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23/01/2020

West Nowra Landfill Extension RtS – Response to further EPA comments on Air Quality assessment

Dear Sheelagh,

This letter has been prepared to address the NSW Environment Protection Authority's (EPA) request for further information (in the letter dated 15th November 2019) on the Air Quality assessment undertaken to support the Environmental Impact Statement (EIS) and Response to Submissions (RtS) for the proposed West Nowra Landfill Extension SSD 7187.

The response has been prepared based on the following inputs:

- A teleconference to discuss the issues raised within the EPA's correspondence and identify and agree upon where further assessment was required. Attendees for the teleconference included relevant representatives from the Department of Planning Industry and Environment, the EPA (including the EPA's Technical Advice Air (TA-Air) Unit), Arcadis, Shoalhaven City Council and SLR Consulting Air Quality Specialists.
- Additional modelling and assessment undertaken by SLR Consulting.

A detailed response to each of the issues raised has been prepared by SLR Consulting and is included as Attachment A.

During the additional assessment, it was identified that in the original Air Quality Impact Assessment, there was a typographical error in the label and emissions reported for Stage 4 landfill sub-cell 1 – intermediate cover. As a result of this error the Surface Odour Emission Rate (SOER) for the intermediate cover area was modelled as the same SOER as daily cover, which is considered to be unrealistically high for intermediate cover areas. As shown within Attachment A, when remodelled with a more realistic SOER, the odour criterion of 5 ou is not exceeded at either of the R1 or C2 receivers.

As such, no further air quality assessment or mitigation is required or warranted.

Yours sincerely

Sean Fishwick
Senior Environmental Scientist
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ATTACHMENT A ADDITIONAL AIR QUALITY MODELLING AND ASSESMENT (SLR CONSULTING, 2019)

23 January 2020

620.13429-L05-v1.0.docx

Arcadis
Level 16, 580 George Street
Sydney
NSW 2000

Attention: Sean Fishwick

Dear Sean

Shoalhaven Landfill Extension
Response to EPA Submission

As requested, please find below SLR's response to the request for additional information issued by the NSW Environment Protection Agency (EPA) and the Department of Planning, Industry and Environment (DPIE) in relation to the Air Quality Impact Assessment prepared by SLR (ref. 610.15781-R06-v1.0.doc, dated 14 January 2019) for the proposed extension of the Shoalhaven Landfill in West Nowra.

1 Responses to EPA Comments

SLR's response to the issues raised are addressed in turn below.

	EPA Comment/Request	Response
1	*Comment*: Whilst additional information has been provided on the adopted odour emissions, the use of data from other impact assessments without supporting test reports or information on the conditions during testing adds uncertainty to the assessment.	SLR acknowledges this comment, and adds that the estimation of fugitive odour emissions from landfilling/composting operations always has a significant level of uncertainty associated with it, even with site-specific data. Hence a range of conservative assumptions were made to address this. No further information is understood to be required.
2	The project derived odour impact assessment criteria has not considered neighbouring commercial receptors. *Recommendation*: Adequately addressed	No further response required.

EPA Comment/Request		Response
3	*Recommendation*: The proponent be requested to: 1. Present predicted odour impacts for both C2 and R1 accounting for average and maximum odour emission rates for the landfill area, daily cover area, leachate dam and irrigation area; 2. Where exceedance of odour impact assessment criteria are predicted, the proponent must investigate mitigate measures. In considering mitigation measures the proponent should include interrogation or analysis of individual source contributions to predicted odour concentrations 3. Present additional modelling incorporating the mitigation measures identified to demonstrate compliance with the impact assessment criteria adopted for the project.	It is noted that TA-Air agrees that where a landfill gas extraction system is implemented with due diligence on identifying and rectifying issues with capping and containment, odour emissions from the capped areas could be managed. And that as such, the odour emissions from the final capped areas in stages 2, 3 and 4 can be excluded from the modelling to provide a more realistic emissions scenario for the proposed operations. SLR also wishes to clarify that the intent of the additional modelling using average emission rates is to show the sensitivity of the results to this conservative assumption. The average emission rates simply represent the average of the available data and are not required to be linked to any specific mitigation measure, as suggested in the TA-Air response. It is also noted that Commercial Receptor C2 is on land zoned SP2 Infrastructure, as are the existing and proposed Landfills at West Nowra. The Objectives of Zone SP2 are to (1) provide for infrastructure and related uses, and (2) to prevent development that is not compatible with that or may detract from the provision of infrastructure. It is therefore considered inappropriate for the odour nuisance criterion for sensitive receptors to be applied to this receptor. To require it to meet a sensitive receptor odour criterion would mean that it is considered to be a use that does not meet the objectives of the zone within which it is located. Nonetheless, SLR has performed additional modelling and analysis to provide the additional information requested by TA-Air. This information is provided in **Section 2**.
4	*Comment*: The RtS does not explicitly commit to not cause offensive odour beyond the site boundary. Regardless, the Environment Protection Licence and Section 129 of the POEO Act outline regulatory responsibilities to not cause offensive odour beyond the boundary.	This commitment must be made by the proponent, not SLR. No further response required.
5	*Comment*: TA-Air notes that no contingency measures have been nominated. Comments regarding contingencies measures are provided to assist a proponent in their ability to comply with Section 129 of the POEO Act. Regardless, TA-Air considers that the proponent should investigate mitigation measures to reduce the modelled risk of odour impacts, as discussed previously in the advice.	Addressed in section 2.6 below.

