

Selfs Point Sewage Treatment Plant

Odour Impact Assessment Report

PREPARED FOR TASWATER | MARCH 2024

We design with community in mind

Revision Schedule

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1.0 EXECUTIVE SUMMARY

This report has been prepared for the Tasmanian Water and Sewer Corporation (TasWater) to provide an Odour Impact Assessment for Selfs Point Sewage Treatment Plant (STP). Odour impact has been assessed using dispersion modelling investigating the potential odour impact of the upgraded works at the site boundary and at local sensitive receptors (mainly at the residential properties along Risdon Road and Queens Walk located west and south of the STP, respectively) as well as the nearby cultural sensitive receptors such as the rugby club and sports field, bridge club and rowing club to determine expected residual odour impacts.

This assessment uses odour emission rates from the Sydney Water database and historical site-specific odour emission data from the Selfs Point STP odour sampling conducted by Environ Odour Australia Pty Ltd in February 2016 along with impacts from changes to the process, most notably by increasing the solids retention time from 15 days to 20 days¹. Where there have been process units that were not sampled, odour emission rates have been obtained from Stantec's global emission and contaminant load database with the most representative data adopted.

The odour impact has been assessed on a quantitative basis using the CALPUFF atmospheric dispersion model (Version 7.2.1, Level 150618 - the latest version of the model). The model was set up in accordance with the following documents:

- Atmospheric Dispersion Modelling Guidelines V1.0, EPA Tasmania, October 2020
- Environment Protection Policy (Air Quality) 2004 (Air Quality EPP), Environment Division, Department of Tourism, Arts and the Environment, Tasmania;
- Environmental Protection Authority (EPA) Board Statement: Update to Air Pollutant Design Criteria used in the Environmental Impact Assessment (EIA) Process, EPA, Tasmania;
- Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the Approved Methods for Modelling and Assessment of Air Pollutants in NSW, Australia. Prepared for NSW Office of Environment and Heritage (OEH), Sydney Australia. Barclay, J.J and Scire, J.S., Atmospheric Studies Group, TRC, 2011.

The predicted ground-level odour concentrations from this dispersion modelling study were compared against the odour impact assessment criteria in Table 1-1.

Table 1-1: Odour Impact Assessment Criteria used in this Study

Regulatory Authority	Reference Document	Dispersion Model Averaging Period and Percentile Value	Impact Assessment Criterion
The Air Quality EPP 2004	The Air Quality EPP, 2004	1-hour average, 99.5 th percentile concentrations	2.0 odour units (ou) assessed at the boundary of the facility

For the purpose of this assessment, the odour impact has been assessed against the Air Quality EPP 99.5th percentile 2.0 ou boundary criterion. The following scenarios for Selfs Point STP were considered:

Scenario 1: Expanded site with Sydney Water database odour emission rates

Scenario 2: Expanded site with odour emission data measured from site²

¹ This will likely have the effect of reducing the measured specific odour emission rates by 25%.

² With relevant locations reduced by 25% (i.e. emission rates of secondary anoxic and aerobic zones, oxidation ditches and MBR are 75% of the respective emission rates taken from the historical measured data)

Scenario 3: Expanded site with odour emission data measured from site but with enhanced odour capture and treatment

The Sydney Water odour emission database is comprised of more than ninety samples of anoxic and aerobic zones, with those emission rates representative of the proposed plant process units adopted. The single sample from the aerobic and anoxic zones of the existing plant have been modelled within Scenario 2. More details are provided in Section 6.5.3.

The predicted 99.5%ile 1-hourly average ground level odour concentrations for odour are shown in Figure 1-1, Figure 1-2 and Figure 1-3 as isopleth contour plots (lines of equal odour concentration) for the modelled scenarios. These figures highlight the potential off-site odour impact. The maximum odour concentration as predicted at the plant boundary is shown in Table 1-2.

The goal of the dispersion modelling exercise with respect to odour impacts beyond the site boundary was to assess the site's odour footprint when expansion works have occurred. Scenario 1 has been developed to identify the odour impact from the expanded plant using specific odour emission rates from the Sydney Water Best Practice odour database. These specific odour emission rates allow for operations which do not include pre-fermenters. The results from this scenario shows compliance with the 2 ou boundary criterion in all directions. All sensitive receptors modelled have predicted impact below 1 ou.

The upgraded plant modelled in Scenario 2, which is based on on-site measurements that are impacted by the pre-fermenters, exceeds the Air Quality EPP 2004 boundary criterion of 2.0 ou in the southern, south western and south eastern areas. Some of the nearest residential sensitive receptors (to the west of the site), and cultural receptors, the rowing club and the cat centre have predicted impact above 1.0 ou yet below 2 ou. The highest odour concentration at a sensitive receptor is predicted at the Sports field (# 1) of 2.6 ou which is 25m from the southern boundary of the plant. The bridge club house (#4) and the Rugby club house (#5) also predict values greater than 2 ou of 2.3 and 2.2 ou, respectively. The rowing club (#2) and the 10 Lives cat centre (#3) predict 1.5 and 1.9 ou, respectively. All other sensitive receptors are predicted to be less than 2 ou.

Whilst Scenario 2 was based on site measured data, this is likely influenced by the use of pre-fermenters which are known to cause increase in specific odour emissions for downstream wastewater treatment process units.

If, after commissioning and re-measurement of odour emission rates, it is determined that the measurements are similar to those in 2016 (i.e. no change from the removal of the pre-fermenters and that data from the Sydney Water odour emission database is not representative), a further option is to cover, extract and treat foul air from the most odorous uncovered sources being the anoxic zones. Scenario 3 was based on Scenario 2, but with an enhanced level of odour control with the anoxic zones covered and a greater odour control unit on site to treat more extracted foul air. The results from this scenario shows compliance with the 2 ou boundary criterion. All sensitive receptors are below 1 ou.

Table 1-2: Maximum Predicted Odour Concentration at the Plant Boundary for Scenarios 1, 2 and 3

Scenario	Description	Highest ou concentration at the plant boundary	X Coordinate (km)	Y Coordinate (km)	Location of maximum boundary concentration
Scenario 1	Sydney Water Emission rates	0.95	525.928	5255.872	southwest boundary
Scenario 2	Measured emission rates influenced by pre-fermenters	3.55	525.928	5255.872	southwest boundary
Scenario 3	Enhanced odour capture	1.77	525.927	5255.873	southwest boundary

TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

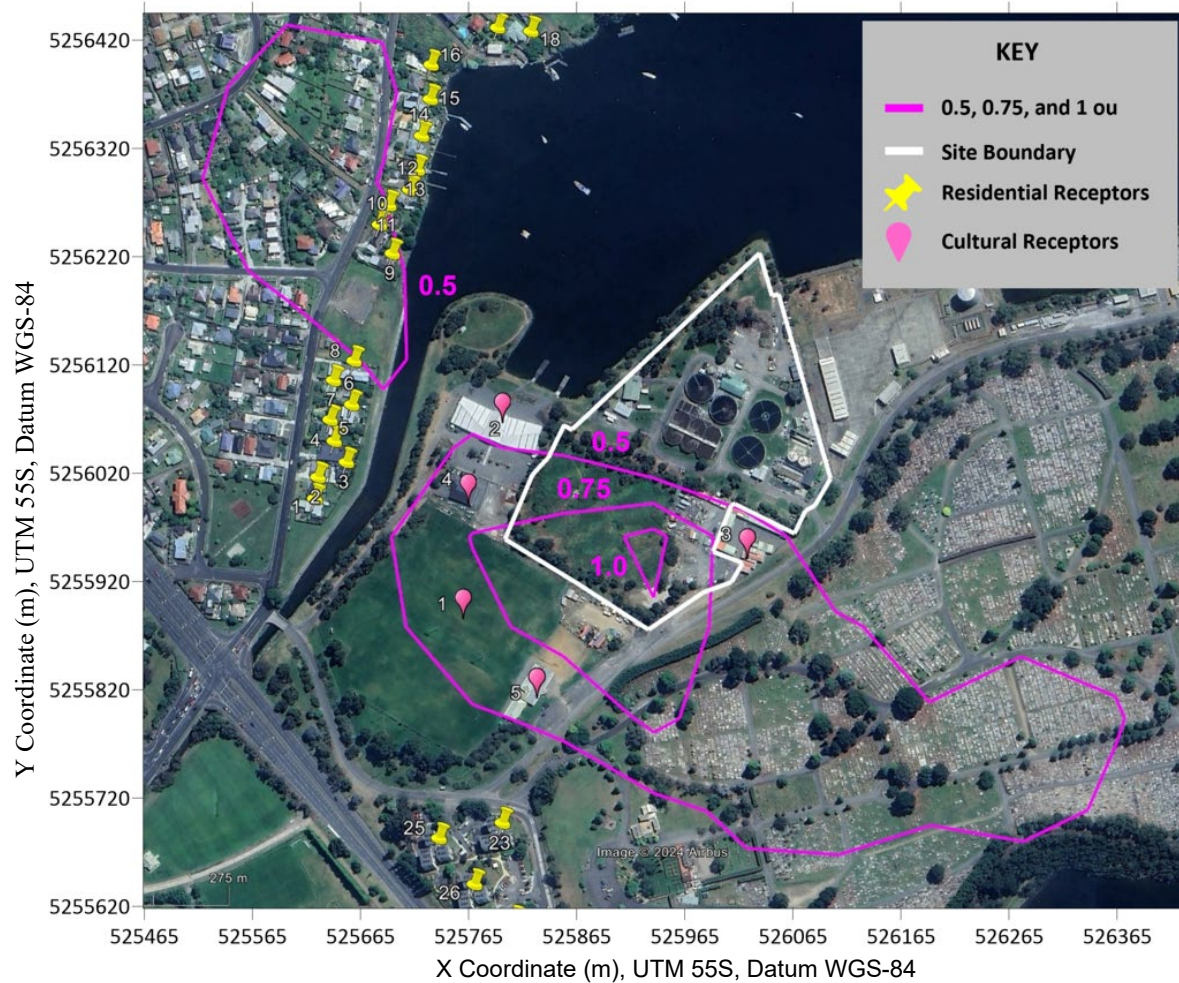


Figure 1-1 Overlay Plot of 0.5, 0.75 and 1 ou for 99.5%ile 1-hour Average Odour Concentration for Scenario 1. No odour isopleths can be seen at the 1 ou and 2 ou isopleths.

TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

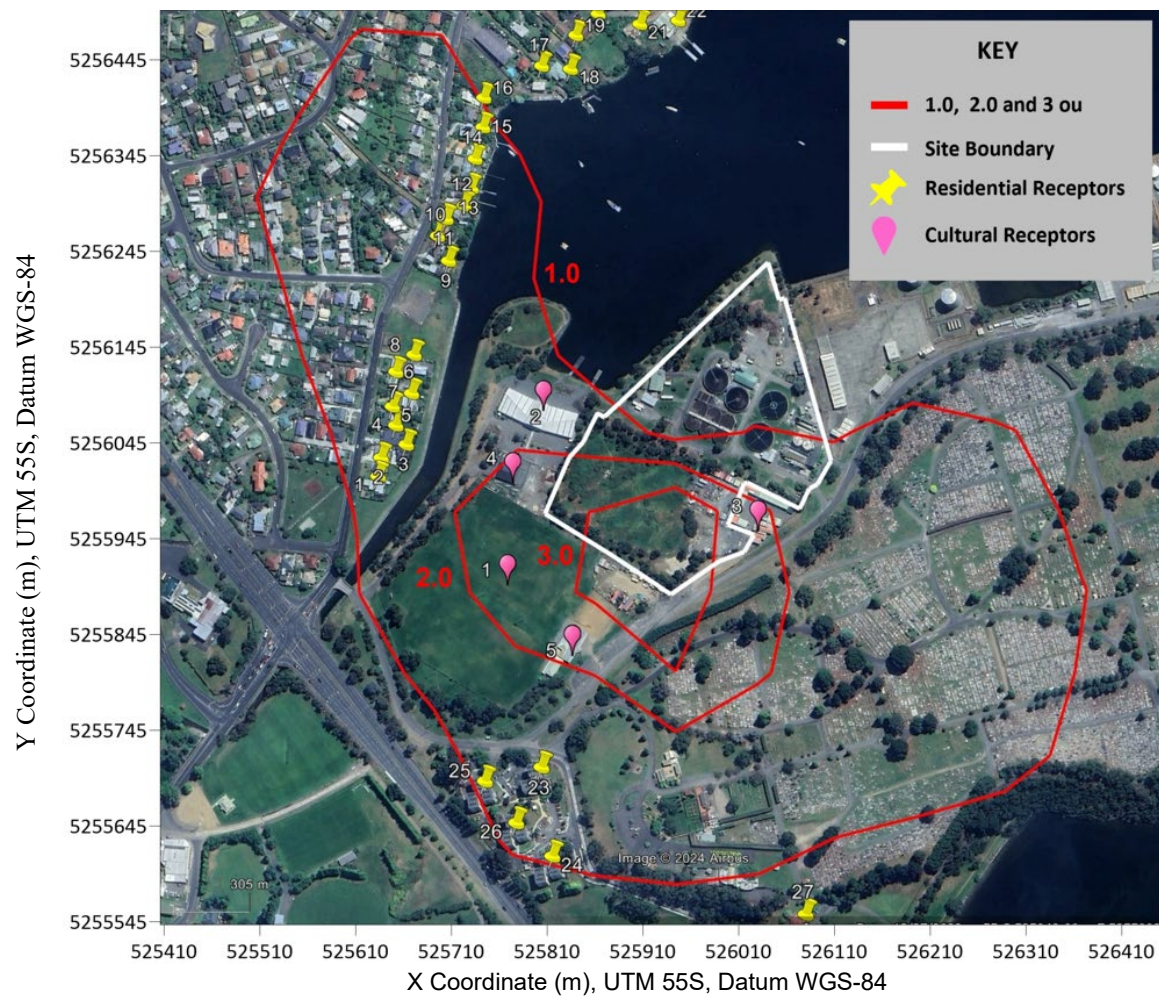


Figure 1-2 Overlay Plot of 1.0 ou, 2.0 ou and 3.0 for 99.5%ile 1-hour Average Odour Concentration for Scenario 2

TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

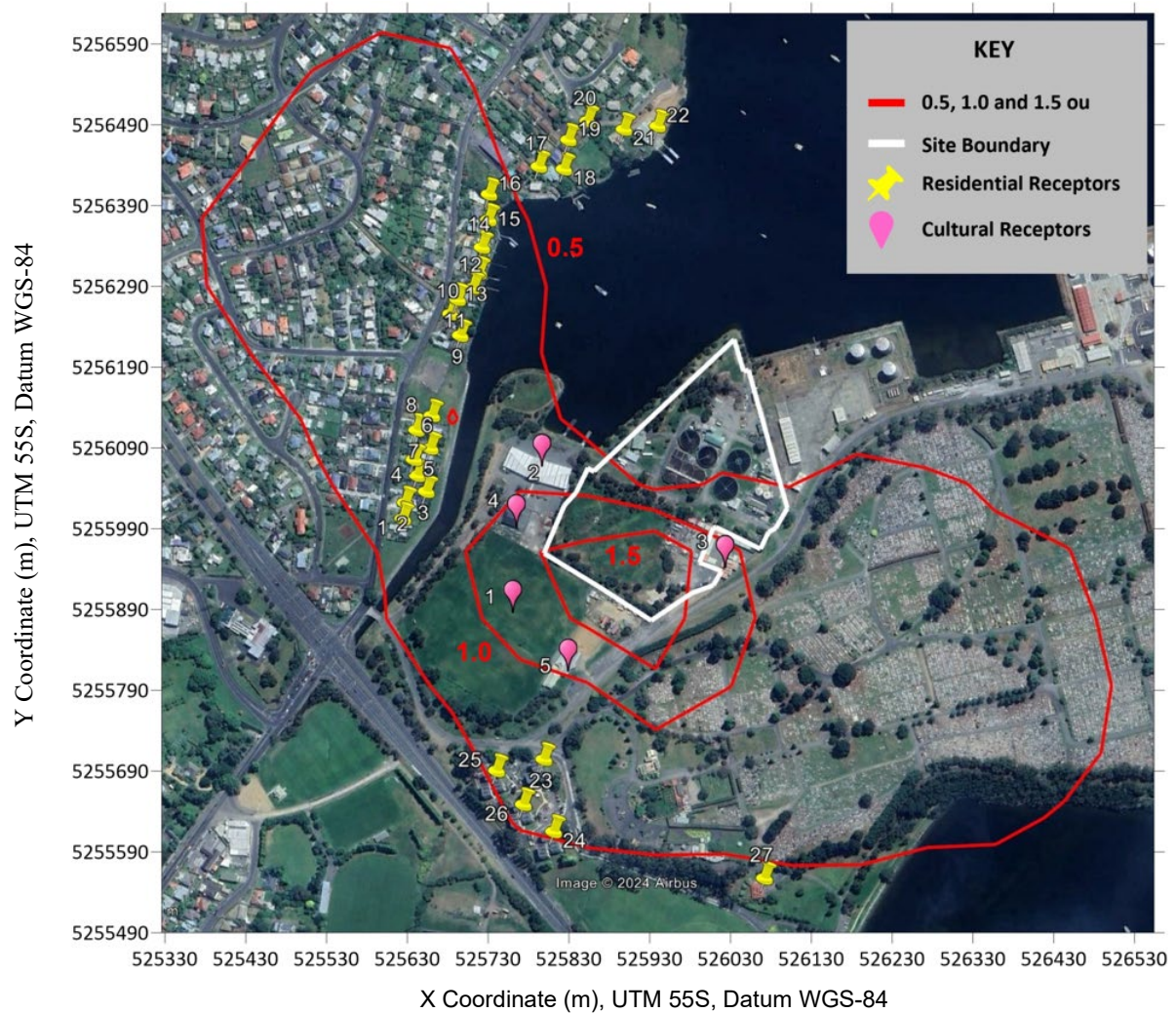


Figure 1-3: Overlay Plot of 0.5 ou, 1.0 and 1.5 ou for 99.5%ile 1-hour Average Odour Concentration for Scenario 3

In addition to the expanded site, seven upset scenarios were modelled, as follows:

- Upset Scenario 1:** Aeration goes offline
- Upset Scenario 2:** OCU Extraction stops
- Upset Scenario 3:** Solids retention time drops from 20 days to 15 days
- Upset Scenario 4:** Pressure relief valve on both digesters open
- Upset Scenario 5:** Activated carbon filter change over
- Upset Scenario 6:** Digester system failure
- Upset Scenario 7:** Higher emissions from tanker waste deliveries

All of the upset scenarios have been modelled conservatively. First, they have been modelled as if the upset condition was occurring for every hour of the entire year. This was done to ensure the worst meteorological conditions throughout the year have been captured. In reality, these upset conditions are likely to be infrequent

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and occur for short durations of time. In addition, all the upset scenarios have been based off the higher SOERs modelled within Scenario 2 (expanded plant using odour emission data measured from site³).

Table 1-2 below provides details on what changes have been modelled, the safeguards in place and how frequently each upset scenario is expected to occur.

Table 1-3: Upset Scenarios Summary

Upset Scenario	Description of Upset	Changes to Model	Existing Safeguards	Expected Frequency and Duration of Occurrence
1	Aeration goes offline for up to 4 hours leading to aerobic zones becoming more anoxic	Aerobic zone odour emission rates increase by approximately 10%	Standby redundancy in blowers Blowers on separate supply lines to ensure redundancy is only minimally affected by power outages	Once every two years for up to four hours
2	Extraction stops leading to capture of foul air to drop such that capture is only from the impact of covering	Capture efficiency drops from 99% to 60% in covered units	Standby redundancy in foul air fans	Once every two years for up to four hours
3	Solids retention time reduces from 20 days to 15 days leading to an increase in odour emissions from biological processes	Odour emission increases by approximately 33% from biological processes	Large bioreactor volumes Standby redundancy in wasting pumps Automated wasting systems to maintain a solids retention time	Once every five years for up to four weeks
4	Pressure relief valves on both digesters open leading to odorous biogas release	2,000 m ³ /h of 16,800 ou foul air discharged from each digester	Biogas sent to cogeneration facility Flare in case cogeneration facility goes offline or if digesters become over pressurised	Once every 10 years for up to four hours
5	Activated carbon filter on odour control unit is changed, leading to	Odour concentration in treated air from OCU increases	Sufficient activated carbon to last for >12 months	Once every year for up to five days

³ With relevant locations reduced by 25% (i.e. emission rates of secondary anoxic and aerobic zones, oxidation ditches and MBR are 75% of the respective emission rates taken from the historical measured data)

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Upset Scenario	Description of Upset	Changes to Model	Existing Safeguards	Expected Frequency and Duration of Occurrence
	discharge of air that has only been biologically treated	from 500 ou to 2,000 ou		
6	Digester system fails leading to sludge processes emitting higher odour	Sludge processes emit odour at five times their regular emission rate	Robust monitoring and control of digestion processes	Once every five years for up to four weeks
7	Containment on the tankered waste storage systems fails leading to higher odour from these areas	Capture from the tankered waste storage tanks reduces from 99% to 60%	Standby redundancy in foul air fans and cam-lock connections to prevent spills outside of contained system	Once every two years for up to four hours

Upset scenario 4 (pressure relieve valves opening) is predicted to have the largest impact on the residential receptors to the west of the site with the 2ou contour encompassing some 50 residences. It should be noted that there are multiple safeguards in place to prevent this from occurring and, if it does occur, it would need to coincide with unfavourable meteorological conditions in order to affect so many residences.

Upset scenario 2, where foul air extraction stops, has an increased offsite odour emission. This increased impact predominantly affects the southeast, south and southwestern side of the site with the 2 ou contour extending approximately 228m to the southeast, 218m to the south, and 169m to the southwest of the plant boundary. There is some impingement of the 2 ou curve over receptor number R8 to the west of the site.

Upset scenario 3, where the solids retention time drops from 20 days to 15 days, the 2 ou contour extends 164m to the southeast, 162m to the south and 145m to the southwest of the plant boundary. No sensitive receptors are exposed to odour concentration greater than 2 ou.

All other upset scenarios (1, 5, 6 and 7) resulted in negligible changes to the predicted odour impact offsite and were similar to that of Scenario 1, where the 2 ou contour extends 125m to the southeast, 135m to the south and 115m to the southwest of the plant boundary.

All the upset scenarios were modelled assuming they could occur at any time of the year and are therefore conservative as constant emissions have been assumed for all meteorological conditions for all hours of the year. In reality, upset scenario 2 is expected to occur once every 2 years for up to 4 hours, upset scenario 3 is expected to occur once every 5 years for up to four weeks, and upset scenario 4 which produced the biggest odour footprint is expected to occur once every ten years for up to four hours.

These results suggest that the site is unlikely to generate an odour impact under most upset conditions modelled, however if the pressure relief valves open (after all other safeguards fail) there may be some odour affecting residences to the west of the site.

2.0 INTRODUCTION

2.1 BACKGROUND

Hobart City Council has three sewage catchment areas and two wastewater treatment plants, one at Selfs Point and one at Macquarie Point, which treat the central Hobart catchment suburbs including Lenah Valley, New Town, Mount Stuart, Sandy Bay, Dynnyme, Tolmans Hill, Mount Nelson and Taroona. Wastewater from the northern catchment has been treated at Selfs Point since 1974. In 1997, the Selfs Point Plant was upgraded to biological nutrient removal standard and effluent from the southern catchment has been pumped to the plant for treatment since that date with all dry weather flows being pumped to Blinking Billy Point.

TasWater has engaged Stantec to conduct an odour impact assessment of the Selfs Point STP. The odour impact assessment has been conducted to investigate the potential odour impact of the upgraded works at local sensitive receptors (mainly at the residential properties along Risdon Road located west of the STP and cultural sensitive receptors directly adjacent to the plant). The upgrade includes for the decommissioning of most of the processes on site, and the development of a new oxidation ditch/carousel type biological process. This assessment uses emission rates from the Sydney Water database and site-specific odour emission data from the Selfs Point STP odour sampling conducted by Environ Odour Australia Pty. Ltd. in February 2016, taking into account changes due to the upgrade. Where there have been process units that were not sampled, odour emission rates have been obtained from Stantec's global emission and contaminant load database with the most representative data adopted.

The first scenario was developed investigating the odour impact of the expanded site based on the Sydney Water odour emission database. This scenario was considered the base case and has been labelled Scenario 1.

The second scenario uses a set of conservative SOERs based on historical site-specific measured odour emission data which rely on pre-fermenters that will not be in the new upgrade.

The Selfs Point STP site currently uses pre-fermenters. The pre-fermenters break down long chained carbohydrates into volatile fatty acids (VFAs) which make the biological treatment processes more efficient. A side effect of this pre-fermentation is that all downstream biological process units tend to have a much higher odour emission rate than normal. As the new upgrade does not use pre-fermentation, an odour impact scenario, Scenario 1, was conducted assuming the plant had similar specific odour emission rates as per the Sydney Water odour database. Therefore, the use of these specific odour emission rates from the Sydney Water database allows for operations which do not include pre-fermenters. Whereas in Scenario 2, the use of the conservative SOERs may not be appropriate due to the use of pre-fermenters which are known to cause increase in specific odour emissions for downstream wastewater treatment process units.

A third scenario, Scenario 3, was developed investigating the odour impact attributed to the site if an enhanced cover and treatment plan occurred. This included for covering the anoxic zones (from both the individual oxidation ditch/carousels and from the common secondary anoxic zone), extracting foul air and treatment in the site odour control unit (OCU).

These scenarios are summarised below:

Scenario 1: Expanded site with Sydney Water database odour emission rates

Scenario 2: Expanded site with odour emission data measured from site

Scenario 3: Expanded site with odour emission data measured from site but with enhanced odour capture and treatment

More details on the odour emission rates for each scenario are provided in Section 6.5.3.

In addition to investigating the potential odour impact of the upgraded works, TasWater has requested that Stantec consider seven upset scenarios as follows. Note that all these upset scenarios were based off the higher SOERs modelled within Scenario 2 (expanded plant using odour emission data measured from site), in order to ensure conservatism.

- Upset Scenario 1** – Aeration goes offline. This assumes aeration goes offline for a period of up to 4 hours. The impact is that aerobic zones become more anoxic (though not fully anoxic) and specific odour emission rates from aerobic zones increase by approximately 10%.
- Upset Scenario 2** – OCU extraction stops. This assumes that the odour control unit fans both go offline and foul air extraction ceases. This reduces capture efficiency from covered process units from 99% to 60% (i.e. capture is relying purely on covers and not from extraction).
- Upset Scenario 3** – Solids retention time drops from 20 days to 15 days. This assumes that wasting from the biological processes increases dramatically, leading to a shorter sludge age. In turn, this would increase odour emission rates from biological processes by approximately 33%.
- Upset Scenario 4** – Pressure relief valve on both digesters open. This assumes that, despite all safeguards in place, digester gas is released into the environment from both digesters simultaneously. Each pressure relief valve would have a flow of approximately 2,000 m³/h with an odour content of 18,600 ou.
- Upset Scenario 5** – Activated carbon filter change over. Under this scenario the activated carbon from the OCU is depleted resulting in an odour emission rate of 2,000 ou instead of the usual 500 ou.
- Upset Scenario 6** – Digester system failure. In the event that the digester fails it is expected that the dewatering processes start emitting at 5 times their regular emission rates.
- Upset Scenario 7** – Higher emissions from tanker waste deliveries. This assumes that the foul air extraction ceases from the tankered waste deliveries causing capture to drop from 99% down to 60%.

2.2 SCOPE OF WORK

The objectives of this odour study were to:

- Review the data and information relating to the existing site configuration and the revised expansion at Selfs Points STP, including the site layout and processes, potential odour sources, odour complaint data and the location of off-site sensitive receptors;
- Prepare a site-wide odour emissions inventory for Selfs Point STP including odour emission rates for each potential odour source using the Sydney Water odour emission database and historical site-specific odour sampling data (Olfactometry) for inclusion in the dispersion model, and justify the use of Stantec's Global Database to supplement these results if necessary;
- Consider revised odour emission scenarios for three operating scenarios namely:
 - Expanded site with Sydney Water database odour emission rates
 - Expanded site with odour emission data measured from site
 - Expanded site with odour emission data measured from site but with enhanced odour capture and treatment
- Consider a new revised odour emission scenario (Scenario 2) for seven possible upset events namely:
 - Aeration going offline
 - Extraction ceasing
 - Solids retention time reducing
 - Digester pressure relief valves opening
 - Activated carbon changeout
 - A failure of the digester systems, and
 - Reduction in extraction from tankered waste deliveries.

- Prepare a 3-Dimensional CALMET meteorological data file based on observations for inclusion in the CALPUFF dispersion model;
- Develop and run the CALPUFF dispersion model, incorporating a 3-Dimensional CALMET meteorological data file, fine-scale terrain and land use data, and odour emission source inputs to simulate odour dispersion conditions at Selfs Point STP in order to predict the odour impact;
- Assess the potential odour impact using contour plots showing the 99.5th percentile odour levels, and identify whether the modelling results satisfy the requirements specified in the Air Quality EPP, 2004.
- Produce an odour impact assessment report (this document) for TasWater outlining the odour dispersion modelling methodology, model inputs and assumptions, and modelling results in the form of isopleth contour plots showing odour concentration at modelled sensitive receptor locations.

The dispersion modelling predictions were assessed against the Air Quality EPP odour impact criteria to determine whether site-wide regulatory compliance was achieved. The 99.5th percentile modelling predictions were reported against the impact assessment criterion of 2 odour units (ou) at the boundary of the plant.

The CALPUFF dispersion modelling and reporting was carried out in accordance with the following documents:

- Atmospheric Dispersion Modelling Guidelines V1.0, EPA Tasmania, October 2020
- Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the Approved Methods for Modelling and Assessment of Air Pollutants in NSW, Australia. Prepared for NSW Office of Environment and Heritage (OEH), Sydney Australia. Barclay, J.J and Scire, J.S., Atmospheric Studies Group, TRC, 2011

[It should be noted that whilst this is an NSW document, it is referred to by many other EPAs across Australia.]

2.3 COMMENTS ON ODOUR DESIGN REQUIREMENTS AND INTERPRETATION OF DISPERSION MODELLING RESULTS

In the Section, *Principles applied to the Environmental Impact Assessment Process* within the 2022 Tasmania EPA Board Statement⁴, when a scheduled activity is submitted to the EPA Board for an EIA under the Environmental Management and Pollution Control Act (EMPC Act), the EPA Board is guided by the principles and provisions of the 2004 Air Quality EPP⁵ in assessing the risk of environmental harm or nuisance from air pollutant emissions emanating from the activity.

If the emission of air pollutants is likely to cause environmental harm or nuisance, the EPA Board requires the proponent to undertake atmospheric dispersion modelling to determine the likely ground level concentrations, or design criteria, that should not be exceeded for an unknown mixture of air pollutants causing odour.

The EPA Board Statement has a process of consideration for the risk of environmental harm or nuisance. The required process for a proponent to follow is based on the principles of the Air Quality EPP. These are:

1. The application of Best Practice Environmental Management and Accepted Modern Technology to avoid or minimise air pollutant emissions from the facility.
2. Design of the facility with appropriate management and control systems of air pollutant emissions so as to demonstrate that the activity will not compromise the environmental values of the Air Quality EPP (provided in Clause 6 of the Air Quality EPP) and will not pose a risk of environmental harm or nuisance to surrounding receptors.
3. Calculation of potential impact of air pollutant emissions from the activity based on air dispersion modelling, using methodologies approved by the Director, EPA.
4. The application of the most appropriate air pollutant management options and monitoring systems to address the potential emissions to air and minimise the environmental risk posed by them.

⁴ [Air Pollutant Design Criteria - EPA Board Statement](#)

⁵ [ENVIRONMENT PROTECTION POLICY \(AIR QUALITY\) \(epa.tas.gov.au\)](#)

5. Commitment to build the equipment and infrastructure and operate the activity as approved in the EIA process to ensure the air pollutant emissions will not pose a risk of environmental harm or nuisance.

Refer to Section 4.0 of this report for more discussion.

3.0 STUDY AREA

3.1 LOCATION AND SURROUNDING LAND USE

The Selfs Point STP is located at 12 Selfs Point Road on the southern shore of New Town Bay. The STP expansion will occupy land to the south of the existing plant at 10 Selfs Point Road with some process units retained within the existing plant.

The plant is bounded by land zoned Port and Marine, cemetery and industrial properties to the east, Recreation to the west and Community Purpose to the south. Residential premises are located to the north and west across New Town Bay and New Town Rivulet and to the south-west at the Queens Walk Apartments. The residences on Risdon Road located approximately 150 m from the west boundary of the works are considered to be the nearest sensitive receptors. The New Town Bay Rowing Centre, the Buckingham Rowing Club, the Hobart Cat Centre and the Tasmanian Bridge Association are the sites nearest commercial properties. Figure 3-1 shows the location of the STP and its surrounding areas, including the proposed site boundary outlined in red.



Figure 3-1: Aerial Photograph of Selfs Point STP and Surrounds

3.2 PROCESS DESCRIPTION

The Selfs Point STP consists of a preliminary treatment including screening and grit removal followed by primary treatment in primary setting tanks. The primary effluent is then treated in a hybrid biological stage combining trickling filters and Biotenpho nutrient removal technology in a triple-ditch configuration. Approximately 40-45%

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of effluent is sent to two trickling filters, and the remainder is pumped to the anaerobic zone of the Biotenpho process.

Following treatment in the trickling filters, effluent is pumped to the Biotenpho bioreactors, downstream of the anaerobic zone. Biotenpho effluent is then transferred to two secondary clarifiers. Following secondary clarification, the secondary effluent is disinfected using ultraviolet light and chlorine gas. Some percentage of the primary sludge (~25%) is pumped to the anaerobic digesters prior to dewatering, whilst the remainder is pumped to the pre-fermenter. From the pre-fermenter, sludge is pumped to the anaerobic zone of a Biotenpho process. Waste activated sludge is stabilised with lime after dewatering. The majority of the sludge is dewatered using a centrifuge prior to being beneficially used for agricultural purposes.

The STP would expand into land to the south of the existing plant at 10 Selfs Point Road with most existing process units being decommissioned, within the existing plant boundary. Figure 3-2 presents a site plan of the proposed STP expansion including both retained and new processes units.

