Reverse Sensitivity Assessment for Arataki Re-Zoning Proposal

HASTINGS DISTRICT COUNCIL

Phase One Advice on Odour

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Reverse Sensitivity Assessment for Arataki Re-Zoning Proposal

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Appendix A. Section 6.1.4 of the RMMP

Executive Summary

Jacobs has undertaken a desktop data collection and review phase to provide preliminary advice on the reverse sensitivity effects of the proposed rezoning at Arataki Road (the Arataki Extension). This report sets out our initial findings of the effects of the proposal on the Te Mata Mushroom Company (TMM), who are a neighbour to land scheduled for rezoning.

TMM is an established business operating with appropriate resource consents in place, albeit there are current issues with compliance. The TMM operation as it is presently, is already affecting the amenity of residential areas that are further away than the land covered under the Arataki Extension. Further residential subdivision in the Arataki area as proposed, will further impact on the ability of TMM to comply with the condition of its resource consent relating to odour performance. We consider this is likely to be the case even if TMM completes currently required upgrades to further internalise odour.

Encroachment and intensification of residential activity within the Arataki Extension can reasonably be expected to have a significant reverse sensitivity impact on TMM, because the present Plains Zone of the area is expected to have a higher tolerance to the lower level and residual odours that would occur from TMM even with odour fully controlled to the extent practicable.

Our report broadly considers the advantages and disadvantages of mitigation options available to the developer of the proposed residential zone, and assesses how likely we consider the reverse sensitivity issues can be overcome through mitigation.

From our initial review it appears that available mitigation measures to the subdivision developer are either unlikely to be effective or practicable for offsetting the reverse sensitivity effect. Further analysis of the mitigation options is recommended should Hastings District Council, on balance of other matters, still wish to pursue the rezoning proposal.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to provide advice to the Hastings District Council (the Client) in relation to reverse sensitivity aspects of a proposal for residential development adjacent to the Te Mata Mushroom (TMM) site at Arataki Road, Havelock North in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

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1. Introduction

The Hastings District Council (HDC) has commissioned Jacobs New Zealand Limited to undertake an assessment of the potential reverse sensitivity effects on an odour discharger likely to result from a proposed zoning change in the Hastings District Plan (HDP). Land that is currently zoned as Plains Zone[1] along Arataki Road is proposed to be rezoned for residential development in the HDP.

Part of the land for proposed rezoning is on the immediate boarder with Te Mata Mushrooms (TMM), which has been operating at its site since 1967. TMM currently undertakes both composting and mushroom growing operations. Mushroom farming is classified as Intensive Rural Production (IRP) under the HDP, and is a controlled activity in the Plains Zone.

TMM discharges contaminants to air from a composting and mushroom growing operation and associated activities under its resource consent number DP100128A, which expires 31 May 2025. The Hawkes Bay Regional Council prepared a consent officer's report and granted the air discharge consent to TMM in 2011 (HBRC, 2011[2]).

We note that any activity permitted by the HDP in the Plains Zone is allowed to establish at the site; dairy farming is one such activity. TMM has stated an intention to develop an intensive barn dairy operation and has obtained discharge authorisations for discharge to land of farm dairy effluent (FDE). We understand that further authorisations are likely to be required to establish an intensive barn dairying operation at the TMM site.

The proposed rezoning at Arataki Road to General Residential would result in an increased intensity of residential dwellings in closer proximity to the TMM operation. This change would thereby increase the sensitivity of the land use adjacent to TMM. The increased sensitivity would have the potential to negatively impact on the TMM activities such as: requiring a tighter level of control on TMM's activities and/or potentially limiting future expansion of the activity. This potential effect on TMM is known as reverse sensitivity.

Our report has been prepared to advise the HDC on the potential reverse sensitivity effects of the proposed zoning change as they relate to odour from TMM. The focus of the report is on the reverse sensitivity effects on the current lawfully established activities at TMM. We consider that TMMs stated intention to establish intensive dairy barning does not materially alter or affect the conclusions of this report, other than that the additional activities would provide an additional source of odour that would be in close proximity to the proposed Arataki Extension.

[1] Under the Hasting District Plan (Amended, 2012) the main focus for the Plains Zone is to sustain the life supporting capacity of the soil resource. The zone allows for the operation of rural activities.
[2] Hawkes Bay Regional Council, *Assessment of Resource Consent Application*, Te Mata Mushrooms Ltd, 2011.

2. Planning background

This section outlines information provided by the HDC summarising the background to the re-zoning proposal at Arataki Road, in the Hastings District[3].

The Heretaunga Plains Urban Development Strategy (HPUDS) identifies areas that are broadly suitable to accommodate housing development to meet projected population growth requirements within Hastings and surrounding Districts for 2015 to 2045. These areas have been integrated into both the Regional Policy Statement and the Proposed Hastings District Plan (Appendix 1). The Proposed Hastings District Plan further identifies those HPUDS areas anticipated to meet the greenfield needs within the lifespan of the Plan (Appendix 2). Arataki Extension is one such area.