2 Additional Modelling and Source Contribution Analysis

2.1 Revisions to Source Data for Proposed Operations

As requested by EPA in the comments provided in response to the additional information provided on 16 October 2019, SLR has performed a source contribution analysis for receptors R1 and C2, and additional modelling for the average emission rate and maximum emission rate scenarios.

In performing this analysis, it was identified that in the original Air Quality Impact Assessment (AQIA), there was a typographical error in the label and emissions reported for one source in Table 14 for the landfilling operations. This table had the Surface Odour Emission Rate (SOER) for the "Stage 4 landfill sub-cell 1 – final cover" source set at 0.04 ou.$m^3/m^2/s$. This source should have been labelled "Stage 4 landfill sub-cell 1 – *intermediate* cover". In addition, as shown in Table 13 of the AQIA, there was only one sampling result available for intermediate cover, which gave a comparatively low SOER of 0.04 ou.$m^3/m^2/s$, the same as the average SOER measured for final capped areas. To address this in the original AQIA modelling, the Stage 4 landfill sub-cell 1 intermediate cover area was actually modelled with an SOER of 2.16 ou.$m^3/m^2/s$ (same as daily cover).

Upon review however, the use of the daily cover SOER for intermediate cover areas is considered to be unrealistically high and gives a disproportionate contribution for this source compared to the other landfill sources. As part of this updated modelling therefore, the SOER used for intermediate cover areas in the previous air quality impact assessment for West Nowra Landfill (*West Nowra Recovery Park EIS – Air Quality Assessment*, GHD, 2015) of 0.0841 ou.$m^3/m^2/s$ has been used. This value was sourced from an odour audit performed at the Lucas Heights Waste and Recycling Centre in 2006, and was used in this updated modelling instead of the value of 0.04 ou.$m^3/m^2/s$ reported for intermediate cover areas in the Eastern Creek Landfill monitoring survey, which is based on one sample only and could therefore potentially underestimate emissions from this source. For consistency, the SOER used for the other Stage 4 sub-cells was also updated from 0.04 ou.$m^3/m^2/s$ to 0.0841 ou.$m^3/m^2/s$.

For clarity, the emission inventories for the two model runs for proposed operations (ie using average and maximum SOERs) are provided in **Table 1**. As shown in the table, the emissions from leachate irrigation have been included in the modelling for both scenarios.

2.2 Modelling of Current Operations

To assist in 'ground-truthing' the modelling results, two new emission scenarios representative of current operations have also been modelled, one using the average measured SOERs and the other using the maximum measured SOERs. The composting emissions are unchanged, however the active area, daily cover and intermediate cover sources have been moved to be located within the Stage 3 footprint, based on current aerial imagery. Leachate irrigation was not included in these scenarios. The emissions used in these modelling scenarios are shown in **Table 2**.

Table 1 Odour Emission Inventories – Proposed Extension

Source	Area (m^2)	Assumed SOER ($ou.m^3/m^2/s$)		Odour Emission Rate ($ou.m^3/s$)	
		Average	Maximum	Average	Maximum
LANDFILL					
Active waste disposal area *	100	1.97	3.65	197	365
Daily Cover *	200	1.78	2.16	356	432
Intermediate cover - remainder sub-cell 1	11,200	0.0841	0.0841	942	942
Intermediate cover - sub-cells 2-6	61,225	0.0841	0.0841	5,149	5,149
Leachate dam	6,500	0.15	0.19	975	1,235
Leachate irrigation area	14,000	0.15	0.19	2,100	2,660
			Total - Landfill	**9,719**	**10,783**
COMPOSTING					
Green waste stockpile #	53	4.0		212	
Screening #	-	-		4,960	
Transfer operations (FEL) #	20	8.0		160	
Unloading #	20	5.3		106	
Shredder #	-	-		5,740	
Static windrows	1,306	3		3,918	
Maturation windrows (with turning)	690	1.7		1,173	
Matured stockpile	790	0.6		474	
			Total - Composting	**16,743**	

* During the night-time (5pm – 8am) emissions from the active waste disposal area were reduced to reflect daily cover in this area

Day-time operations only

Table 2 Odour Emission Inventories – Current Operations

Source	Area (m^2)	Assumed SOER ($ou.m^3/m^2/s$)		Odour Emission Rate ($ou.m^3/s$)	
		Average	Maximum	Average	Maximum
LANDFILL					
Active waste disposal area *	100	1.97	3.65	197	365
Daily Cover *	200	1.78	2.16	356	432
Intermediate cover	25,200	0.0841	0.0841	2,119	2,119
Leachate dam	6,500	0.15	0.19	975	1,235
			Total - Landfill	**3,647**	**4,151**
COMPOSTING					
Green waste stockpile #	53	4.0		212	
Screening #	-	-		4,960	
Transfer operations (FEL) #	20	8.0		160	
Unloading #	20	5.3		106	
Shredder #	-	-		5,740	
Static windrows	1,306	3		3,918	
Maturation windrows (with turning)	690	1.7		1,173	
Matured stockpile	790	0.6		474	
			Total - Composting	**16,743**	

* During the night-time (5pm – 8am) emissions from the active waste disposal area were reduced to reflect daily cover in this area

Day-time operations only

2.3 Predicted Odour Impacts at R1 and C2 – Average and Maximum Emission Rates

Contour plots showing the 99th percentile odour concentrations predicted for each scenario are attached. The incremental odour impacts predicted at all discrete receptor locations included in the modelling are shown in **Table 3**.