The new process will include a new inlet works with associated pumping stations. Flow will then pass into the new primary settling tanks for primary treatment. Primary effluent will then flow to the secondary treatment process which will consist of two oxidation ditch/carousels with a combined secondary aerobic and secondary anoxic zone. Each oxidation ditch/carousel will include an aerobic portion, a deaeration portion, an anoxic portion, and a swing zone that can either be used with aeration or without aeration depending on the needs of the plant. Secondary treated effluent is then separated from mixed liquor through the membrane bioreactors, which are an aerated process. Primary sludge from the primary settling tanks and waste activated sludge from the oxidation ditches/carousels will be sent to the dewatering plant for thickening and digestion. Digested sludge will be dewatered and held in enclosed sludge outloading bins. Thickening and dewatering processes will be held within the dewatering building. A cogeneration unit will burn digester gas to create electricity and heat for use on site. In the event that the cogeneration facility goes offline, a flare will burn digester gas. A tankered waste receive facility will allow tankered waste to be discharged directly to the anaerobic digesters.

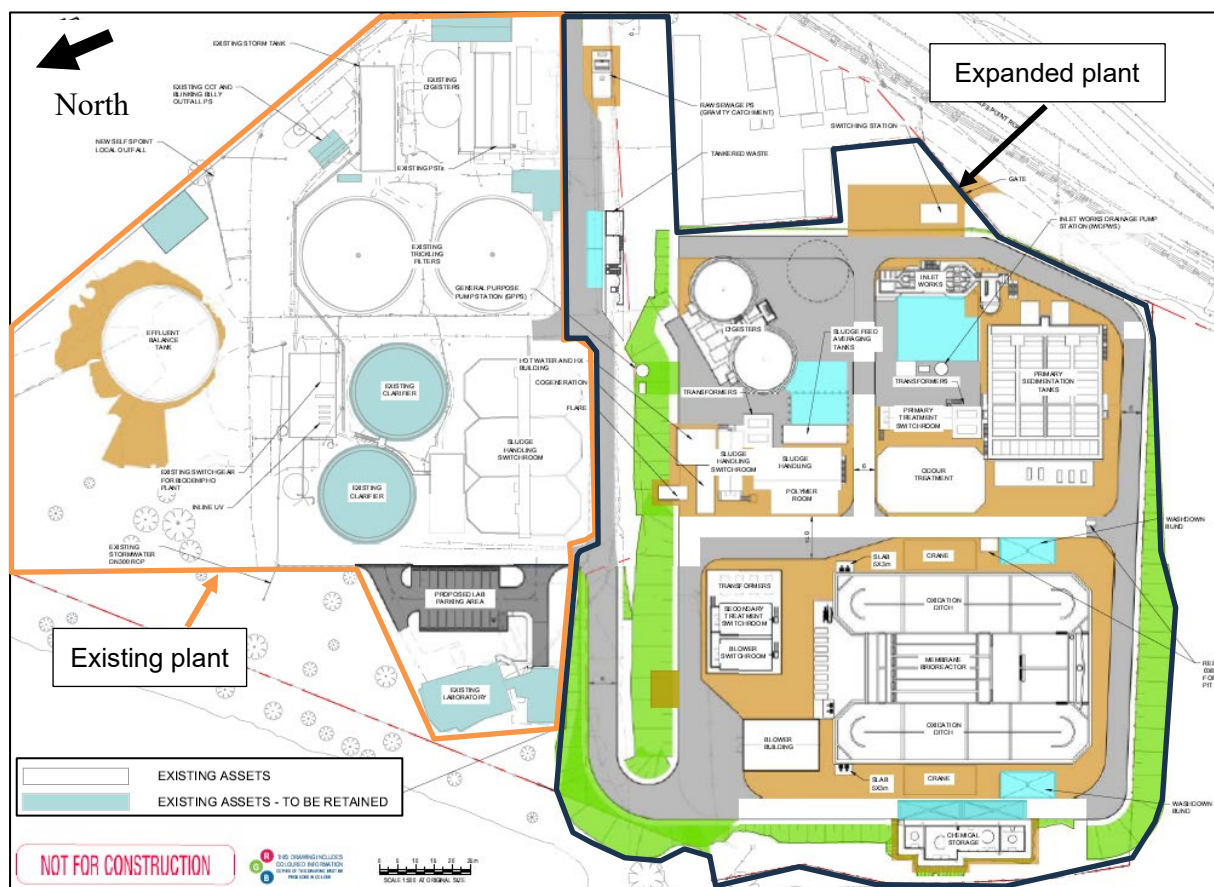


Figure 3-2: Selfs Point STP – Proposed Site Layout Including Expansion

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Figure 3-3 provides a georeferenced overview of how the sources and site buildings have been translated into the model. The sources and buildings were all entered and modelled in a north-south direction for ease of input into the model. In a review of earlier revisions of this Odour Impact Assessment Report, Tasmania EPA raised concerns regarding the accurate representation of odour emission sources and buildings in the model. Tasmania EPA were concerned that any discrepancies between the model and the design of the facility (in particular the orientation of the area sources and buildings) may lead to an underestimation of the environmental impact of odour emissions from the site.

To assess the impact, one of the scenarios modelled (Scenario 2) was remodelled with all buildings and sources reoriented to better reflect the expected site layout. This assessment identified a very minor difference in modelled odour impact. The 1 ou isopleth moved by some +/- 4m in different directions. The maximum boundary odour between the two layouts was the same and at almost the identical location at the southern tip of the plant boundary. It was concluded that the change in orientation of the sources made very little difference either at the boundary or at sensitive receptors.

Figure 3-3 shows the original alignment which was used for all scenarios modelled and presented in this Odour Impact Assessment. The full findings of the sensitivity analysis for the re-orientation of odour sources and buildings are provided in Appendix F.

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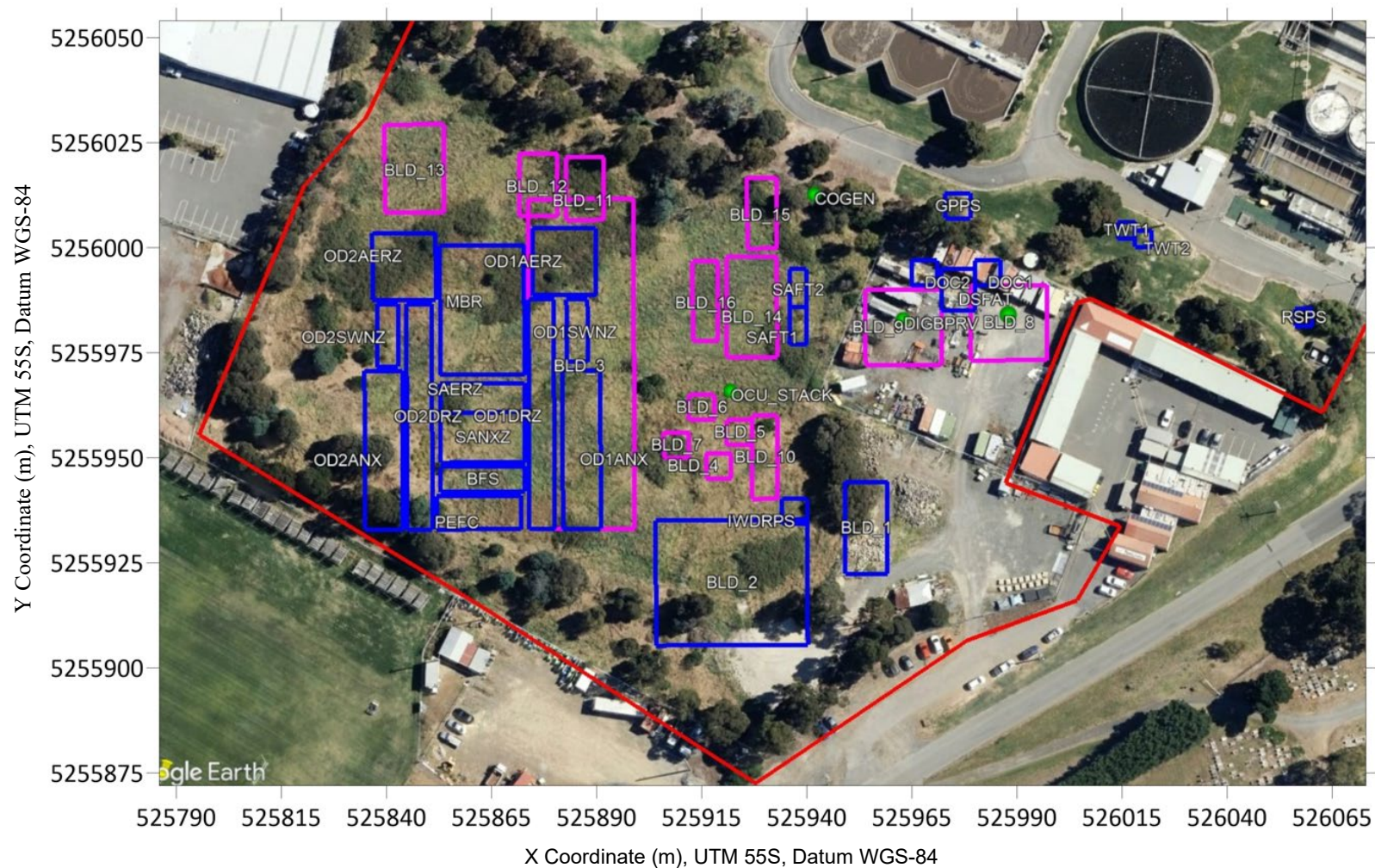


Figure 3-3: Selfs Point STP – Modelled site layout including expansion, existing and proposed buildings. Blue are new area sources, Purple are buildings and Green are point sources.

3.3 ODOUR CONTROL UNIT

There is 1 No. odour control unit (OCU) that will be operational on site. The odorous air from the following covered process units will be treated in the OCU and discharged through a 14 m high stack.

- Raw sewage pumping station with 99% odour capture efficiency.
- General purpose pumping station with 99% odour capture efficiency.
- Inlet works with 99% odour capture efficiency.
- Inlet works drainage pumping station with 99% odour capture efficiency.
- Primary settling tanks with 99% odour capture efficiency.
- Primary effluent feed chamber with 99% odour capture efficiency.
- Bioreactor flow splitter with 99% odour capture efficiency.
- Sludge averaging feed tanks with 99% odour capture efficiency.
- Digested sludge feed averaging tank with 99% odour capture efficiency.
- Digester outlet chambers with 99% odour capture efficiency.
- Tankered waste tanks with 99% odour capture efficiency.

The screenings/grit bins, drum thickeners, centrifuges and sludge out loading bins will also be connected to the OCU and will have approximately 99% capture efficiency. Residual fugitive odour emissions from these process units have not, however, been modelled. This is because the residual fugitive emissions from all these sources constitute a negligible odour emission and have been omitted from the model.

In general, 99% capture efficiency is readily achievable at STPs through a combination of increased ventilation and cover sealing. This roughly translates to a sustained pressure differential of 15 Pa between the headspace under covers and ambient air.

It is believed that the OCU will involve a two-stage process. The first stage will involve a biological type of process with the second stage involving an adsorption based process, such as activated carbon. The intent with this two-stage process is that any sudden changes in load to the OCU that may pass through the first stage will be captured in the second stage. So long as the load is steady, the biological stage will keep load off the activated carbon stage, thus reducing the frequency of activated carbon change out.

4.0 ASSESSMENT CRITERIA FOR ODOUR

4.1 LEGISLATIVE CONTEXT

As detailed in Section 2.3 of this report, the Tasmania EPA Board is guided by the principles and provisions of the 2004 Air Quality EPP in assessing the risk of environmental harm or nuisance from air pollutant emissions emanating from an activity. The Air Quality EPP requires dispersion modelling to determine the likely ground level concentrations that should not exceed 2 ou at the plant boundary at the 99.5th percentile over a 1-hour averaging period.

The objective of the Air Quality EPP is to protect Tasmania's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

Under the Environmental Management and Air Pollution Control Act⁶ (EMPCA) of 1994 which is the primary environmental protection and pollution control legislation in Tasmania, proposals are assessed to ensure they will not adversely affect environmental values including air quality, public amenity and safety. Odour impacts are a frequent and significant cause of environmental nuisance. The Act places a general environmental duty on persons carrying out that activity that causes or is likely to cause environmental harm.

The legislative framework for environmental management in Tasmania relevant to odour includes:

- The EMPCA Act 1994 which is the primary environmental protection and pollution control legislation in Tasmania giving general provisions and recommendations;
- The Air Quality EPP 2004 which prescribes environmental values, air quality objectives and air management hierarchy;
- The EPA Board Statement, 2022: An Update to Air Pollutant Design Criteria used in the Environmental Impact Assessment Process.

4.2 POTENTIAL ODOUR NUISANCE EFFECTS

The odour assessment contained in this report evaluates the potential for the activities and processes on-site at Selfs Point STP to cause odour nuisance at off-site sensitive receptors e.g., residential properties located in close proximity to the site boundary (see Section 3.1, 4.3, and 6.3).

It is generally accepted that the following factors create odour nuisance or odour complaints:

- Frequency: How often a person is exposed to the odour. In this modelling report, the frequency aspect is addressed by the limits set in the percentile limits of the odour being present.
- Intensity: In this context, the intensity is the perceived strength of the odour. In this modelling report, this is addressed by the odour strength and reported in odour units ('ou'), as described below.
- Duration: How long the odour is present for. In this modelling report, the frequency aspect is addressed by the limits set in the percentile limits and the averaging times of the odour being present.
- Offensiveness (often combined with Location or Context): This can be highly subjective. For instance, a person passing by a bakery may find the smell of baking pleasing, but a person living near a bakery was exposed to the same odours continuously within their home they may find the same baking odours highly offensive. Alternatively, many people would find rendering odours offensive on their own but in the context of that person being at the rendering facility, and expecting the odours to be present, they may find the odours unpleasant but not offensive.

⁶ [Environmental Management and Pollution Control Act 1994 \(EMPCA\) | EPA Tasmania](#)

- Location or Context: This can be highly subjective and the same analogies of the bakery and rendering plant described for 'Offensiveness' apply.

4.3 SENSITIVITY OF THE RECEIVING ENVIRONMENT

In Tasmania, the odour concentration is assessed at or beyond the boundary of a facility (whichever is higher). Similarly, to other states in Australia, the sensitivity of the receiving environment is important to be considered in an odour impact assessment. The degree of sensitivity in a particular location is based on characteristics of the land use, including the time of day and the reason why people are at the particular location (e.g., for work or recreation).

The definition for the term 'sensitive receptor' could not be found in Tasmanian legislation or guidelines, however the term 'sensitive use' is defined in Section 4.1 of the Hobart Interim Planning Scheme (HIPS) 2015⁷ as "a residential use or a use involving the presence of people for extended periods except in the course of their employment, such as in a caravan park, childcare centre, dwelling, hospital or school."

Sensitive receptors in this assessment include all the residential (mainly along Risdon Road and Queens Walk), educational and commercial premises located north, north-west, west, south-west and south of the STP. Table 4-1 and Figure 4-1 show residential receptors included in this assessment.

In addition, 5 cultural sensitive receptors were identified as per Table 4-2 and Figure 4-2.

Table 4-1 Residential Sensitive Receptors Surrounding Selfs Point STP

Receptor Number	X Coordinate (km)	Y Coordinate (km)	Description
1	525.616	5255.983	Residential properties along Risdon Road
2	525.619	5256.003	
3	525.647	5256.016	
4	525.634	5256.036	
5	525.630	5256.055	
6	525.651	5256.071	
7	525.637	5256.096	
8	525.652	5256.111	
9	525.687	5256.212	
10	525.675	5256.239	
11	525.684	5256.258	
12	525.703	5256.272	
13	525.710	5256.291	
14	525.714	5256.323	

⁷ This is mirrored in the Tasmanian Planning Scheme – State Planning Provisions (May, 2023)

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Receptor Number	X Coordinate (km)	Y Coordinate (km)	Description
15	525.724	5256.358	
16	525.724	5256.392	
17	525.785	5256.425	
18	525.817	5256.422	
19	525.822	5256.458	
20	525.846	5256.483	
21	525.891	5256.473	
22	525.933	5256.477	
23	525.789	5255.683	Residential properties along Queens Walk
24	525.801	5255.595	
25	525.731	5255.669	
26	525.764	5255.628	
27	526.057	5255.535	

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Figure 4-1 Residential sensitive receptors surrounding Selfs Point STP

Table 4-2: Cultural sensitive receptors surrounding Selfs Point STP

Receptor Number	X Coordinate (km)	Y Coordinate (km)	Description
1	525.77183	5255.90064	Sports field

Receptor Number	X Coordinate (km)	Y Coordinate (km)	Description
2	525.79502	5256.06260	Rowing club
3	526.04172	5255.94421	10 Lives Cat Centre
4	525.75953	5255.99938	Bridge Club
5	525.82524	5255.81590	Rugby Club house



Figure 4-2: Cultural Sensitive Receptors Surrounding Selfs Point STP

4.4 ODOUR IMPACT ASSESSMENT CRITERIA

4.4.1 Odour Units (ou) and Assessment Criteria

In Australia, the strength of odours for use in odour impact assessments is expressed in odour units (ou). The odour units are effectively dilution ratios. 1 ou is taken to be the lowest odour strength that the average person can detect in the most stringent of laboratory conditions. At this strength 50% of a statistical population would only be able to say that an odour was present but not recognise the smell. As an example, an odour strength of 500 ou means that the original odour would need to be diluted approximately 500 times to reach the 1 ou concentration.

The Air Quality EPP 2004 has defined the level at which an odour is perceived to be a nuisance as 2 ou.

Schedule 3 of the Air Quality EPP states that atmospheric dispersion modelling should be performed to ensure that the predicted maximum ground level concentration does not exceed the concentration criteria specified below. The atmospheric dispersion calculation should consider local terrain and meteorology, the effect of

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background concentrations, the contribution of adjacent sources and the need to preserve the capacity of the local environment to receive future emissions.

For the purpose of the Schedule, the maximum predicted ground level concentration specified in column 2 of Table 4-3 is defined as the percentile peak concentration specified in column 4 of Table 4-3

Table 4-3: Odour Impact Assessment Criteria as per the Air Quality EPP 2004

Column 1	Column 2	Column 3	Column 4
	Criterion	Averaging Period	Percentile
Unknown Mixture	2 ou ^{1a}	1 hour	99.5 ^b

Note 1 'Odour unit' has the same meaning as in Australian Standard AS/NZS 4323.3 Stationary source emissions – Determination of odour concentration by dynamic olfactometry.

Note a Modelled 99.9th percentile concentration at or beyond the boundary of a facility (wherever is higher) in cases where local high-quality meteorological and emissions data are available. In cases where such data is not available, the 100th percentile concentration modelled at or beyond the boundary of a facility applies.

Note b Modelled 99.5th percentile concentration at or beyond the boundary of a facility (whichever is higher) in cases where local high-quality meteorological and emissions data are available. In cases where such data are not available, the 100th percentile concentration modelled at or beyond the boundary of a facility applies.

5.0 ASSESSMENT METHODOLOGY – METEOROLOGY

5.1 INTRODUCTION

CALPUFF (Scire et al 2000)⁸ is a multi-layer, multi-species non-steady-state puff dispersion model used to simulate the effects of time and space varying meteorological conditions on pollutant transport. It consists of three main components:

- CALMET (Scire et al 2000)⁹ (a diagnostic 3-dimensional meteorological model)
- CALPUFF (an air quality dispersion model)
- CALPOST (a post-processing package).

Geophysical data including land use and terrain elevations at 150 m resolution are also processed and introduced into the wind field.

CALPUFF is recommended for use in all applications experiencing one or more of the following, all of which are relevant to the Selfs Point STP site:

- Coastal environments e.g., sea breeze circulations and coastal fumigation
- Moderate terrain
- Non-steady state conditions
- Surface temperature inversions
- Periods of calm or light winds

In order to capture important coastal and terrain-induced flows, CALMET was used to develop a 3-dimensional hourly gridded meteorological domain. Inputs into CALMET included fine-scale terrain (150 m resolution) and detailed fine scale land use from Google Earth, surface observation meteorological data, and upper air data from Hobart airport. Hobart airport records twice daily (12 hours apart) profiles of vertical meteorological data. This data was infilled using 12-hourly TAPM data at the same location, but offset from the radiosonde data by 6 hours. This resulted in 6 hourly vertical profiles of upper air data were available to the model every 24 hours.

The latest versions of the models were used in this analysis: CALMET version 6.5.0 (Level 150223), CALPUFF version 7.2.1 (Level 150608) and TAPM Version 4.0.

5.2 METEOROLOGICAL MODELLING

Two advanced State-of-Science models have been used to develop the three-dimensional meteorological wind fields in this assessment:

- TAPM (The Air Pollution Model), developed by CSIRO DAR Melbourne (Hurley 2008¹⁰)
- CALMET a diagnostic meteorological model (Scire et al 2000¹¹).

In this application a single hourly TAPM profile was extracted from the innermost (1km) nest of gridded 3-dimensional data set near Hobart airport and was used to improve the temporal performance of the Hobart airport radiosonde data. The Hobart airport radiosonde data has been used as input to the CALMET model along with

⁸ J.Scire, D.Strimaitis, B.Yamartino. 2000. A User's Guide for the CALPUFF Dispersion Model.

⁹ J.Scire, F. Robe, M.Fernau, B. Yamartino. 2000. A User's Guide for the CALMET Meteorological Model

¹⁰ Hurley, P. 2008. TAPM V4. User Manual. CSIRO Marine and Atmospheric Research Internal Report No. 5.

¹¹ Scire J.S, F. Robe, M. Fernau, R Yamartino, 2000: A User's Guide for the CALMET Meteorological Model.

surface observations from three local stations and other land surface characteristics in a manner recommended by (Barclay and Scire 2011¹²). The three surface observation stations used in the modelling are:

- Hobart Airport
- Ellerslie Road
- New Town

5.3 THE TAPM MODEL

5.3.1 Overview of TAPM Model

The TAPM air pollution model predicts 3-dimensional meteorology and air pollution concentrations. The model is a PC-based interface that allows the user to set up and run TAPM. It is connected to databases of terrain, vegetation and soil type, leaf area index, sea-surface temperature, and synoptic scale meteorological analyses for various regions around the world. TAPM has a long history of use in Australia and New Zealand.

5.3.2 Development of TAPM over Selfs Point STP

The nearest upper air station measurement to Selfs Point is Hobart Airport, located only 16 km east of the Selfs Point STP. Hobart airport releases twice daily radiosonde profiles at midnight and midday GMT time which is approximately 1000 hr and 2200 hr local standard time every day. While the Hobart radiosonde data on its own accord fulfilled the 12-hour interval minimum model requirements it was supplemented every 6 hours by TAPM data at the same location.

Hobart Airport is a very important station whose inclusion in the meteorological model will greatly improve the quality of the modelling over just using model derived upper air data. Hobart Airport is considered representative of the upper air data over Selfs Point STP for the following reasons:

- Hobart Airport is only 16 km east of Selfs Point STP site.
- It is located in a north-east to south-east valley system.
- It is representative of the boundary layer meteorology (50 m – 1000 m), (wind speed, wind direction, temperature, relative humidity and pressure) over Selfs Point.
- Recordings occur at ~ 1000 hr and 2200 hr, which is not an ideal representation of the pre-dawn early morning sounding, but is representative of the morning profile.
- The data is of very good quality with almost no missing data.

In this assessment, a TAPM vertical profile at Hobart Airport has been extracted, evaluated and used to repair and fill in the missing temporal gaps to the Hobart Airport radiosonde data.

5.3.3 TAPM Model Domains and Settings

Four TAPM modelling domains (30 km, 10 km, 3 km and 1 km) were used to develop the 1 km 3-dimensional meteorological fields. The first coarse domain is at a grid size of 30 km, followed by a 10 km nested second domain, followed by a 3 km nest and finally a 1 km innermost nest. The detailed domain configuration is listed in Table 5-1.

¹²Barclay, J.J and J.S. Scire. 2011. Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the Approved Methods for Modelling and Assessments of Air Pollutants in NSW, Australia. NSW Office of Environment and Heritage, Sydney Australia. Atmospheric Studies Group, TRC, Boston, USA.

Table 5-1: TAPM Model Domain Configuration for Selfs Point STP for 2021

Model Parameter	Domain 1	Domain 2	Domain 3	Domain 4
Grid Cells	30 x 30	30 x 30	30 x 30	30 x 30
West-East Range (km)	900	300	90	30
South-North Range (km)	900	300	90	30
Grid Size (km)	30	10	3	1
Surface Elevation (m)	10	10	10	10
Top of Grid Elevation (m)	14,000	14,000	14,000	14,000
Vertical Levels	35	35	35	35

The TAPM model domain configuration has 35 vertical layers from the surface to 8000 m. Eighteen of the vertical layers are in the lower boundary layer, below 1,000 m, i.e., 10, 25, 50, 75, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1,000 m. The height of the layers ranges from 10 m above the surface to 8,000 m. The centre of the TAPM grid is 42.834S and 147.301E. The centre coordinates of the TAPM grid in local units is 0.0 and 0.0 km as shown in Table 5-2.

Table 5-2 TAPM Model Centre Point Coordinates

TAPM Centre Grid Point coordinates	X Coordinate Latitude	Y Coordinate Longitude Northing
Latitude and Longitude	42.834	147.301
Local Values at the centre of the grid	0.0	0.0
Begin and End Dates	January 1, hour 1, 2021	December 31, hour 23, 2021

Figure 5-1 shows the annual TAPM wind rose for 2021 at the location of Hobart Airport as well as the Hobart Airport radiosonde for 2021 (hours 1000 hr and 2200 hr) at 50 m. The third wind rose is the Hobart Airport radiosonde profile combined with the TAPM data (1600 hr and 0400 hr). The 50 m, 100 m, 250 m and 1000 m wind roses for TAPM, the radiosonde data and the combined TAPM\radiosonde data are shown in Appendix C.

The annual 10 am and 10 pm wind rose from Hobart Airport at 50m shows the dominant northwest flow, which persists throughout the diurnal cycle. The annual TAPM wind rose at 50m which includes all hours of the day is very similar to that from Hobart Airport and shows that while Hobart only records winds twice a day, the dominant flows are still captured by the radiosonde airport. Winds from other directions are variable and only account for a small percentage of the year. The purpose of Figure 5-1 is to show that Hobart airport and TAPM are similar and that the dominant northwest winds which persist most of the day are captured by both TAPM and Hobart airport. This provides confidence that a combined method of using both TAPM and Hobart Airport radiosonde data will complement one another.

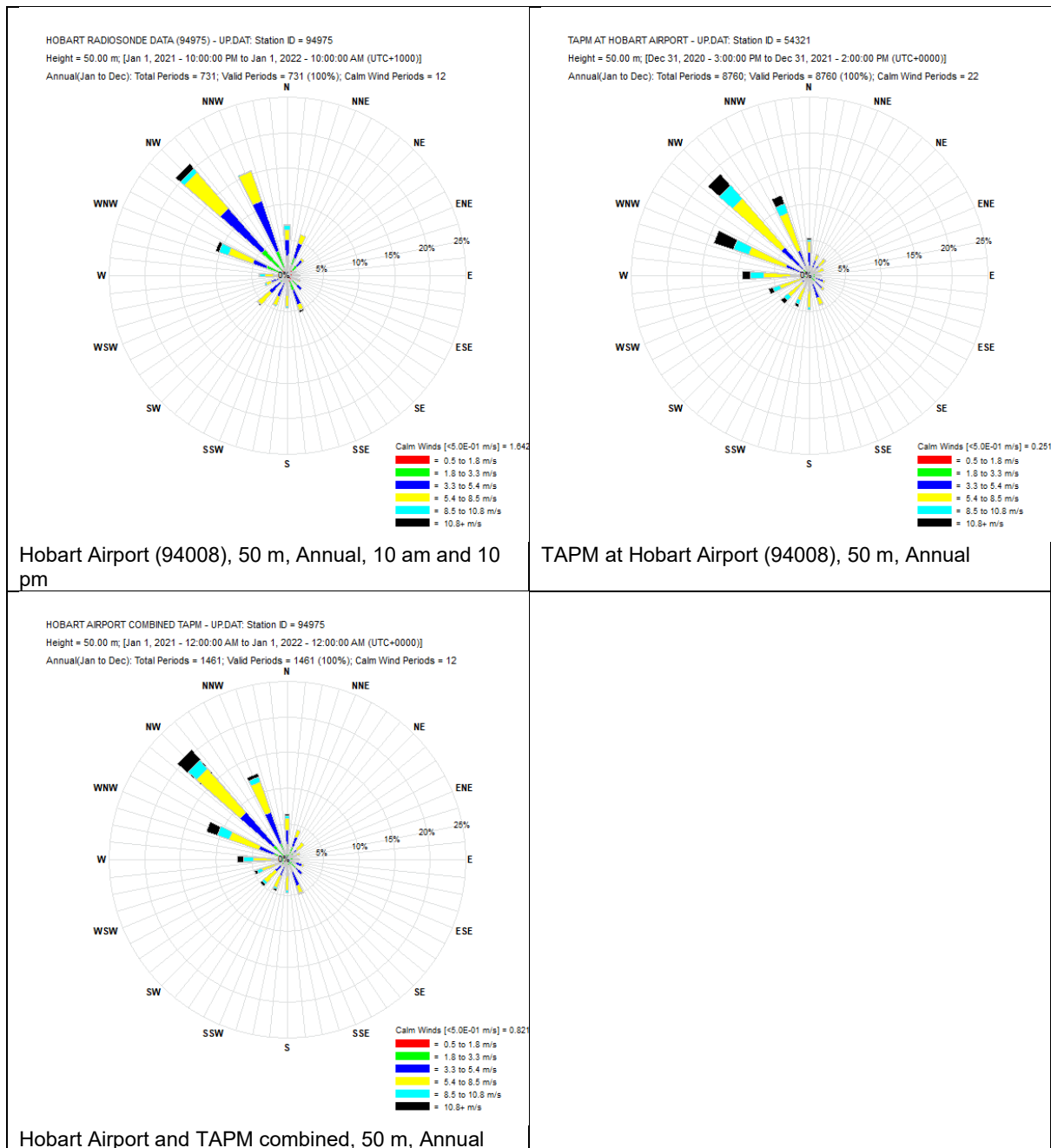


Figure 5-1: 50m Wind Roses at Hobart Airport from TAPM, Hobart Radiosonde Station, and from the Repaired Hobart Data that was Used in the Model

5.4 THE CALMET MODEL

The CALMET meteorological model consists of a diagnostic wind field module and micrometeorological modules for over-water and overland boundary layers. The diagnostic wind field module uses a two-step approach to the computation of the wind fields (Douglas and Kessler, 1988¹³). In the first step, an initial-guess wind field is adjusted for kinematic effects of terrain, slope flows, and terrain blocking effects to produce a Step 1 wind field.

¹³ Douglas S and R. Kessler, 1999. Users Guide to the Diagnostic Wind Field Model (Version 1.0), Systems Application, Inc. San Rafael, CA

The second step consists of an objective analysis procedure to introduce observational data into the Step 1 wind field to produce a final wind field. The techniques used in the CALMET model are briefly described below.

Step 1 Wind Field

- **Kinematic Effects of Terrain:** The approach of Liu and Yocke (1980¹⁴) is used to evaluate kinematic terrain effects. The domain-scale winds are used to compute a terrain-forced vertical velocity, subject to an exponential, stability-dependent decay function. The kinematic effects of terrain on the horizontal wind components are evaluated by applying a divergence-minimization scheme to the initial guess wind field. The divergence minimization scheme is applied iteratively until the three-dimensional divergence is less than a threshold value.
- **Slope Flows:** The slope flow algorithm in CALMET is based on the shooting flow algorithm of Mahrt (1982¹⁵). This scheme includes both advective-gravity and equilibrium flow regimes. At night, the slope flow model parameterizes the flow down the sides of the valley walls into the floor of the valley, and during the day, upslope flows are parameterized. The magnitude of the slope flow depends on the local surface sensible heat flux and local terrain gradients. The slope flow wind components are added to the wind field adjusted for kinematic effects.
- **Blocking Effects:** The thermodynamic blocking effects of terrain on the wind flow are parameterized in terms of the local Froude number (Allwine and Whiteman, 1985¹⁶). If the Froude number at a particular grid point is less than a critical value and the wind has an uphill component, the wind direction is adjusted to be tangent to the terrain.

Step 2 Wind Field

- The wind field resulting from the adjustments described above of the initial-guess wind is the Step 1 wind field. The second step of the procedure involves the introduction of observational data into the Step 1 wind field through an objective analysis procedure. An inverse-distance squared interpolation scheme is used, which weighs observational data heavily in the vicinity of the observation station, while the Step 1 wind field dominates the interpolated wind field in regions with no observational data. The resulting wind field is subject to smoothing, an optional adjustment of vertical velocities based on the O'Brien¹⁷ (1970) method, and divergence minimization to produce a final Step 2 wind field.

5.4.1 CALMET Meteorological Modelling Domain Configuration

The meteorological modelling domain expands an area of 27.9 km in the east-west direction and 25 km in the north-south direction. The CALMET model domain was made large enough to capture the large-scale synoptic flow patterns as well as smaller three-dimensional flows like the sea and land breeze. Ideally the horizontal grid resolution should be fine enough to capture all dominant geophysical features such as the hills to the west of the STP, but it is equally important to include a large portion of the region around the site. The CALMET model domain consists of 186 m x 167 m grid cells with a horizontal grid resolution of 150 m. In the vertical, a stretched grid is used with a fine resolution in the lower layers in order to resolve the mixed layer was chosen with a somewhat coarser resolution aloft. The twelve vertical levels are: 10, 30, 60, 100, 140, 240, 480, 820, 1,250, 1,750, 2,250 and 2,750 m.

Selfs Point STP does not have its own on-site meteorological data which means that the meteorology at the STP was interpolated from nearby Australian Bureau of Meteorology (BOM) stations located on Ellerslie Road, and the EPA station in New Town (600m to the south of the STP) in conjunction with the fine scale terrain. The upper air is primarily influenced by the Hobart radiosonde station above 35m and from vertical extrapolation of both New Town and Ellerslie Road stations up to 35m. Although conditions at Selfs Point will not be expected to be

¹⁴ Liu, M.K. and M. A. Yocke, 1980: Siting of wind turbine generators in complex terrain. J. Energy, 4, 10:16

¹⁵ Mahrt, L., 1982: Momentum Balance of Gravity Flows. Journal of Atmos. Sci., 39, 2701-2711

¹⁶ Allwine, K.J. and C.D. Whiteman, 1985: MELSAR: A mesoscale air quality model for complex terrain: Volume 1-Overview, technical description and user's guide. Pacific Northwest Laboratory, Richland, Washington.

