The City of Cockburn for example supports a number of buffers to minimise various conflicts (eg odour, wetlands, midge, heavy industry).

- *Expansion of the plant beyond 160ML/d should contain odours within that buffer* **6, 11, 12**

Total odour emissions for the future 240ML/d plant will inevitably be greater than for the 160ML/d plant, (even accounting for the high level of odour control which will be implemented for the existing plant and for the future augmented plant) because of additional fugitive emissions and periodic odour releases during planning and

unplanned maintenance of a larger plant. The review of the buffer has been based on likely odour emissions for the future augmented plant, in accordance with the DOE's Air Quality and Air Pollution Modelling Guidance Notes (2000).

3.5 Land uses in buffer

- *No residents should be subject to odours inside or outside of any proposed buffer* **8**
- *Recommends conservative approach to compatible land uses within the buffer to minimise exposure of sensitive receptors* **2**
- *Supports the need for a comprehensive planning study to examine alternative uses of the Urban Deferred zoned land if the buffer remains unchanged* **9**
- *Supports the need for a comprehensive planning study, initiated by the City, to examine alternative uses of the Urban Deferred zoned land if the buffer remains unchanged* **14**

The Water Corporation supports structure planning as the mechanism to review existing and possible future land uses in the buffer in terms of addressing environmental constraints (such as protecting Lake Coogee as an EPP wetland, midge impacts) and their compatibility with the predicted odour emissions from the plant and the high levels of odour generated by Lake Coogee in summer.

The Water Corporation considers that following the implementation of the odour control works outlined in the SER, odour levels within the buffer will be considerably reduced and compatible with a wide variety of land uses other than residential. The Water Corporation is willing to work with the City of Cockburn, landholders and the Department of Planning and Infrastructure to address any residual land use conflicts.

- *Recommends housing development as the appropriate land use for the area currently within the buffer, specifically for foreign workers and students working/training at the nearby Marine Technology Park* **5**
- *Opposes industrial and commercial uses of the Urban Deferred zoned area* **9, 14**

The Water Corporation strongly opposes any form of residential intensification within the Urban Deferred buffer.

The Water Corporation acknowledges the opposition to industrial and commercial development of the buffer. The Water Corporation also acknowledged in the SER that industrial development, while compatible with odour, was not suitable for the land in question.

The Water Corporation considers that some forms of commercial development (such as nurseries, garden and landscaping centres, golf course, private recreation facilities, rural residential uses permitting a variety of home-based businesses (transport, earthmoving, equipment hire, horse agistment, riding schools) may be attractive both in terms of odour compatibility and the specific environmental attributes of the land in question. This should be canvassed during structure planning for the area. The Water Corporation is willing to work with the City of Cockburn, landholders and the Department of Planning and Infrastructure to achieve compatible land uses within the buffer.

- *Private land within the buffer should be purchased by the Water Corporation and rezoned to public purposes (odour buffer) to prevent its use for residential purposes and to also provide a revegetated 100m buffer for the Lake* **17**

The Water Corporation acknowledges that the Urban Deferred buffer land is both subject to a number of specific constraints but is also attractive for and suited to a number of uses. For this reason The Water Corporation supports structure planning as the means to determine the most appropriate use(s) in consultation with landholders and other stakeholders.

3.6 Issues associated with odour modelling

- *Questions discrepancy in SER and GHD value management study in terms of odour emissions from the Tanker Receival facility (4,400 and 32,000 OU)* **1**

  The preliminary odour inventory prepared in January 2005 for the Value Management Study included three sources for the tanker receival facility:

Tanker receival facility	10,000 OU/s
Tanker vents (intermittent)	12,000 OU/s
Truck unloading (intermittent)	10,000 OU/s

  Consulting Environmental Engineers, in reviewing the odour inventory in 2005 for incorporation in the SER, concluded that the intermittent odour emissions from tanker vents and truck unloading could be controlled by extending the existing odour control system at the facility. Odour emissions for truck unloading was therefore not included in the long term odour inventory, and emissions from tanker vents were reduced to 2000 OU/s. Further investigations were made of the likely odour emission rates from the tanker receival facility and by August 2005 it was decided that a smaller odour emission rate of 2400 OU/s was more representative of 75 percentile odour emissions from this source.