As shown in **Table 3**, for the proposed operations, the odour criterion of 5 ou is not exceeded at either R1 or C2 when the emissions from the final capped areas in Stages 2 and 3 are excluded and the sub-cells 2-6 of Stage 4 are modelled with a revised SOER for intermediate cover areas consistent with the previous odour assessment performed for the site. The concentrations predicted are significantly lower than those presented in the AQIA and those presented in SLR's letter dated 16 October 2019. This is due to the reduction in the SOER used for the intermediate cover area.

The odour concentrations predicted for the proposed landfill extension scenario are higher than those predicted for current operations at all discrete receptor locations. As may be expected, the predicted increase in odour levels is most significant for Receptors C1 (now closed) and C2 as the landfill operations are moving closer to these receptors.

The absence of any significant odour complaints history for the current operations is consistent with the low odour concentrations predicted for the current emission scenarios. However, now that the conservative assumptions regarding odour emissions from intermediate cover areas have been revised, the results predicted for the closest receptor locations are lower than might be expected given the relatively small separation distances, and are much lower than the previous results presented in the AQIA. This is discussed further in **Section 2.5**.

Table 3 Odour Concentrations Predicted at R1 and C2

Receptor	Predicted Odour Concentration (ou, 99.9th percentile, nose-response time)			
	Average SOERs for Landfill Sources		Maximum SOERs for Landfill Sources	
	Current Operations	Proposed Operations	Current Operations	Proposed Operations
R1	0.4	1.1	0.5	1.1
R2	0.3	0.7	0.4	0.7
R3	0.4	0.6	0.4	0.6
R4	0.3	0.5	0.3	0.5
R5	0.2	0.4	0.2	0.4
R6	0.3	0.4	0.3	0.5
R7	0.3	0.4	0.3	0.5
R8	0.3	0.5	0.3	0.6
R9	0.5	0.7	0.5	0.7
C1	1.1	3.9	1.2	3.9
C2	0.8	3.9	0.9	3.9
C3	0.1	0.2	0.1	0.2
Criterion	**5.0**			

2.4 Time Series Analysis

While the revised modelling shows compliance at R1 and C2 for the proposed emission scenarios, plots are attached to provide information on the time of day that peak concentrations are predicted to occur at these receptors. These plots show that, as noted in the previous reports, peak concentrations are predicted during the late afternoon night-time.

2.5 Source Contribution Analysis

While the revised modelling shows compliance at R1 and C2 for the proposed emission scenarios, a source contribution analysis has been performed for the odour concentrations predicted at Receptors R1 and C2. The relative contributions of the main sources to the predicted odour concentrations for current and proposed operations (using maximum SOERs) are shown in the pie charts attached, with further detail provided in the bar chart below.

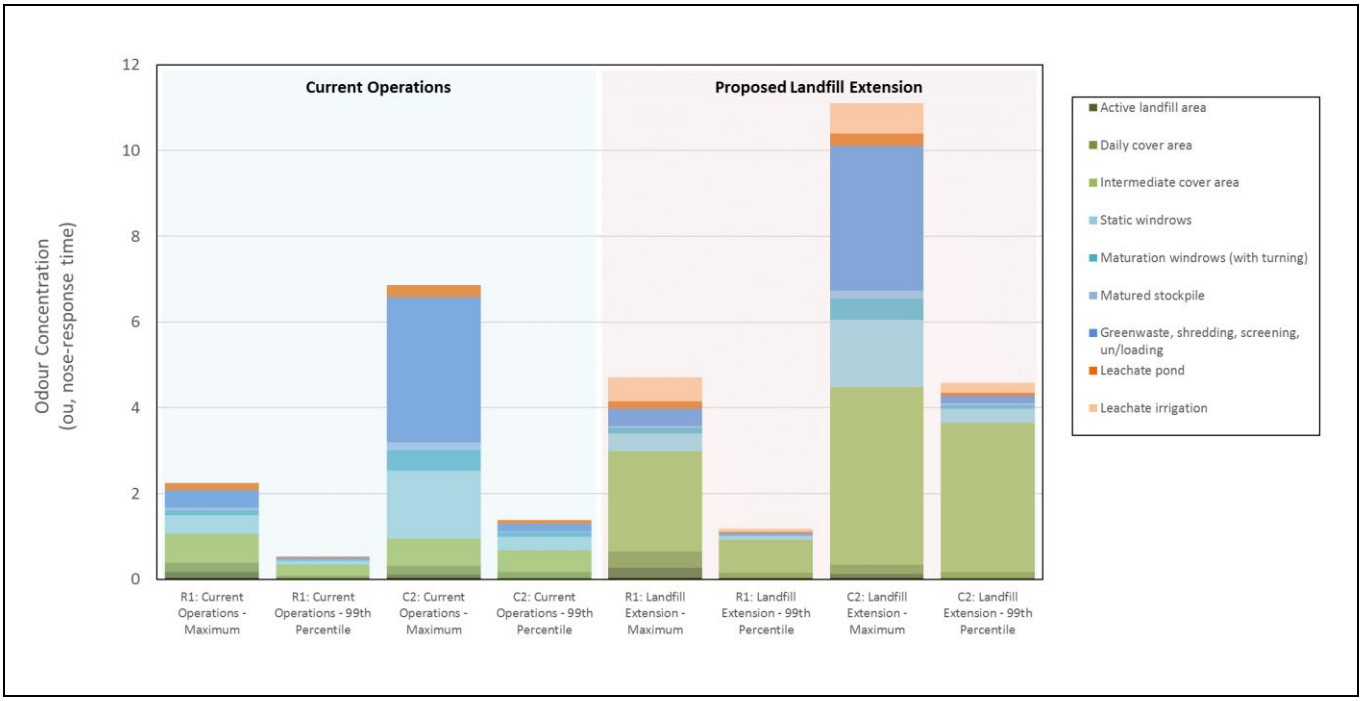
In reviewing this analysis, it is important to note that source contribution file exported from the CALPUFF model for a given receptor location lists the peak odour concentration predicted for each source on any hour of the year, not the concentration attributable to that source for the same hour that the cumulative peak odour concentration is predicted to occur. For example, for this analysis, the following source contribution files were extracted for R1 and C2:

- Rank 1 (maximum) source contribution file: lists the maximum 1-hour average (converted to nose-response time) odour concentration predicted on any hour of the year for each individual source at the specified receptor.
- Rank 88 (99th percentile) source contribution file: lists the 88th highest 1-hour average (converted to nose-response time) odour concentration predicted for each individual source at the specified receptor.

The individual source predictions contained in each file therefore do not sum to equal the cumulative maximum or 99th percentile odour predictions given by the model for each receptor because the individual predictions can occur on different hours. Instead, the total combined odour concentration given by summing the individual source predictions is higher than the cumulative impact predicted by the model as it is the sum of all the individual worst case impacts. Nonetheless, the total combined impacts shown in the bar chart in **Figure 1** are not radically higher[1] than the cumulative concentrations reported in **Table 3** and are therefore expected to provide a reasonable representation of the source contributions to the peak cumulative off-site predictions.

[1] The biggest differences occur in the combined maximum (Rank 1) predictions at R1 for the current operations scenario and at C2 for the proposed operations scenario which are just over double the cumulative predictions given by the model.

Figure 1 Contribution Analysis (Using Maximum SOERs)



A review of the pie charts and bar chart shows the following:

- As may be expected, the key contributors to the peak odour concentrations vary depending on:
  - Whether the analysis is performed for the 99th percentile or maximum predictions; and
  - The receptor location.
- For current operations, the maximum odour prediction at C2 is driven by the composting operations, while the intermediate cover area is also a significant contributor for the 99th percentile prediction at C2 and the maximum and 99th percentile odour concentrations predicted at R1.
- For the proposed landfill extension, the leachate irrigation activity is still predicted to be a relatively minor contributor to the maximum predicted off-site concentrations.
- For the proposed landfill extension scenario, the intermediate cover area is a major contributor to both the combined maximum and 99th percentile odour predictions at both R1 and C2. The area used in the modelling for intermediate cover is still very conservative as it includes sub-cells 2-6 as well as the remainder of sub-cell 1 (ie the area other than that allocated as the active face and the daily cover area).
- The shredding and screening operations are responsible for over 90% of the combined "greenwaste, shredding, screening, unloading" maximum odour concentrations predicted at C2 for both the current and proposed scenarios.
- The contribution from the active face and daily cover emissions to both the combined maximum and 99th percentile predictions at both R1 and C2 are negligible for both current and proposed operations. Even if the SOER for the active face was ten times higher than that assumed in the emission inventory calculations, it would have no material impact on the total odour impacts predicted for either scenario, particularly at the 99th percentile, because of the small areas involved.

As noted in **Section 2.3**, now that the conservative assumptions regarding odour emissions from intermediate cover areas have been revised, the 99th percentile results predicted for the closest receptor locations are much lower than the results presented in the AQIA. It is possible that the emissions are now slightly underpredicted, however as there have been no complaints recorded in relation to normal operation conditions (ie outside of isolated abnormal wet-weather operating conditions) it is equally possible that the results for the current operations scenario are a fair reflection of existing odour levels. As shown in **Figure 1**, while the 99th percentile predictions would be undetectable at R1 and C2, there are hours in the early evening, night time and early morning when odours may be detectable at C2, which is a reasonable expectation given its close proximity to the site.

2.6 Mitigation Measures

For the proposed landfill extension scenario, the 99th percentile odour concentrations are predicted to increase by a factor of 3 at R1 and by a factor of 4 at C2. This increase is associated with fugitive emissions from the intermediate cover area. For the current and proposed maximum odour concentrations predicted at C2, odours from the shredding and screening activities in the composting area are also a significant contributor. This would therefore suggest that should complaints be received from C2, the most appropriate mitigation measure would be to postpone shredding and screening activities until the recurrence of favourable meteorological conditions. Based on the modelling the most appropriate mitigation measure for R1 would be ensuring that the intermediate cover is placed and maintained to minimise odours from this source and that completed cells are covered with final cover as soon as practicable.

It is SLR's opinion however, that given the highly variable nature of fugitive odour emissions from landfill and composting operations, and the high level of uncertainty associated with the measurement and quantification of odours from landfills, the modelling results can only be used as an indicative tool in identifying potential key sources. The modelling shows that the key contributor to high odour levels varies significantly depending on the receptor location and the meteorological conditions. In addition, as shown by the complaints history, odour issues at the site are most likely to arise as a result of abnormal operating conditions. As per the AQIA and subsequent letter report, in the event of an odour complaint being received, the most important action is therefore for site staff to investigate operating conditions on site to identify whether the odours are originating from the Facility, and (where on-site sources are identified) take the targeted and appropriate actions to minimise/eliminate them.