The area immediately west of Arataki Road was zoned General Residential in 2007 and has now been substantially developed (over the past 6 years) to warrant development of a Structure Plan for the land generally east of Arataki Road as shown in red on Figure 1.

Part of the Structure Plan considerations include an assessment as to the suitability of the land for residential development having regard to the reverse sensitivity effects of adjacent or nearby rural land uses and the 'right to farm' principle, which are endorsed by the RPS. The structure plan process will also determine the nature of any mitigation required to facilitate residential development.

The intention of HPUDS is that the land along the eastern side of Arataki Road be developed to a similar density as the residentially zoned land along the western side.

TMM previously used an area of land leased from HDC off Brookvale Road as part of its operation. A subdivision has now occurred and that land is to be transferred to North Peak Properties (TMM). At the same time HDC has purchased a reserve strip along the eastern edge of the Arataki extension adjacent to TMM.

The lots owned by North Peak were subject to a consent application to expand TMM's operations adding additional buildings in 2013.

TMM discharges to air from a composting and mushroom growing operation and associated activities under resource consent number DP100128A, which expires 31 May 2025. In 2014 the HBRC granted TMM an air discharge consent number DP130118A to discharge from an intensive dairy farm activity incorporating housing and feeding of 80 cows in a barn with access to pasture for grazing. The barn is to be located adjacent to the composting operation. We understand that TMM may intend to use straw from the housing of the dairy cows in the mushroom composting operation, although TMM has not yet applied for any changes to the mushroom farm air discharge consents that would allow for this. A dairy effluent storage pond is also proposed for storage of washdown water.

[3] E-mail, Roger Wiffin on behalf of HDC to Deborah Ryan of Jacobs (13 February 2015).