- *SER assumes all odours from various sources are additive, including lake odour. This is not the case, odours are not cumulative* **1**

  The Water Corporation recognises that odours of substantially different character are not cumulative. This is why the relatively large contribution of odours measured from gas engine exhausts (22,500 OU/s representing 8.5% of all odours measured in 2003 by The Odour Unit) was not included in the odour inventory for modelling the plant's odour footprint by CEE (2003).

  However odours of similar character are considered to be cumulative, especially when the odour levels from the different sources are at low levels. This assumption is behind the correlation of the odour model predictions with community complaints and reported odour concerns in the survey – and the selection of the 5 OU contour as representative of the distinct level of odour. At a low level, all the residual odours from the Woodman Point plant are considered to have a similar character of "sewage" or wastewater treatment-type odour.

No odour contours have been published adding the Lake odours to the treatment plant odours, although an argument could be advanced that the lake odours have a similar Hydrogen Sulphide character as the treatment plant odours. Levels of up to 15 ppm Hydrogen Sulphide have been measured by a very sensitive handheld instantaneous Hydrogen Sulphide analyser, as being emitted from the Lake's drying eastern margin in summer. If odour contours for the combined sources of the treatment plant (at 240 ML/d after Stage 3 controls) and the Lake were prepared, as indicated in the Department of Environment's Air Quality and Air Pollution Modelling Guidance Notes (2000) the 5 OU contour would be 300 to 500 m east of the Lake, much further east than recommended by the Water Corporation in the SER (see additional comments above).

- *The odour modelling has still not been assessed for its technical veracity* **19**

The Water Corporation commissioned a peer review of the modelling by Pacific Air and Environment in September 2005 as a quality check just prior to submitting the SER to the EPA. The EPA commissioned Air Assessments to undertake a detailed peer review of the Corporation's SER, including the modelling. This raised a number of generally small issues which the Corporation has addressed separately. Air Assessments findings has not changed the Corporation's view of the revised buffer. The Water Corporation expects the EPA will undertake its own review of the technical basis of the Water Corporation's SER in forming its advice to the Minister for the Environment.

- *Modelling is based on most conservative assessment of each input so that the modelled odour impact zone is grossly exaggerated, including artificially high levels of complaints, and inappropriate inputs to the model (dismissing 30m ridge on which the plant is situated, focussing too much on odour impacts during calms rather than under sea breeze conditions, odour sampling carried out when odours known to be at their worst and when there was a pre planned odour event at the plant, fudge factor applied to odour values prior to modelling, including Lake odour inappropriately to add to the odour impact zone, and inadequate sample size to allow validation of odour footprint with residents experiences of odour)* **19**
- *Odour modelling needs to allow for the height difference of the plant relative to the level of the Lake and adjoining land* **13**
- *The Water Corporation has undertaken many modelling runs using different scenarios, but has chosen to present only a near worst case scenario* **19**

The Water Corporation refutes the allegation that its modelling exaggerates the odour footprint from the plant. The Water Corporation's consultant, Consulting Environmental Engineers has generally followed the Department of Environment's Air Quality and Air Pollution Modelling Guidance Notes (2000), and has recognised the DOE's requirements that "estimates of emissions employed in modelling assessments are realistic and that uncertainty is balanced by conservatism".

In relation to the specific criticisms above:

-The program of odour sampling undertaken in 2003 at the plant is recognised as being the most extensive and comprehensive program undertaken in Australia.

The work showed that odour emissions are highly variable. As a result an odour emission rate for each source was determined as the 75 percentile level, which is halfway between the average emission rate and the worst emission rate; so it is a conservative estimate without being the "most conservative assessment". This is not a fudge factor, but a reasonable attempt at accounting for the high variability of odours emitted from the plant.

-The 2003 odour sampling program was originally scheduled to be undertaken from January to March 2003, specifically to coincide with the summer/autumn period when odour emissions from wastewater treatment plants in WA are at their worst and most community odour complaints are received. This is in line with the DOE's Odour Methodology Guideline 2002. However the sampling program had to be delayed because of problems with the operation of a quadrant of the SBR, which was generating higher levels of odour than normal. The program was commenced in March 2003 only when the plant returned to normal operation.