¹⁷ O'Brien, J.J., 1970: A note on the vertical structure of the eddy exchange coefficient in the planetary boundary layer. J. Atmos. Sci., 27, 1213-1215

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identical to that of New Town station, the sites are very similar in their land use type, elevation height and aspect along the coastline. The Hobart airport, New Town and Ellerslie Road stations record wind speed, wind direction, relative humidity, pressure and temperature. In addition, Hobart Airport records cloud cover and cloud ceiling height. Cloud data is important for determining hourly atmospheric stability which has been extracted from the Hobart Airport data.

The locations and details of the four surface observation stations that were assessed for this study are shown in Figure 5-2 and detailed in Table 5-3. Hobart Airport and Ellerslie Road are owned and operated by the BOM, New Town is owned and operated by Tasmania EPA. Two additional stations, Mount Wellington and Dennes Point were assessed for their input into the model but were removed from the model as neither station improved the wind field.

Table 5-3: Surface Stations Assessed for Use in the Model

Agent	Name	ID	UTM 56S Easting (km)	UTM 56S Northing (km)	Elevation (m)	Anemometer Height (m)	Meteorological Parameters Recorded
BOM	Hobart Airport	94008	541.1335	5257.5075	4.0	10.0	Wind speed, wind direction, temperature, relative humidity, pressure, cloud cover and cloud ceiling height
BOM	Ellerslie Road	94029	526.7662	5251.3819	50.5	20.0	Wind speed, wind direction, temperature, relative humidity
EPA	New Town	11111	525.7469	5255.2822	20.0	10.0	Wind speed, wind direction, temperature, relative humidity, pressure
BOM	Mount Wellington	94087	519.2524	5250.8185	1,260.5	10.0	Wind speed, wind direction, temperature
BOM	Dennes Point	94255	529.0439	5232.0277	5.7	10.0	Wind speed, wind direction, relative humidity, temperature

The final 3-dimensional wind field is a result of the combined interpolation of surface meteorological data from the three meteorological stations, plus the combined TAPM\Hobart airport radiosonde station. In this assessment, the CALMET model has been used in 'OBS' (Observation) only mode where observations have been used solely to determine the initial guess wind field and final wind field. Running CALMET this way can be considered an 'advanced model simulation' or 'refined model run'. Compared to a No-Obs approach where no observations are used. The OBS only run requires significant preparation work in the collection and formatting of the surface observational data and upper air data. Compared to not using any observations (No-Obs), the OBS only approach means very careful consideration needs to be given with respect to the Seven Critical CALMET parameters discussed in Table 5-4.

As well as surface and upper air observations, CALMET also requires geophysical data including gridded fields of terrain elevations and Land Use categories. Gridded fields of other geophysical parameters such as surface roughness length, albedo, Bowen Ratio, a soil heat flux parameter, anthropogenic heat flux and vegetation leaf area index are also required. These values can be specified as a function of the Land Use type. Geophysical data is discussed in the next section.

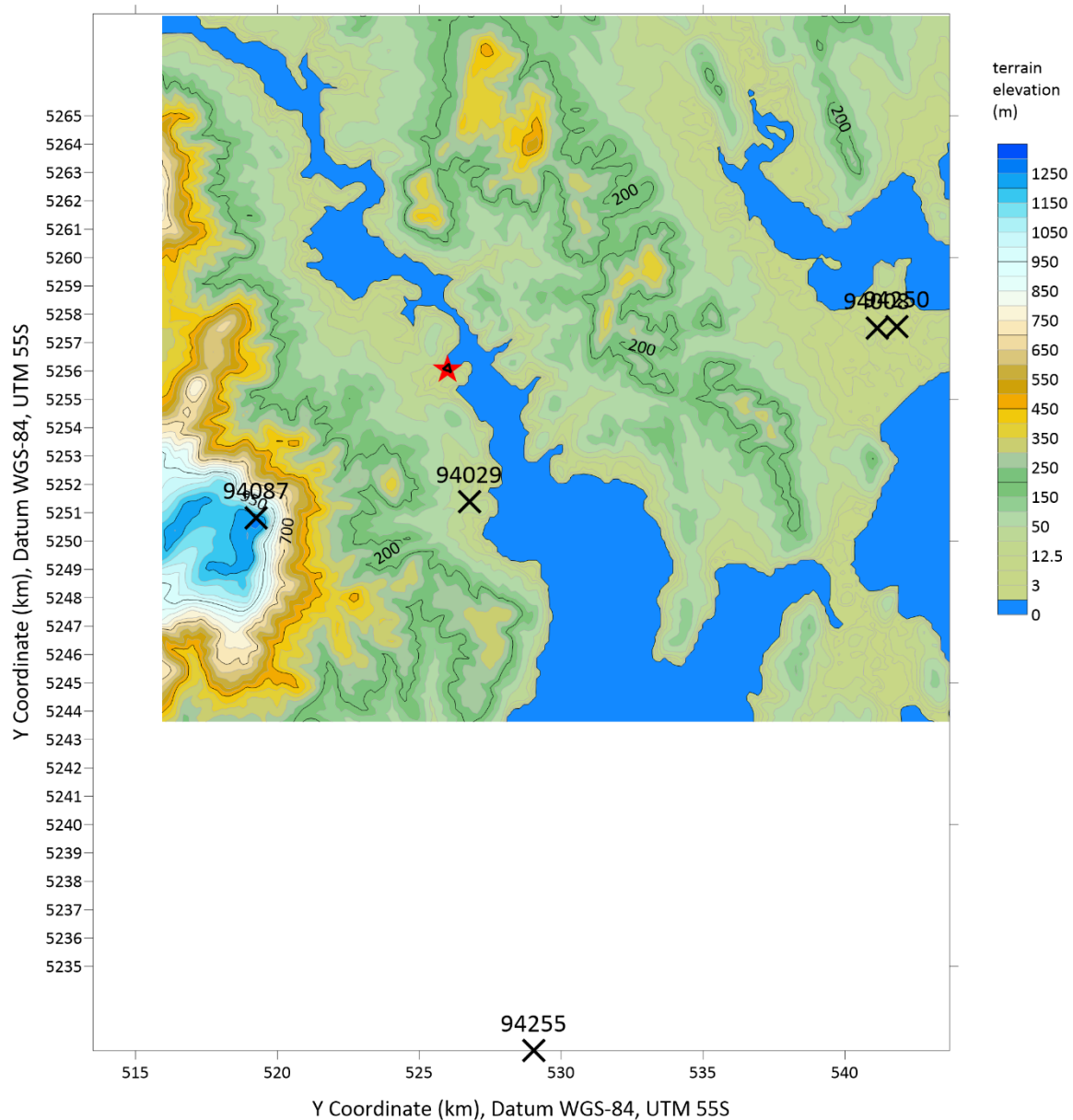


Figure 5-2: Surface Observation Sites Plus Local and Regional Topography Surrounding the Selfs Point STP Site (Red Star) within the CALMET Meteorological Model Domain

The surface stations assessed in the modelling of Selfs Point STP are also shown. [Note: Only Ellerslie Road (94029), New Town (11111) and Hobart Airport (94008) were used in the modelling]. A second station was co-located at Hobart Airport (station ID 94250), as shown in the plot, but indicates a historic shift in position of the BOM station].

5.4.2 Land Use and Terrain

Terrain data used in the model is 30 m SRTM3 satellite data. The gridded x (east-west), y (north-south) and z (elevation) data is representative of the local terrain within the modelling domain which assists in simulating the effects of land surface elevations on plume dispersion. Figure 5-3 shows the terrain contours overlain the dominant Land Use types.

Gridded land use data was derived from the US Geological Survey's (USGS) 1 km resolution global land cover characteristics data base for use in a wide range of environmental and modelling applications. The data set is

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derived from the 1 km Advanced Very High Resolution Radiometer (AVHRR) data spanning a 12-month period from April 1992 to March 1993.

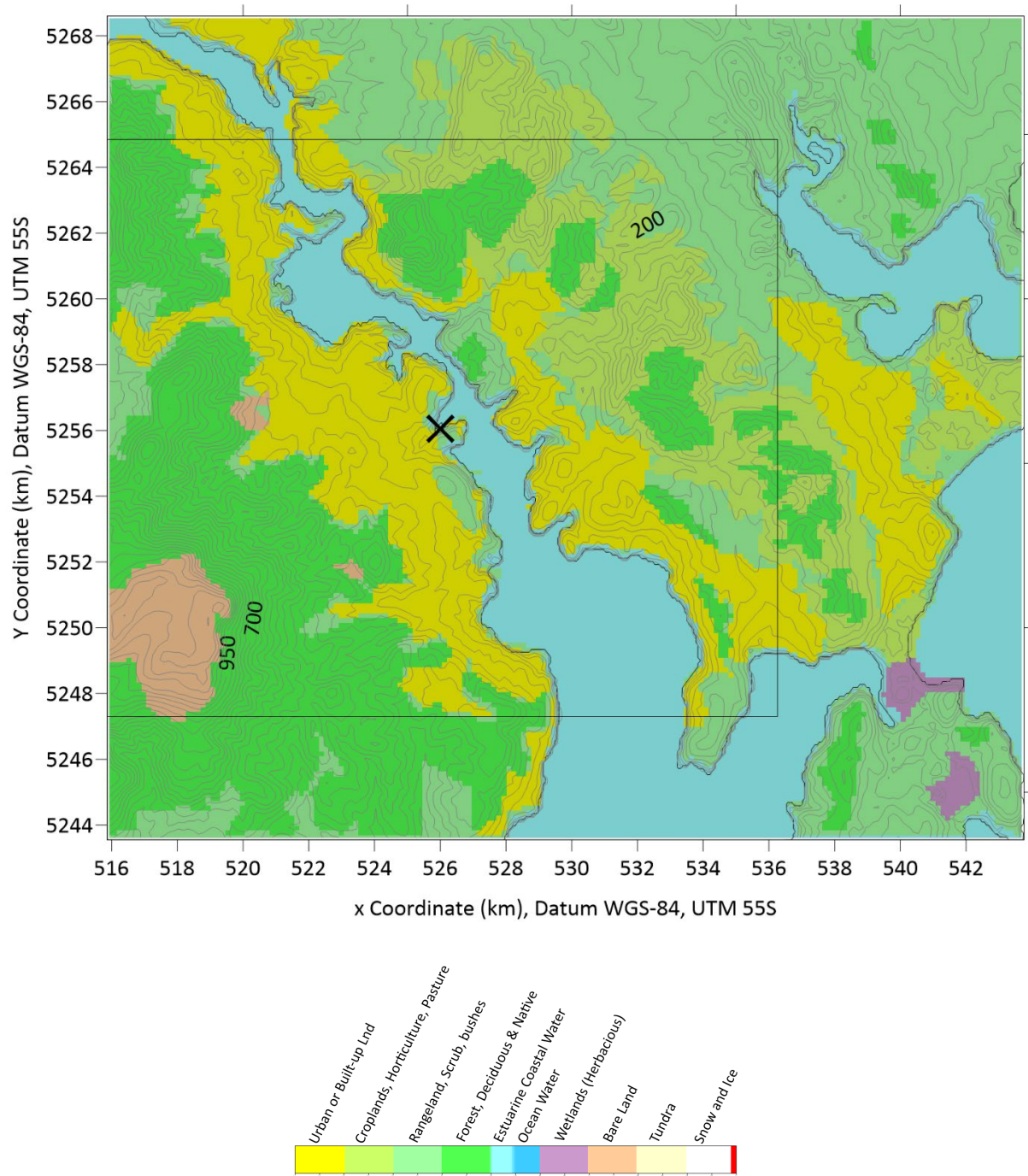


Figure 5-3: Terrain Contours and Dominant Land Use Types used in the CALMET Model (Selfs Point STP – Black Cross). The inner computational domain is also shown (Black square).

5.4.3 CALMET Model Switches

The initial guess wind field in this assessment is a domain mean wind interpolated from all of the observation stations, local topography, and land use type. The Hobart Airport data has not been used at 10 m but has been relied upon for all levels above the surface.

5.4.3.1 Step 1 Wind Field

In developing the Step 1 wind field, CALMET adjusts the initial guess field to reflect the effects of the terrain, including slope flows and blocking effects. Slope flows are a function of the local slope and altitude of the nearest crest. The crest is defined as the highest peak within a radius TERRAD around each grid point. The value of TERRAD is determined based on an analysis of the scale of the surrounding terrain. For this application, a value of 15.0 km was chosen which takes into account the significant (up to 1,271m) Mount Wellington Massif directly west and within 8 km of Sels Point STP. Mount Wellington and the surrounding terrain places an important role in the diurnal wind patterns at Sels Point, importantly Mount Wellington assists in steering and aligning the flow along the Derwent River.

5.4.3.2 Step 2 Wind Field

In Step 2, observations are usually incorporated into the Step 1 wind field to produce a final wind field. Each observation site influences the final wind field within a radius of influence (parameters RMAX1 at the surface and RMAX2 aloft). Observations and Step 1 wind field are then weighted by means of parameters R1 at the surface and R2 aloft. At a distance R1 from an observation site, the Step 1 wind field and the surface observations are weighted equally. For this application, three surface observation stations have been used to develop the surface flow field. See Table 5-4 for a description of the parameters and the values that were used in this assessment.

This second step in the processing of the wind field by the diagnostic model consists of four sub-steps: interpolation, smoothing, O'Brien adjustment of vertical velocities, and divergence minimisation. The interpolation scheme employed by the model allows observational data to be heavily weighted in the vicinity of the observational station, while the Step 1 wind field dominates the interpolated wind field in regions where there is no observational data. In this assessment, a maximum surface weighting of 4.0 km (RMAX1) was applied, whilst the relative weighting of the first guess field and observation in the surface layer were given a weighting of just 2.0 km (R1). Above the surface, the maximum weighting of 100.0 km (RMAX2) was applied, whilst the relative weighting of the first guess field and observation in all layers aloft was also given a weighting of 100 km (R2). This means Hobart airport radiosonde was allowed to influence an area of approximately 100 km around itself. This is a reasonable estimate as the entire region will be experiencing similar diurnal and land and sea breeze patterns. All other model switches in the model are default options.

Table 5-4: Critical CALMET (user-defined) Model Switches and their Options for this Assessment

Seven Critical User Parameters	Value	Description
RMAX1	4.0 km	Maximum radius of influence over land in the surface layer (km).
R1	2.0 km	Relative weighting of the first guess field and observations in the surface layer (km).
RMAX2	100.0 km	Maximum radius of influence over land aloft (km).
R2	100.0 km	Relative weighting of the first guess field and observations aloft (km).
TERRAD	15 km	Radius of influence of terrain feature
BIAS	-1.0, -0.5	Bias parameters used here to remove the influence of Hobart radiosonde at

Seven Critical User Parameters	Value	Description
	For layer 1 and layer 2. At upper levels Hobart Airport was weighted 100%.	the surface and to remove 50% effect of upper air station at 30 m. Above 30m the model is configured to increasingly on the Hobart radiosonde station.

5.5 METEOROLOGICAL MODEL EVALUATION

A full evaluation of the output of the CALMET model at the STP has been conducted and is discussed below. CALMET has been evaluated in multiple formats which are briefly described as follows:

- Spatial wind field plots – hourly snapshots of wind speed and wind direction.
- Wind rose plots – graphical tool to show whether modelled wind speed and direction are similar to the most relevant observation point.
- Scatter plots – these plots are used to compare 2 sets of values or pairs. These plots will be used to show the relationship between the meteorological variable versus time of day.

The output of CALMET has been evaluated at the location of Selfs Point STP at grid point X = 525.975 km, Y = 5256.03 km, UTM 55S. Appendix A includes hourly wind roses by season and by time of day at the location of the STP site as well as at the three stations used in the modelling, Hobart Airport, Ellerslie Road and New Town. Appendix B includes hourly diurnal scatter plots of each of the following parameters: wind speed (m/s), wind direction (deg), temperature (K), Pasquill Gifford stability class (1-6), relative humidity (%), surface pressure (hPa), short wave solar radiation (W/m²) and mixing height (m) at the location of the STP site. The scatter plots display every single hour of data for every year and provide an excellent easy to view graphical display which can be used to evaluate the meteorological data and ensure that the data falls within the expected meteorological boundaries.

Light winds (< 1.8 m/s) occur approximately 40% of the time at Selfs Point STP site. This is almost identical to nearby New Town meteorological station (36.7 %). Hobart Airport and Ellerslie Road record far fewer light winds of 7.4 % and 19.2% at Ellerslie road. Calms (< 0.5 m/s) occur for 5.4% of the time at Selfs Point which is slightly more than New Town of 3.9%. Moderate winds in the range of 3.3 to 5.4 m/s occur for 21% of the time at Selfs Point and 22.2% of the time at New Town station. Strong winds > 8.5 m/s occur rarely at Selfs Point and are predicted to occur for just 0.6% of any year, consistent with what is measured at New Town. These winds when they occur are primarily from the north-west.

Terrain and slope effects at Selfs Point STP site are significant. The Mount Wellington massif west of the site steers the flow and is partly the reason for the dominant north-west flow, which is further steered by the Derwent Estuary. Onshore south-east flow only occurs during the afternoons and primarily in summer.

Table 5-5: Frequency of Winds Predicted from the Selfs Point STP Compared to Observations from nearby Ellerslie Road and New Town

Source	< 0.5 m/s	0.5 – 1.8 m/s	1.8 – 3.3 m/s	3.3 – 5.4 m/s	5.4 – 8.5 m/s	8.5 – 10.8 m/s	> 10.0 m/s
	Percentage (%)						
Ellerslie Road	1.2	18.0	32.6	34.8	12.6	0.7	0.1
Hobart Airport	1.9	5.5	21.4	38.0	26.7	5.2	1.2
New Town	3.9	32.8	35.4	22.2	5.0	0.5	0.1
CALMET at Selfs Point STP	5.4	34.6	33.9	20.9	4.6	0.5	0.1

Analysis of the wind roses shows the following:

- The dominant winds at Selfs Point STP are from the northwest and accounts for more than 47.6% of all winds. The second most dominant wind category is from the southeast, which accounts for 13.9% of all winds.
- Winds from the northeast, and southwest are few and only account for 8.9% and 6.6% of all winds, respectively.
- The number of calm and light winds < 0.5 m/s totals 474 hours in the year (i.e., 5.4% of the time). 34.6% of the entire year has winds in the range 0.5 – 1.8 m/s and 33.9% of all winds are in the range 1.8 m/s – 3.3 m/s. In addition, 73.9% of all winds predicted at Selfs Point are < 3.3 m/s. Only 20.9% of all winds are in the moderate wind speed range of 3.3 – 5.4 m/s. Therefore, the majority of winds occurring at the STP are light.
- The strongest winds are from the northwest, tend to occur in summer and spring between the hours of 0700 hr and 1200 hr, although they only account for 0.6% of the entire year.
- Easterlies, made up of southeast, east and northeast winds occur for 8.9% of the entire year at Selfs Point, primarily in the summer months.
- The highest percentage of calm and light winds occurs during the winter months and at night.

Appendix B shows diurnal scatter plots of wind speed (m/s), wind direction (deg), temperature (K), pressure (mb), relative humidity (%), short wave radiation (W/m²), mixing height (m) and stability as predicted at the STP.

The temperature shows a normal diurnal pattern with the highest temperatures occurring between 10h00 hr and 1100 hr and the lowest temperatures occurring in the early morning at 0600 hr. The lowest temperature is 0.0 °C at 0600 and the maximum temperature is approximately 35 °C at 1100 hr. The annual relative humidity ranges from 14% to 96% with the average around 60-70%. On a daily basis, there is a diurnal pattern to relative humidity which is at its lowest in the middle of the day. The lowest the RH occurs at 1200 hr of 14%. This low humidity will tend to occur under moderate winds in the middle of summer.

The stability profile is normal, showing very unstable atmospheric conditions during the daytime between 1000 hr and 1300 hr. Weakly unstable conditions can occur between 0600 hr and 1500 hr during the daytime. Neutral conditions occur whenever the wind is moderate to strong and can occur at any time of the day. Stable conditions tend to occur at night up to sunrise and after sunset. Stable atmospheric conditions are associated with very light winds and calm conditions. Temperature inversions are common in stable conditions.

The mixing height pattern is normal showing the highest mixing levels occurring in the afternoon. The peak mixing height of 2561 m occurs at 1500 hr and is beyond the time of maximum solar insolation which is normally at midday. This is normal as the mixing height generally continues to grow through the afternoon as the land continues to heat. At sunset the mixing collapses back to less than 500m and in some cases as low as 50m during the night. At night time, the mixing height generally remains below 500 m, although strong winds during the night can cause the mechanical night-time mixing height to exceed 2,000 m on the rare occasion but mostly will cause the mixing height to increase up to around 1,000 m.

5.6 SUITABILITY OF YEAR 2021

A single year of meteorological data for 2021 has been used in this assessment of the modelling of odorous air discharges from the Selfs Point STP site. In support of the selection of 2021, the following reasons apply:

- Year 2021 is a recent year which has important positive implications for the quality of the measuring instruments. Wind speed is now routinely measured down to 0.1 m/s with high grade quality automatic weather stations.
- In the first round of modelling, the year 2019 was included in the modelling and produced almost identical results.
- All of the weather stations used in the model have data records that go back sometimes as long as 30 years. This is important for establishing trust and reliability.

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- The more recent the data the less the amount of missing data typically occurs in the surface weather records. This is partly due to the good quality instruments on later years, the quality of remote communication and the transfer and storage of data. (There was virtually no missing data from either of the surface stations or the Hobart airport radiosonde station)

The annual 1500 hr and 0900 hr wind rose as the mean annual frequency of surface wind speed and wind direction based on hourly observations for the 65-year long term mean at Hobart Airport (1958-2023) and 130-year long term mean at Ellerslie Road (1893-2023) are compared to that from 2021, morning (0700 hr-1200 hr) and afternoon (1200 hr-1800 hr) as shown in Figure 5-4 and Figure 5-5 for Hobart Airport and Ellerslie Road, respectively. The direction of the longest spoke shows the wind direction with the greatest frequency. Colour bands show various wind speed ranges. The dominant wind direction at Hobart Airport is from the north-west (at morning and night time) and from the south-east during the afternoon. The long term and 2021 wind roses at Ellerslie Road are very similar to that from Hobart Airport. The annual morning and afternoon wind roses from Hobart Airport in 2021 are very similar to the long-term mean.

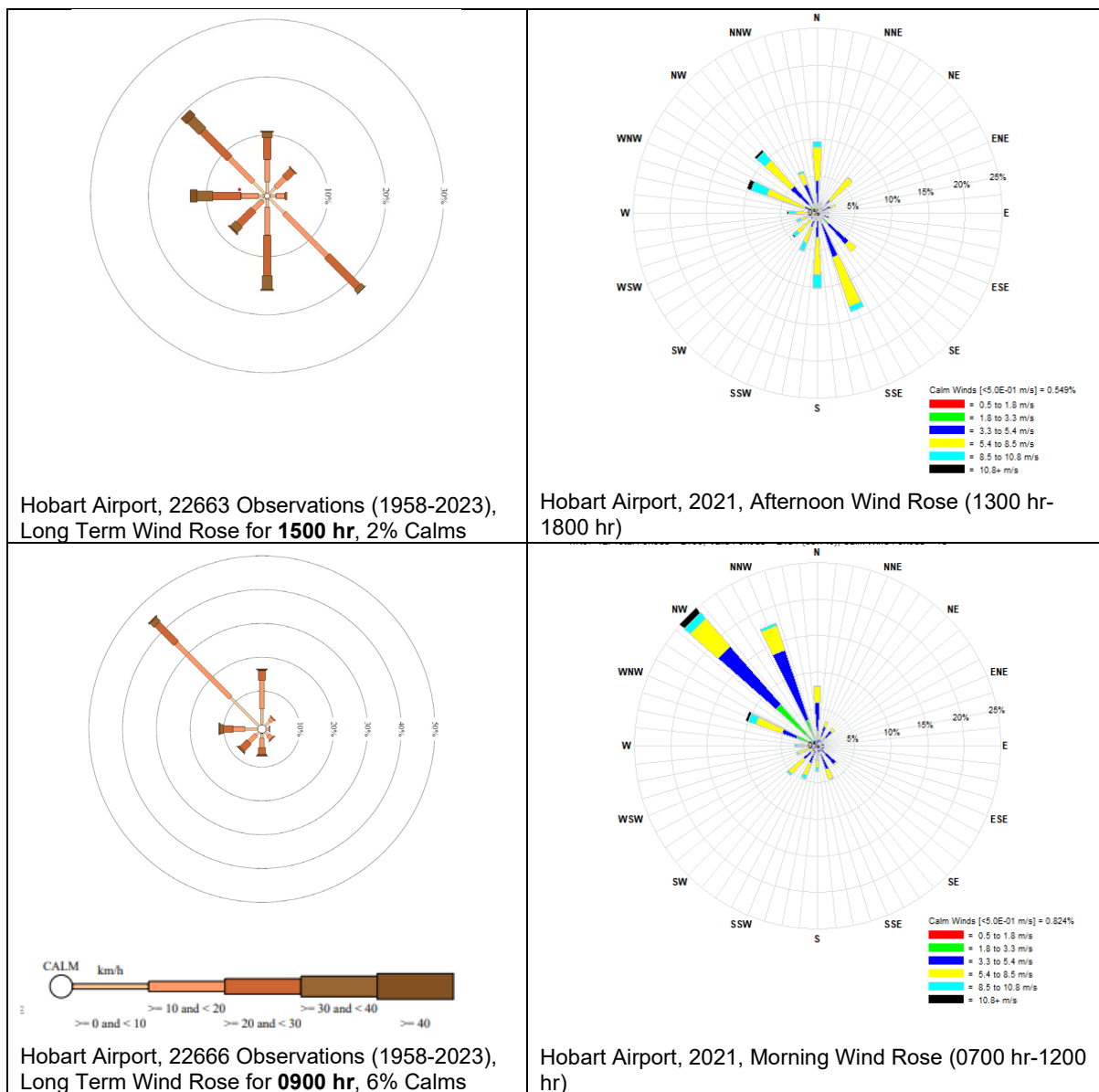


Figure 5-4: Long-term Annual Wind Rose from Hobart Airport vs. 2021 Annual Wind Rose for the Morning and Afternoon

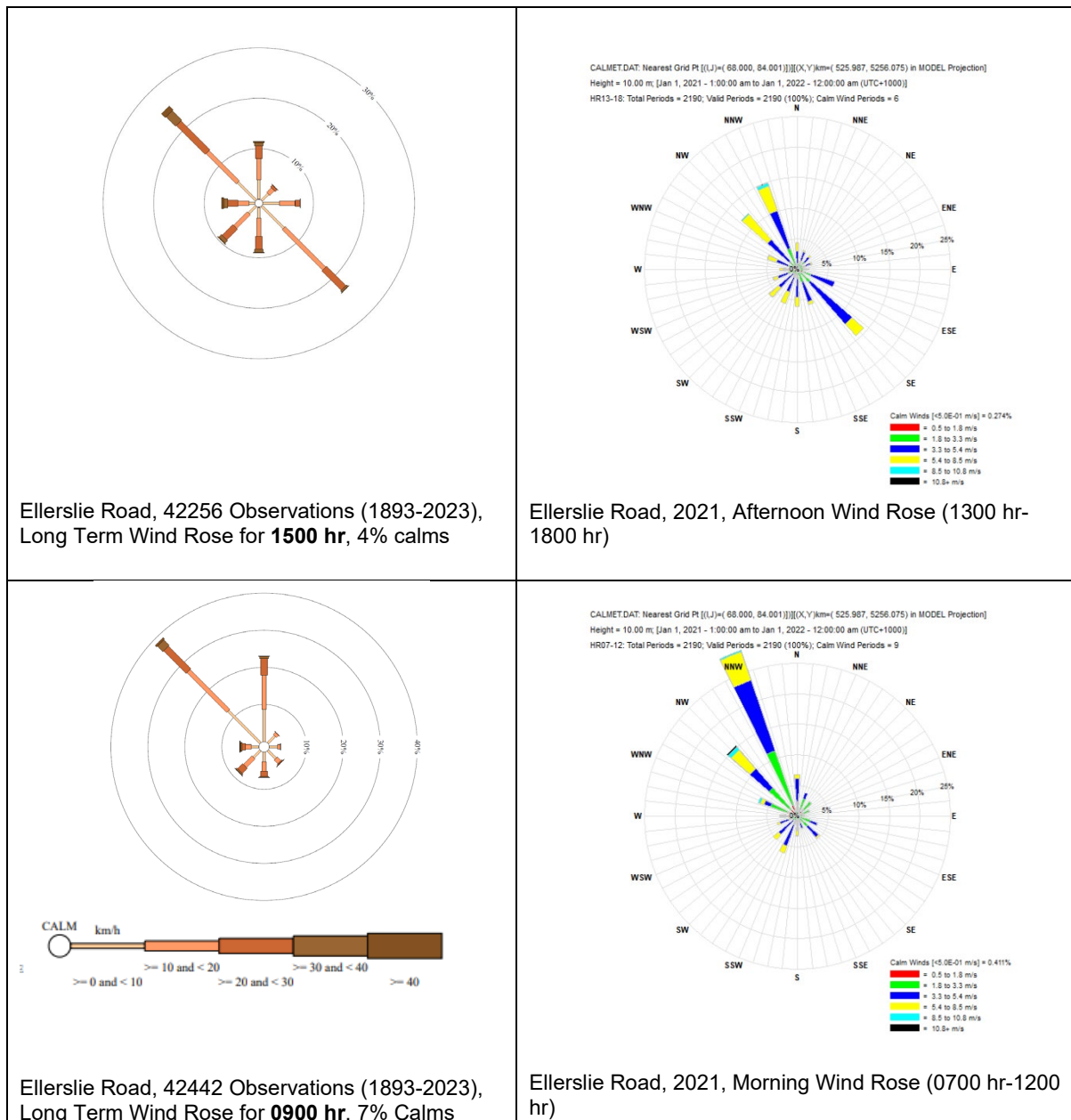


Figure 5-5: Long-term Annual Wind Rose from Ellerslie Road vs. 2021 Annual Wind Rose for the Morning and Afternoon

6.0 ASSESSMENT METHODOLOGY – DISPERSION

6.1 CALPUFF MODEL

The atmospheric dispersion modelling assessment was conducted through the use of CALPUFF (Version 7.2.1, Level 150618), which is the latest version of the model. The model was set up in accordance with information contained in the Air Quality EPP guideline. Ground-level odour concentrations were predicted over a regular Cartesian receptor grid covering a region of approximately 4 km by 4 km area (in the X and Y directions). The CALPUFF modelling area was centred over Selfs Point STP, which was also the centre of the CALMET grid.

6.2 MODEL INPUTS

The following parameters were included in the dispersion modelling of odours from the Selfs Point STP facility:

- A 20.4 km x 17.4 km Cartesian, computational dispersion grid within a 27.9 km x 25.0 km meteorological model domain with a 150 m grid resolution over which the 3-dimensional wind and temperature field were created to model the 2021 meteorological data. The meteorological data input into CALPUFF was in the form of 12 binary files which included 3 surface stations and the combined TAPM\Hobart upper air data;
- A geophysical dataset including terrain and land use data to simulate the effects of the land surface on plume dispersion. The SRTM (Shuttle Radar Topography Mission) terrain data has a resolution of approximately 30 m. Land use data was created directly from Google Earth, 2020 imagery;
- A finely spaced receptor file (specific locations on the ground at which ground-level concentrations are computed) containing terrain elevations sourced from the SRTM3 data. The final receptor grid is shown in Figure 6-1. Terrain effects were modelled using the partial plume path adjustment method. A total of 6,126 discrete receptors were used in the modelling (explained in Section 6.3);
- Odour source details such as location, dimensions, discharge parameters and emission rates. Odour emission rates (OERs) specified in $\text{ou.m}^3/\text{s}$ were used for point sources and specific odour emission rates (SOERs) specified in ou.m/s were used for area sources. SOERs and odour concentration values were taken from the previous dispersion model study as well as typical odour emissions from similar process units observed at other sites. Constant emission rates were assumed for all sources;
- Downwash has been considered from buildings and structures surrounding the central OCU stack, the Cogeneration stack and digester pressure relief valves in Scenarios 1, 2, 3 and all seven upset scenarios. All point sources were modelled as wake-affected stacks;
- Seven 'failure' events have been considered in this assessment as described in section 2.1. For all upset scenarios except upset scenarios 2 and 4, the emission rates were increased, but the sources and their characteristics remained the same as per Scenario 2, the expanded site. The upset scenario 2 has been modelled with an exclusion of OCU stack odour emission with increased emission rates from covered sources (i.e. no odour treatment) and no change to other sources. Whereas the upset scenario 4 has been modelled with an inclusion of digester pressure relief valves odour emission with no change to other sources;
- Background concentrations of odour or other pollutants have been assumed to be negligible, owing to the residential and recreational land use surrounding the site, and therefore have not been included in the model.

6.3 RECEPTOR NETWORK

In this assessment, a detailed finely spaced receptor network was generated out to 4.0 km in all directions from the site boundary, thereby covering a region of more than 8 km x 8 km all around the STP. All receptors have been treated as sensitive receptors and each receptor has a discrete terrain elevation height as determined from

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the USGS Shuttle Radar Topography Mission (SRTM) data for the world. A total of 6,126 receptors have been used in this assessment. There are:

- 89 fence line receptors, spaced at approximately 25 m around the site boundary;
- 3,206 receptors spaced at 30 m intervals, extending 700 m from the site boundary in all directions;
- 1,967 receptors spaced at 100 m intervals, extending 2.2 km from the site boundary in all directions;
- 832 receptors spaced at 250 m intervals, extending 4.0 km from the site boundary in all directions.
- 5 cultural, 'sensitive receptors' at the location of the rugby field, bridge club, rowing club, rugby club house and 10 Cat lives Centre.
- 27 residential properties along Risdon Road and Queens Walk located west and south of the STP, respectively.

Figure 6-1 shows the entire receptor network used in the model, relative to the STP location (Red boundary). Black cross hair cursors represent the three nested grids of arbitrary receptors. Green receptors are the 27 residences and blue are the 5 original cultural receptors.