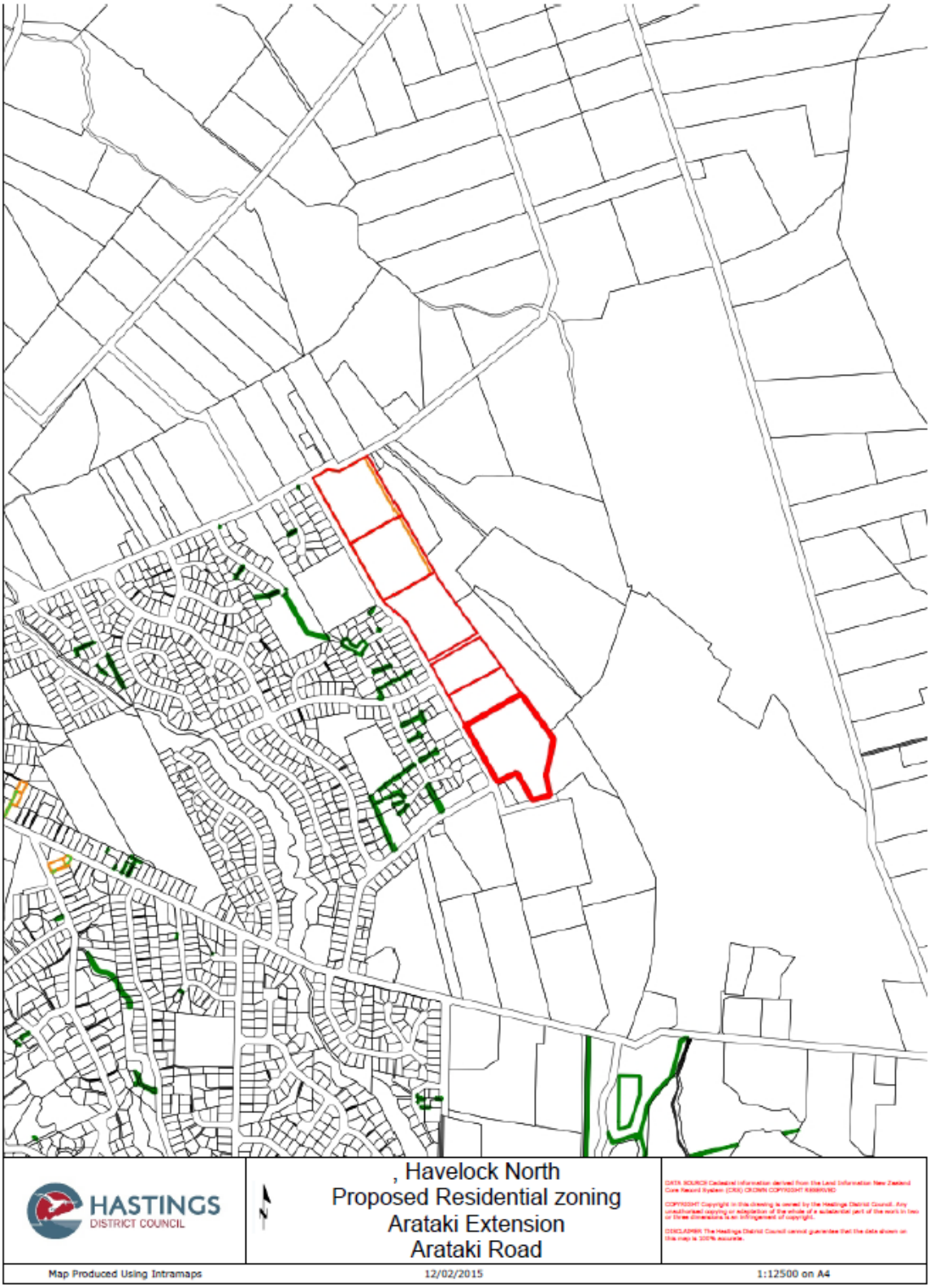

Figure 1 Map showing location of area to be rezoned residential

3. Reverse sensitivity and internalisation

3.1 Background

Reverse sensitivity has been identified in case law as a consideration under the Resource Management Act (RMA). Reverse sensitivity is generally considered as one of many potential environmental effects. Reverse sensitivity is used to refer to the effects of sensitive activities on other activities in their vicinity, particularly by leading to restraints in the carrying on of those activities.[4] Restraints could include limitations on the operations such as operating hours, restrictions on when certain activities are allowed, increased expenditure on control systems or limitations on the ability to expand operations.

The converse of reverse sensitivity is internalisation, the principle of which is that those who create adverse effects must confine them within their own sites rather than ask society to deal with them. RMA case law supports both views although the general duty to avoid, remedy or mitigate adverse effects (i.e. internalise) tends to be the overriding consideration. Buffer zones to disperse odours and prevent adverse effects may be reasonable, but only where all reasonable measures have been implemented to internalise the adverse effects, such as was the case in *Hill v Matamata Piako DC and Waikato RC (EnvC A06599)*[5].

One case where reverse sensitivity was a key consideration in the judge's decision is that of *McMillan v. Waimakariri DC (EnvC, A010/97)*. The Council sought a plan change for a residential type subdivision adjacent to two pig farms. The change was declined on the basis of reverse sensitivity because of encroachment on the pig farming activity. In this case, the court considered there was adequate land available for rural-residential subdivision elsewhere in the district and the plan change was not an efficient use of land in the area, such that the potential reverse sensitivity effect on two pig farms was deemed not to meet the purpose of the RMA.

In this report, we have considered both the extent to which TMM has, or is required to, internalise its odour effects and the likelihood of reverse sensitivity effects on TMM because of odour resulting from increased sensitivity of the receiving environment.

3.2 Reverse sensitivity and odour assessment approach

In order to assess the potential reverse sensitivity effect of the proposed subdivision, it is necessary to try to quantify or otherwise assess the effect of the odour from TMM. That is by considering the potential for odour to impact on the amenity values of a nearby environment we can ascertain the likelihood and the degree of the reverse sensitivity effect from an increase in the sensitivity of that environment.

For this report we have undertaken a preliminary assessment, to review currently available information on odour from TMM in a desk top study in order to provide initial advice on the reverse sensitivity effects of the proposed zoning change. Our assessment has involved consideration of current consents relating to TMM, compliance status and public complaint records regarding odour.

The assessment criterion for odour acceptability is a subjective one and generally takes the form:

> *"there shall be no objectionable or offensive odour to the extent that it causes an adverse effect at or beyond the boundary of the site".*

A condition of this form has been incorporated into TMM's consent conditions as discussed in Section 4.3 of this report.

Whether an odour objectionable or offensive to the extent there is an adverse effect depends on the frequency, intensity, duration, offensiveness and location of the odour event. These factors are collectively known as the FIDOL factors and they are included in an advice note regarding assessing odour under TMMs air discharge consent conditions. The Hawkes Bay Regional Council (HBRC) has incorporated a procedure in the Regional

[4] *Auckland Regional Council v Auckland CC [1997]*
[5] MfE, *Good Practice Guide for Assessing and Managing Odour in New Zealand*, June 2003.

Resource Management Plan (RRMP) explaining how assessments are to be done, which is reproduced as Appendix A.

The MfE Odour Guide summarises the factors to be taken into account when interpreting odour complaint and council investigation records as presented in Figure 2. Ultimately weighting is needed to evaluate each factor and draw conclusions on whether an 'ordinary reasonable person' would consider that the odour is having a significant adverse effect or not.