-The complaints are not considered to be "artificially high", and are the lowest received by the Water Corporation compared to its other two large Metropolitan Plants (prior to the recent upgrades at the Subiaco and Beenyup Plants). Indeed, the opposite is true, as during discussions prior to completion of the SER and during the EPA's consultation period many people said that they had been annoyed by odour but had not lodged a complaint. As stated in the SER, the low number of complaints about odour prior to late 2003 (ie before the Water Corporation informed local residents in early 2004 about the need to maintain the buffer) gave the Water Corporation the impression that there was not an odour problem.

-The height difference between the plant and the adjacent land has been accounted for in the modelling. Most of the sources of odour are at or close to ground elevation and so, under westerly winds, the odours travel down the slope of the ridge and spread across the Lake. The location of the plant on the eastern side of the ridge makes it more likely that fugitive odours will reach the Lake.

-The odour model predicted odour levels under all wind conditions, including sea breeze conditions as well as near-calm conditions, and the 99.9 percentile condition is presented, which will reflect the odour levels at times of low wind speeds and low dispersion rates, as required by DOE's Air Quality and Air Pollution Modelling Guidance Notes (2000).

-Lake Coogee odour was modelled separately. No odour contours have been published adding the at times strong odours from the Lake to the treatment plant odours

-It is true that the sample size in the area east of the Lake to Stock Road was not sufficiently large for the results to be statistically valid, however the results do provide a strong indication at least that residents east of the Urban Deferred buffer find odours to be highly annoying. This would indicate that residents closer to the plant (within the buffer) would likely find the odours to also be highly annoying. Based on the comparison of the predicted odour contours and the pattern of odour complaints, as well as the results of the survey of community annoyance about odour, there appears to be good agreement between

the odour model predictions of odour and community reactions to adverse odour. Comments from residents during the community consultation phase reinforced the perception that the model is successfully predicting the extent of odour impact.

-The SER presents the modelling prediction for the 99.9 percentile case – which is the situation that is expected to occur for only 8 hours per year. This "near worst case" scenario is used to ensure that outside the buffer in residential areas, there will be negligible adverse impacts due to odour.

- *The changing weather patterns which increase the odour footprint from the plant need to be considered* **13**

  The Water Corporation agrees with this comment. The variation in wind and weather conditions have been considered in the modelling by examining odour levels each hour over a 2-year period (approximately 17,000 hours). The 99.9 percentile odour contours plotted in the SER reflect the most unfavourable wind and dispersion conditions in the 2-year period.

3.6 Community odour survey / odour complaints

- *Questions why community odour complaints have come to nothing* **1**

Until late 2003 the Water Corporation had received only a very few complaints each year concerning operations at the plant. The Water Corporation therefore surmised that the plant was operating in an acceptable manner. In late 2003 following the comprehensive odour sampling and modelling program, the Water Corporation became concerned that the odour footprint of the plant was such that it should have been triggering a high level of complaints. The community odour survey was undertaken in late 2003 as a check to assess the level of community concern with odours in the vicinity of the plant, to confirm whether the low level of complaints were 'real' or an anomaly, and depending on the results, to determine the extent of any odour control works that may have been required.

It was only after December 2003, when the Water Corporation informed landholders in the Urban Deferred area in writing of its intention to both undertake significant investment in odour control works to bring the odour footprint back to the existing buffer, and of the need to retain the existing buffer, that the number of odour complaints increased significantly.

- *A 1800 complaint line should be implemented, managed by the EPA and reported to the Minister* **3, 7, 8, 10**

The Water Corporation established an 1800 number in mid January 2006. This is managed by the Water Corporation. The Water Corporation reports annually on all odour complaints about the plant to the DOE as required by its Licence.

- *Questions the validity of the odour survey undertaken in 2003 including its accuracy, role of the Water Corporation in undertaking the survey, independent verification by EPA/DOE* **16**

The Water Corporation commissioned Market Equity (now Synovate) to undertake the community odour survey. The Water Corporation was involved in finalising the design of the questionnaire, but the actual implementation of the survey was conducted entirely by Market Equity. Market Equity surveyed 260 residents in three sub-areas, which is a sufficiently large sample size overall for the results to be statistically valid at a 95% confidence level.

It is unfortunate that the boundary of the survey catchment area to the east of the plant was set at Stock Road, but understandable as the Water Corporation had been told on numerous occasions by residents living east of the plant that they do not experience undue odour levels; and this was also corroborated by the low number of complaints at the time.