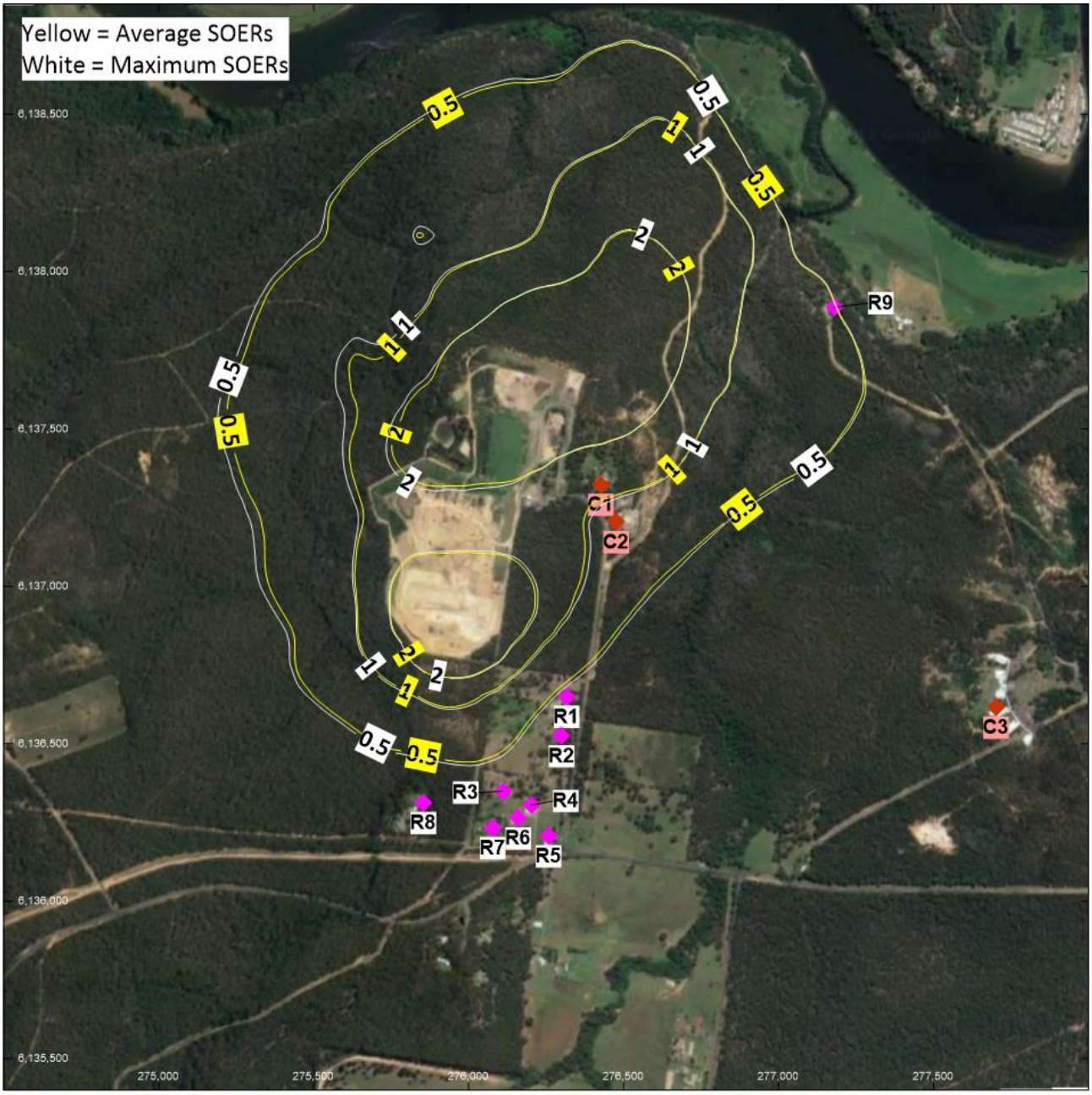
We trust the above information closes out the issues raised by TA-Air in relation to odour. Should you require any further information, please don't hesitate to contact the undersigned.

Yours sincerely

Technical Director - Air Quality

Checked/
Authorised by: FR/GS

Figure 2 Contour Plot of 99th Percentile Odour Concentrations – Current Operations



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Project Number:	610.15781
Dispersion Model:	CALPUFF
Modelling Period:	2014
Projection:	GDA 1994 MGA Zone 56
Date:	16/12/2019