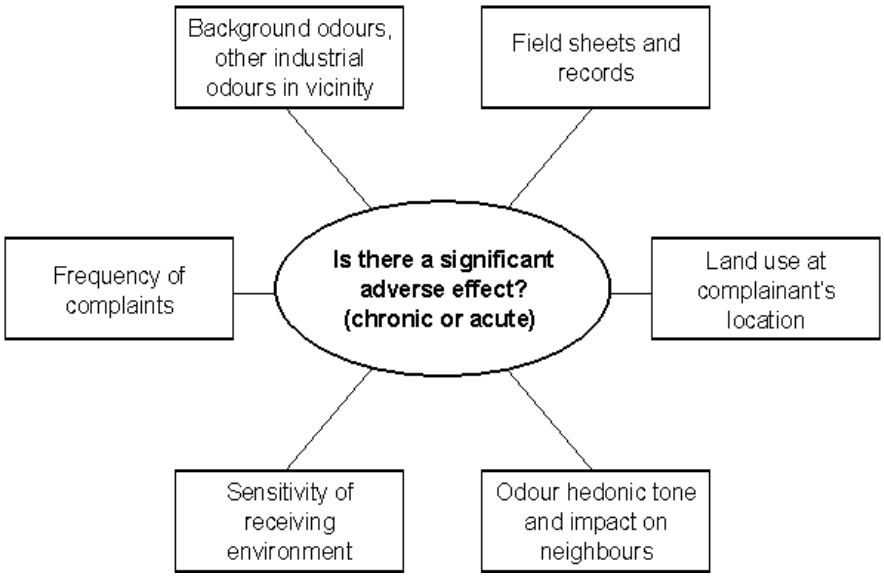

Figure 2 Factors in considering if there is an adverse effect from odour (MfE 2003)

When considering location this involves consideration of receiving environment sensitivity and has a direct impact on the assessment as to whether odour constitutes an adverse effect. Sensitivity is discussed further below.

There are a range of additional methods to quantify odour effects, but none can provide a fully objective conclusion as to whether effects are or are likely to be acceptable. Consideration of options for further assessment of odour effects are discussed in Section 8.2 of this report.

In order to consider how the above factors affect the likelihood of reverse sensitivity effects on TMM, we also reviewed the local wind conditions and the recommended separation distances for similar operations in Australia

4. Land use sensitivity and amenity expectations

4.1 Sensitivity of land uses to odour

Certain amenity values are associated with different types of receiving environments. Table 1 provides some examples of land use and the typical classification of their sensitivity to odour. The classification as high or low varies depending on both the nature of the land use, and the nature of the odour and the expectations associated with that land use. People in sensitive areas, such as residential areas, demand higher amenity in their environment.

While both rural and residential (or living) environments can both have high sensitivity to some odours, people in rural environments will be more tolerant of lower intensity odours considered characteristic of that environment. This is as shown in Table 1 where people in rural and rural residential areas, while generally considered to be of low sensitivity to rural odours, can still be classified as high sensitivity to non-rural odours, such as those from industrial activities.

Table 1 Examples of sensitivity for different land uses (from Table 2.2 MfE Odour Guide)

Land use type	Sensitivity classification			Comments and reasons for classification
	High	Mod	Low	
Residential/ living (high-density residential)	✓			People of high sensitivity to odours can be exposed. People can be present at all times of day and night, both indoors and outdoors. Visitors to the area who are unfamiliar with an odour are likely to raise awareness of a problem. In cases of mixed land uses, where the residences are present with industry, the use may be judged to have the same sensitivity as residential depending on the circumstances.
Rural residential (low-density residential, minimum property size around 1 ha)	✓		✓	Lower population density, therefore less opportunity for exposure to odour. People of high sensitivity can be exposed at all times of the day and night. Rural-type background odours may be present but are usually lower intensity than in a rural zone. Residents tend to work in cities and return home at night or weekends and may not be desensitised to rural-type odours. Can be sensitive to non-rural-type odours (e.g. rendering plant or landfill odours). Overall high or low sensitivity, depending on the circumstances of the particular area.
Rural	✓		✓	Low population density means low opportunity for exposure to odour. People living in and visiting rural areas generally have a high tolerance for rural-type odours. May be highly sensitive to non-rural type odours (e.g. rendering plant or landfill odours).

The proposed change in land use at Arataki would mean that the sensitivity of the receiving environment would increase with a lower tolerance to odour such as from intensive rural production undertaken at TMM. This means that tighter controls on TMM's activities could be required to meet the odour condition discussed above compared to if the activity was in a less sensitive location.

A second factor is the intensity of the development, higher density high sensitivity environments, such as urban residential, will have a higher potential for reverse sensitivity effects than a low density high sensitivity environment.

4.2 Amenity expectations within the Arataki Extension

The Arataki Extension, as proposed, is on the rural-urban fringe of Havelock North. While the proposal is for a residential environment, which has typically high sensitivity to odour, some people moving into the area may have an expectation that being on the boundary of a rural area, they may experience rural type odours periodically such as from silage or manure spreading. Other people may expect a very high amenity environment characterised by 'clean fresh air'. In any case, we consider that the majority of people moving into a new residential area, such as Arataki, would have high expectations for amenity.

If rezoned as planned the Arataki Extension would be of a similar character to the adjoining area of Arataki and the occupants of the new area are likely to share the amenity expectations of the existing residents. These expectations are reflected within the relevant Planning Documents (Eg the Proposed Hastings District Plan, Anticipated outcome HNR3: "A residential environment that is free from excessive noise, odour, dust, glare and vibration nuisance").