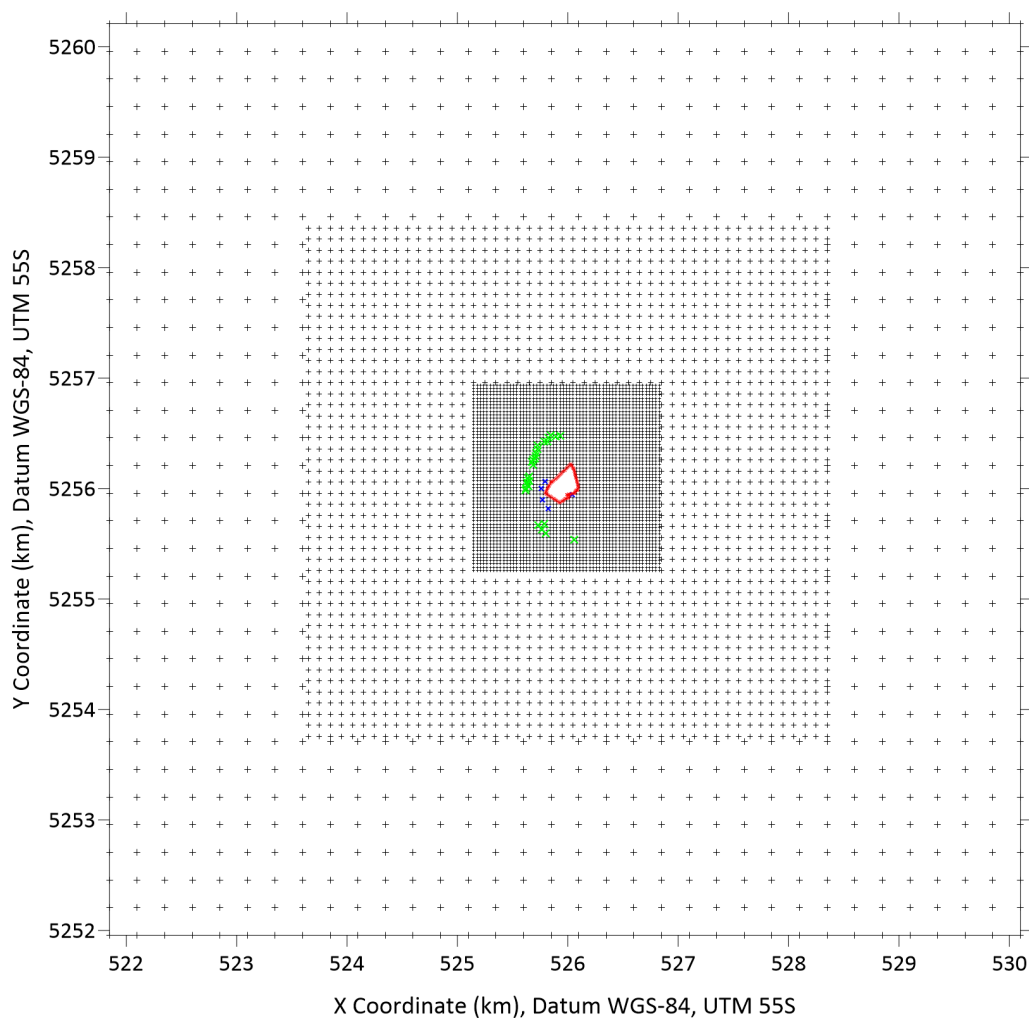


Figure 6-1: Receptor Network Used in the Dispersion Model

6.4 BUILDING DOWNWASH

The site buildings were input into the CALPUFF model using the Building Profile Input Program (BPIP) and the effects of building downwash were modelled in CALPUFF using the Plume Rise Model Enhancements (PRIME)

module. The OCU stack, the Cogeneration stack and digester pressure relief valves (in upset scenario 4 only) are considered wake affected. Figure 6-2 shows some of the structures nearby to the OCU stack, Cogeneration stack and the digester pressure relief valves. Tables in Appendix D identify those buildings which were deemed to cause building downwash.



Figure 6-2: Existing and Proposed Building Structures on the Selfs Point site. Purple are new buildings. Green are point sources.

6.5 ODOUR SOURCES AND EMISSION RATES

6.5.1 Description of Model Scenarios

The aim of the odour dispersion modelling and impact assessment of the Selfs Point STP expansion was to investigate the potential odour impact of the upgraded works at nearby local sensitive receptors (mainly at the residential properties along Risdon Road and Queens Walk located west and south of the STP, respectively) and determine if odour mitigation measures are required.

The scenarios involved in this assessment are:

- Scenario 1:** Expanded site with Sydney Water database odour emission rates
- Scenario 2:** Expanded site with odour emission data measured from site
- Scenario 3:** Expanded site with odour emission data measured from site but with enhanced odour capture and treatment

Figure 6-3 represent the odour sources considered in the dispersion modelling scenarios.

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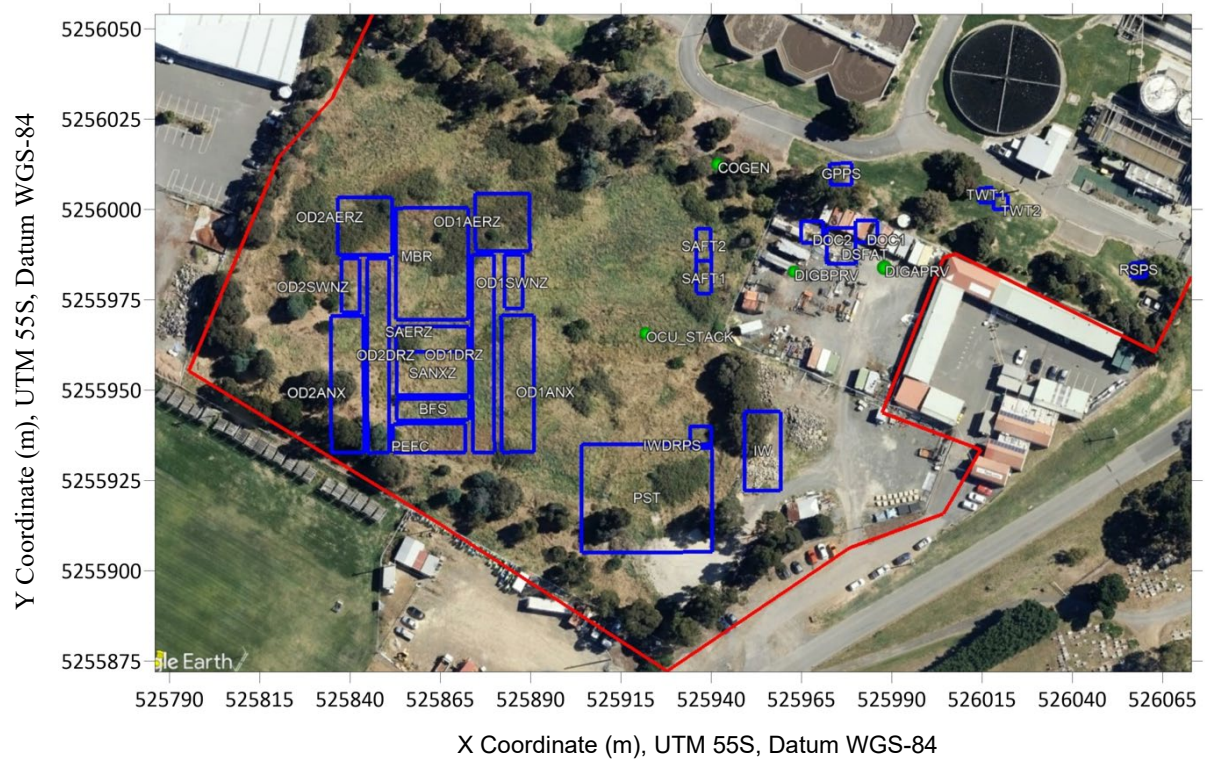


Figure 6-3 Odour Sources included in the Dispersion Model for Scenario 1, 2 and 3

6.5.2 Omitted Sources

A number of process units on-site were not included in the odour dispersion model of Selfs Point STP. These sources are listed below.

- Sources that have been through biological treatment (post-biological treatment/tertiary treatment) have been excluded from the assessment due to non-offensive hedonic tone and assumed low odour concentration. If these were included, there would be the following odour emissions impact:
 - Effluent balance tank – Area of 1,385 m² at SOER of 0.02 ou.m³/s.m² = 27.7 ou.m³/s
 - Chlorine contact tank – Area of 230 m² at SOER of 0.02 ou.m³/s.m² = 4.6 ou.m³/s

These sources combined, if included, would account for approximately 1% of odours from area sources on site less than 0.5% of all odours from site for Scenario 2.
- The frequency and duration of short-term variable operations such as waste receipt tanker movements are not consistent and therefore, such operations have been excluded from this assessment to prevent over estimation of total site emissions, however the residual odour from the tankered waste tanks has been included.
- For digesters, 100% capture of odour from digesters for use in the cogeneration unit is a common practice as specified in the Sydney Water “Odour emissions database development – Best practice odour emissions”, 2007. This is standard practice for digesters given digester gas is extracted for use in cogeneration, and that the fugitive escape of digester gas would lead to a flammable atmosphere. As such, covers on the digesters are generally tighter than for the other covered areas on STPs, such as inlet works or PSTs. Therefore, digesters A and B have been excluded as odour sources.
- Screenings/grit bins, drum thickeners, centrifuges and sludge out loading bins are fully enclosed and ducted to the odour control unit on site. The residual fugitive odour emissions from these sources are considered negligible. If they were included, they would have an approximate odour emission as follows:
 - 2 No. Screenings/grit bins at 4 m² each, with an SOER of 4.77 ou.m³/s.m² and 99% capture efficiency = 0.38 ou.m³/s
 - 4 No. Sludge outloading bins at 4 m² each, with an SOER of 3.26 ou.m³/s.m² and 99% capture efficiency = 0.52 ou.m³/s

These sources combined, if included, would account for less than 0.1% of odours from area sources on site. They have therefore been omitted as odour sources in the assessment.

6.5.3 Specific odour emission rates

Specific odour emission rates (SOERs), in ou.m³/m²/s, provide an odour flux rate per square meter. The SOERs for different processes can vary widely between treatment plants. In biological processes, anaerobic zones tend to be the most odorous, followed by anoxic zones. Aerobic zones tend to have a very low odour.

Some upstream processes can have a negative impact on SOERs from downstream processes. This is common in sites with pre-fermenters or where sludge is held within primary settling tanks for longer periods (thereby causing pre-fermentation to occur within the primary settling tank instead of a dedicated pre-fermenter). Figure 6-4 below, from the Sydney Water odour emissions database, shows the impact of thickening and pre-fermenting on odour from primary settling tanks. In this case, odours from primary settling tanks that use thickening and pre-fermenting have an SOER three to six (average 3.5) times greater than those without thickening and pre-fermenting.

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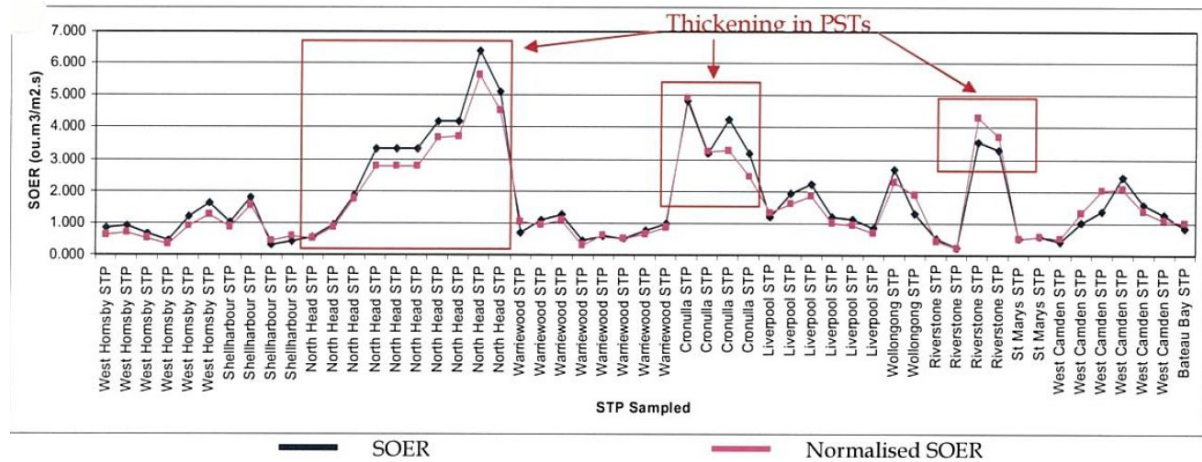


Figure 6-4: Extract on Primary Settling Tanks from the Sydney Water Best Practice Odour Emissions Database (2007)

Sites with longer solids retention times (SRTs) tend to generate lower SOERs. This is because there is a greater destruction of volatile substances, the longer the solids are allowed to act. Figure 6-5 below provides a snapshot from the Stantec global odour database, along with 95% confidence intervals, on the impact of SOER related to sludge age for aerobic processes. This dataset amalgamated data from 16 sites with similar processes and feeds from across Australia. When the SRT is short, the SOER tends to be higher and fluctuate more.

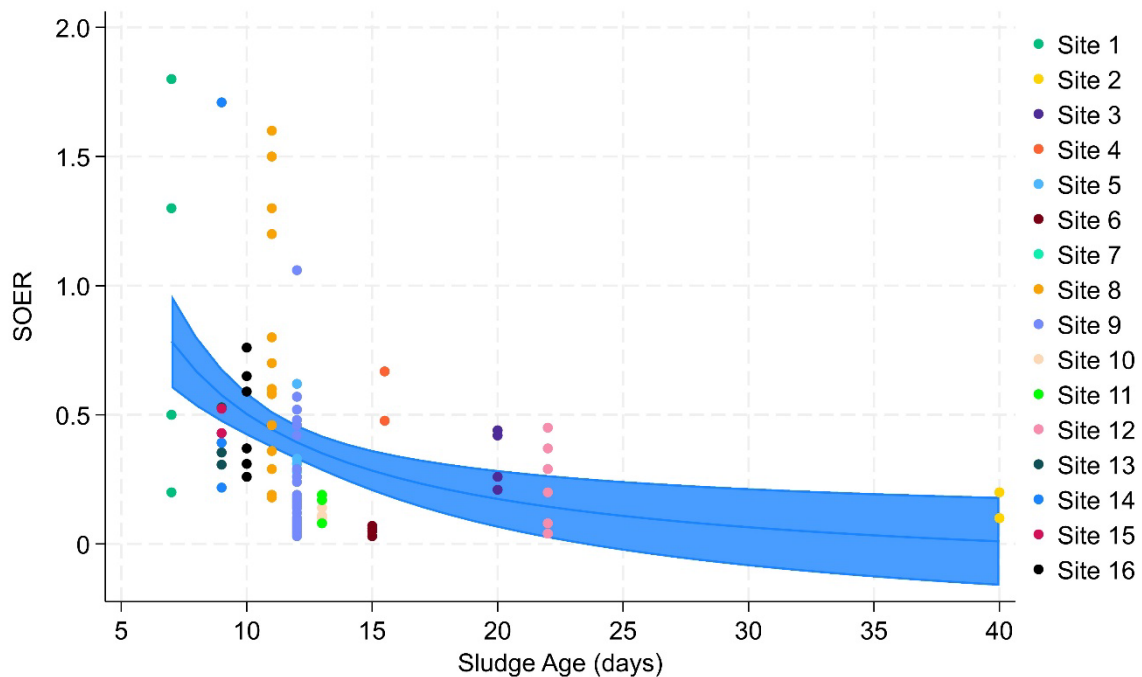


Figure 6-5: Relationship and 95% Confidence Interval of SOER vs SRT (Sludge Age)

As the SRT increases, the SOER decreases and becomes more stable. Whilst there is significant fluctuation, a broad relationship exists whereby the average SOER measured at one SRT can be modified to an average SOER at another SRT as per the following formula:

$$SOER_2 = SOER_1 * \frac{SRT_2}{SRT_1}$$

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Table 6-1 provides a summary of SOERs measured at Selfs Point and how they compare to SOERs at other Tasmanian sites, as well as with the Sydney Water best practice emissions database. The number of samples (n) taken from Selfs Point and the number of samples that led to the best practice emission rates in the Sydney Water odour emissions database is also provided.

Table 6-1: SOERs from Different Sites

Source Description	Selfs Point STP (measured)	Tasmanian Site 1 (measured)	Tasmanian Site 2 (measured)	Sydney Water Best Practice Odour Emissions Database
Specific odour emission rates (ou.m/s)				
Primary Settling Tank	1.51 n=1	4.50	-	1.1 (without thickening) n=37
Anaerobic zone	4.54 n=1	-	-	1.5 n=5
Anoxic zone	2.27 n=1	-	-	0.5 n=28
Aerobic zone	0.94 n=1	0.048 – 0.145	0.015 – 0.14	0.3 (Biodenipho aerated zone) n=10 0.08 (long sludge age aerobic zones) n=52 0.03 - 0.08 (oxidation ditches) n=2
Mixed zone	1.34 n=1	-	-	-
Secondary clarifiers	0.02 n=1	-	-	0.1 (secondary clarifiers) n=33 0.02 (tertiary clarifiers) n=4

It should be noted that the aerobic zones from biodenipho plants are almost four times greater than other long sludge age aerobic zones in the Sydney Water database.

As it can be seen from the above table that the Sydney Water odour emission database is comprised of more than ninety samples of anoxic and aerobic zones, with those emission rates representative of the proposed plant process units adopted. The single sample from the aerobic and anoxic zones of the existing plant have been modelled within Scenario 2.

Three scenarios have been modelled as part of this odour impact assessment. The SOERs modelled for each of the major process units are found in Table 6-2. Note that these values do not have any capture efficiency applied. For each scenario, a capture efficiency is applied depending on how effective the covering and containment is likely to be. This is detailed more in sections 6.5.4, 6.5.5 and 6.5.6.

Table 6-2: SOERs Used in Each Scenario

Source Description	Scenario 1	Scenario 2 and 3	Comments
	As per Sydney Water database where appropriate	As per site measurements (modified for SRT where appropriate)	

Source Description	Scenario 1	Scenario 2 and 3	Comments
	ou.m/s		
Inlet works	4.77	4.77	Based on SOERs from other inlet works with similar odour measurements to that measured from site in 2016
Tankered waste tanks	9.54	9.54	Double inlet works
Primary settling tanks	1.51	1.51	
Primary effluent feed chamber	1.51	1.51	As per primary settling tanks
Bioreactor flow splitter	1.51	1.51	As per primary settling tanks
Secondary anoxic zone	0.5	1.70	
Secondary aerobic zone	0.08	0.71	
Oxidation ditch – anoxic influenced zone	0.5	1.70	
Oxidation ditch – swing zone	0.29	1.01	Average of aerobic and anoxic zones in Scenario 1
Oxidation ditch – aerobically influenced zone	0.08	0.71	
Oxidation ditch – deaeration zone	0.29	1.21	Average of aerobic and anoxic zones in all scenarios
Membrane bioreactor	0.08	0.12 ^{Note 1}	
Sludge tanks	3.26	3.26	Based on maximum of culled data from Sydney Water best practice odour emissions database

Italics – modified based on an upgraded plant SRT of 20 days compared to 15 days during site measurements.

Note 1 – 0.16 ou.m/s from Cedar Grove modelling which in turn was from two sites in QLD which each had an SRT of 13 days.

6.5.4 Scenario 1

The odour emission sources included in the dispersion modelling are represented as either point sources or area sources. These are shown in Table 6-3 and Table 6-4 for area and point sources, respectively, for Scenario 1. Table 6-5 provides the overall odour emission from site.

The characteristics of each source type are outlined briefly below:

Area sources are usually low-lying odour emission sources such as tanks, ponds and stockpiles; where ambient conditions of wind and temperature determine the rate of odour emission from the source. The emission rate is a surface flux rate per unit area or a 'Specific Odour Emission Rate' (SOER), in $\text{ou.m}^3/\text{m}^2/\text{s}$. Note this is the same as $\text{ou.m}^2/\text{s}$ which is the nomenclature adopted in this report.

Point sources are odour emission sources such as stacks, where there is a relatively high velocity of air through a relatively small orifice. A wake-affected point source is where the discharge of the point source is within the zone of disturbed air that is created as the wind passes around or over nearby structures such as building or trees. Wake-free point sources are where the discharge of the point source is more than 2.5 times the height of the largest nearby building, therefore surrounding buildings do not influence the stack top airflow. To calculate the odour emission rate for a point source, the specified volumetric air flow rate is multiplied by the monitored odour concentration value. This provides an 'Odour Emission Rate' (OER) in $\text{ou.m}^3/\text{s}$. Note this is the same as ou/s which is the nomenclature adopted in this report.

Volume sources are commonly modelled to represent fugitive emissions from within a building, for example emissions through doorways or under unsealed building eaves, based on the prevailing meteorological conditions.

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Table 6-3: Area Source Parameters for Scenario 1

Odour Source	Source ID	Base Elevation (m)	Height (m)	Surface Area (m ²)	Uncontained SOER (ou.m/s)	Uncontained OER (ou.m ³ /s)	Capture Efficiency (%)	Contained SOER (ou.m ³ /s)	Contained OER (ou.m ³ /s)
Preliminary Treatment									
Inlet works drainage pump station	IWDRPS	8.00	0.00	7.10	4.77	33.87	99%	0.05	0.34
General purpose pump station	GPPS	8.00	0.00	7.10	4.77	33.87	99%	0.05	0.34
Raw sewage pump station	RSPS	7.00	0.00	20.00	4.77	95.40	99%	0.05	0.95
Tanker waste tank 1	TWT1	6.00	6.50	12.60	9.54	120.20	99%	0.10	1.20
Tanker waste tank 2	TWT2	6.00	6.50	12.60	9.54	120.20	99%	0.10	1.20
Inlet works	IW	8.00	5.50	220.00	4.77	1049.40	99%	0.05	10.49
Primary Treatment									
Primary sedimentation tanks and associated channel	PST	7.00	6.05	1075.00	1.51	1623.25	99%	0.02	16.23
Secondary Treatment									
Primary effluent feed chamber	PEFC	7.00	3.50	160.00	1.51	241.60	99%	0.02	2.42
Bioreactor flow splitter	BFS	7.00	7.00	126.00	1.51	190.26	99%	0.02	1.90
Secondary anoxic zone	SANXZ	7.00	5.90	234.00	0.50* ¹	117.00	0%	0.50	117.00
Secondary aerobic zone	SAERZ	7.00	5.90	143.00	0.08* ¹	11.44	0%	0.08	11.44
Oxidation ditch 1 – Anoxic influenced zone	OD1ANX	7.00	5.90	343.00	0.50* ¹	171.50	0%	0.50	171.50
Oxidation ditch 1 – Swing Zone	OD1SWNZ	7.00	5.90	75.00	0.29* ¹	21.75	0%	0.29	21.75
Oxidation ditch 1 – Aerobically influenced zone	OD1AERZ	7.00	5.90	241.00	0.08* ¹	19.28	0%	0.08	19.28
Oxidation ditch 1 – Deaeration zone	OD1DRZ	7.00	5.90	327.00	0.29* ¹	94.83	0%	0.29	94.83
Oxidation ditch 2 – Anoxic influenced zone	OD2ANX	7.00	5.90	343.00	0.50* ¹	171.50	0%	0.50	171.50
Oxidation ditch 2 – Swing Zone	OD2SWNZ	7.00	5.90	75.00	0.29* ¹	21.75	0%	0.29	21.75
Oxidation ditch 2 – Aerobically influenced zone	OD2AERZ	7.00	5.90	241.00	0.08* ¹	19.28	0%	0.08	19.28
Oxidation ditch 2 – Deaeration zone	OD2DRZ	7.00	5.90	327.00	0.29* ¹	94.83	0%	0.29	94.83
Membrane bioreactor and associated channels (RAS overflow, MBR feed etc.)	MBR	7.00	4.00	611.25	0.08* ¹	48.90	0%	0.08	48.90

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Odour Source	Source ID	Base Elevation (m)	Height (m)	Surface Area (m ²)	Uncontained SOER (ou.m/s)	Uncontained OER (ou.m ³ /s)	Capture Efficiency (%)	Contained SOER (ou.m ³ /s)	Contained OER (ou.m ³ /s)
Sludge Treatment									
Sludge averaging feed tank 1	SAFT1	7.00	5.50	35.00	3.26	114.10	99%	0.03	1.14
Sludge averaging feed tank 2	SAFT2	7.00	5.50	35.00	3.26	114.10	99%	0.03	1.14
Digested sludge FAT	DSFAT	8.70	5.50	16.80	3.26	54.77	99%	0.03	0.55
Digester outlet chamber 1 (Digester A)	DOC1	8.70	0.00	5.90	3.26	19.23	99%	0.03	0.19
Digester outlet chamber 2 (Digester B)	DOC2	8.70	0.00	5.90	3.26	19.23	99%	0.03	0.19

*1 75% of measured SOER has been used. This is due to the solids retention time (SRT) of the expanded plant being 20 days whereas measurements on site were taken from a plant that was operating at 15 days SRT. Stantec's Global Emissions Database was used to identify a reduction on SOER based on this change on SRT.

Table 6-4: Point Source Parameters for Scenario 1

Source ID	Source Description	Base Elevation (m)	Stack Height (m)	Diameter (m)	Flow rate (m ³ /s)	Exit Velocity (m/s)	Odour (ou)	Exit Temp. (K)	Total OER (ou.m ³ /s)
OCU	Odour Control Unit Stack	8.00	14.00	0.83	8.05	14.88	500	293.15	4,025.00
COGEN	Cogeneration Stack	7.00	12.00	0.10	0.08	15.0	2,500	773.15	200.00

Table 6-5: Total Odour Emission for Scenario 1

Odour Sources	Odour Emission (ou.m ³ /s)*
Area Sources	830
Point Sources	4,225
All Sources	5,055

*Not including any seasonal and operational variations.

6.5.5 Scenario 2

The odour emission sources included in the dispersion modelling are represented as either point sources or area sources. These are shown in Table 6-6 and Table 6-7 for area and point sources, respectively, for Scenario 2. Table 6-8 provides the overall odour emission from site.

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Table 6-6: Area Source Parameters for Scenario 2

Odour Source	Source ID	Base Elevation (m)	Height (m)	Surface Area (m ²)	Uncontained SOER (ou.m/s)	Uncontained OER (ou.m ³ /s)	Capture Efficiency (%)	Contained SOER (ou.m ³ /s)	Contained OER (ou.m ³ /s)
Preliminary Treatment									
Inlet works drainage pump station	IWDRPS	8.00	0.00	7.10	4.77	33.87	99%	0.05	0.34
General purpose pump station	GPPS	8.00	0.00	7.10	4.77	33.87	99%	0.05	0.34
Raw sewage pump station	RSPS	7.00	0.00	20.00	4.77	95.40	99%	0.05	0.95
Tanker waste tank 1	TWT1	6.00	6.50	12.60	9.54	120.20	99%	0.10	1.20
Tanker waste tank 2	TWT2	6.00	6.50	12.60	9.54	120.20	99%	0.10	1.20
Inlet works	IW	8.00	5.50	220.00	4.77	1049.40	99%	0.05	10.49
Primary Treatment									
Primary sedimentation tanks and associated channel	PST	7.00	6.05	1075.00	1.51	1623.25	99%	0.02	16.23
Secondary Treatment									
Primary effluent feed chamber	PEFC	7.00	3.50	160.00	1.51	241.60	99%	0.02	2.42
Bioreactor flow splitter	BFS	7.00	7.00	126.00	1.51	190.26	99%	0.02	1.90
Secondary anoxic zone	SANXZ	7.00	5.90	234.00	1.70* ¹	397.80	0%	1.70	397.80
Secondary aerobic zone	SAERZ	7.00	5.90	143.00	0.71* ¹	101.53	0%	0.71	101.53
Oxidation ditch 1 – Anoxic influenced zone	OD1ANX	7.00	5.90	343.00	1.70* ¹	583.10	0%	1.70	583.10
Oxidation ditch 1 – Swing Zone	OD1SWNZ	7.00	5.90	75.00	1.01* ¹	75.75	0%	1.01	75.75
Oxidation ditch 1 – Aerobically influenced zone	OD1AERZ	7.00	5.90	241.00	0.71* ¹	171.11	0%	0.71	171.11
Oxidation ditch 1 – Deaeration zone	OD1DRZ	7.00	5.90	327.00	1.21* ¹	394.04	0%	1.21	394.04
Oxidation ditch 2 – Anoxic influenced zone	OD2ANX	7.00	5.90	343.00	1.70* ¹	583.10	0%	1.70	583.10
Oxidation ditch 2 – Swing Zone	OD2SWNZ	7.00	5.90	75.00	1.01* ¹	75.75	0%	1.01	75.75
Oxidation ditch 2 – Aerobically influenced zone	OD2AERZ	7.00	5.90	241.00	0.71* ¹	171.11	0%	0.71	171.11
Oxidation ditch 2 – Deaeration zone	OD2DRZ	7.00	5.90	327.00	1.21* ¹	394.04	0%	1.21	394.04
Membrane bioreactor and associated channels (RAS overflow, MBR feed etc.)	MBR	7.00	4.00	611.25	0.12* ¹	73.35	0%	0.12	73.35

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Odour Source	Source ID	Base Elevation (m)	Height (m)	Surface Area (m ²)	Uncontained SOER (ou.m/s)	Uncontained OER (ou.m ³ /s)	Capture Efficiency (%)	Contained SOER (ou.m ³ /s)	Contained OER (ou.m ³ /s)
Sludge Treatment									
Sludge averaging feed tank 1	SAFT1	7.00	5.50	35.00	3.26	114.10	99%	0.03	1.14
Sludge averaging feed tank 2	SAFT2	7.00	5.50	35.00	3.26	114.10	99%	0.03	1.14
Digested sludge FAT	DSFAT	8.70	5.50	16.80	3.26	54.77	99%	0.03	0.55
Digester outlet chamber 1 (Digester A)	DOC1	8.70	0.00	5.90	3.26	19.23	99%	0.03	0.19
Digester outlet chamber 2 (Digester B)	DOC2	8.70	0.00	5.90	3.26	19.23	99%	0.03	0.19

*1 75% of measured SOER has been used. This is due to the solids retention time (SRT) of the expanded plant being 20 days whereas measurements on site were taken from a plant that was operating at 15 days SRT. Stantec's Global Emissions Database was used to identify a reduction on SOER based on this change on SRT.

Table 6-7: Point Source Parameters for Scenario 2

Source ID	Source Description	Base Elevation (m)	Stack Height (m)	Diameter (m)	Flow rate (m ³ /s)	Exit Velocity (m/s)	Odour (ou)	Exit Temp. (K)	Total OER (ou.m ³ /s)
OCU	Odour Control Unit Stack	8.00	14.00	0.83	8.05	14.88	500	293.15	4,025.00
COGEN	Cogeneration Stack	7.00	12.00	0.10	0.08	15.0	2,500	773.15	200.00

Table 6-8: Total Odour Emission for Scenario 2

Odour Sources	Odour Emission (ou.m ³ /s)*
Area Sources	3,059
Point Sources	4,225
All Sources	7,284

*Not including any seasonal and operational variations.

6.5.6 Scenario 3

The odour emission sources included in the dispersion modelling are represented as either point sources or area sources. These are shown in Table 6-9 and Table 6-10 for area and point sources, respectively, for Scenario 3. Table 6-11 provides the overall odour emission from site.

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Table 6-9: Area Source Parameters for Scenario 3

Odour Source	Source ID	Base Elevation (m)	Height (m)	Surface Area (m ²)	Uncontained SOER (ou.m/s)	Uncontained OER (ou.m ³ /s)	Capture Efficiency (%)	Contained SOER (ou.m ³ /s)	Contained OER (ou.m ³ /s)
Preliminary Treatment									
Inlet works drainage pump station	IWDRPS	8.00	0.00	7.10	4.77	33.87	99%	0.05	0.34
General purpose pump station	GPPS	8.00	0.00	7.10	4.77	33.87	99%	0.05	0.34
Raw sewage pump station	RSPS	7.00	0.00	20.00	4.77	95.40	99%	0.05	0.95
Tanker waste tank 1	TWT1	6.00	6.50	12.60	9.54	120.20	99%	0.10	1.20
Tanker waste tank 2	TWT2	6.00	6.50	12.60	9.54	120.20	99%	0.10	1.20
Inlet works	IW	8.00	5.50	220.00	4.77	1049.40	99%	0.05	10.49
Primary Treatment									
Primary sedimentation tanks and associated channel	PST	7.00	6.05	1075.00	1.51	1623.25	99%	0.02	16.23
Secondary Treatment									
Primary effluent feed chamber	PEFC	7.00	3.50	160.00	1.51	241.60	99%	0.02	2.42
Bioreactor flow splitter	BFS	7.00	7.00	126.00	1.51	190.26	99%	0.02	1.90
Secondary anoxic zone	SANXZ	7.00	5.90	234.00	1.70* ¹	397.80	99%	0.02	3.98
Secondary aerobic zone	SAERZ	7.00	5.90	143.00	0.71* ¹	101.53	0%	0.71	101.53
Oxidation ditch 1 – Anoxic influenced zone	OD1ANX	7.00	5.90	343.00	1.70* ¹	583.10	99%	0.02	5.83
Oxidation ditch 1 – Swing Zone	OD1SWNZ	7.00	5.90	75.00	1.01* ¹	75.75	0%	1.01	75.75
Oxidation ditch 1 – Aerobically influenced zone	OD1AERZ	7.00	5.90	241.00	0.71* ¹	171.11	0%	0.71	171.11
Oxidation ditch 1 – Deaeration zone	OD1DRZ	7.00	5.90	327.00	1.21* ¹	394.04	0%	1.21	394.04
Oxidation ditch 2 – Anoxic influenced zone	OD2ANX	7.00	5.90	343.00	1.70* ¹	583.10	99%	0.02	5.83
Oxidation ditch 2 – Swing Zone	OD2SWNZ	7.00	5.90	75.00	1.01* ¹	75.75	0%	1.01	75.75
Oxidation ditch 2 – Aerobically influenced zone	OD2AERZ	7.00	5.90	241.00	0.71* ¹	171.11	0%	0.71	171.11
Oxidation ditch 2 – Deaeration zone	OD2DRZ	7.00	5.90	327.00	1.21* ¹	394.04	0%	1.21	394.04
Membrane bioreactor and associated channels (RAS overflow, MBR feed etc.)	MBR	7.00	4.00	611.25	0.12* ¹	73.35	0%	0.12	73.35

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Odour Source	Source ID	Base Elevation (m)	Height (m)	Surface Area (m ²)	Uncontained SOER (ou.m/s)	Uncontained OER (ou.m ³ /s)	Capture Efficiency (%)	Contained SOER (ou.m ³ /s)	Contained OER (ou.m ³ /s)
Sludge Treatment									
Sludge averaging feed tank 1	SAFT1	7.00	5.50	35.00	3.26	114.10	99%	0.03	1.14
Sludge averaging feed tank 2	SAFT2	7.00	5.50	35.00	3.26	114.10	99%	0.03	1.14
Digested sludge FAT	DSFAT	8.70	5.50	16.80	3.26	54.77	99%	0.03	0.55
Digester outlet chamber 1 (Digester A)	DOC1	8.70	0.00	5.90	3.26	19.23	99%	0.03	0.19
Digester outlet chamber 2 (Digester B)	DOC2	8.70	0.00	5.90	3.26	19.23	99%	0.03	0.19

*1 75% of measured SOER has been used. This is due to the solids retention time (SRT) of the expanded plant being 20 days whereas measurements on site were taken from a plant that was operating at 15 days SRT. Stantec's Global Emissions Database was used to identify a reduction on SOER based on this change on SRT.