This had the effect of limiting the number of residents who were surveyed, so that the accuracy of the results obtained from this sub-area is less than for the survey overall, being plus or minus 18%. However the results obtained are very consistent between residents and so the Corporation is confident that they are an accurate representation of the views of residents living east of the plant.

It is also unfortunate that the random basis of selection of interviewees (the standard approach which is widely used to reduce bias in the survey results) resulted in only 2 of the 30 interviewees being residents living within the buffer. In terms of odour impact on residents living within the buffer, the survey results can be considered an accurate but somewhat conservative representation of their views.

Market Equity was chosen to undertake the survey, as it is a very reputable company with significant experience in this type of work. Interviewer Quality Control Australia was introduced s an industry-led quality standard for market research data collection and data management. Synovate Australia views IQCA as a minimum standard and imposes internal checks on each and every step of the process undertaken, often going beyond IQCA standards. Synovate Australia has supported IQCA since its introduction and has retained full accreditation since the system was implemented, through its in-house field services in Perth.

- *Questions why the Water Corporation encourages residents to report unacceptable odour emissions as the information was used to support the odour survey results, not to support improved Plant operations* **16**

  Community odour complaints are taken seriously by the Water Corporation. Under the conditions of its DOE Licence the Water Corporation is required to log all complaints with relevant supporting data, including an assessment of likely cause of the odour emission (eg operating conditions at the plant at the time of the emission, any ‘out of spec’ operations at the plant, etc), and an assessment of remedial action required to prevent a re-occurrence. In this way odour complaints support improved management and operations at the plant. The higher level of odour complaints received since 2004 have also helped the Water Corporation to understand the nature of odour events, to plan the odour control works, and to support the case for the works proposed in the SER.

  All available information on community odour impacts have been used to verify the modelling of the current plant emissions. This includes residents’ reported level of annoyance in the 2003 community odour survey, odour complaints, and

field checks of ambient odour levels undertaken by Consulting Environmental Engineers This is a necessary process to build confidence in the modelling results for the plant with future odour controls in place.

3.7 Maintenance at the plant

- *Plant is considered very poorly managed and maintained, especially relative to the Subiaco Plant, with no continuous improvement plan in place* **19**
- *Plant maintenance is inadequate and adding to odour problems* **6, 11, 12**
- *Odour problems have become worse at the plant because of lack of ongoing maintenance* **13**

The Water Corporation pays careful attention to maintenance, particularly in terms of the existing odour control equipment, at the plant. Maintenance is undertaken on a planned basis and plant operators and the laboratory staff at the plant have a close working relationship to ensure the optimum operation of the equipment.

Internal audits of the operation of the plant are undertaken and there will be an independent, external audit undertaken of the plant in mid 2006. In addition the DOE undertakes a site inspection annually, which involves an audit of the plant against the Licence requirements. Other inspections/visits are also undertaken by the DOE on a more informal basis throughout the year.

It is difficult to comprehend the comment that there is no continuous plan in place when the SER proposes some $100 million of odour improvements.

- *The Water Corporation should be prosecuted for the high odour levels resulting from deterioration of membrane seals on the primary sedimentation tanks* **19**

No biological or other membrane has been installed under the covers on the primary tanks. It is noted that the system to contain odours in the primary sedimentation tanks at the plant (ie covering and sealing together with air extraction to achieve negative pressures under the covers), is inferior to that recently installed at Subiaco and Beenyup WWTPs. While maintenance has routinely been carried out on the covers and seals, it has proven difficult to achieve ongoing containment of emissions. The SER proposes to address this.

3.8 Ongoing community consultation

- *A transparent and accountable community liaison process be established between the Water Corporation and residents* **10**
- *Fully supports proposed ongoing stakeholder consultation* **2**
- *The community consultative committee should be reviewed to be made more inclusive of local residents and independent of the Water Corporation, and focus on odour management at the plant* **8**

A new Community Reference Group is being established with an independent Chairperson and representatives of the broader community, and other stakeholders, including the Department of Environment.

The Water Corporation advertised the position of independent chairperson in early 2006 and a chairperson was jointly agreed by the Water Corporation and the Department of Environment in May 2006. The Chairperson has been appointed for a term of one year, specifically to assist in establishing the new Community Reference Group, in selecting the members of the Group, facilitating the Group's work in its first year, and developing a mechanism to select a new chairperson to take the Group beyond its first formative year. Nominations for new CRG members closed in May 2006.