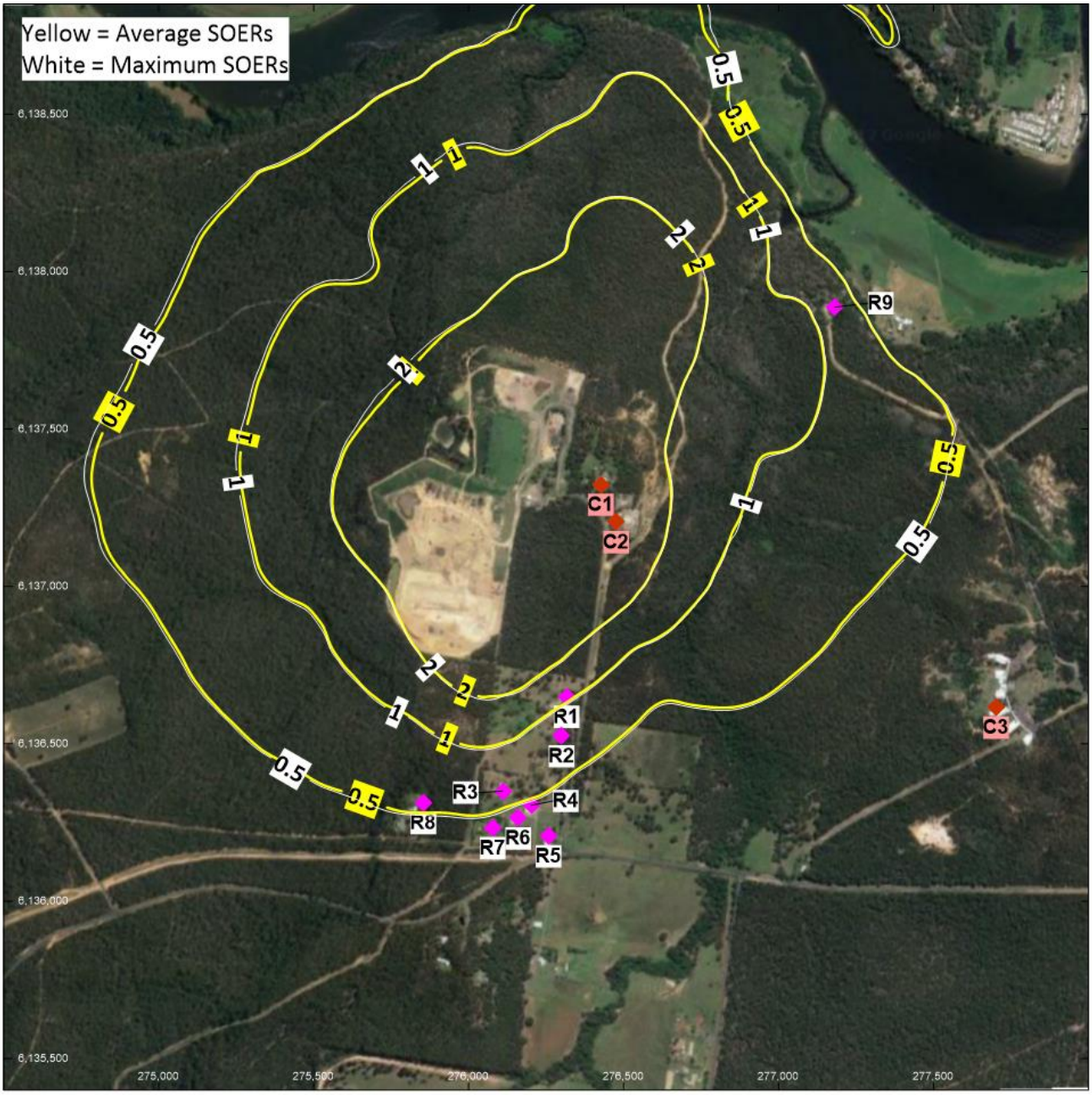
Shoalhaven City Council

West Nowra Recycling and Waste Facility Air Quality Impact Assessment

Incremental Impact - Current operation

Pollutant	Odour	Averaging Period	Nose Response	Unit	OU

Figure 3 Contour Plot of 99th Percentile Odour Concentrations – Proposed Landfill Extension



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West Nowra Recycling and Waste Facility
Air Quality Impact Assessment