Table 6-10: Point Source Parameters for Scenario 3

Source ID	Source Description	Base Elevation (m)	Stack Height (m)	Diameter (m)	Flow rate (m ³ /s)	Exit Velocity (m/s)	Odour (ou)	Exit Temp. (K)	Total OER (ou.m ³ /s)
OCU	Odour Control Unit Stack	8.00	14.00	0.9	9.58	15	500	293.15	4,791.67
COGEN	Cogeneration Stack	7.00	12.00	0.10	0.08	15.0	2,500	773.15	200.00

Table 6-11: Total Odour Emission for Scenario 3

Odour Sources	Odour Emission (ou.m ³ /s)*
Area Sources	1,511
Point Sources	4,992
All Sources	6,502

*Not including any seasonal and operational variations.

6.5.7 Upset Scenarios

Seven potential 'failure' events were considered in this assessment, as follows;

Upset Scenario 1 – Aeration goes offline. This assumes aeration goes offline for a period of up to 4 hours. The impact is that aerobic zones become more anoxic (though not fully anoxic) and specific odour emission rates from aerobic zones increase by approximately 10%.

Upset Scenario 2 – OCU extraction stops. This assumes that the odour control unit fans both go offline and foul air extraction ceases. This reduces capture efficiency from covered process units from 99% to 60% (i.e. capture is relying purely on covers and not from extraction).

Upset Scenario 3 – Solids retention time drops from 20 days to 15 days. This assumes that wasting from the biological processes increases dramatically, leading to a shorter sludge age. In turn, this would increase odour emission rates from biological processes by approximately 33%.

Upset Scenario 4 – Pressure relief valve on both digesters open. This assumes that, despite all safeguards in place, digester gas is released into the environment from both digesters simultaneously. Each pressure relief valve would have a flow of approximately 2,000 m³/h with an odour content of 18,600 ou (as per the Sydney Water best practice odour emissions database).

Upset Scenario 5 – Activated carbon filter change over. Under this scenario the activated carbon from the OCU is depleted resulting in an odour emission rate of 2,000 ou instead of the usual 500 ou.

Upset Scenario 6 – Digester system failure. In the event that the digester fails it is expected that the dewatering processes start emitting at 5 times their regular emission rates.

Upset Scenario 7 – Higher emissions from tanker waste deliveries. This assumes that the foul air extraction ceases from the tankered waste deliveries causing capture to drop from 99% down to 60%.

All the other sources and emission rates remain the same as per Scenario 2 (expanded site with measured odour emission data). A summary of the upset scenarios, safeguards in place and expected frequency and duration of events occurring is found in Table 6-12.

Table 6-12: Upset Scenarios Summary

Upset Scenario	Description of Upset	Changes to Model	Existing Safeguards	Expected Frequency and Duration of Occurrence
1	Aeration goes offline for up to 4 hours leading to aerobic zones becoming more anoxic	Aerobic zone odour emission rates increase by approximately 10%	Standby redundancy in blowers Blowers on separate supply lines to ensure redundancy is only minimally affected by power outages	Once every two years for up to four hours
2	Extraction stops leading to capture of foul air to drop such that capture is only from the impact of covering	Capture efficiency drops from 99% to 60% in covered units	Standby redundancy in foul air fans	Once every two years for up to four hours
3	Solids retention time reduces from 20 days to 15 days leading to an increase in odour emissions from biological processes	Odour emission increases by approximately 33% from biological processes	Large bioreactor volumes Standby redundancy in wasting pumps Automated wasting systems to maintain a solids retention time	Once every five years for up to four weeks
4	Pressure relief valves on both digesters open leading to odorous biogas release	2,000 m ³ /h of 16,800 ou foul air discharged from each digester	Biogas sent to cogeneration facility Flare in case cogeneration facility goes offline or if digesters become over pressurised	Once every 10 years for up to four hours
5	Activated carbon filter on odour control unit is changed, leading to discharge of air that has only been biologically treated	Odour concentration in treated air from OCU increases from 500 ou to 2,000 ou	Sufficient activated carbon to last for >12 months	Once every year for up to five days

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Upset Scenario	Description of Upset	Changes to Model	Existing Safeguards	Expected Frequency and Duration of Occurrence
6	Digester system fails leading to sludge processes emitting higher odour	Sludge processes emit odour at five times their regular emission rate	Robust monitoring and control of digestion processes	Once every five years for up to four weeks
7	Containment on the tankered waste storage systems fail leading to higher odour from these areas	Capture from the tankered waste storage tanks reduces from 99% to 60%	Standby redundancy in foul air fans and cam-lock connections to prevent spills outside of contained system	Once every two years for up to four hours

7.0 ODOUR IMPACT ASSESSMENT RESULTS

7.1 SCENARIO 1: EXPANDED PLANT WITH SYDNEY WATER DATABASE ODOUR EMISSION RATES

The impact result for the expanded plant using odour emission rates from the Sydney Water Best Practice odour emissions database can be found in Figure 7-1, Scenario 1, the base case. The 2.0 ou odour isopleth (Air Quality EPP - boundary criterion) is absent, indicating compliance with the boundary criterion. The 0.5 ou, 0.75 ou and 1.0 ou contours are shown instead. The highest predicted boundary odour concentration is 0.95 ou.

All sensitive receptors modelled have a predicted impact below 1 ou.

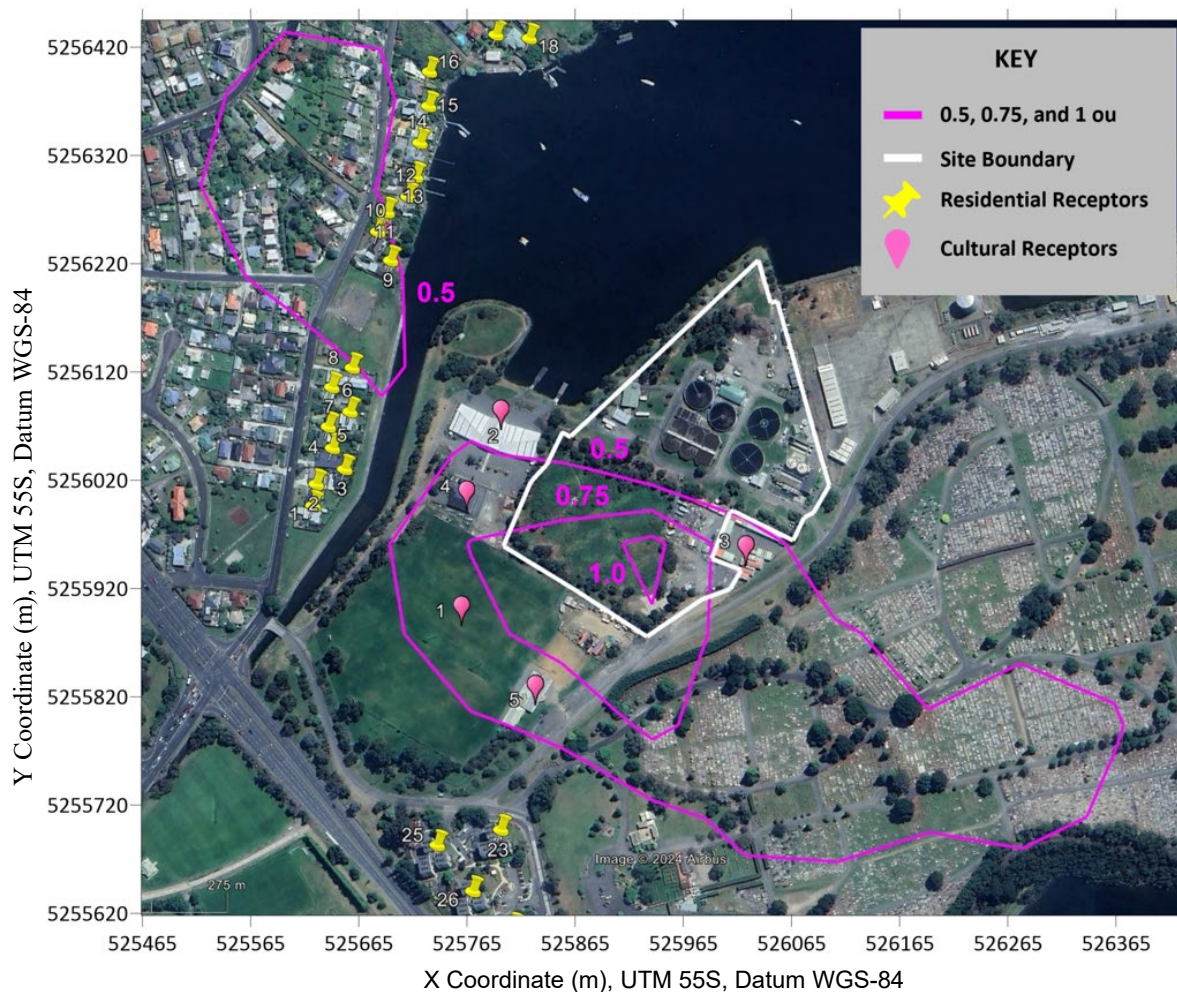


Figure 7-1: 0.5, 0.75 and 1 ou 99.5%ile 1-hour Average Odour Concentration for Scenario 1

7.2 SCENARIO 2: EXPANDED PLANT WITH MEASURED ODOUR EMISSION RATES

The impact result for the expanded plant using the odour emission data measured from site, impacted by the pre-fermenters, can be found in Figure 7-2. The 2.0 ou odour isopleth (Air Quality EPP 2004 - boundary criterion)

extends beyond the site boundary to the southern, south eastern and south western boundaries of the site. It encompasses most of the cultural receptors (sports field #1 at 2.6 ou, bridge club #4 at 2.3 ou, and rugby club house #5 at 2.3 ou).

The 1.0 ou isopleth extends beyond the site boundary in most directions, and encompasses up to 50 residential receptors and all the cultural receptors (#1 to #5).

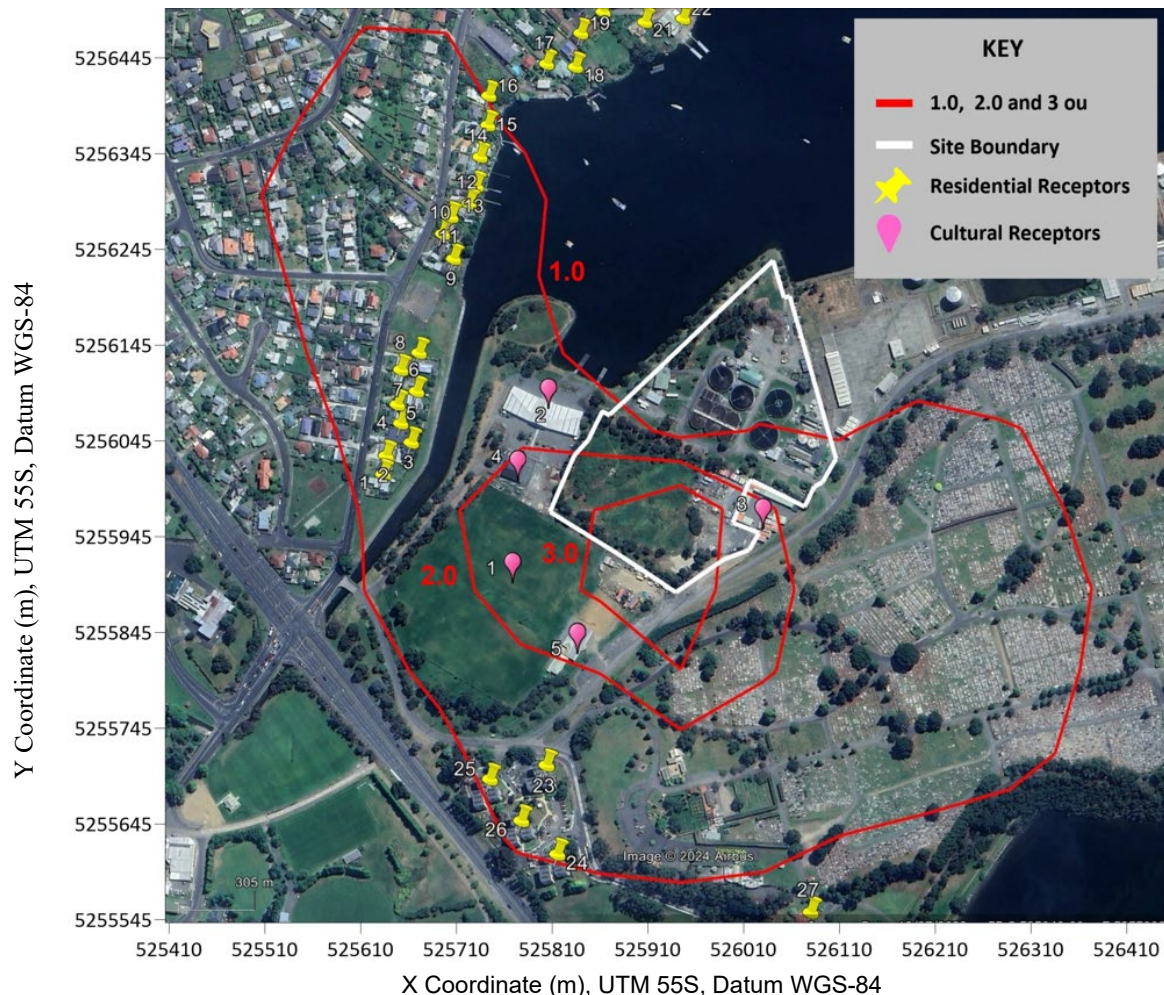


Figure 7-2: 1.0 ou, 2.0 ou and 3 ou, 99.5%ile 1-hour Average Odour Concentration for Scenario 2

7.3 SCENARIO 3: EXPANDED PLANT WITH ENHANCED ODOUR CONTROL AND COVERING

The impact result for the expanded plant using historical site-specific measured odour emission rates (impacted by pre-fermenters) from Scenario 2, but an enhanced odour control and covering regime (i.e. all anoxic zones covered, extracted and treated) can be found in Figure 7-3. The 2.0 ou odour isopleth (Air Quality EPP - boundary criterion) is absent, indicating compliance with boundary conditions. The 0.5 ou, 0.75 ou and 1.0 ou contours are shown instead. The highest predicted boundary odour concentration is 1.77 ou.

The 1 ou contour extends across the southern, south eastern and south western boundary of the plant.

All residential receptors modelled have a predicted impact below 1 ou however some cultural receptors modelled have a predicted impact above 1 ou.

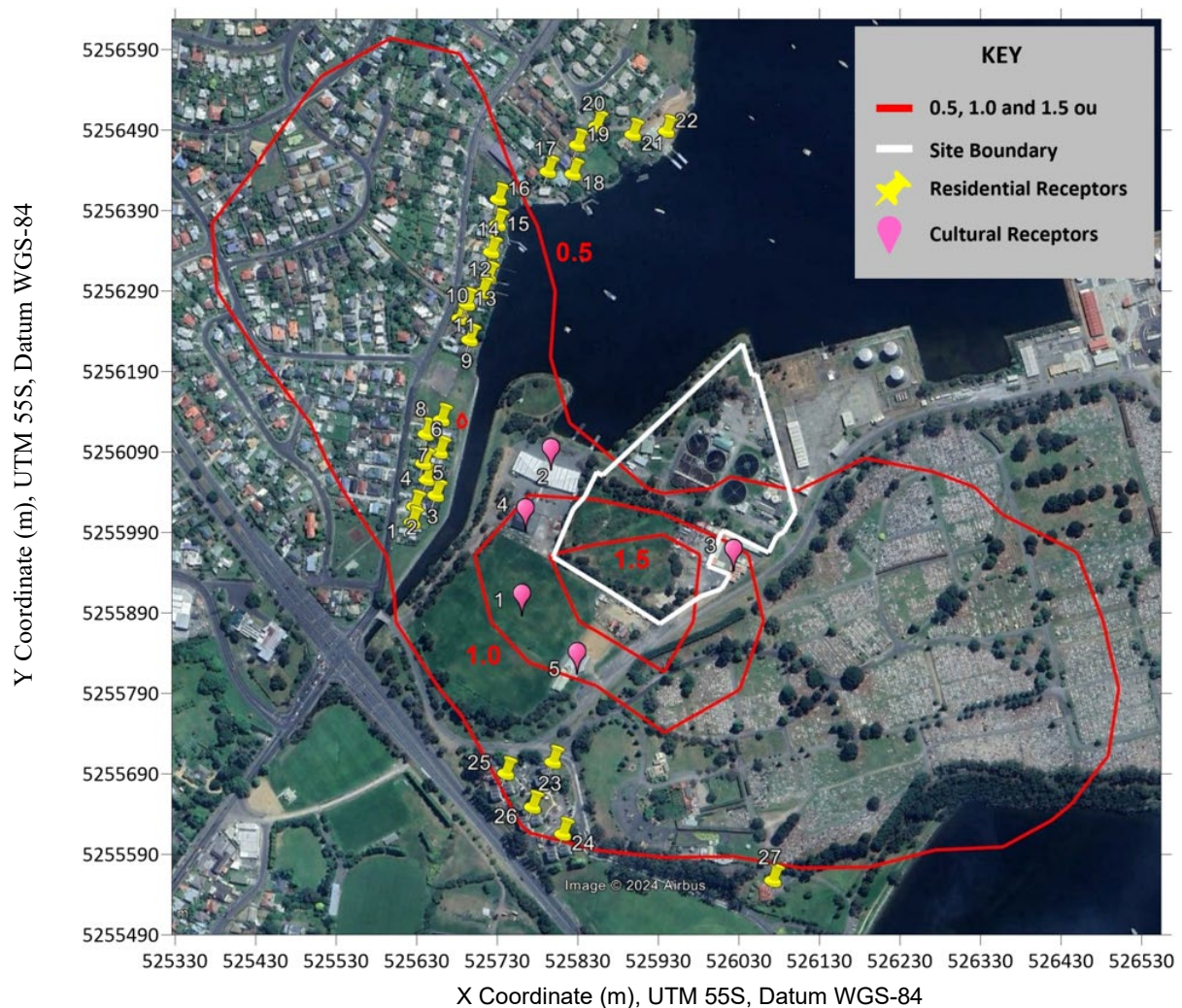


Figure 7-3: 0.5 ou, 1.0 and 1.5 ou 99.5%ile 1-hour Average Odour Concentration for Scenario 3

The maximum concentration at the plant boundary is shown in Table 7-1 for each of the modelled scenarios. The highest concentration predicted at the southern tip of the plant boundary is 3.5 ou for Scenario 2 which uses measured odour emissions. When Sydney Water emission rates were used the maximum plant boundary concentration reduced to 0.95 ou. With enhanced odour capture, the maximum boundary concentration is 1.77 ou.

Table 7-1: Maximum Predicted Odour Concentration at the Plant Boundary for Scenarios 1, 2 and 3

Scenario	Description	Highest ou concentration at the plant boundary	X Coordinate (km)	Y Coordinate (km)	Location of maximum boundary concentration
Scenario 1	Sydney Water Emission rates	0.95	525.928	5255.872	southwest boundary
Scenario 2	Measured emission rates	3.55	525.928	5255.872	southwest boundary

Scenario	Description	Highest ou concentration at the plant boundary	X Coordinate (km)	Y Coordinate (km)	Location of maximum boundary concentration
Scenario 3	Enhanced odour capture	1.77	525.927	5255.873	southwest boundary

7.4 UPSET SCENARIOS

The odour impact result for the seven 'Upset' events can be found in Figure 7-4.

Upset scenario 4 (pressure relieve valves opening) is predicted to have the largest impact on the residential receptors to the west of the site with a 2 ou contour encompassing some 50 residences. It should be noted that there are multiple safeguards in place to prevent this from occurring and, if it does occur, it would need to coincide with unfavourable meteorological conditions in order to affect so many residences.

Upset scenario 2, where foul air extraction stops, has an increased offsite odour emission. This increased impact predominantly affects the eastern side of the site with the 2 ou contour extending approximately 228m to the southeast, 218m to the south, and 169m to the southwest of the plant boundary. There is some impingement of the predicted 2 ou curve over receptor number R8 to the west of the site.

Upset scenario 3, where the solids retention time drops from 20 days to 15 days, the 2 ou contour extends 164m to the southeast, 162m to the south and 145m to the southwest of the plant boundary. No sensitive receptors are predicted to be exposed to odour concentration greater than 2 ou.

All other upset scenarios (1, 5, 6 and 7) resulted in negligible changes to the predicted odour impact offsite and were similar to that of Scenario 1, where the 2 ou contour extends 125m to the southeast, 135m to the south and 115m to the southwest of the plant boundary.

All the upset scenarios were modelled assuming they could occur at any time of the year and are therefore conservative as constant emissions have been assumed for all meteorological conditions for all hours of the year. In reality, upset scenario 2 is expected to occur once every 2 years for up to 4 hours, upset scenario 3 is expected to occur once every 5 years for up to four weeks, and upset scenario 4 which produced the biggest odour footprint is expected to occur once every ten years for up to four hours.

These results suggest that the site is unlikely to generate an odour impact under most upset conditions modelled, however if the pressure relief valves open (after all other safeguards fail) there may be some odour affecting residences to the west of the site.

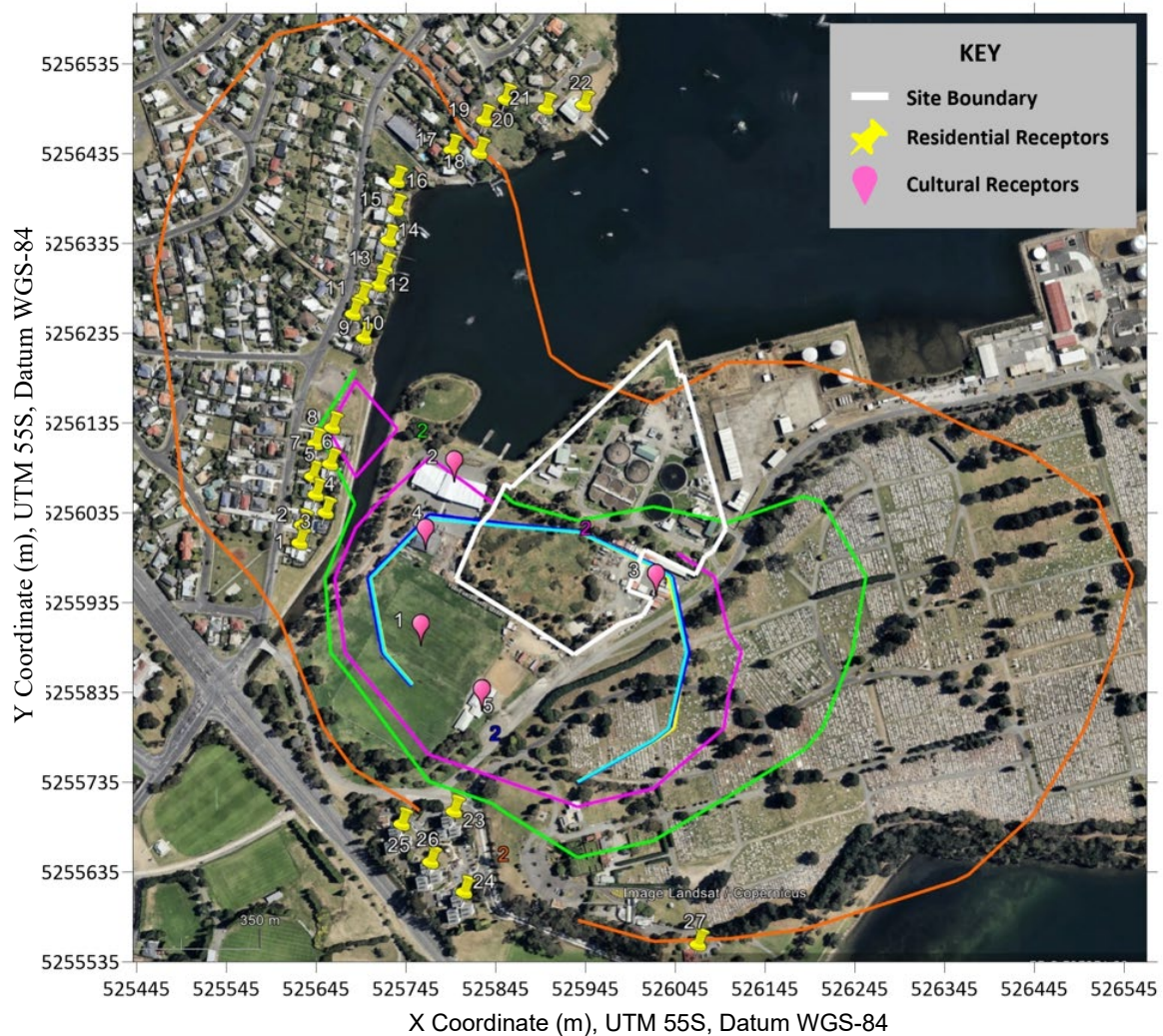


Figure 7-4: 2.0 or 99.5%ile 1-hour Average Odour Concentration for Upset Scenarios, where Upset 1 is dark blue, Upset 2 is green, Upset 3 is magenta, Upset 4 is orange, Upset 5 is yellow, Upset 6 is cyan, and Upset 7 is pink.

Table 7-1 shows the predicted odour concentrations (ou) at each of the cultural receptors for each of the scenarios modelled.

Table 7-2: Odour Concentrations at the Sensitive 'Cultural' Receptors

Cultural Sensitive Receptor Nos.	S1	S2	S3	U1	U2	U3	U4	U5	U6	U7
Sports Field #1	0.7	2.6	1.3	2.7	3.6	3.4	4.2	2.6	2.6	2.6
Rowing Club #2	0.5	1.5	0.8	1.6	2.2	2.0	3.7	1.6	1.6	1.6
10 Lives Cat Centre #3	0.5	1.9	1.0	1.9	3.4	2.5	6.1	1.9	1.9	1.9
Bridge Club #4	0.6	2.3	1.2	2.3	3.1	2.9	4.3	2.3	2.3	2.3
Rugby Club House #5	0.6	2.2	1.1	2.3	3.2	2.9	3.0	2.2	2.2	2.2

TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Note: Bold values indicate the odour concentration exceeding the 2 ou criterion.

Table 7-3: Odour concentrations at the sensitive 'residential' receptors

Rct No.	X Coord (km)	Y Coord (km)	S1	S2	S3	U1	U2	U3	U4	U5	U6	U7
1	525.616	5255.983	0.3	1.2	0.6	1.2	1.6	1.5	2.4	1.2	1.2	1.2
2	525.619	5256.003	0.3	1.2	0.6	1.2	1.7	1.5	2.5	1.2	1.2	1.2
3	525.647	5256.016	0.4	1.3	0.7	1.4	1.8	1.7	2.8	1.4	1.3	1.4
4	525.634	5256.036	0.4	1.3	0.7	1.3	1.7	1.6	2.8	1.3	1.3	1.3
5	525.630	5256.055	0.4	1.3	0.7	1.3	1.7	1.6	2.8	1.3	1.3	1.3
6	525.651	5256.071	0.4	1.4	0.8	1.5	1.9	1.8	3.0	1.5	1.4	1.4
7	525.637	5256.096	0.4	1.4	0.8	1.5	1.9	1.8	2.9	1.5	1.4	1.4
8	525.652	5256.111	0.5	1.6	0.9	1.6	2.1	2.0	3.0	1.6	1.6	1.6
9	525.687	5256.212	0.5	1.6	0.9	1.6	1.9	1.8	3.1	1.7	1.6	1.6
10	525.675	5256.239	0.5	1.5	0.9	1.5	1.8	1.7	3.0	1.6	1.5	1.5
11	525.684	5256.258	0.5	1.5	0.8	1.5	1.8	1.7	3.0	1.6	1.5	1.5
12	525.703	5256.272	0.5	1.4	0.8	1.4	1.7	1.6	2.9	1.5	1.4	1.4
13	525.710	5256.291	0.4	1.3	0.7	1.3	1.6	1.5	2.8	1.4	1.3	1.3
14	525.714	5256.323	0.4	1.2	0.7	1.2	1.5	1.4	2.8	1.3	1.2	1.2
15	525.724	5256.358	0.4	1.1	0.7	1.1	1.4	1.2	2.7	1.3	1.1	1.1
16	525.724	5256.392	0.4	1.0	0.6	1.0	1.3	1.1	2.6	1.2	1.0	1.0
17	525.785	5256.425	0.3	0.7	0.4	0.8	1.0	0.9	2.2	0.8	0.8	0.8
18	525.817	5256.422	0.2	0.6	0.4	0.7	0.9	0.8	2.1	0.7	0.7	0.7
19	525.822	5256.458	0.2	0.6	0.3	0.6	0.8	0.7	1.9	0.6	0.6	0.6
20	525.846	5256.483	0.1	0.5	0.3	0.5	0.7	0.6	1.7	0.5	0.5	0.5
21	525.891	5256.473	0.1	0.4	0.2	0.5	0.7	0.6	1.1	0.5	0.5	0.5
22	525.933	5256.477	0.1	0.4	0.2	0.4	0.7	0.5	0.6	0.4	0.4	0.4
23	525.789	5255.683	0.3	1.2	0.6	1.2	1.8	1.5	2.0	1.2	1.2	1.2
42	525.801	5255.595	0.3	1.0	0.5	1.0	1.5	1.3	1.7	1.0	1.0	1.0
25	525.731	5255.669	0.3	1.0	0.5	1.0	1.5	1.3	1.8	1.0	1.0	1.0
26	525.764	5255.628	0.3	1.0	0.5	1.1	1.6	1.3	1.7	1.1	1.1	1.1
27	526.057	5255.535	0.3	0.8	0.4	0.8	1.3	1.0	1.9	0.9	0.8	0.8

Note: Bold values indicate the odour concentration equal to or exceeding the 2 ou criterion.

Table 7-4: Maximum Predicted Odour Concentration at the Plant Boundary for Upset Scenarios

Scenario	Description	Highest ou concentration at the plant boundary	X Coordinate (km)	Y Coordinate (km)	Location of maximum boundary concentration
Upset 1	Aeration goes offline for up to 4 hours leading to aerobic zones becoming more anoxic	3.63	525.928	5255.873	South
Upset 2	Extraction stops leading to capture of foul air to drop such that capture is only from the impact of covering	4.08	525.990	5255.942	south
Upset 3	Solids retention time reduces from 20 days to 15 days leading to an increase in odour emissions from biological processes	4.58	525.925	5255.874	south
Upset 4	Pressure relief valves on both digesters open leading to odorous biogas release	6.41	526.010	5255.950	South east
Upset 5	Activated carbon filter on odour control unit is changed, leading to discharge of air that has only been biologically treated	3.52	525.923	5255.871	Southern point
Upset 6	Digester system fails leading to sludge processes emitting higher odour	3.52	525.936	5255.873	south
Upset 7	Containment on the tankered waste storage systems fails leading to higher odour from these areas	3.57	525.928	5255.872	Southern point

8.0 CONCLUSION

TasWater has engaged Stantec to conduct odour dispersion modelling and impact assessment of the Selfs Point STP. The odour impact assessment has been conducted to investigate the potential odour impact of the upgraded works at the site boundary and at the local sensitive receptors (mainly at the residential properties along Risdon Road located west of the STP), as well as to determine if further odour mitigation measures are required. In addition to the upgraded works, dispersion modelling has also been conducted on seven potential upset scenarios.

The plant is bounded by land zoned Port and Marine, cemetery and industrial properties to the east, Recreation to the west and Community Purpose to the south. Residential premises are located to the north and west across New Town Bay and New Town Rivulet and to the south-west at the Queens Walk Apartments. The residences on Risdon Road located approximately 150 m from the west boundary of the works are considered to be the nearest sensitive receptors. The New Town Bay Rowing Centre, the Buckingham Rowing Club, the Hobart Cat Centre and the Tasmanian Bridge Association are the sites nearest commercial properties.

The STP would expand into land to the south of the existing plant at 10 Selfs Point Road with most existing process units being decommissioned, within the existing plant boundary. Figure 3-2 presents a site plan of the proposed STP expansion including both retained and new processes units.

The new process will include a new inlet works with associated pumping stations. Flow will then pass into the new primary settling tanks for primary treatment. Primary effluent will then flow to the secondary treatment process which will consist of two oxidation ditch/carousels with a combined secondary aerobic and secondary anoxic zone. Each oxidation ditch/carousel will include an aerobic portion, a deaeration portion, an anoxic portion, and a swing zone that can either be used with aeration or without aeration depending on the needs of the plant. Secondary treated effluent is then separated from mixed liquor through the membrane bioreactors, which are an aerated process. Primary sludge from the primary settling tanks and waste activated sludge from the oxidation ditches/carousels will be sent to the dewatering plant for thickening and digestion. Digested sludge will be dewatered and held in enclosed sludge outloading bins. Thickening and dewatering processes will be held within the dewatering building. A cogeneration unit will burn digester gas to create electricity and heat for use on site. In the event that the cogeneration facility goes offline, a flare will burn digester gas. A tankered waste receival facility will allow tankered waste to be discharged directly to the anaerobic digesters.

The odour impact has been assessed on a quantitative basis using the CALPUFF atmospheric dispersion model (Version 7.2.1, Level 150618 – the latest version of the model). The model was set up in accordance with the following documents:

- Atmospheric Dispersion Modelling Guidelines V1.0, EPA Tasmania, October 2020
- Environment Protection Policy (Air Quality) 2004 (Air Quality EPP), Environment Division, Department of Tourism, Arts and the Environment, Tasmania;
- Environmental Protection Authority (EPA) Board Statement: Update to Air Pollutant Design Criteria used in the Environmental Impact Assessment (EIA) Process, EPA, Tasmania;
- Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the Approved Methods for Modelling and Assessment of Air Pollutants in NSW, Australia. Prepared for NSW Office of Environment and Heritage (OEH), Sydney Australia. Barclay, J.J and Scire, J.S., Atmospheric Studies Group, TRC, 2011.