The new CRG will be involved in advising the Water Corporation on a range of issues associated with managing and operating the State's largest wastewater treatment Plant, including, but not limited to, odour.

- *Need continuous communication between adjoining residents and the Water Corporation to monitor odour performance and impacts* **13**

The new CRG will be involved in determining appropriate forms of communication with residents and other stakeholders on all issues associated with the plant, including developing and implementing the Odour Improvement Plan, and reviewing action on complaints received on the 1800 number.

- *Supports preparation of structure plan to allow community input to land planning* **2**

The Water Corporation is committed to supporting structure planning within the Urban Deferred area to address any residual land use conflicts.

3.9 Health effects of odour emissions

- *Questions the sludge treatment stack emission limit for mercury, and whether there are any treatment processes which could result in heavy metal emissions to the local airshed* **1**
- *Concerned about the environmental impacts of substances emitted to air (bio aerosols, heavy metals, VOCs, etc)* **21**
- *Questions whether EPA/DOE/DOH are aware of any health effects of the odours emitted from the plant* **16**

Odour emissions are the only relevant factor in terms of emissions to the airshed associated with the Woodman Point Wastewater Treatment Plant. There are trace levels of certain heavy metals in the raw wastewater, but these are partitioned into the solids (biosolids) during treatment. The Department of Health strictly regulates the levels of contaminants in biosolids. It is worth noting that the submission from the Department of Health (submission 2) has raised no issues in relation to any of the above perceived concerns.

4. WATER CORPORATION RESPONSE TO OTHER ISSUES

4.1 Provision of funding to undertake the proposed works

- *Sufficient Government funding be provided to ensure the odour control works are effective long term* **5**
- *All three stages of proposed odour control measures must be implemented, with guaranteed funding* **3, 6, 7, 10, 11, 12**

The Water Corporation is unable to commit to funding the works beyond its current approved capital program, because of competing demands across the State. To date the Water Corporation has sought and received funding approval of $30.567 million from the Department of Treasury and Finance. The Corporation is currently seeking additional funding from Treasury to enable sufficient works to meet the Licence requirement of achieving 50% reduction in odour emissions to be implemented by the end of 2008. Funding for any additional work that may be required in the future will be addressed at a future time.

The Water Corporation is aware that the Treasurer has requested an Economic Impact Assessment be undertaken of the proposed odour control works at the plant.

4.2 Issues associated with the 2002 Amplification of the plant

- *The Water Corporation should honour its commitment and indications given to residents, City of Cockburn and DOE during the 2002 amplification of the plant, that the buffer would be contracted back to the Lake margin, and odours would be reduced to 5OU* **10, 18**
- *Concerned that false assurances were given by the Water Corporation that the buffer would be contracted back to the Lake margin* **9**
- *Concerned that the Water Corporation is giving higher priority to other capital works instead of implementing its commitments given for the 2002 upgrade to the plant* **1**
- *Was informed by the Water Corporation that the 750m generic buffer would be contracted to 500m from the plant following the 2002 upgrade* **1**
- *Concerned that the WA 21 Alliance raised expectations that the buffer would be contracted to the eastern margin of the Lake* **19**
- *Concerned about the Water Corporation committing in its environmental management plan for the 2002 Plant upgrade, to reduce odours to 5OU at 99.5% at the eastern and northern margins of the Lake, and then reneging on this commitment* **21**

The Water Corporation has met its commitments for odour management associated with the $150 million Environmental Enhancement Project to upgrade the plant to secondary treatment. The Department of Environment's requirements in terms of odour management for the upgraded Plant, as stated in the Works Approval, were:

> *"The works approval holder shall construct the new facilities such that the overall odour impact of the wastewater treatment plant is reduced in*

comparison with the existing impacts". (Works Approval No 2710 dated 1 April 1999).

Odour modelling was conducted by SKM in 1999 and reported in the 'Woodman Point Wastewater Treatment Plant Amplification – Environmental Assessment and Management Plan' (EAMP). The EAMP anticipated that with odour control in place and at the design capacity of the plant (160ML/d), the 5OU:99.5% contour would be situated "near the eastern shoreline of Lake Coogee, close to the (odour) buffer and land zoned urban to the north and over recreational and industrial land to the west and south." Further, it stated that "the (predicted) odour impacts as defined by the 5OU:99.5%:3 minute contour fall within the current buffer" and accordingly concluded that "a reduction in the buffer may be possible" following confirmation of the performance of the odour control measures post-amplification.