5. Site Description

5.1 Location

The site for rezoning, as shown in red on Figure 3, is located within the Plains Zone under the HDP, which extends from the eastern side of Arataki Road. The existing General Residential Zone extends back towards Havelock North from the western side of Arataki Road. The distance from the TMM site to the existing General Residential Zone is approximately 200 m.

The site at 139 Arataki Road (the former motor camp), shown as D144 on Figure 3, has been purchased by the Ministry of Education for developing a school. Much of the development/building of the residential area on the south-western side of Arataki Road has yet to occur.

Both the proposed school and existing General Residential Land use have already increased the sensitivity of the receiving environment around TMM, which we understand was originally rural zoning for approximately 1 kilometre from the edge of Havelock North.

The TMM site is flat except for a 20 m high escarpment, which runs along the southwestern boundary. Land to the southwest is elevated above the level of the TMM site. Mature trees line the escarpment. The TMM site comprises buildings, concrete areas, mature pines and paddocks used for livestock grazing and wastewater irrigation.

5.2 Meteorology

Figure 4 is the windrose for Whakatu (1997 to 2008), which is the nearest full time meteorological station to the site, and has been reproduced from the BECA Infrastructure Ltd (BECA) report (2010).

HBRC (2011) reports that winds from the north-easterly to easterly directions have the potential to carry odours from TMM to the Brookvale Arataki residential area. These winds occur around 25% of the time. Low wind speeds less than 3 m/s are more likely to result in detectable odours, due to less mixing or pooling of air. Winds from the north-east through to the east and less than 3 m/s occur around 10.5 % of the time[6] (BECA, 2010).