For the purpose of this assessment, the odour impact has been assessed against the Air Quality EPP 99.5th percentile 2.0 ou boundary criterion.

This assessment uses odour emission rates from the Sydney Water Best Practice odour database and historical site-specific odour emission data from the Selfs Point STP odour sampling conducted by Environ Odour Australia Pty Ltd in February 2016 along with impacts from changes to the process. Where there have been process units that were not sampled, odour emission rates have been obtained from Stantec's global emission and contaminant load database with the most representative data adopted.

TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

The following scenarios for Selfs Point STP were considered:

- Scenario 1: Expanded site with Sydney Water database odour emission rates**
- Scenario 2: Expanded site with odour emission data measured from site**
- Scenario 3: Expanded site with odour emission data measured from site but with enhanced odour capture and treatment**

The Sydney Water odour emission database is comprised of more than ninety samples of anoxic and aerobic zones, with those emission rates representative of the proposed plant process units adopted. The single sample from the aerobic and anoxic zones of the existing plant have been modelled within Scenario 2.

The goal of the dispersion modelling exercise with respect to odour impacts beyond the site boundary was to assess the site's odour footprint when expansion works have occurred. Scenario 1 has been developed to identify the odour impact from the expanded plant using specific odour emission rates from the Sydney Water odour database. These specific odour emission rates allow for operations which do not include pre-fermenters. The results from this scenario shows compliance with the 2 ou boundary criterion in all directions. All sensitive receptors are predicted to have odour impact below 1 ou.

The upgraded plant modelled in Scenario 2, using site specific data influenced by the use of pre-fermenters, breaches the boundary limit of 2.0 ou in the southern, south western and south eastern site boundary. Some of the nearest residential sensitive receptors (to the west of the site), and cultural receptors, the rowing club and the cat centre have predicted odour impacts above 1.0 ou yet below 2 ou. The highest odour concentration at a sensitive receptor is predicted at the Sports field (# 1) of 2.6 ou which is 25m from the southern boundary of the plant. The bridge club house (#4) and the Rugby club house (#5) also predict values greater than 2 ou of 2.3 and 2.2 ou, respectively. The rowing club (#2) and the 10 Lives cat centre (#3) predict 1.5 and 1.9 ou, respectively. All other sensitive receptors are predicted to have a modelled impact below 2 ou.

Whilst Scenario 2 was based on site measured data, this is likely influenced by the use of pre-fermenters which are known to cause increase in specific odour emissions for downstream wastewater treatment process units.

If, after commissioning and re-measurement of odour emission rates, it is determined that the measurements are similar to those in 2016 (i.e. no change from the removal of the pre-fermenters and data from the Sydney Water odour emission database is not representative), a further option is to cover, extract and treat foul air from the most odorous uncovered sources being the anoxic zones. Scenario 3 was based on Scenario 2, however with an enhanced level of odour control with the anoxic zones covered and a greater odour control unit on site to treat more extracted foul air. The results from this scenario shows compliance with the 2 ou boundary criterion in all directions. All sensitive receptors have a predicted odour impact below 1 ou.

In addition to the expanded site, seven upset scenarios were modelled, as follows:

- Upset Scenario 1: Aeration goes offline**
- Upset Scenario 2: OCU Extraction stops**
- Upset Scenario 3: Solids retention time drops from 20 days to 15 days**
- Upset Scenario 4: Pressure relief valve on both digesters open**
- Upset Scenario 5: Activated carbon filter change over**
- Upset Scenario 6: Digester system failure**
- Upset Scenario 7: Higher emissions from tanker waste deliveries**

All upset scenarios have been modelled as if the upset condition was occurring for the entire year. This is to ensure the worst meteorological conditions throughout the year have been captured. In reality, these upset conditions are likely to be infrequent and occur for short durations, rather than occurring all year. In addition, all upset scenarios have been based off the higher SOERs modelled within Scenario 2 (expanded plant using odour emission data measured from site).

Upset scenario 4 (pressure relieve valves opening) is predicted to have the largest impact on the residential receptors to the west of the site with a 2ou contour encompassing some 50 residences. It should be noted that

TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

there are multiple safeguards in place to prevent this from occurring and, if it does occur, it would need to coincide with unfavourable meteorological conditions in order to affect so many residences.

Upset scenario 2, where foul air extraction stops, has an increased offsite odour emission. This increased impact predominantly affects the southeast, south and southwestern side of the site with the 2 ou contour extending approximately 228m to the southeast, 218m to the south, and 169m to the southwest of the plant boundary. There is some impingement of the 2 ou curve over receptor number R8 to the west of the site.

Upset scenario 3, where the solids retention time drops from 20 days to 15 days, the 2 ou contour extends 164m to the southeast, 162m to the south and 145m to the southwest of the plant boundary. No sensitive receptors are exposed to odour concentration greater than 2 ou.

All other upset scenarios (1, 5, 6 and 7) resulted in negligible changes to the predicted odour impact offsite and were similar to that of Scenario 2, where the 2 ou contour extends 125m to the southeast, 135m to the south and 115m to the southwest of the plant boundary.

All the upset scenarios were modelled assuming they could occur at any time of the year and are therefore conservative as constant emissions have been assumed for all meteorological conditions for all hours of the year. In reality, upset scenario 2 is expected to occur once every 2 years for up to 4 hours, upset scenario 3 is expected to occur once every 5 years for up to four weeks, and upset scenario 4 which produced the biggest odour footprint is expected to occur once every ten years for up to four hours.

These results suggest that the site is unlikely to generate an odour impact under most upset conditions modelled, however if the pressure relief valves open (after all other safeguards fail) there may be some odour affecting residences to the west of the site

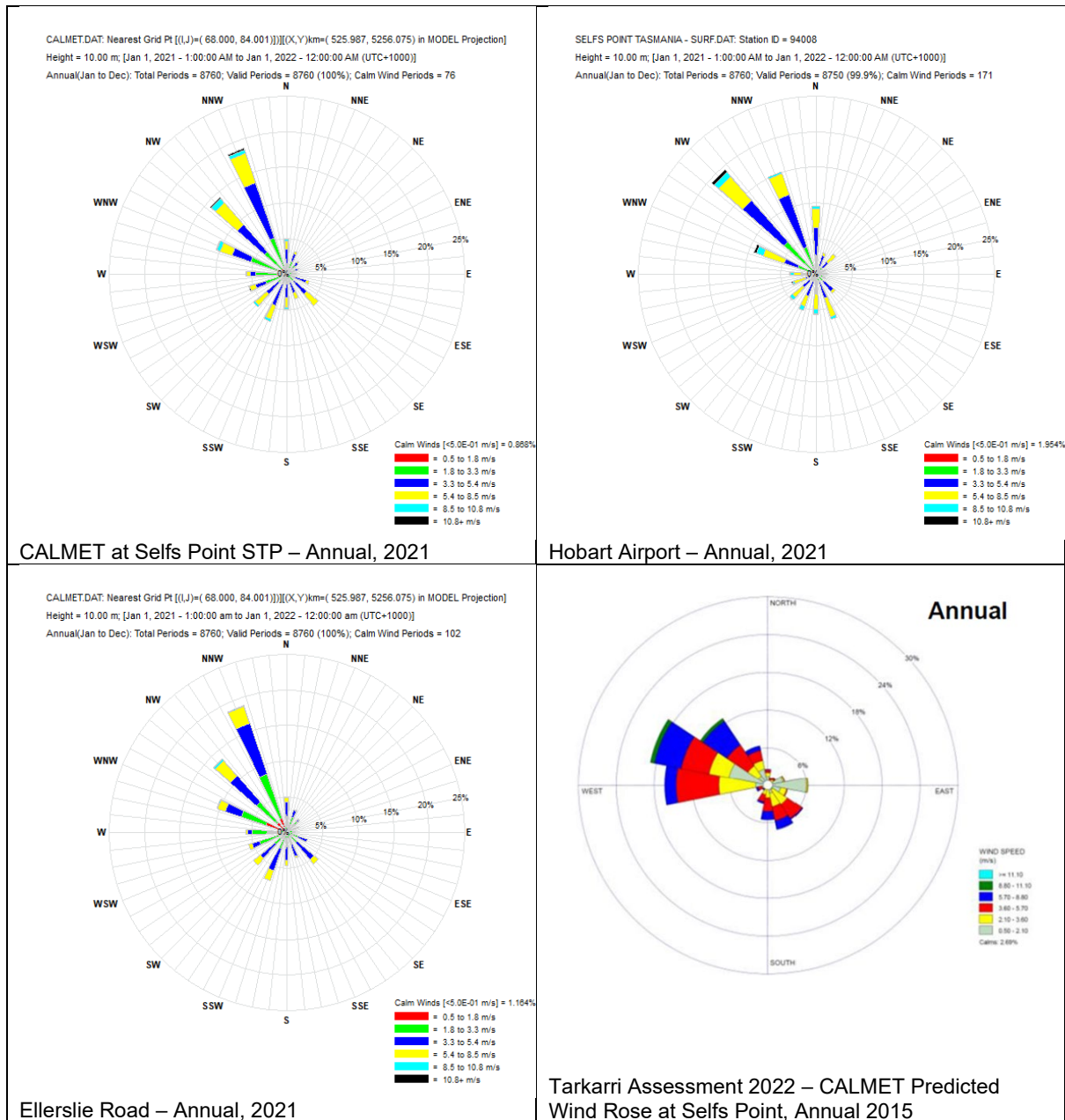
Appendices

We design with community in mind



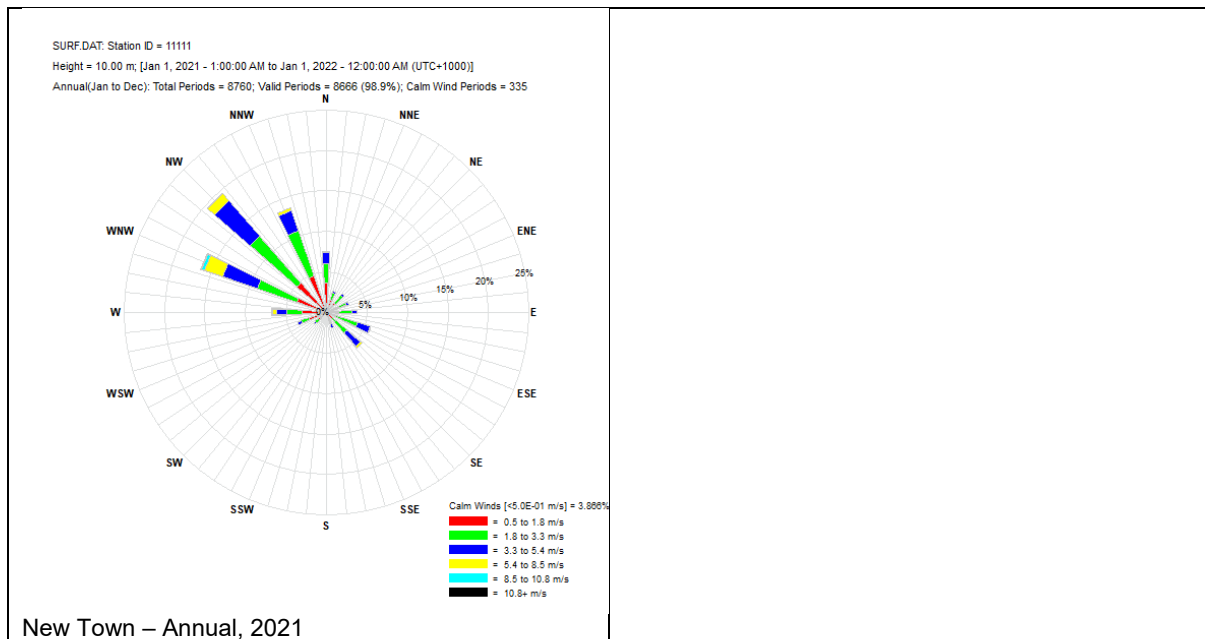
Appendix A WIND ROSES

Hourly predicted wind roses at the Selfs Point STP site compared to measured data at Ellerslie Road and Hobart Airport.



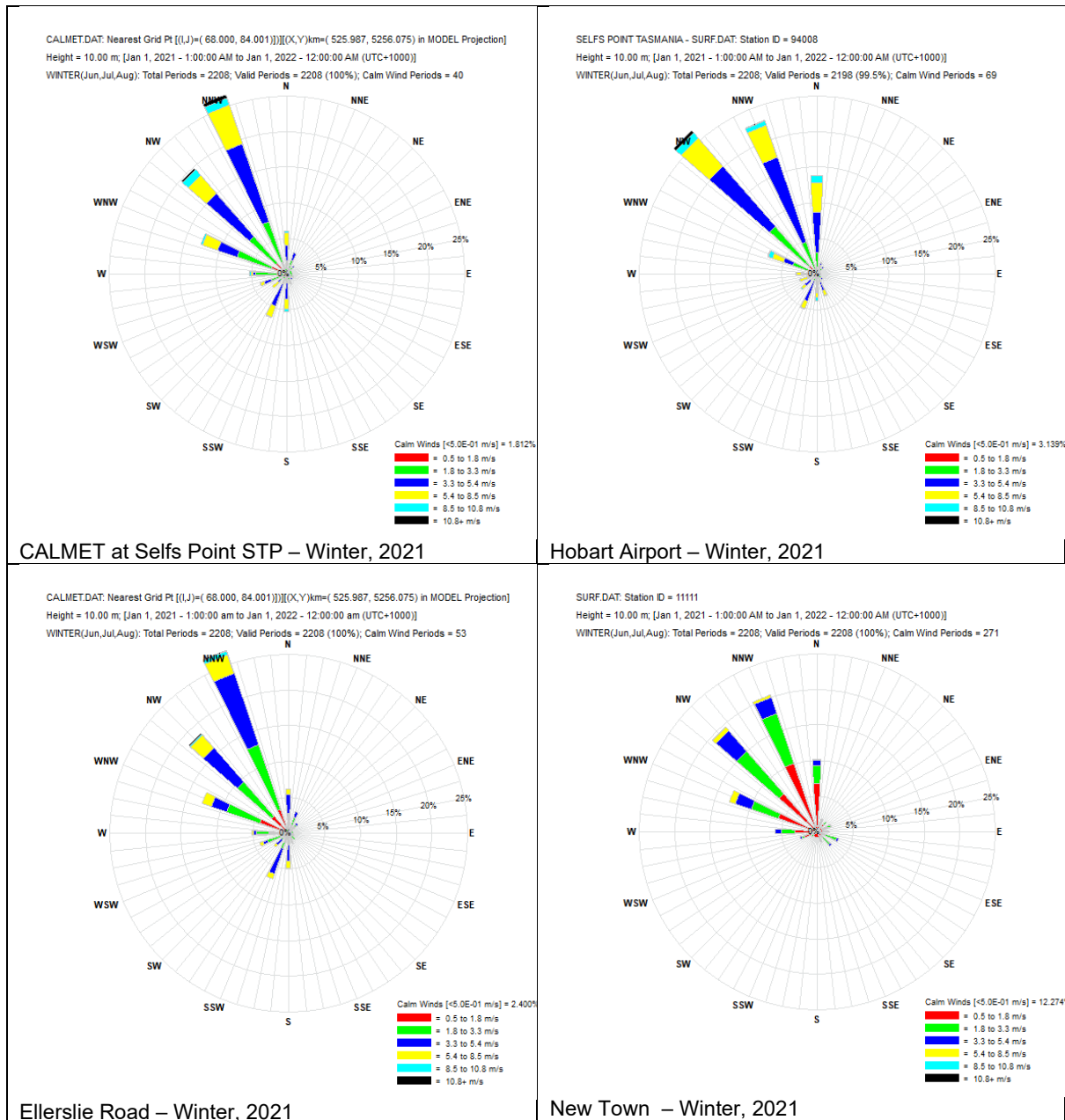
TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix A Wind Roses



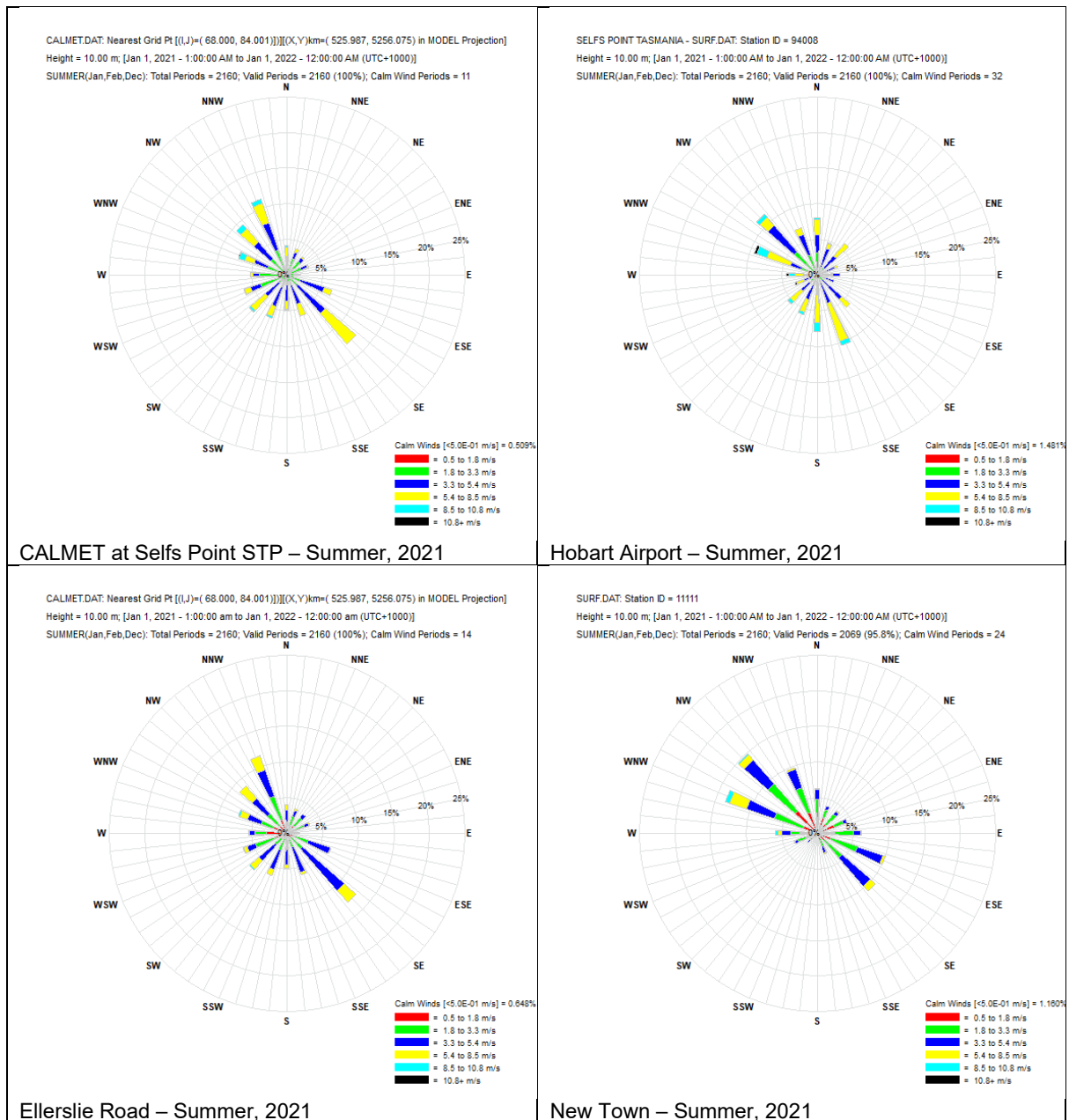
TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix A Wind Roses



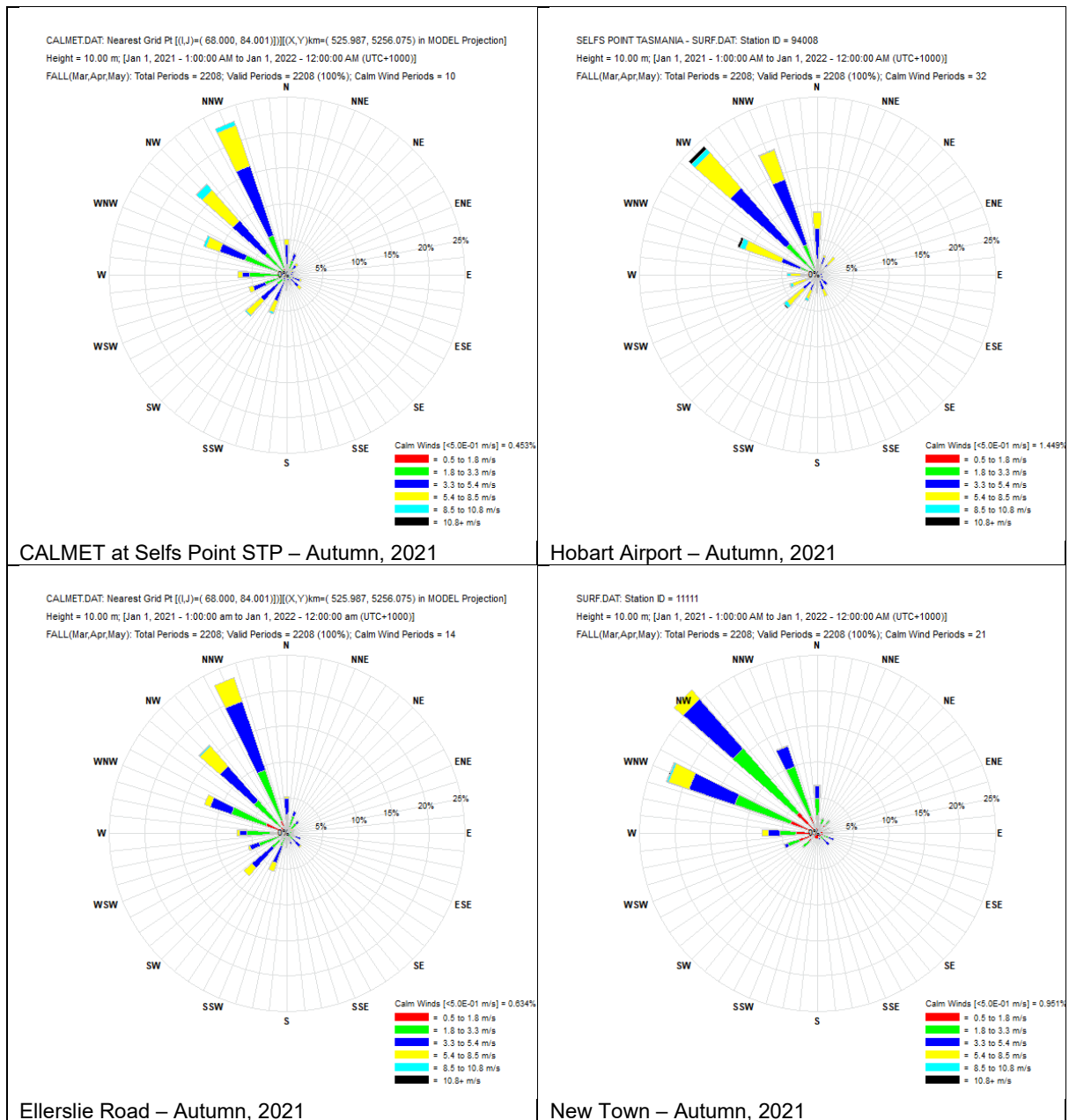
TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix A Wind Roses



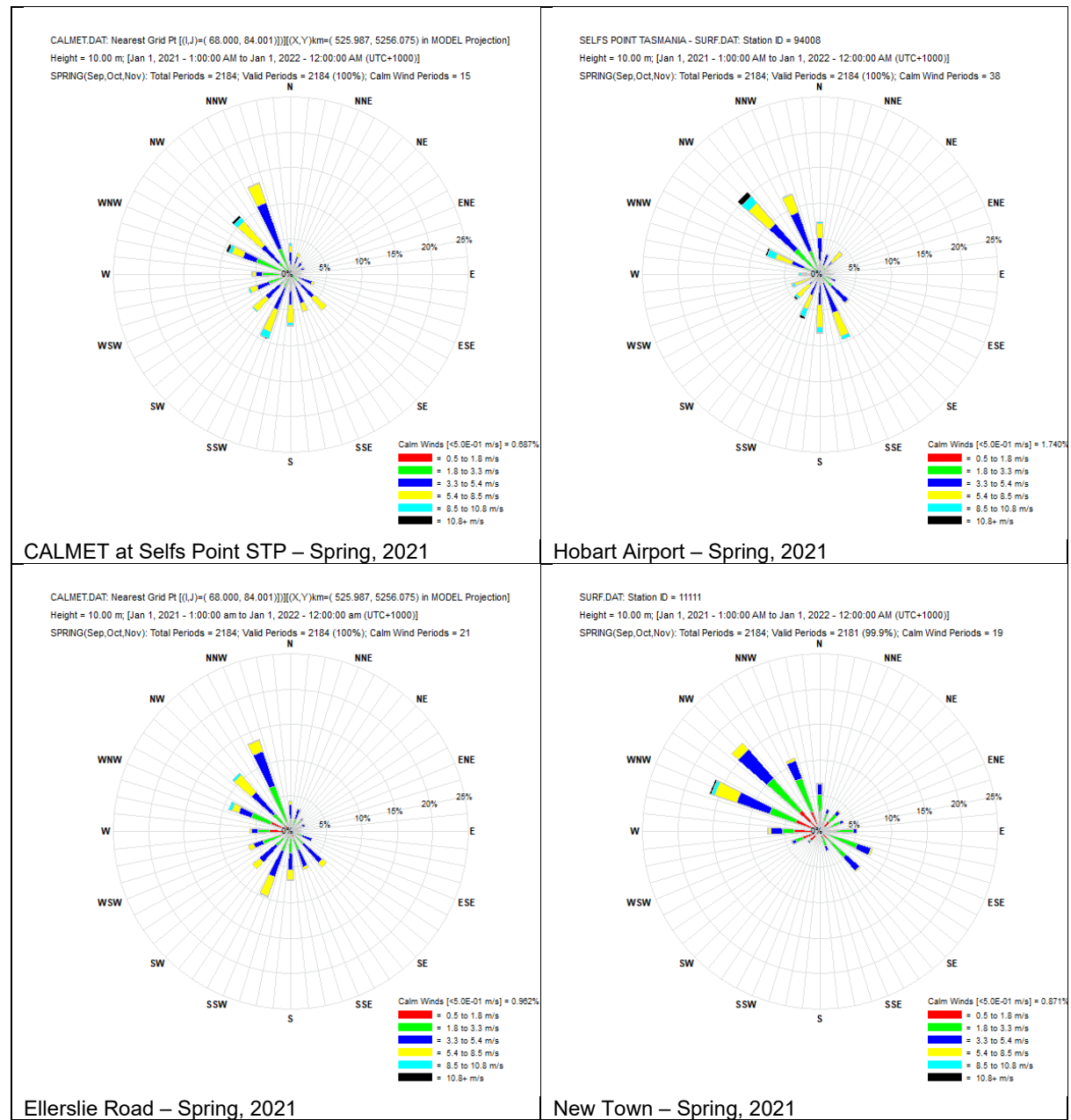
TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix A Wind Roses



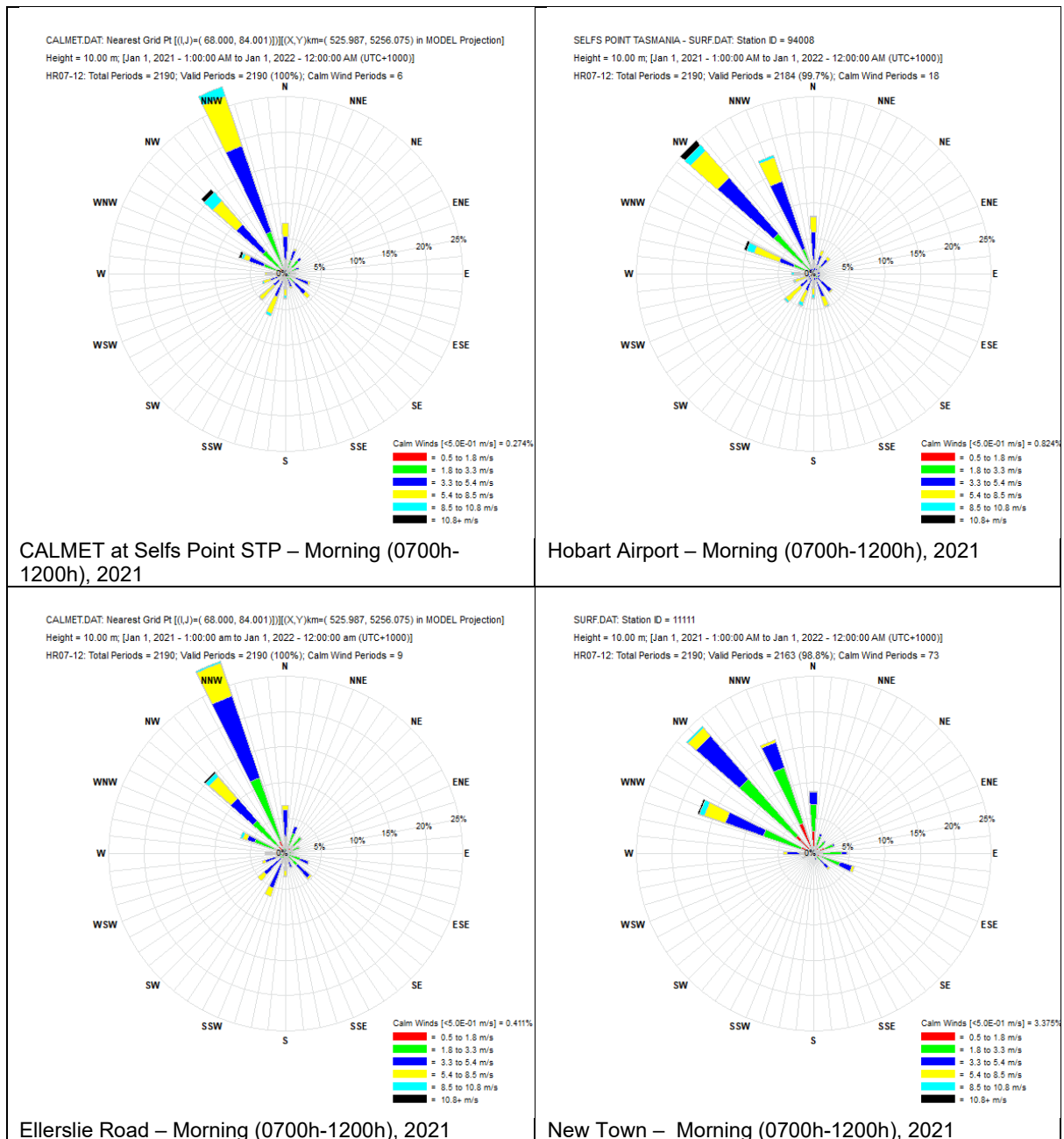
TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix A Wind Roses



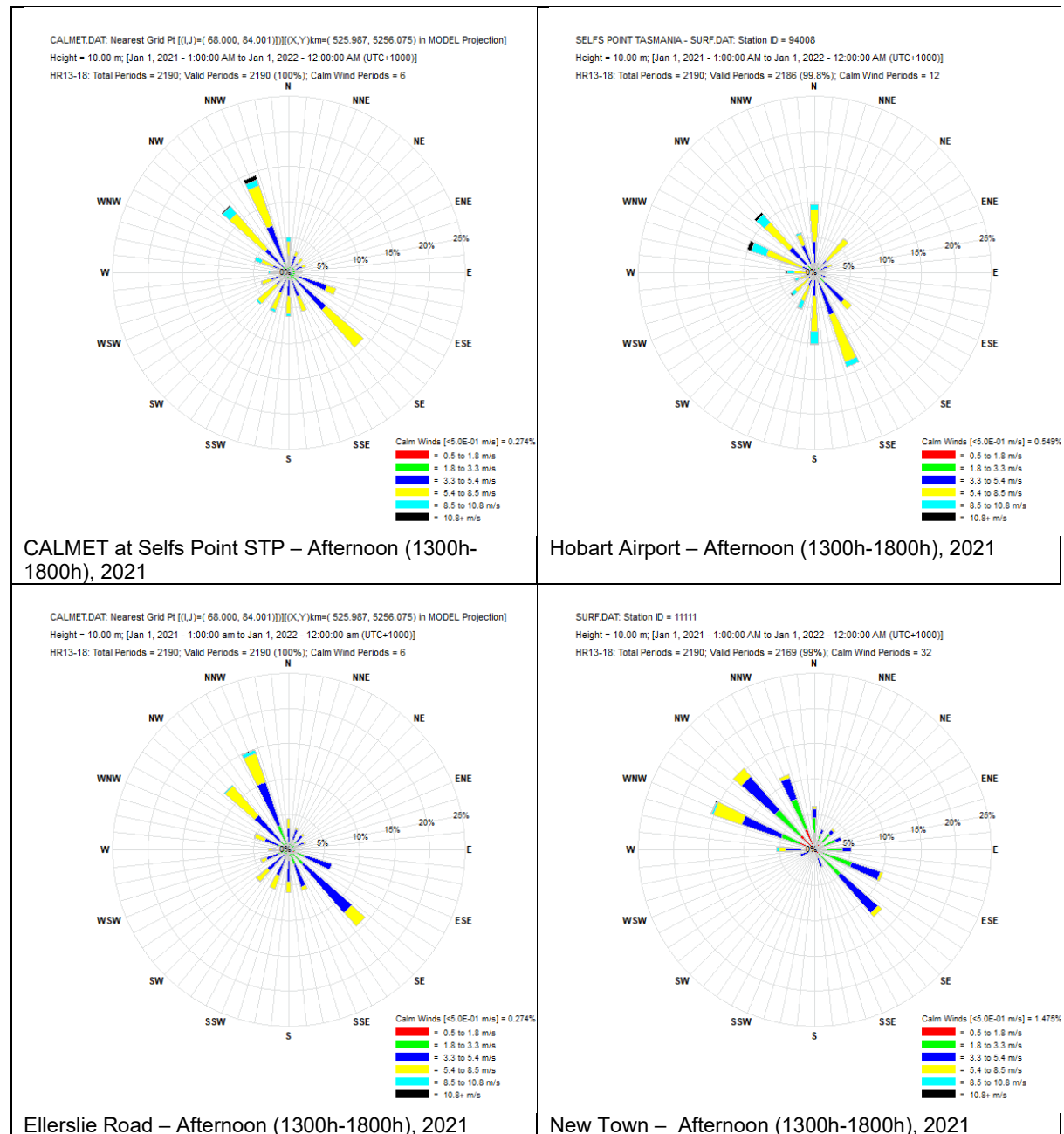
TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix A Wind Roses