Incremental Impact - Landfill Extension

Pollutant	Odour	Averaging Period	Nose Response	Unit	OU

Figure 4 Concentration versus Time of Day Plots – Receptor R1

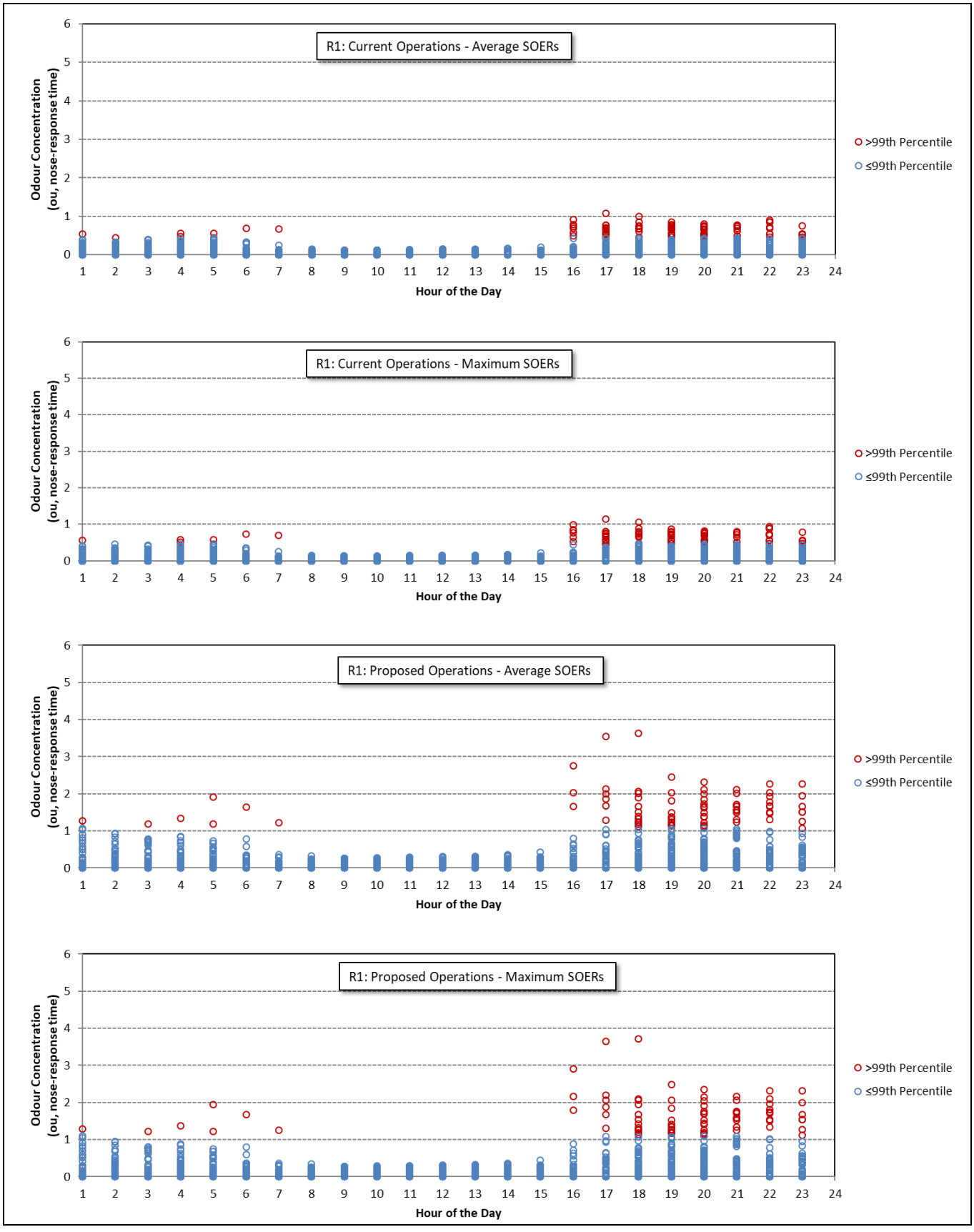


Figure 5 Concentration versus Time of Day Plots – Receptor C2

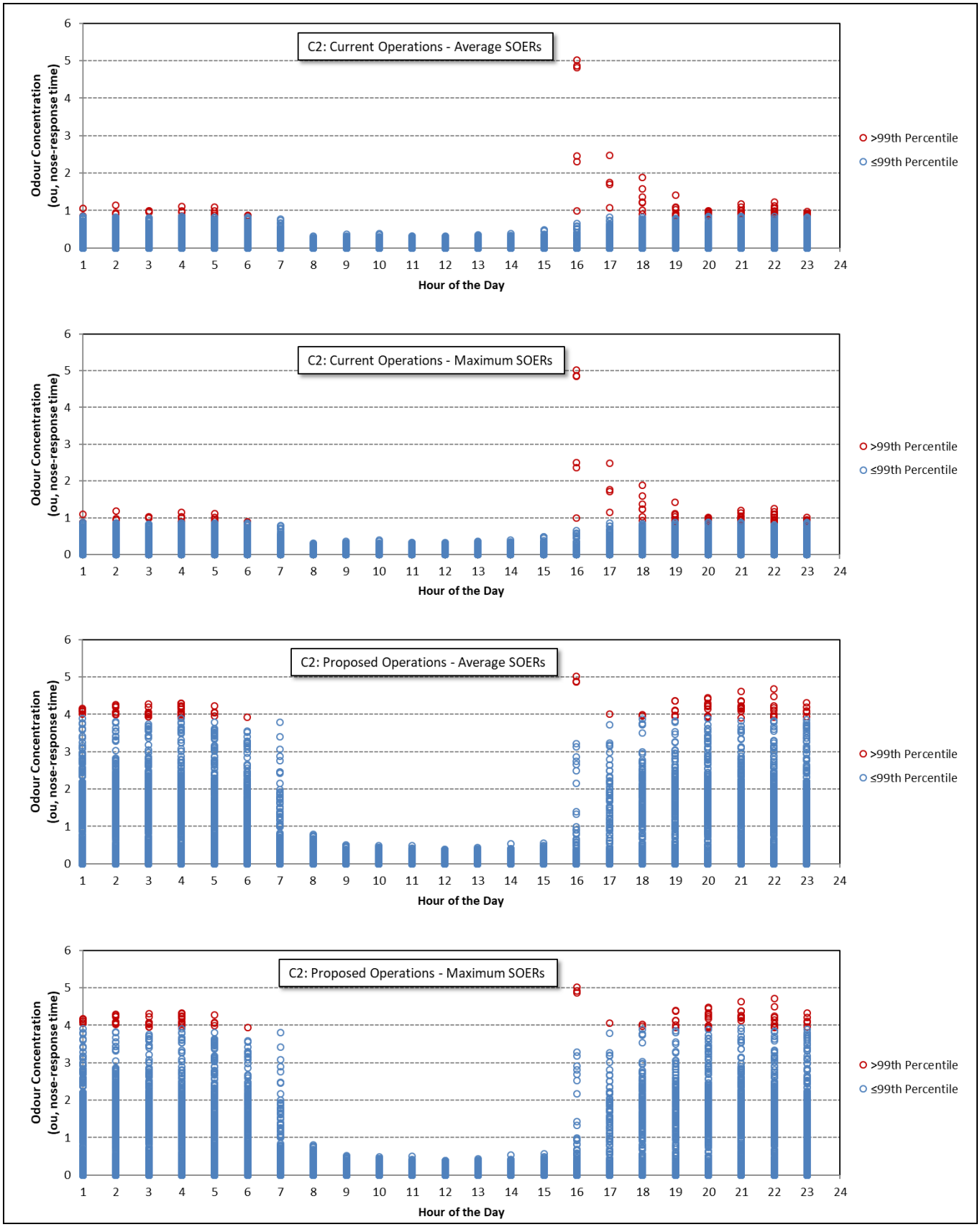


Figure 6 Source Contributions to Maximum and 99th Percentile Predictions at R1