[6] BECA, *Te Mata Mushrooms Odour Source Assessment*, 2010

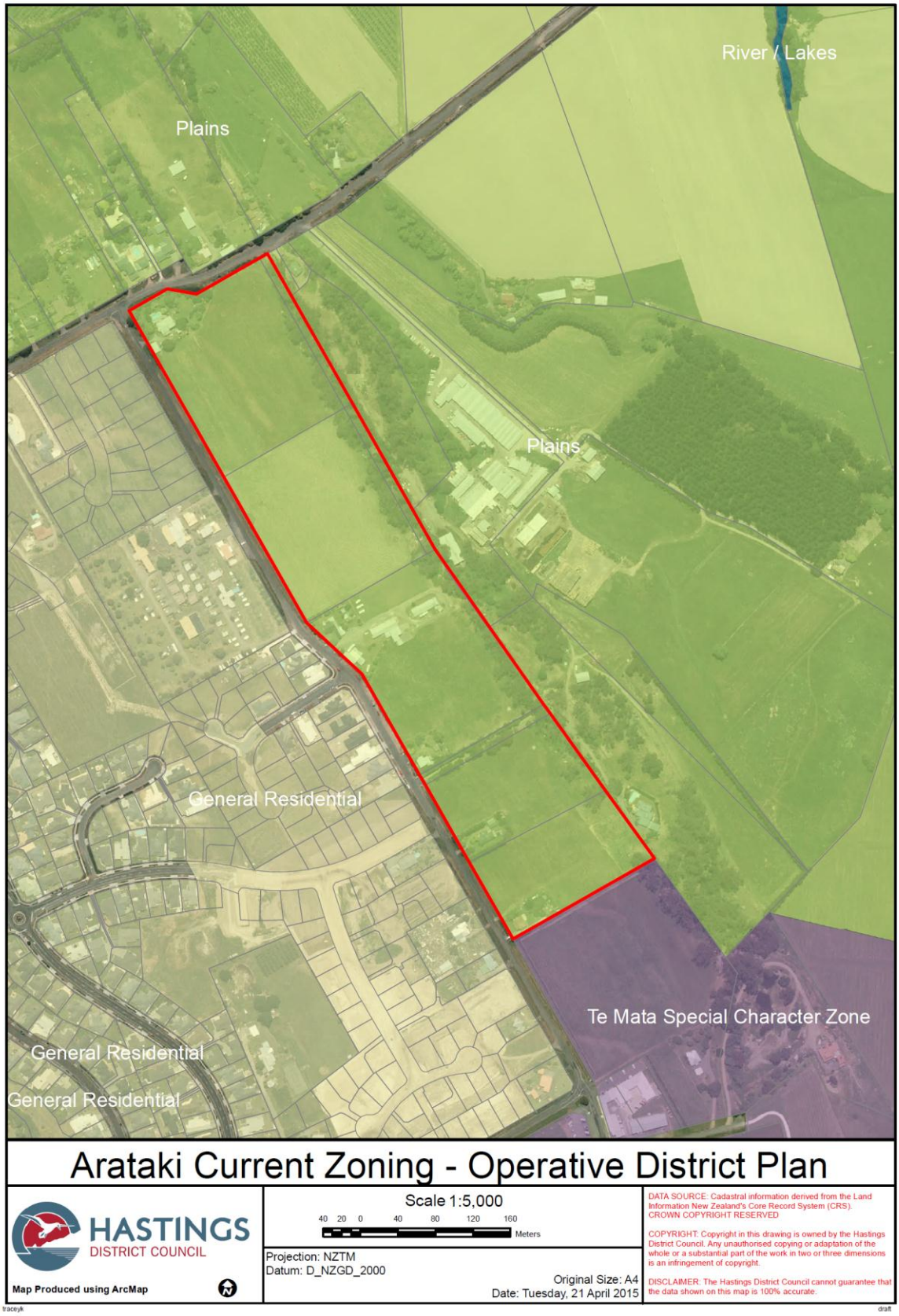

Figure 3 Current zoning at Arataki Road (HDC, January 2015)

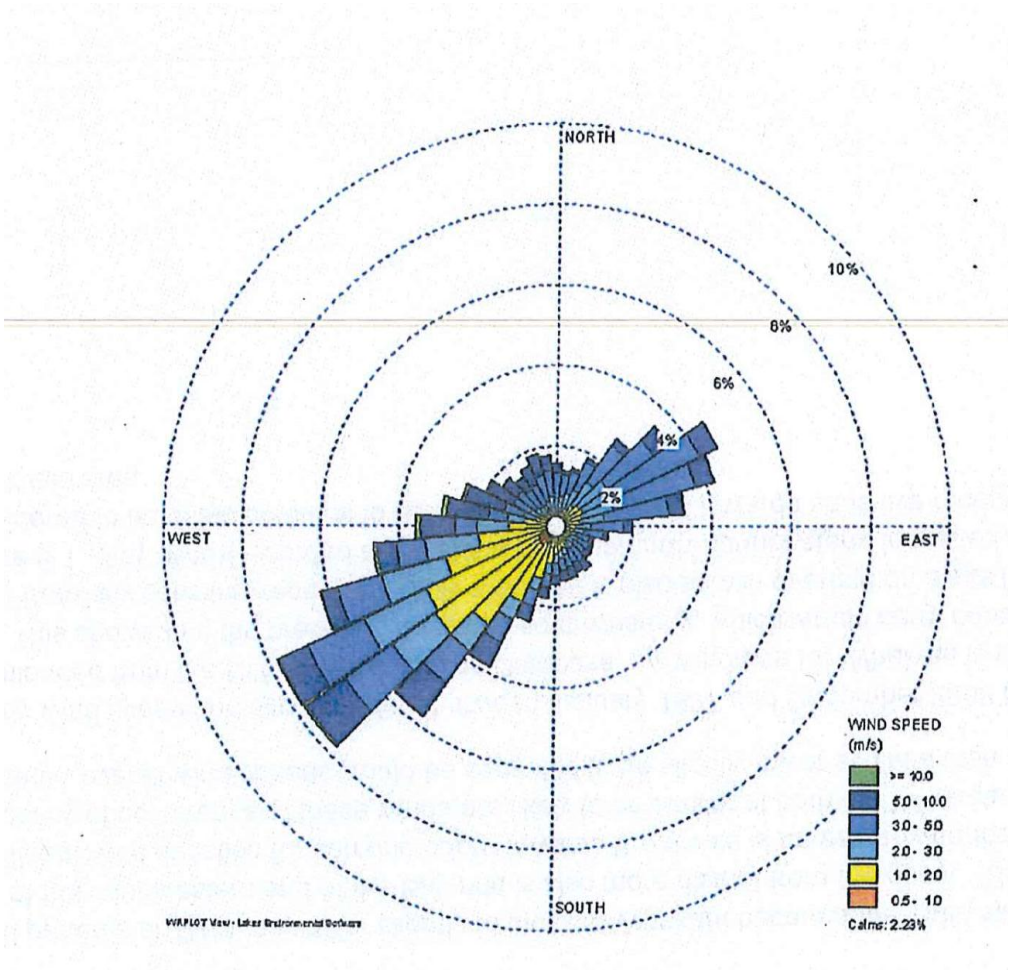

Figure 4 Windrose for Whakatu (1997 to 2008) (Source BECA, 2010)

5.3 Nature of TMM's Activities

TMM's resource consent allows discharges to air from a composting and mushroom growing operation and associated activities with production of up to 120 tonnes of compost per 7 days.

Sources of discharge to air are principally, odour from:

- Storage of raw materials, particularly chicken litter and straw bales wetted with effluent
- Manufacture, pasteurisation, transfer and storage of mushroom compost
- Mushroom growing
- Storage and off-site disposal of spent compost
- Management of wastewater/leachate
- Discharge of wastewater to land via travelling irrigator.

HBRC (2011) describes odours from mushroom composting typically as musty/mouldy and compost/earthy but notes the odours can also be described as rotting vegetation, rotten/dead animal, sulphurous or sewage odour.