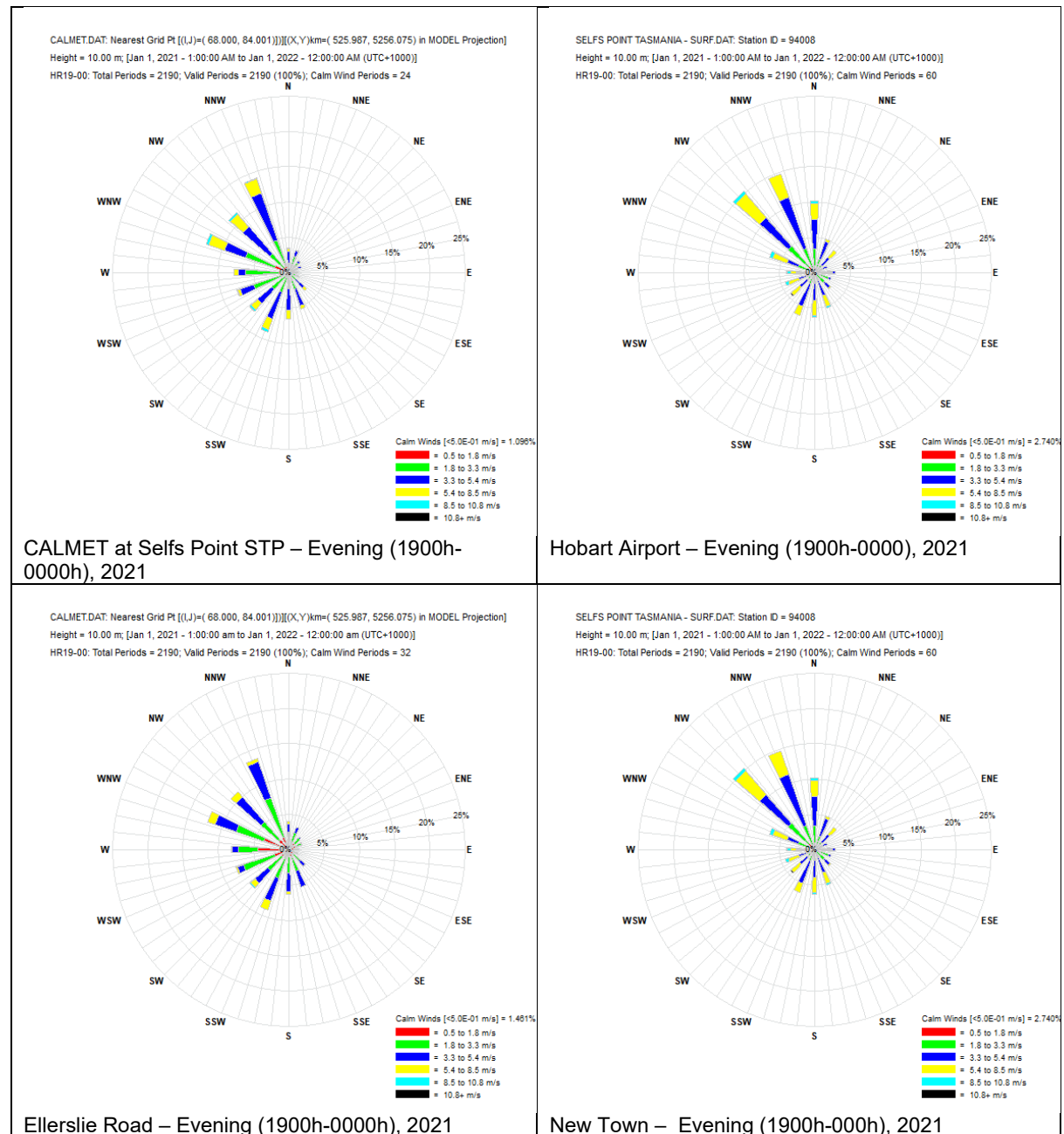
TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix A Wind Roses



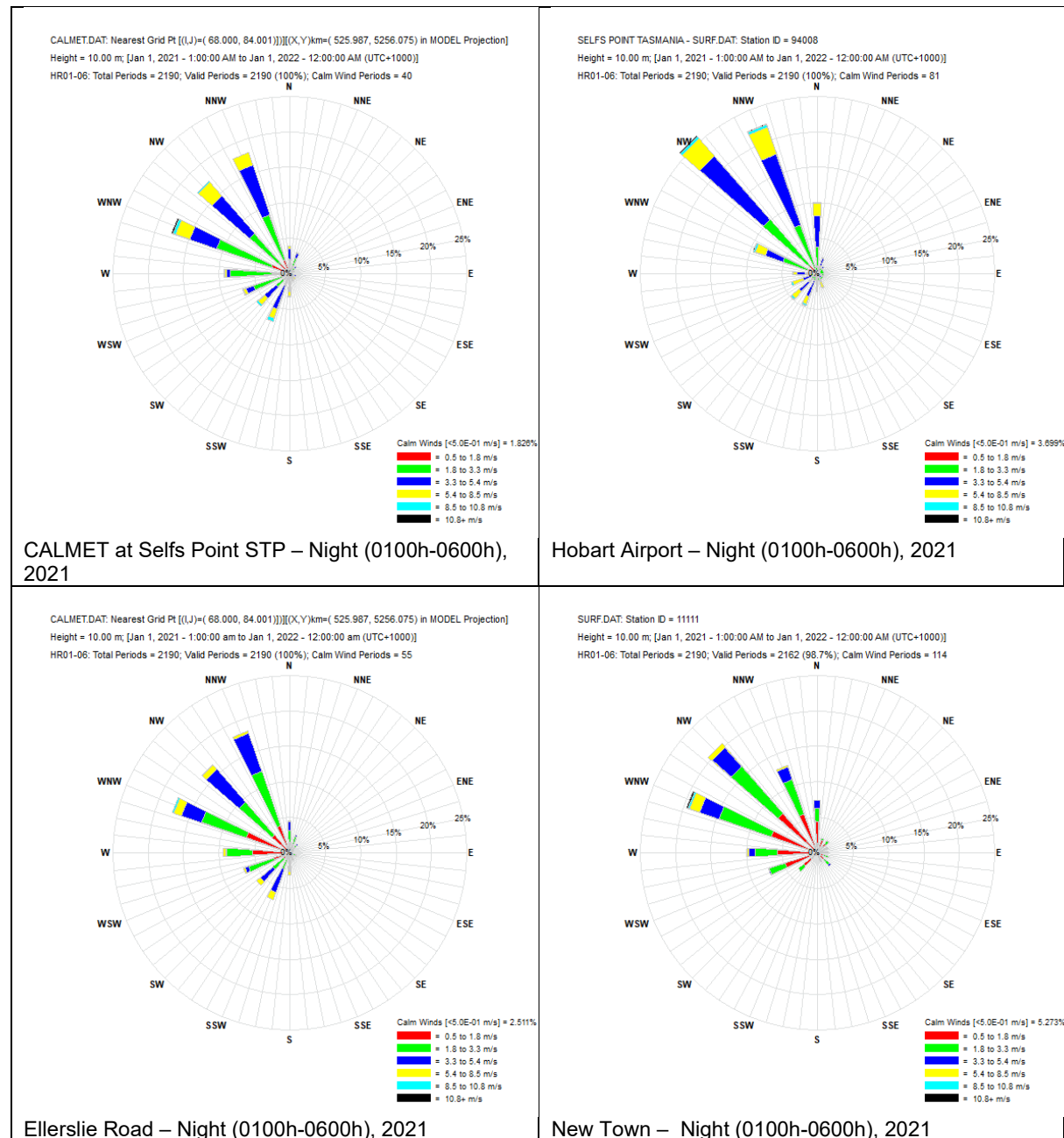
TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix A Wind Roses



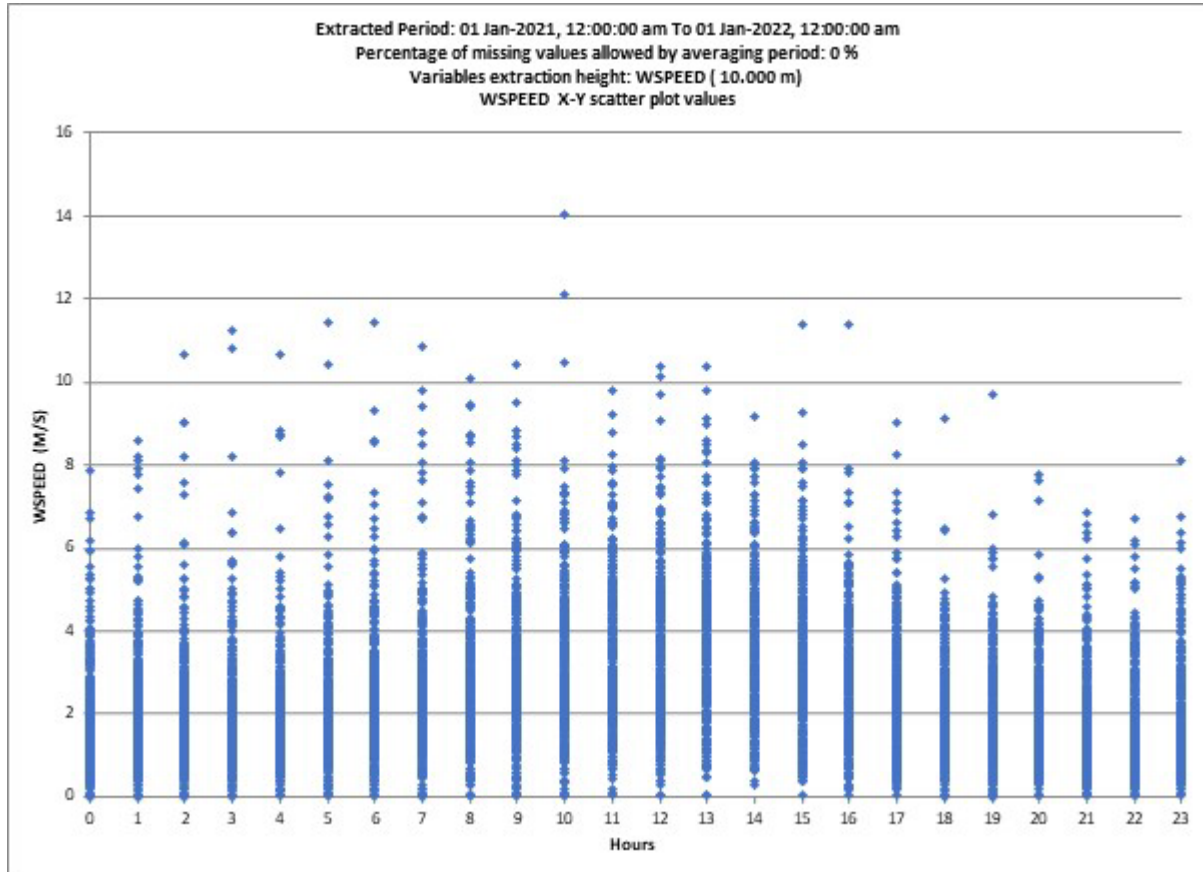
TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix A Wind Roses



Appendix B SCATTER PLOTS

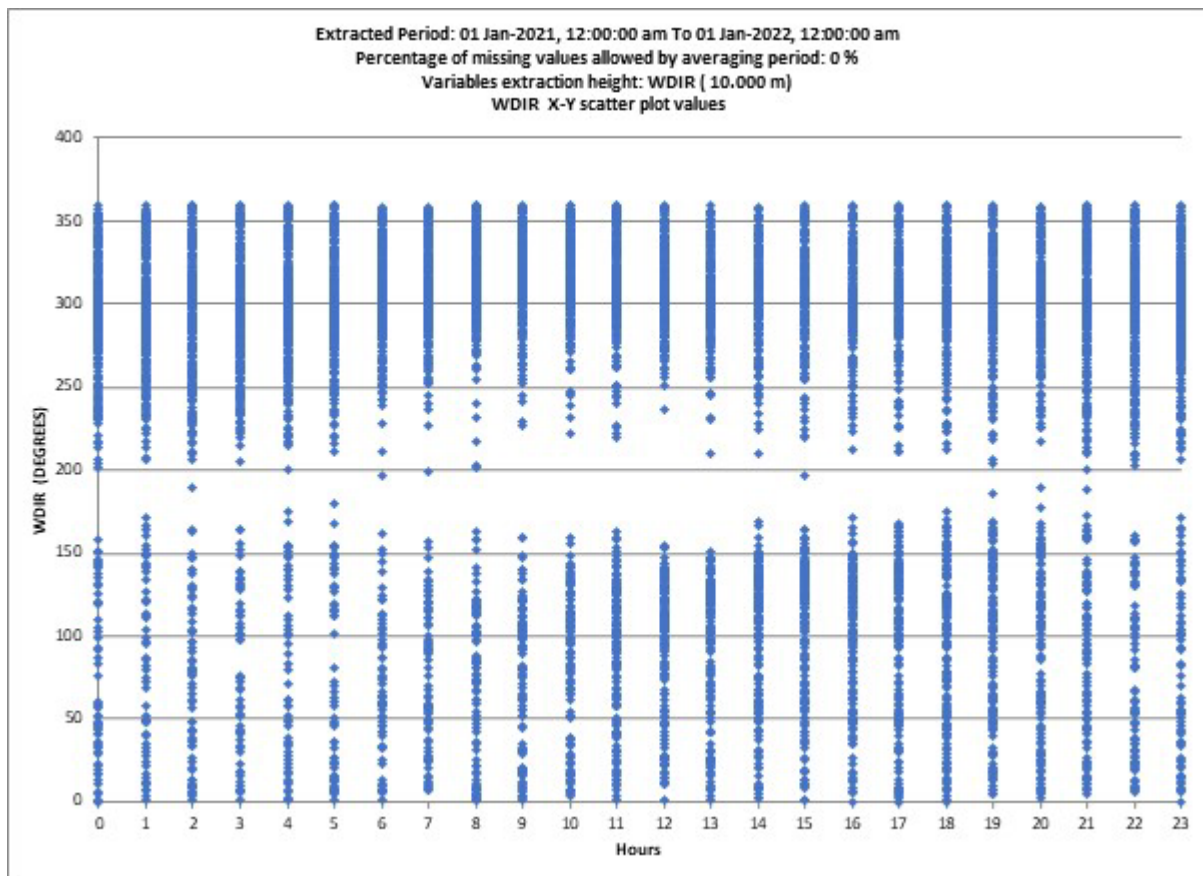
Hourly wind speed scatter plot at the Selfs Point STP



TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix B Scatter Plots

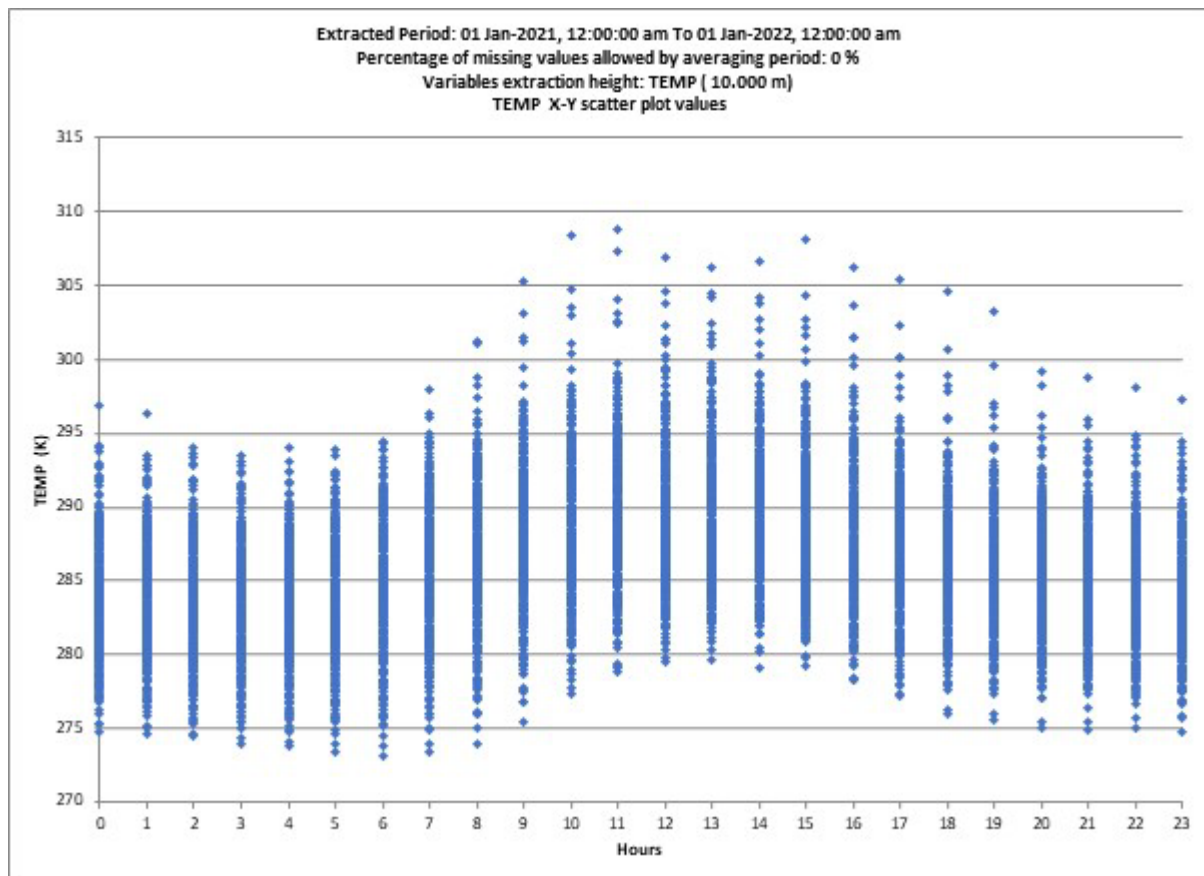
Hourly wind direction scatter plot at the Selfs Point STP



TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix B Scatter Plots

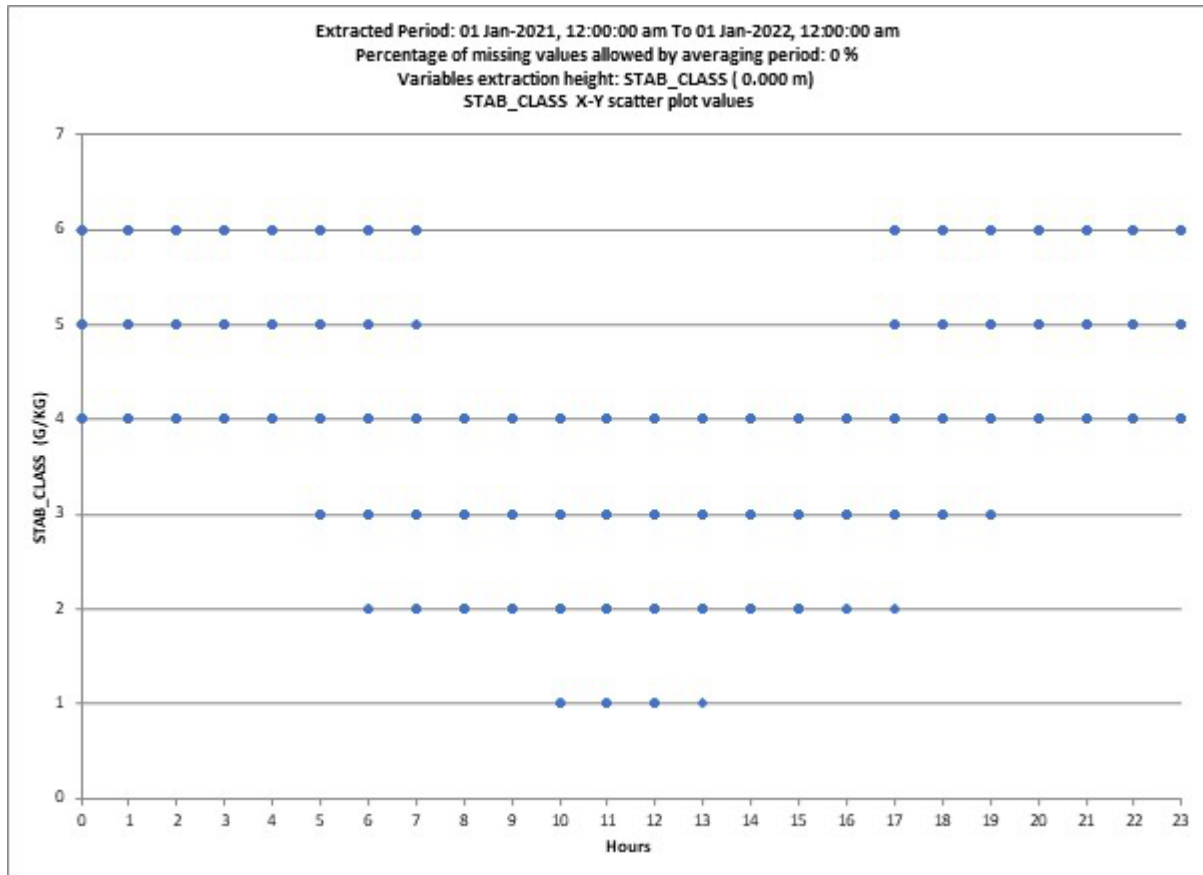
Hourly temperature scatter plot at the Selfs Point STP



TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix B Scatter Plots

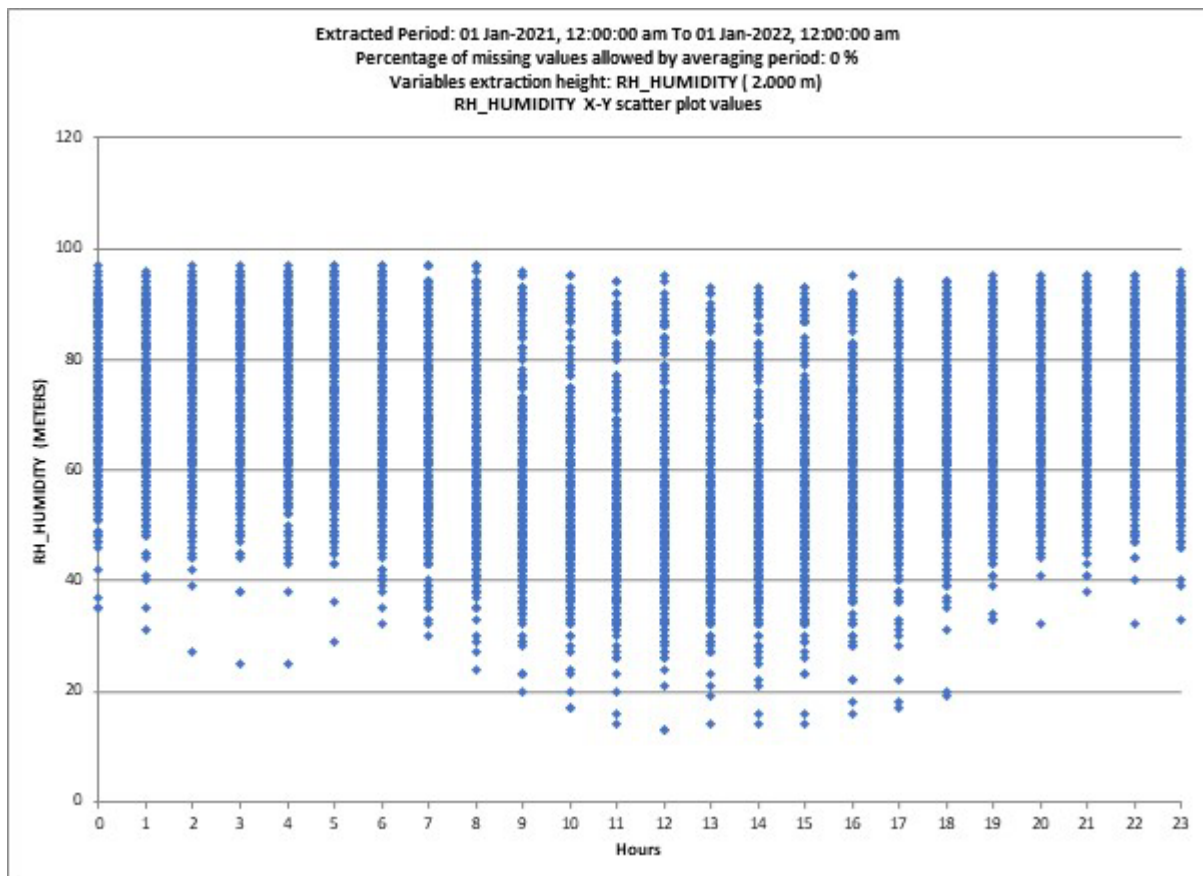
Hourly PG stability (1-6) scatter plot at the Selfs Point STP



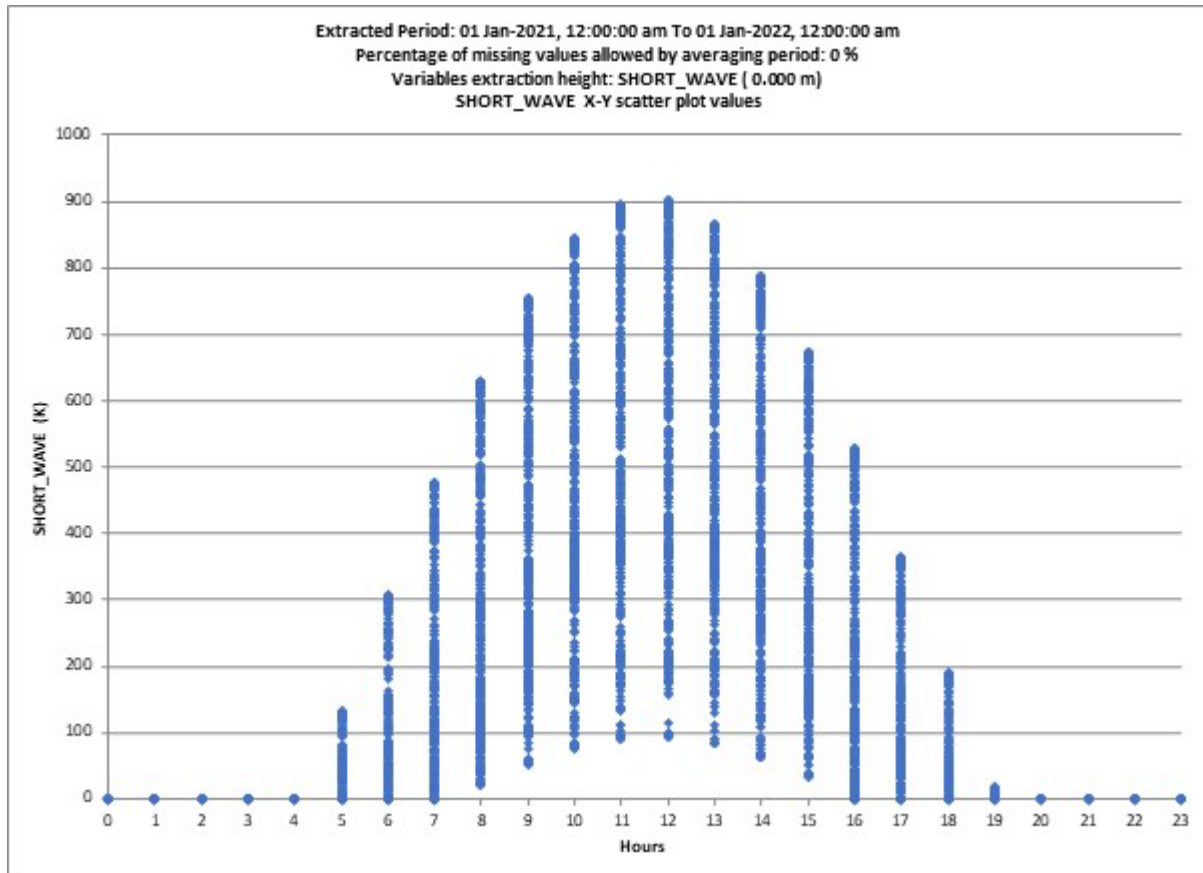
TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix B Scatter Plots

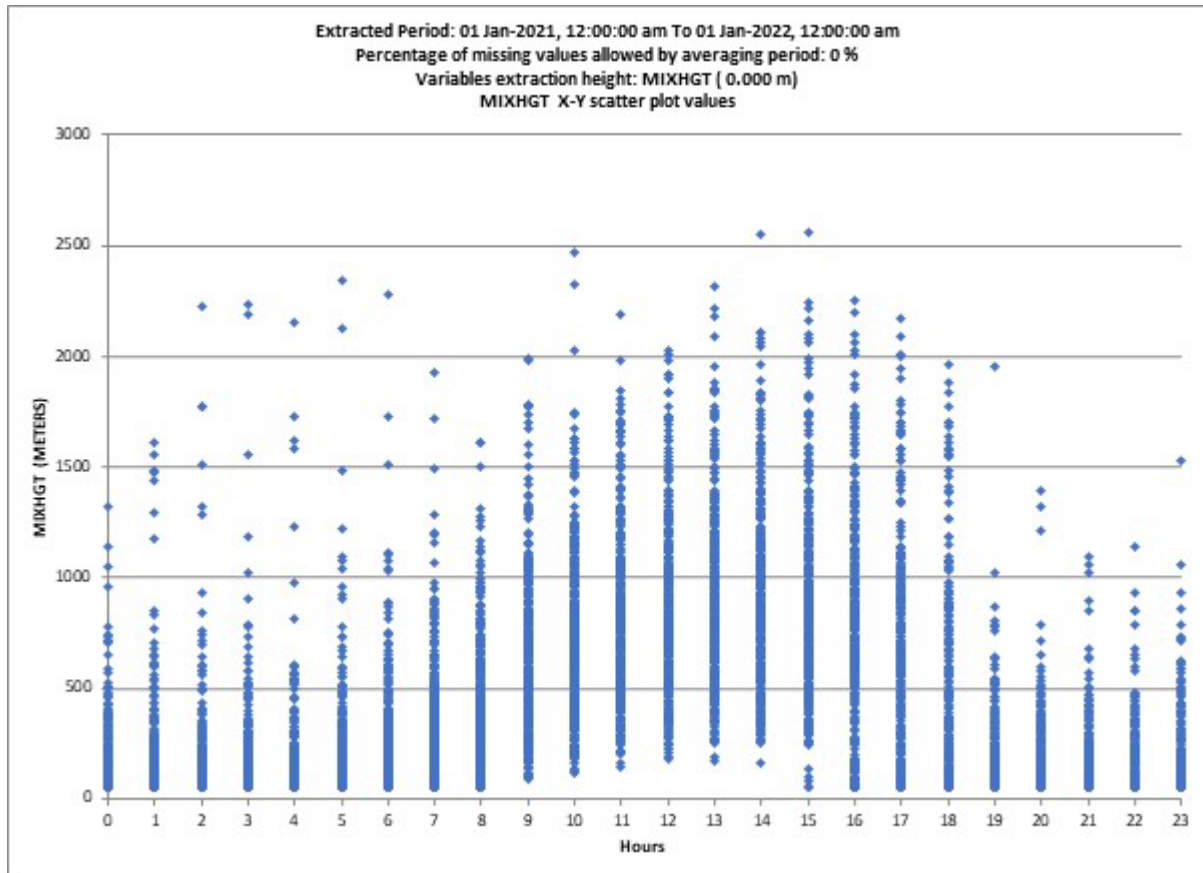
Hourly relative humidity (%) scatter plot at the Selfs Point STP