Any predictions made by the Water Corporation before the construction and operation of the amplified plant, in relation to the final size of the buffer were made in good faith, based on advice from external experts at that time.

The post-amplification odour monitoring program undertaken in 2003 found that, while the Water Corporation had fulfilled the requirements of the Works Approval, more accurate modelling based on more accurate data (see below) indicated that the odour footprint for the (new) plant still extended beyond the buffer.

The Water Corporation accepts it has not met the expectations of the local community and as such has proposed the program of odour control works in the SER. It is unfortunate however, even with the proposed implementation of these significant works, that the residual odour impact will still extend well into the Urban Deferred area east of Lake Coogee, and the existing buffer will need to be retained.

- *Questions why the Water Corporation was so confident that the 2002 upgrade of the plant would result in the contraction of the buffer, if they knew the modelling was based on inadequate data or inappropriate assumptions* **19**
- *Odour problems have become worse at the plant because of …….. the flawed design of the SBR (ie odour control not built in)* **13**

  The Water Corporation employed odour sampling and modelling specialists to provide the best technical advice on the likely odour emissions and the resulting odour footprint from the future, new secondary treatment plant. The advice was based on the state of knowledge about odour emissions, odour sampling, and modelling at that time.

  Since 2000 the Water Corporation has undertaken a considerable number of projects to better understand odour emissions and odour impacts from its major Wastewater Treatment Plants. This body of knowledge places the Water Corporation and its consultants at the forefront of odour science in Australia.

  In hindsight, it is now evident that the odour modelling on which the conclusions in the 1999 report were based was significantly flawed. The major shortcomings of the modelling were:
  -No Australian Standard (AS) method for odour measurement was available
  -No odour criteria were available at the time

-Wind data from Hope Valley was used due to a lack of wind data from the WWTP site. This data has since been found to be a very poor match
-Some significant odour emissions at the plant were not considered, including those from the sludge management process
-Little measured odour data was available to be used in the modelling, and some of that was from other WWTPs rather than the Woodman Point site.

These shortcomings resulted in modelling which was over-optimistic and led to the false expectation by the Water Corporation based on the advice of its consultants that the area of odour impact would be restricted to the buffer zone, or to the eastern margin of Lake Coogee.

The SBR was constructed without odour controls because the advice provided in 2000 by the external consultants was that the predicted emissions from the SBR would be sufficiently low as to not require controls to be implemented.

4.3 Compensation for land in buffer

- *Seeks compensation for their property which is within the buffer, or approval for subdivision* **20**
- *Seeks compensation for loss resulting from property being entirely contained within the buffer* **9**
- *Any increase in the buffer would be subject to compensation* **4**

The Water Corporation believes there is no statutory right to compensation for loss of property value through the imposition of a buffer, provided that the subject land is not rezoned for a public purpose or an existing lawful land use is not prohibited.

It should be noted that the land within the existing buffer was originally zoned and used for rural and semi rural purposes. While the Minister for Planning and the Minister for the Environment approved the land to be rezoned to Urban Deferred in the Metropolitan Region Scheme, this was on the basis that the land was impacted by odour from the Woodman Point WWTP, and hence their approval was specifically conditional on the land NOT being used for odour sensitive land uses including residential intensification.

The Water Corporation believes there are a number of land uses which are suitable for the Urban Deferred area, recognising both the likely odour impacts in the future, and the environmental constraints and attributes of the land. As such, the Water Corporation is keen to work with the City of Cockburn, residents, and key stakeholders to resolve any residual landuse conflicts.

4.4 Use of Mayor Road Pump Station overflow basin

- *Mayor Road PS site should not be used as emergency storage of raw wastewater* **3, 6, 7, 8, 10, 11, 12**

The overflow basin at the Mayor Road (old Munster) pump station is not part of the Woodman Point WWTP site and does not form part of the SER proposals.

The overflow basin is an important ‘backup’ for the Water Corporation’s wastewater conveyance system, which allows for controlled temporary storage into concrete lined ponds during power outages and other emergency situations, rather than accepting raw wastewater backing up in peoples’ houses or uncontrolled discharge into the environment. The Water Corporation endeavours to limit the period of storage to the absolute minimum, and keeps local residents informed about each event and the clean up process.