The TMM air discharge consent includes a condition number 6, which requires "there shall be no objectionable or offensive odour to the extent that it causes an adverse effect at or beyond the boundary of the site.

As noted in Section 2 above, TMM has also obtained air discharge consents for an intensive dairy barning activity and associated farm dairy effluent treatment and disposal. We understand that whether there is a need for further authorisations from the HDC for the dairy barning operation proposal are under consideration, and that further authorisations will likely be needed prior to establishing the activity. Accordingly, we have not specifically considered the dairy barn operations as part of TMMs activities, but we consider the addition of any such activity would not materially affect the conclusions reached on reverse sensitivity effects on TMM in this report.

5.3.1 Compost manufacture

Raw materials for composting are straw, wastewater, chicken litter and gypsum. Phase 1 is a high-temperature reaction that completes the active fermentation of carbohydrates. Phase 2 is a low temperature microbial process that further decomposes the raw materials to produce a substrate suitable for mushroom growing.

Straw has historically been stored outside on a concrete pad. The application for the expansion of the TMM activities, Cheal (2013) noted that a proposed barn will be used for storing hay and will keep hay dry. The HBRC has confirmed that straw is now stored undercover in the barn, but indicated that this was the only upgrade to have occurred since the consents were granted[7].

Chicken litter is stored and kept dry in a 3-sided concrete bunker. Gypsum is mixed with chicken litter and also stored in a concrete bunker. The chicken litter bunker and the gypsum and chicken litter mix bunkers were to be enclosed with soft door flaps under consent condition 9 by March 2012. While we are unsure if enclosure has happened, we understand mixing of chicken litter ad gypsum is now undertaken offsite[8].

In week 1 of the process, straw bales are laid out on a concrete pad. Bales are wet with effluent for around 30 hours on days 6 and 7. Phase 1 composting commencing on day 8, is undertaken in a concrete bunker, with periodic removal from the bunker for turning over a 12 day period. Then compost is separated into 2 bunkers for Phase 2 composting for a further 8 days and following that the compost is processed into mushroom trays for growing.

There are two Phase 1 bunkers that are emptied and filled on alternate weeks. The Phase 1 bunkers have two concrete walls and are enclosed at either end with tarpaulins. Piles are aerated via lines in the floor (forced aeration), and building air is extracted at a single point in the roof of each bunker and vented to a biofilter. Temperature and oxygen are monitored in the piles where temperatures reach 70 – 80 ^{o}C and oxygen is maintained at 6 to 8%.

The Phase 2 bunkers have concrete floors, walls and a roof. Air is recirculated in the bunker and a portion is passively ventilated to air. The Phase 2 bunkers are open to air at two ends during filling.

Leachate and stormwater is collected in an aerated sump. The leachate is circulated between the sump and a storage pond that is not aerated. The current consent required that dissolved oxygen be monitored continuously and maintained above 1 mg/L.

Waste water is incorporated back into the process for wetting the bales, and any excess is irrigated on to adjacent paddocks. Wastewater is discharged on to land situated to the south of the operation and west along Arataki Road. Figure 5 shows the TMM irrigation areas. The proposed farm dairy effluent (FDE) discharge is to areas marked as A, B and E. The existing discharge of mushroom compost wastewater and stormwater continues to occur on areas C and D. HDC staff have advised that the area marked F is no longer utilised by TMM[9].

[7] Pers com, Mike Alerbardi, March 2015.
[8] Cheal Letter to HBRC, REF 2103-027-01L23, 26 March 2015.
[9] Email, T Gray to D Ryan, 22 April 2015.

Figure 5 TMM Wastewater Irrigation Areas

5.3.2 Mushroom growing

In Phase 3 of the TMM operation compost is inoculated with spawn and stored in trays for 17 days. In Phase 4 peat and lime are added and trays are placed in an enclosed, controlled environment buildings over 40 days.

Spent compost is stored on-site, near the site entrance off Brookvale Road on land leased from HDC. Up to 300 m^3 of spent compost may be stored. The compost is pasteurised and supplied for gardening. A new steam out room for pasteurisation of spent compost is proposed as per Figure 6.

5.4 Odour Control and Management System

BECA undertook an Odour Source Assessment for TMM in 2010 to support the air discharge permit application. This section summarises key aspects of the BECA assessment.

BECA considered that at TMM there are multiple activities that require careful management to minimise odour, and particularly to avoid highly offensive type odours, such as those that arise from anaerobic biological activity. Activities of critical importance to odour management, as identified by BECA, were:

- Storage of chicken litter (which may contain dead animals, or have a high moisture content) and contains ammonia.