Hourly short wave solar radiation (W/m^2) scatter plot at the Selfs Point STP



Hourly mixing height (m) scatter plot at the Selfs Point STP

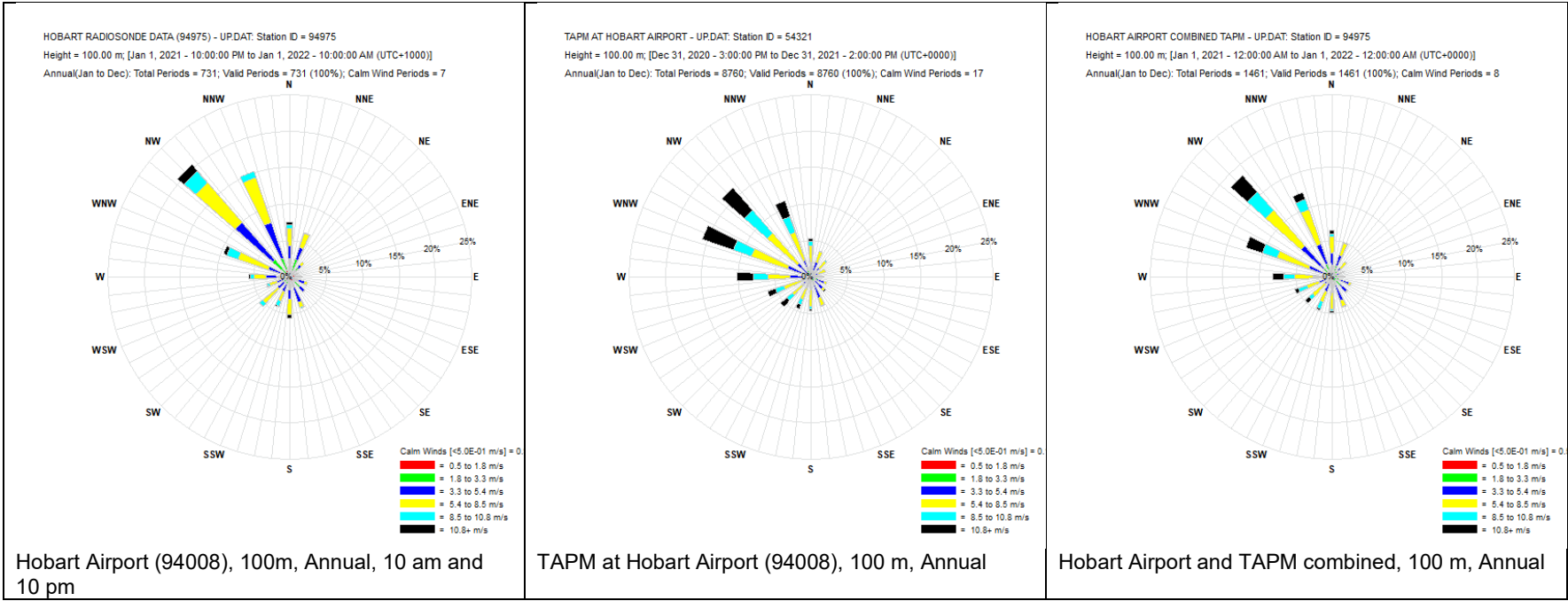


Appendix C UPPER AIR WIND ROSES



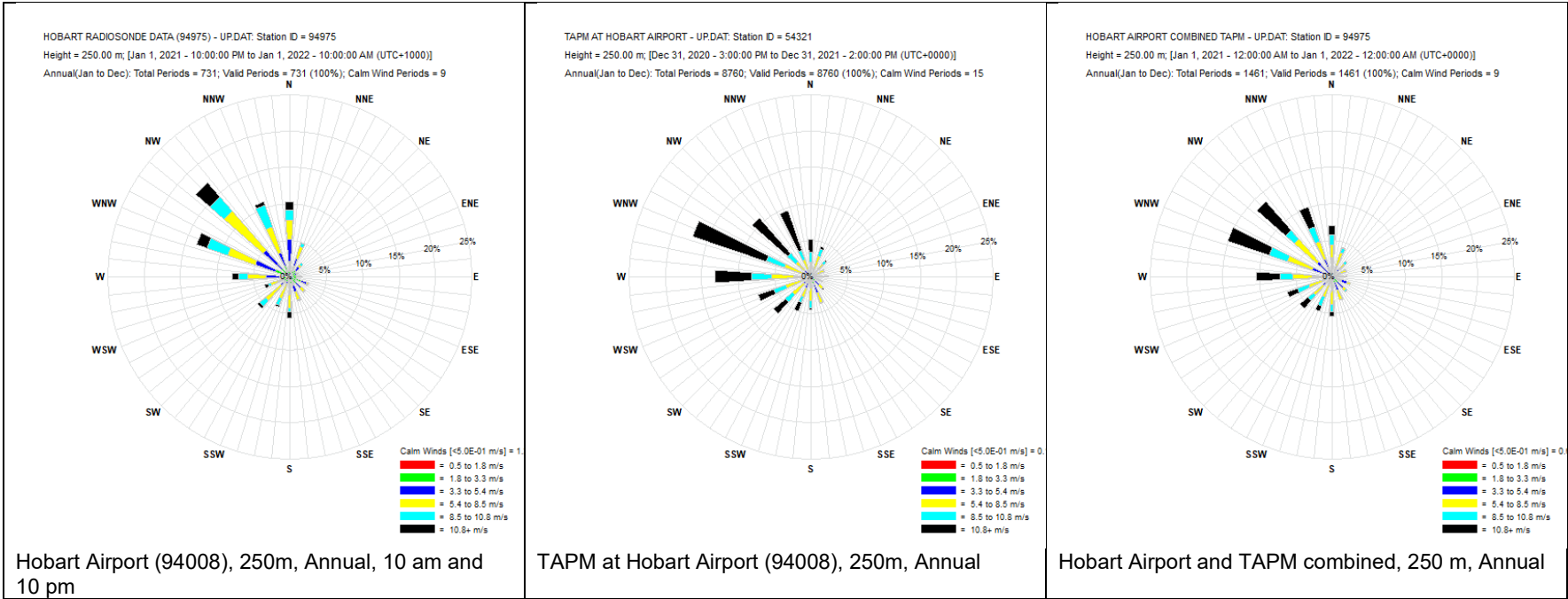
TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix C Upper Air Wind Roses



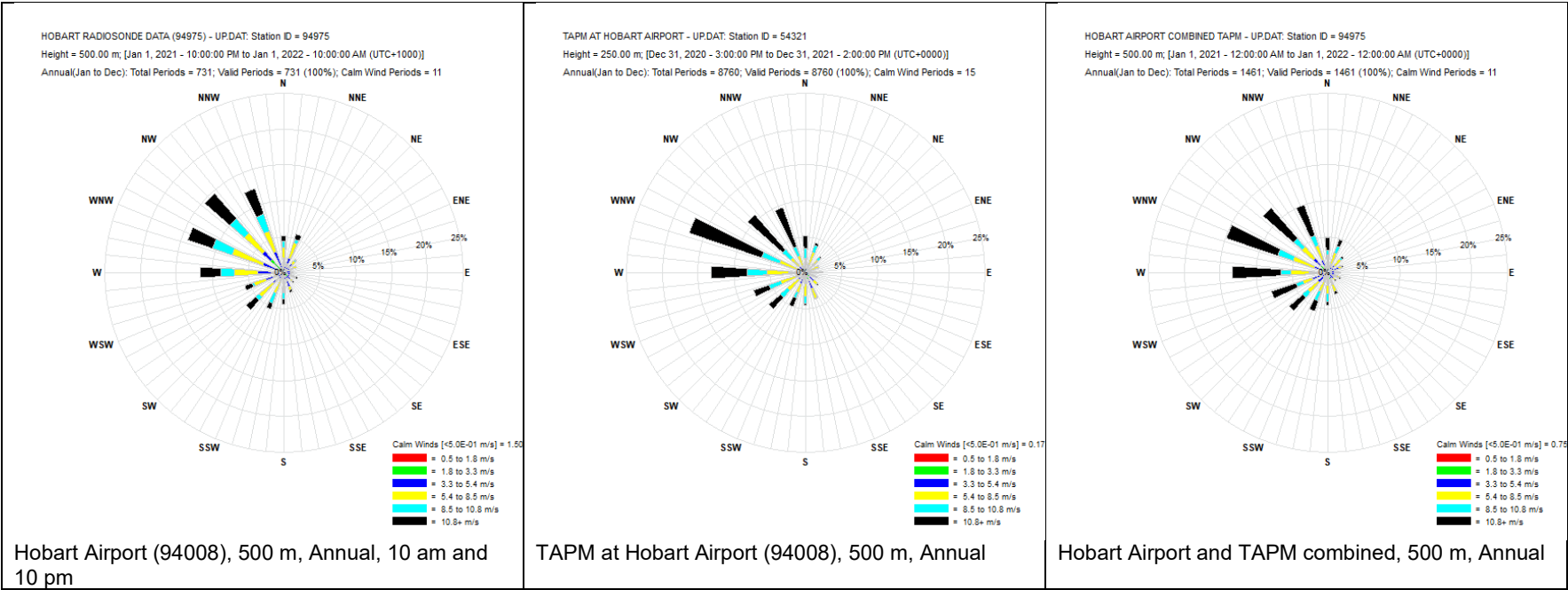
TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix C Upper Air Wind Roses



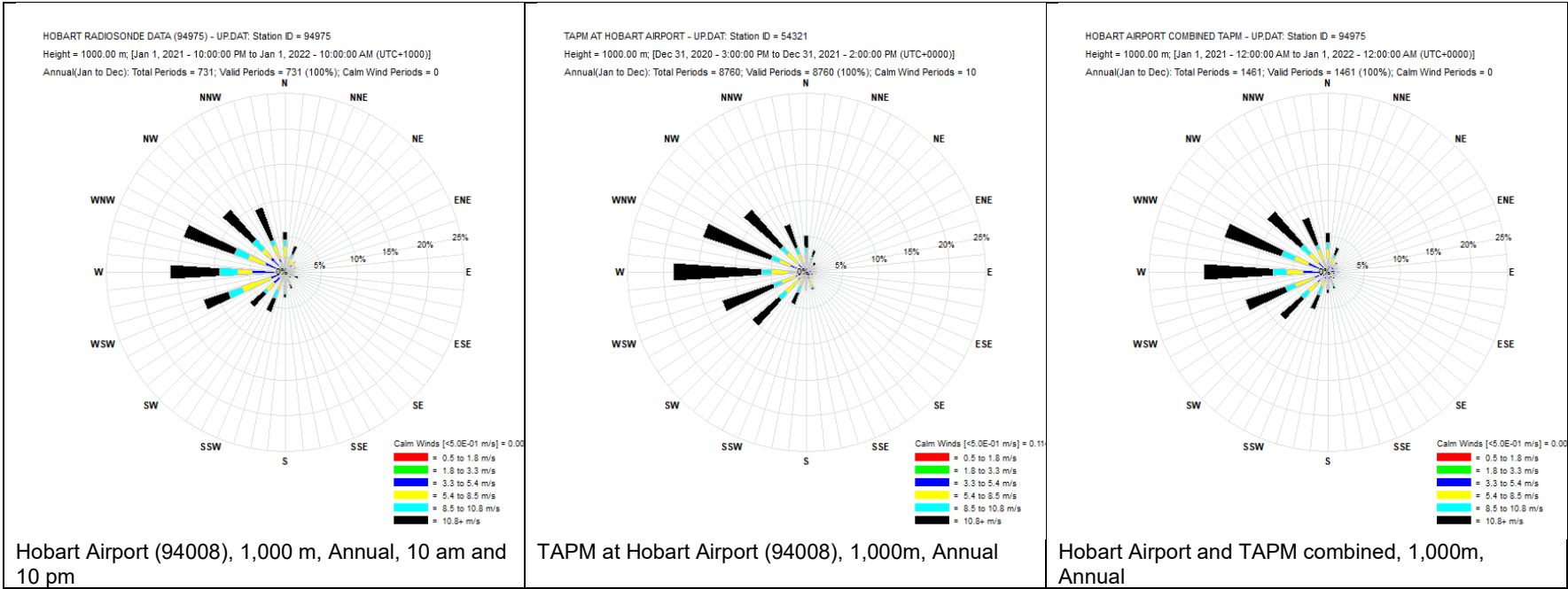
TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix C Upper Air Wind Roses



TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix C Upper Air Wind Roses



Appendix D BUILDING DOWNWASH FILES

OCU Stack

```
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525884.8 5255989.6
525898.4 5255983.2
525870.6 5255923.7
'Bld4-OCUVessel1' 1 8.00
4 6.0
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525922.0 5255951.0
525922.0 5255945.0
'BLD_5-OCUVessel2' 1 8.00
4 6.0
525921.0 5255953.0
525921.0 5255959.0
525927.0 5255959.0
525927.0 5255953.0
'BLD_6-OCUVessel3' 1 8.00
4 6.0
525912.0 5255959.0
525912.0 5255965.0
525918.0 5255965.0
525918.0 5255959.0
'BLD_7-OCUVessel4' 1 8.00
4 6.0
525906.0 5255950.0
525906.0 5255956.0
525912.0 5255956.0
525912.0 5255950.0
'BLD_10-PrimTreatSwitch' 1 8.0
4 9.25
525927.0 5255940.0
525927.0 5255960.0
525933.0 5255960.0
525933.0 5255940.0
'BLD_14-SludgeBld' 1 7.0
4 12.0
525922.0 5255976.0
525932.1 5255997.8
525942.6 5255992.9
525932.4 5255971.1
'BLD_16-PolymerRm' 1 7.0
4 12.0
525914.0 5255980.0
525921.8 5255996.8
525927.3 5255994.2
525919.4 5255977.5
1
'OCU' 8.0 14.0 525917.00 5255968.00
```



TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix D Building downwash files

COGEN Stack

'Bld11-SecTreatRm' 1 7.00
4 8.0
525895.0 5256007.0
525901.1 5256020.1
525909.3 5256016.3
525903.2 5256003.2
'Bld12-BlowerSwitchRm' 1 7.00
4 8.0
525884.0 5256013.0
525890.1 5256026.1
525898.3 5256022.3
525892.2 5256009.2
'Bld13-BlowerBld' 1 7.00
4 8.4
525853.0 5256018.0
525861.9 5256037.0
525874.6 5256031.1
525865.7 5256012.1
'Bld14-SludgeHandBld' 1 7.00
4 12.0
525922.0 5255976.0
525932.1 5255997.8
525942.6 5255992.9
525932.4 5255971.1
'Bld15-SludgeHandSwRm' 1 7.00
4 8.0
525933.0 5255999.0
525940.0 5256014.0
525946.3 5256011.0
525939.3 5255996.0
'Bld16-PolymerRm' 1 7.00
4 12.0
525914.0 5255980.0
525921.8 5255996.8
525927.3 5255994.2
525919.4 5255977.5
'Bld8-DigesterA' 1 8.7
4 15.1
525979.0 5255973.0
525979.0 5255991.0
525997.0 5255991.0
525997.0 5255973.0
'Bld9-DigesterB' 1 8.7
4 15.1
525954.0 5255972.0
525954.0 5255990.0
525972.0 5255990.0
525972.0 5255972.0
1
'COGEN' 7.0 12.0 525937.0 5256019.0



TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix D Building downwash files

Digester A vent

'DigesterA' 1 8.7

4 15.1

525979.0 5255973.0

525979.0 5255991.0

525997.0 5255991.0

525997.0 5255973.0

1

'DIGAPRV' 8.70 15.2 525988.00 5255982.00

Digester B vent

'DigesterB' 1 8.7

4 15.1

525954.00 5255972.00

525954.00 5255990.00

525972.00 5255990.00

525972.00 5255972.00

1

'DIGBPRV' 8.70 15.2 525963.00 5255981.00



Appendix E 2021 MONTHLY HOBART RAINFALL AND MIN AND MAX TEMPERATURE

The figures below show the mean minimum and mean maximum temperature from Hobart Airport and New Town by month for 2021 as well as the mean minimum temperature from Selfs Point STP as predicted by CALMET. The mean minimum temperature at New Town and Selfs Point STP is predicted to be lower than that measured at Hobart airport for all months of the year, although the trend between the two locations is similar, where the lowest temperature occurs in July for both sites. The mean maximum temperature also shows that for all months of the year in 2021, higher mean maximum temperatures are predicted at Selfs Point STP than at Hobart Airport, but the maximum temperature at Selfs Point STP (as predicted by CALMET) is almost identical to that at New Town.

There are multiple reasons why New Town and Selfs Point STP are predicted to have both a higher mean maximum temperature and a lower mean minimum temperature than the airport. Firstly, the two sites are in completely different locations where Hobart Airport is much more exposed and on grassy land which will have an effect on reducing the maximum temperatures. Selfs Point STP is located in the lee of Mt Wellington and is predicted to have much lighter winds. This, and the presence of structures, may mean that both higher maximum temperatures are reached and equally lower minimum temperatures than at Hobart Airport.

From a modelling perspective, a lower minimum temperature suggests a much more stable nighttime atmosphere over Selfs Point than Hobart Airport. This is conservative for modelling which means a more stable atmospheric profile over the STP.

It should be noted that odour generation tends to decrease with temperature, however odour release has been modelled as if summer temperatures were occurring for the entire year. This provides a more conservative approach to modelling.

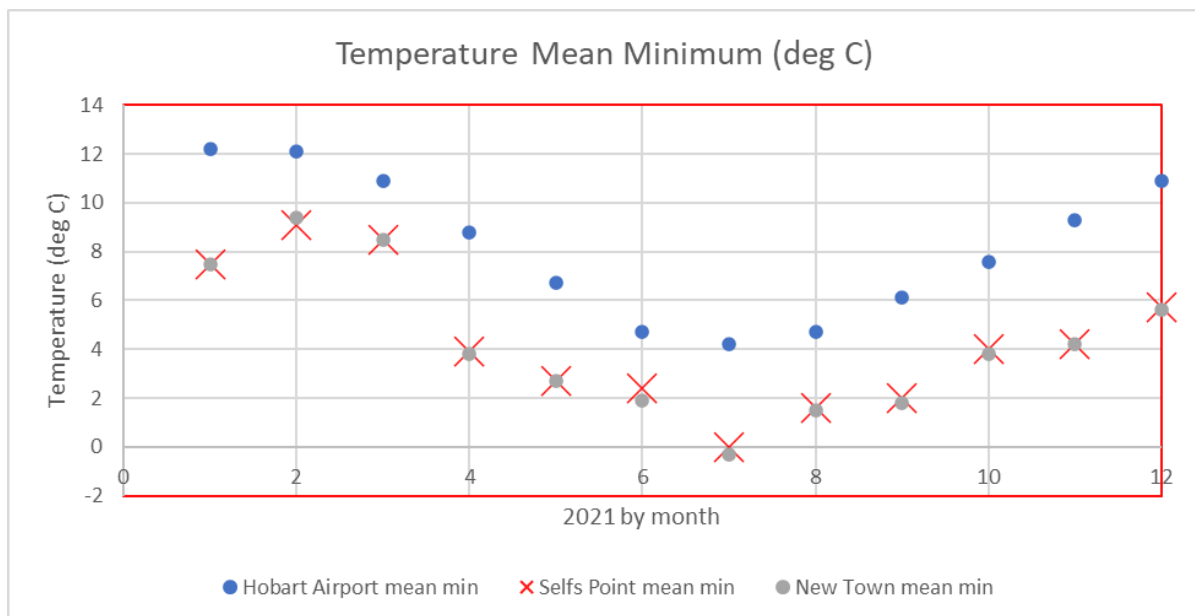


Figure E-1: Temperature mean minimum



TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix E 2021 Monthly Hobart Rainfall and Min and Max Temperature

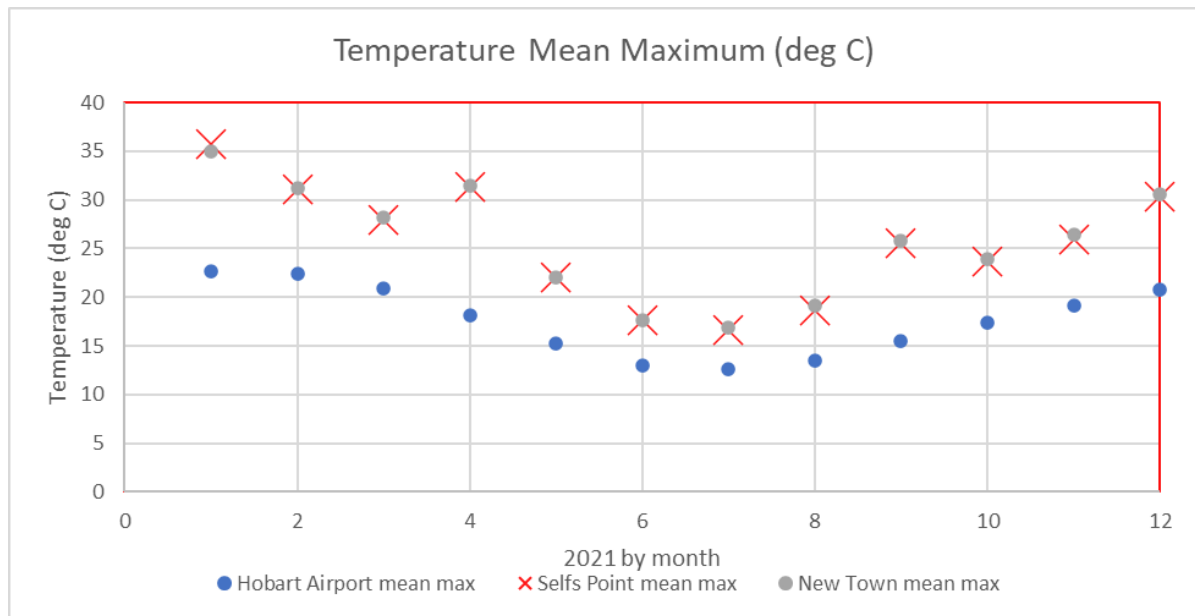


Figure E-2: Temperature mean maximum

Rainfall in Hobart is regular throughout the year, with the most rainfall occurring in December and in Spring. In general between 30 mm and 55 mm occur each month of the year. While rainfall has not been included in the modelling, it can have an affect on the odour potential of odorous sources in a broad sense that cannot be readily simulated. In hot and sunny dry conditions the formation of odorous compounds can be exacerbated. In contrast, during and after rain periods odorous compounds can be washed out, or diluted from the source affecting the odour release.

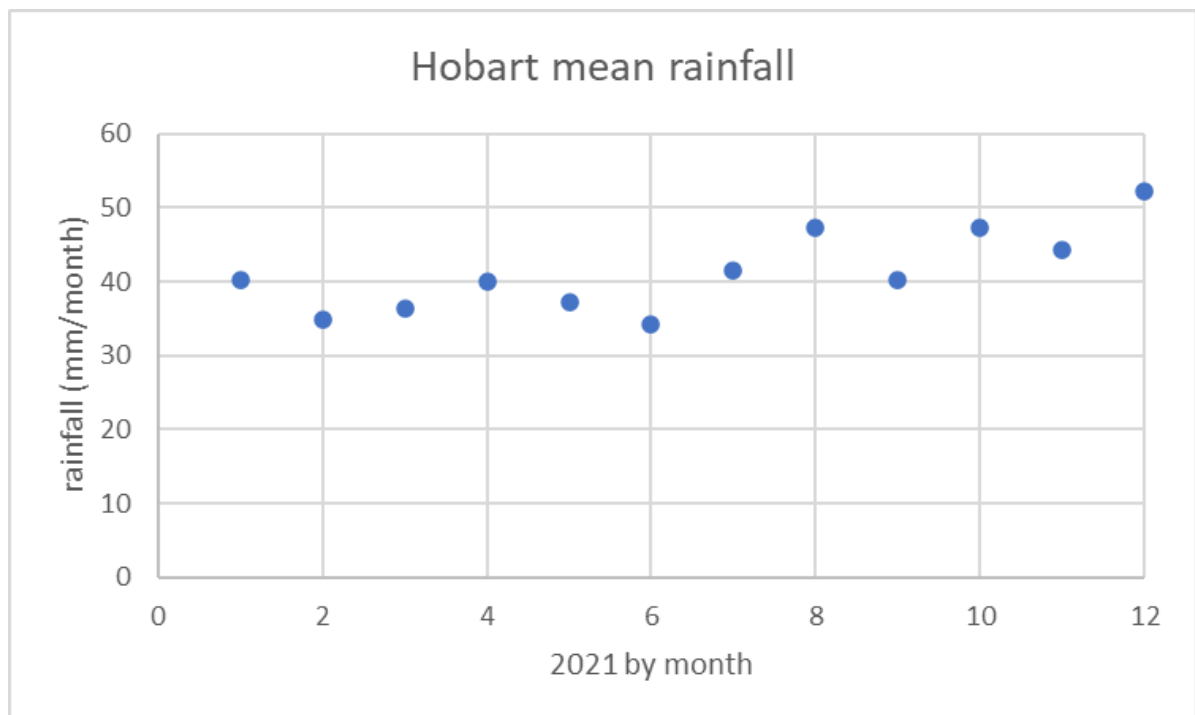


Figure E-3: Hobart mean rainfall



Appendix F REVISED PLANT ORIENTATION

In a review of earlier revisions of the Odour Impact Assessment Report, Tasmania EPA raised concerns regarding the accurate representation of odour emission sources and buildings in the model. Tasmania EPA were concerned that any discrepancies between the model and the design of the facility may lead to an underestimation of the environmental impact of odour emissions from the site. This Appendix identifies impacts associated with any of these discrepancies.

The original source and building coordinates are shown in Figure F-1. These are the coordinates used throughout the main body of the report. The revised source and building coordinates are shown in Figure F-2 which are the coordinates used just for this Appendix to identify the impacts from any discrepancies. Whilst the key parameters, such as the area source size and emission rates, have been accurately characterised the sources and buildings in the original plan were aligned in a north-south orientation rather orientated at an angle as per the design. This meant that the south east corner of some of the sources was offset from the boundary by approximately 5 m – 20 m in the original layout, which was not the case when properly aligned. It should be noted that whilst some portions of each source are located closer to the boundary with the orientation change, other portions of the sources are located further away which partially balances out the overall odour impact.

As a consequence of this, new modelling was conducted for Scenario 2 (measured on-site odours) in order to compare the original model layout with the revised layout. The results for 1 ou are shown in Figure F-3 and for 2 ou are shown in Figure F-4. The results show only a very small 4 m or so difference between the original layout and the new revised layout. Tables F-1, F-2 and Figure F-5 show the comparable differences between the original layout and the new revised layout at the cultural sensitive receptors (Table F-1) and the residential receptors (Table F-2). Figure F-5 shows the location of the maximum boundary concentration for the two different plant layouts. The results at the cultural receptor locations are identical, the results at the residential sensitive receptors are almost identical, and the maximum boundary concentration of 3.5 ou occurs at almost the identical location at the southern tip of the plant boundary.

It can therefore be concluded that the change in orientation of the sources makes very little difference either at the boundary or at sensitive receptors.



TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix F Revised Plant Orientation

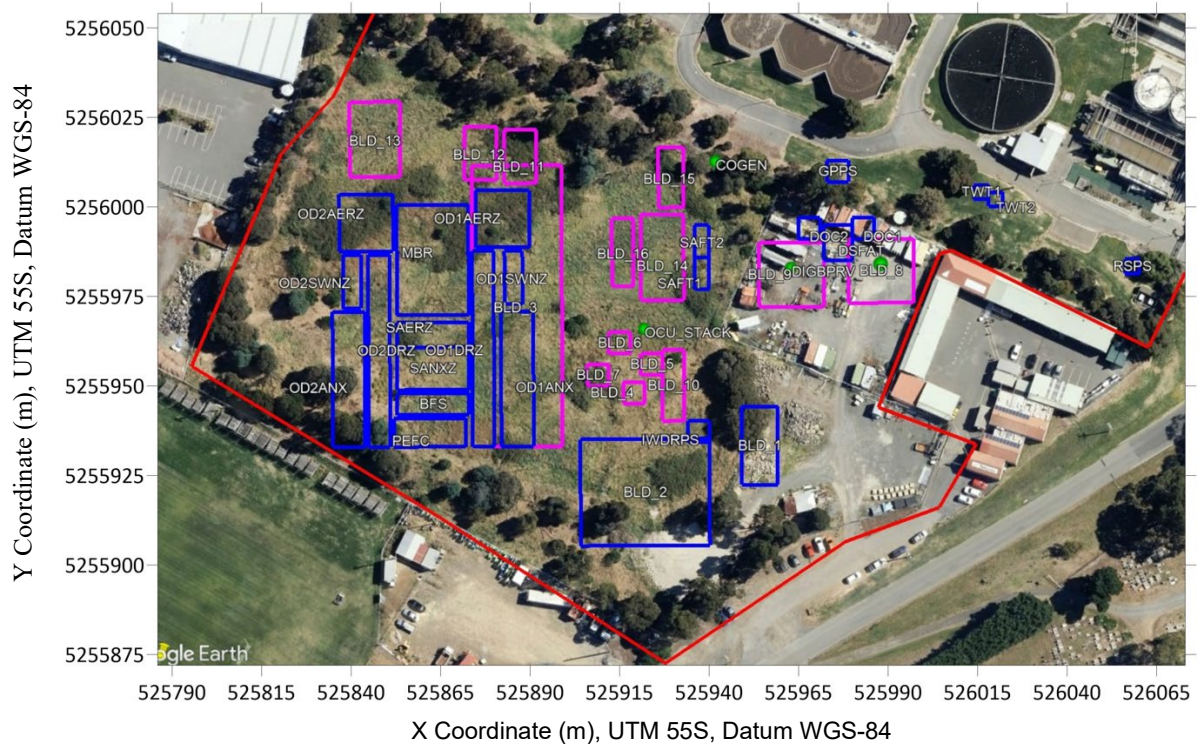


Figure F-1: Area source locations (blue), building locations (purple) and point source locations (black) modelled throughout the main body of the report

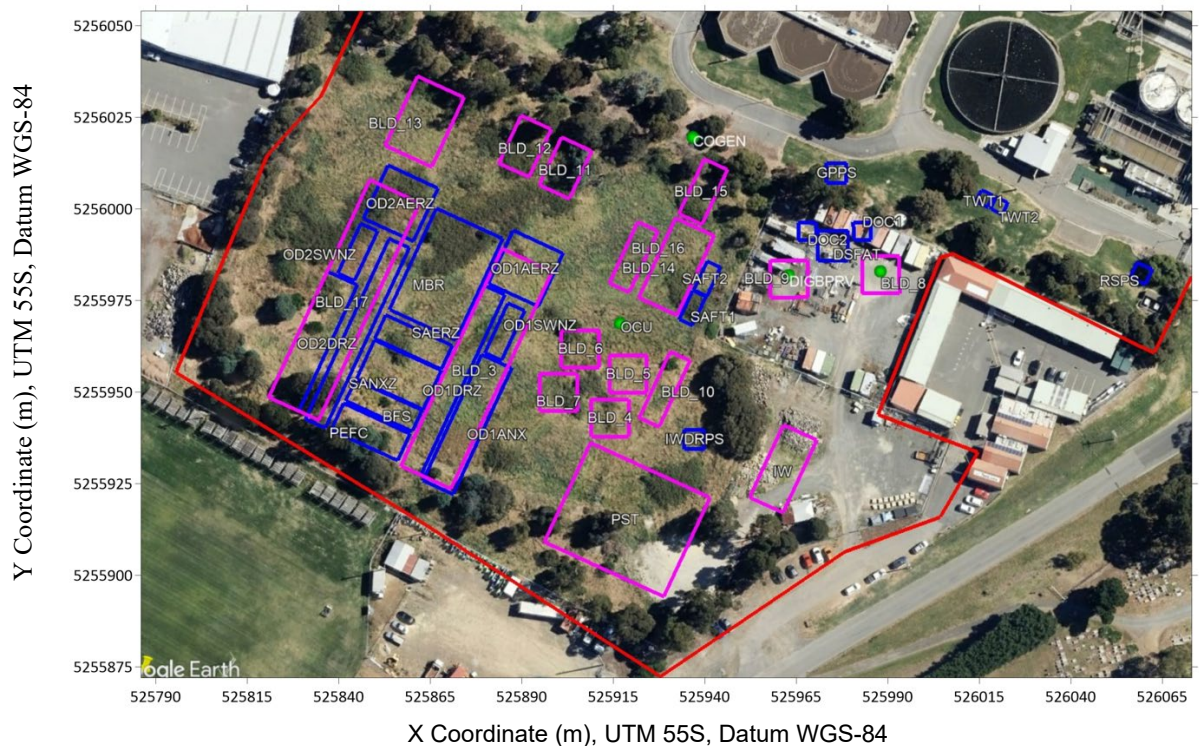


Figure F-2: Area source locations (blue), building locations (purple) and point source locations (black) in revised orientation modelled in this Appendix.





Figure F-3: 1 ou isopleth contour plot for original odour source coordinates (blue) vs. revised odour source coordinates (green)



TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix F Revised Plant Orientation



Figure F-4: 2 ou isopleth contour plot for original odour source coordinates (blue) vs. revised odour source coordinates (green)

Table F-1: Cultural sensitive receptor odour concentrations (bold values are in excess of the 2 ou criteria). Scenario 2, measured odour.

	Original Sensitive Receptor Nos.	Scenario 2 Original Coordinates	Scenario 2 New Revised Coordinates
Cultural receptor	Sports Field #1	2.6	2.6
Cultural receptor	Rowing Club #2	1.5	1.5
Cultural receptor	10 Lives Cat Centre #3	1.9	1.9
Cultural receptor	Bridge Club # 4	2.3	2.2
Cultural receptor	Rugby Club House # 5	2.2	2.3



TASWATER SELFS POINT STP ODOUR IMPACT ASSESSMENT

Appendix F Revised Plant Orientation

Table F-2: Other sensitive receptor odour concentrations (bold values are in excess of the 2 ou criteria). Scenario 2, measured odour for original and revised odour source coordinates.

Ret No.	X Coord (km)	Y Coord (km)	Scenario 2 Original Coordinates	Scenario 2 New Revised Coordinates
1	525.616	5255.983	1.2	1.2
2	525.619	5256.003	1.2	1.2
3	525.647	5256.016	1.3	1.4
4	525.634	5256.036	1.3	1.3
5	525.630	5256.055	1.3	1.3
6	525.651	5256.071	1.4	1.4
7	525.637	5256.096	1.4	1.4
8	525.652	5256.111	1.6	1.6
9	525.687	5256.212	1.6	1.6
10	525.675	5256.239	1.5	1.5
11	525.684	5256.258	1.5	1.5
12	525.703	5256.272	1.4	1.4
13	525.710	5256.291	1.3	1.3
14	525.714	5256.323	1.2	1.3
15	525.724	5256.358	1.1	1.1
16	525.724	5256.392	1.0	1.1
17	525.785	5256.425	0.7	0.8
18	525.817	5256.422	0.6	0.7
19	525.822	5256.458	0.6	0.6
20	525.846	5256.483	0.5	0.5
21	525.891	5256.473	0.4	0.4
22	525.933	5256.477	0.4	0.4
23	525.789	5255.683	1.2	1.2
42	525.801	5255.595	1.0	1.0
25	525.731	5255.669	1.0	1.0
26	525.764	5255.628	1.0	1.1
27	526.057	5255.535	0.8	0.8



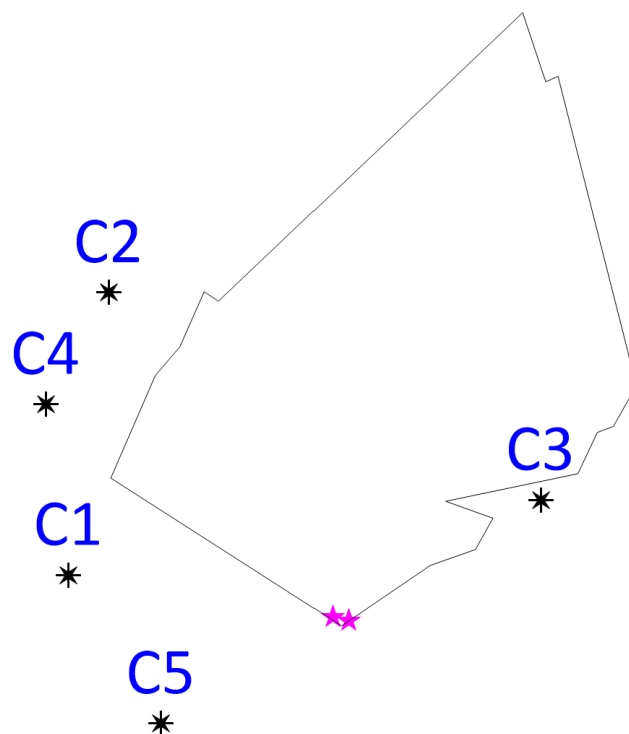


Figure F-5: Location (pink star) of highest boundary odour concentration for Scenario 2 (measured odour) of 3.5 ou for original coordinates and for revised coordinates.



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