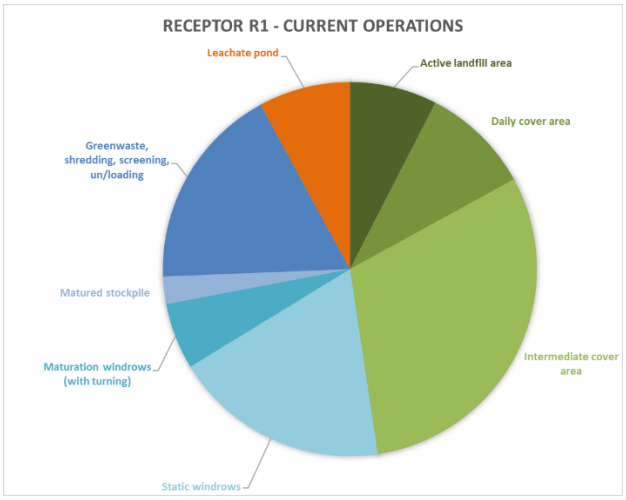
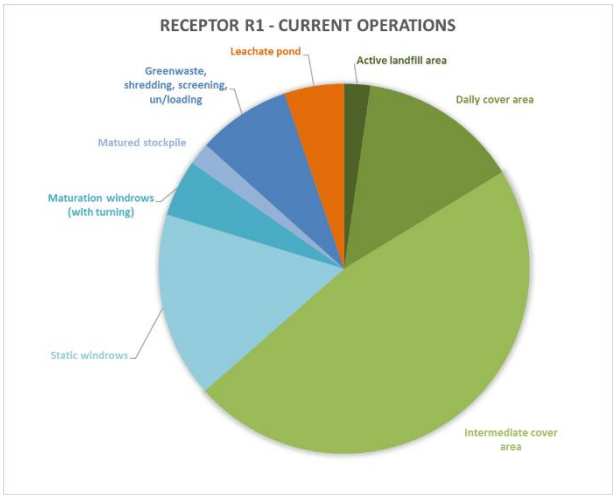
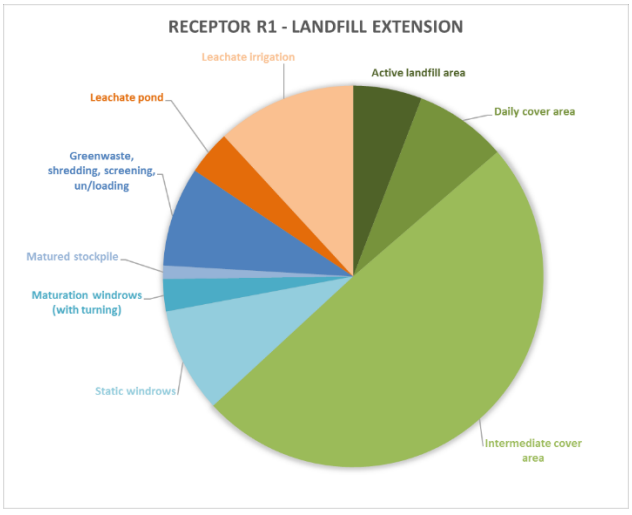
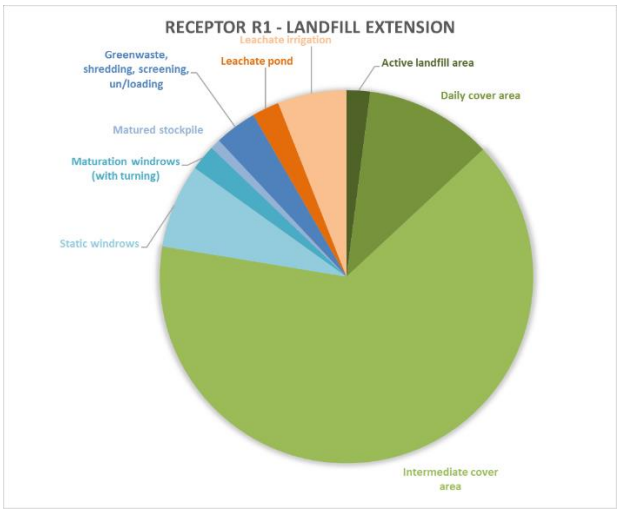
Maximum Prediction	99th Percentile Prediction
	
	

Figure 7 Source Contributions to Maximum and 99th Percentile Predictions at C2

Maximum Prediction	99th Percentile Prediction