Overflows of raw wastewater into the emergency storage facility occur very infrequently (for example only twice in 2006). However the Water Corporation understands the concerns of local residents living in close proximity to the facility, and is considering options to mitigate this situation.

WATER CORPORATION RESPONSE TO AIR ASSESSMENTS PEER REVIEW OF THE SER

May 2006

Figures 1, 2 and 3

Figure 1 Comparison of Predicted 3.5 OU Contour by CEE and Air Assessments, and Recorded Odour Complaints and Concerns

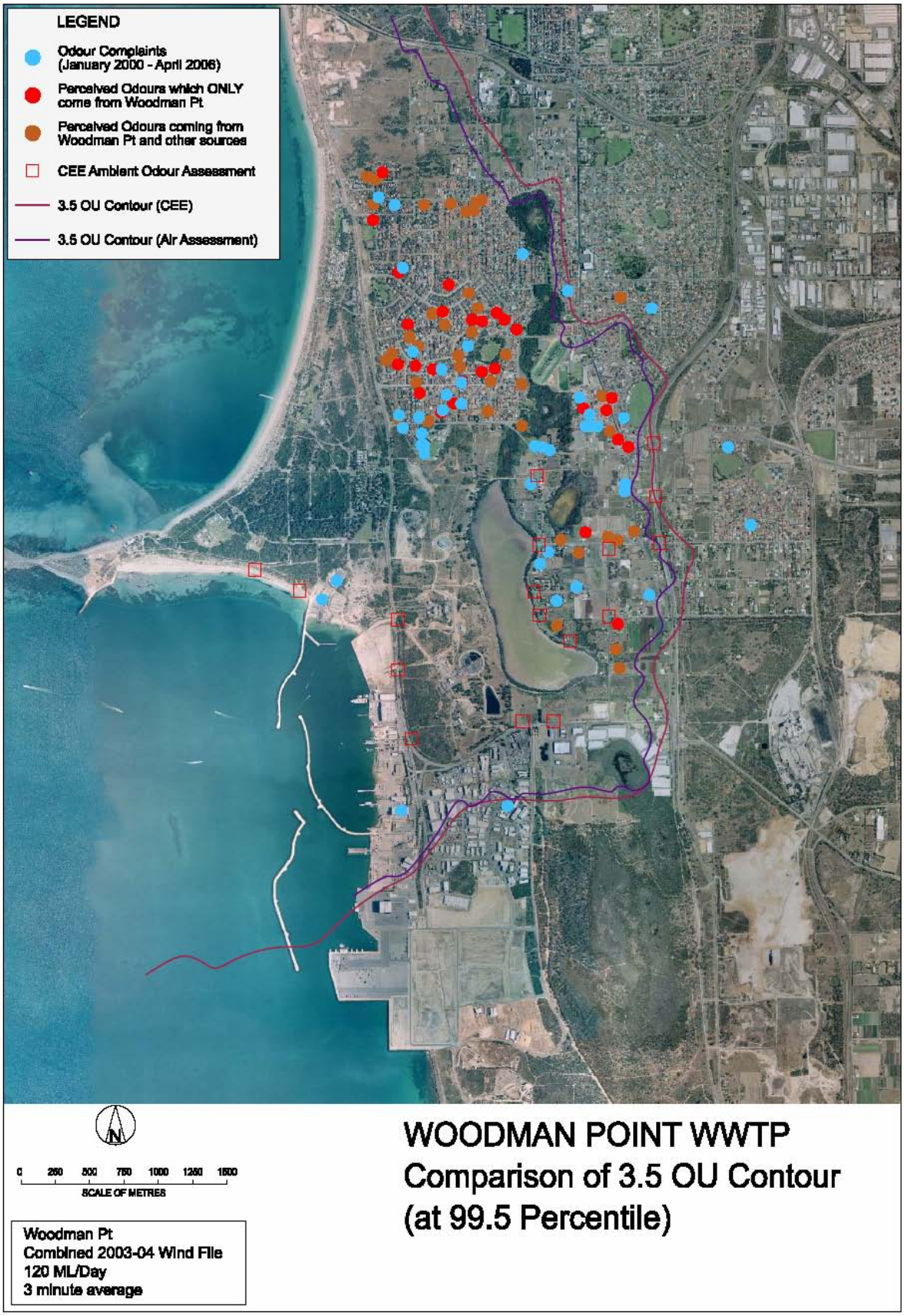

Figure 2 Predicted Odour Contours After All Adjustments to May 2006

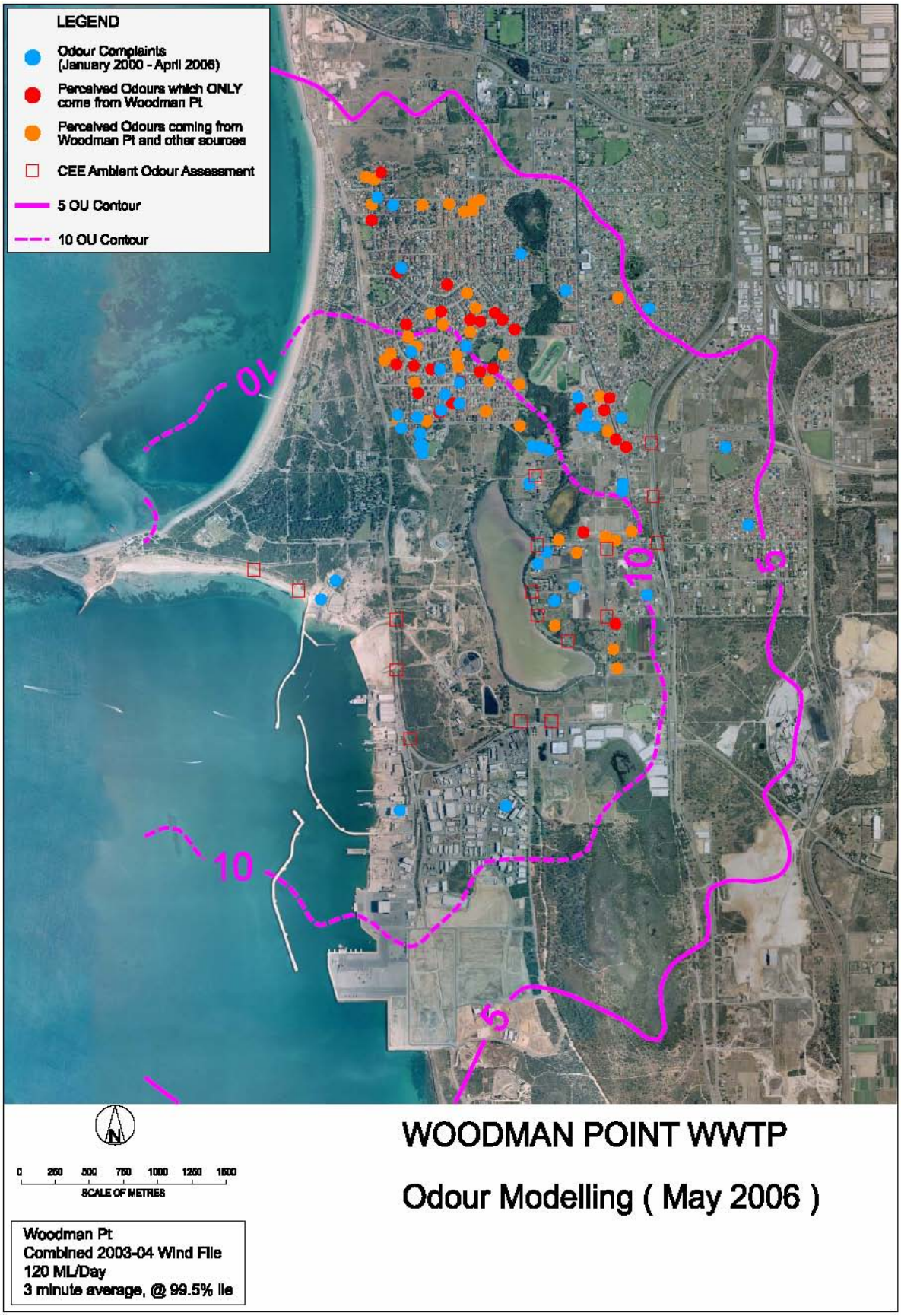

Figure 3 Comparison of Predicted 5 OU Contour for Existing Woodman Point WWTP in the SER and After All Adjustments to May 2006