- Wetting of the straw bales with wastewater; the wastewater itself (being anaerobic) and the straw bales once wet can become anaerobic and are a source of odour. Bales should not be over-wet and need to be broken up to aerate the piles.
- Mixing of chicken litter with gypsum, which contains additional sulphur, results in hydrogen sulphide and other sulphur and nitrogen containing compounds under anaerobic conditions. These compounds are highly odorous and offensive in nature.
- Breaking the straw bales and mixing them with the manure and gypsum mix.
- During Phase 1 composting aeration needs to be controlled to maintain aerobic conditions, but prevent overheating. Fugitive emissions of highly odorous compounds from any anaerobic activity is possible. Ammonia is routinely produced from the process under aerobic conditions. Bunkers are designed to be kept at a slightly negative pressure, but fugitive emissions occur when bunkers are accessed, such as for turning.
- Transfer of compost and mixing is done in the open air. Mixing is done on the concrete pad and aerobic conditions are maintained via aeration lines. However, these lines may become blocked and/or air pressure too low, such that conditions start to become anaerobic.
- Wastewater was identified as having high organic load and high potential for anaerobic conditions to develop due to low aeration levels.
- Spent mushroom compost is stored in piles and can generate an odour when disturbed, particularly if conditions have been warm and wet.
- System failures may occur from inadequate maintenance or breakdown of aeration pumps, channels and holes causing aerobic conditions in the piles; sumps and the storage pond causing anaerobic conditions in the wastewater; and extraction fans and the biofilter causing failure of the odour capture and control system.

Key controls in 2010 were that a biofilter is used to treat Phase 1 air and odour neutralising sprays were used for open air activities, such as opening bales. The odour spray is referred to as an odour neutralising agent although it has a residual perfume, and is called “Superspice.”

BECA assessed the various odours sources and rated these as having low through to high odour potential beyond the boundary. BECA noted the increasing sensitivity of the environment as a result of further development of the residential subdivision to the west of Arataki Road.

BECA made recommendations for possible upgrades to reduce odour as follows:

- Dunking rather than spraying bales (to reduce odour from spraying effluent and avoids over wetting)
- Ensuring chicken litter is kept dry through improved enclosure
- Using an automated bale breaker and/or enclosing bale break
- For compost removal, mixing and replacement, minimise air blown through to avoid stripping (but maintain aerobicity) or provide an additional bunker for mixing inside and provide additional ventilation and enclose to minimise odour during transfers.
- Reduce fugitive emissions from bunkers by increasing extraction (and upsizing the biofilter)
- For compost transfer from phase 1 to phase 2 enclose mixing operation and ventilate phase 2 bunker

BECA noted that the biofilter is possibly undersized and/or is at its maximum loading, further ventilation of bunkers/enclosures will require an expansion of the biofilter capacity.

Many of the controls that were in place at the time BECA undertook the review were management controls such as having Superspice on at specified times, not over wetting, not placing chicken manure and gypsum mix on bales and leaving overnight. These types of controls rely on having a good operator who is well trained and are subject to human error and as such risk periodic failure.

It is apparent that due to the range of factors requiring control and that the factors may be outside of the operator's control (such as chicken manure quality). It is difficult with this type of activity to contain odours, particularly those with high odour potential, within site boundaries at all times.

5.5 Upgrade proposals

At the time the air discharge consent was granted in 2011, measures were recommended to further internalise odours at TMM. The measures were incorporated into the air discharge consent granted by the HBRC. As reported by HBRC consent officer:

> *"The additional mitigation measures initially proposed by the applicant as part of this resource consent application, over and above what is already undertaken at the site, were:*
>
> - *Storing the chicken litter and gypsum substrate in an enclosed bunker in order to maintain it in a dry state (to be completed within 1 year).* (Condition 9)
> - *Using odour control sprays on the turning machine*
> - *Minimising the amount of air that is blown through the compost in the outside windrow so that aerobic conditions are maintained during the composting operation whilst minimising stripping odours.* (We note this is a balancing act).
> - *Monitoring the level of dissolved oxygen in the leachate/wastewater pond in order to maintain aerobic conditions."*

The HBRC has also incorporated by way of conditions staged upgrades requiring capital investment to further enclose activities that are identified as having high potential odour ratings. These being

- Enclosure and ventilation of the turning of the compost between the Phase 1 bunker and the Phase 2 bunkers by March 2015 (Condition 12).
- Continuous monitoring of dissolved oxygen (DO) in the wastewater storage pond with a concentration limit of not lower than 1.0 mg/L (Conditions 10 and 11).

It was noted that the physical emptying and loading of bunkers, and the transfer of compost from Phase 1 to Phase 2 will still be undertaken by a front-end loader operating in an outdoor environment. And ventilation of Phase 2 bunkers is not presently required. Further the outdoor storage of compost has been associated with an odour complaint in the past, and can be an issue when the piles are disturbed. Review conditions were included by HBRC to address these sources should they be identified as causing offensive and objectionable odour beyond the boundary of the property, resulting in adverse effects, at some time in the future.

To date we are advised that the Condition 12 requirements have not been met, although wastewater system have been upgraded to an aerated system with DO monitoring and management.

In 2013, a subdivision consent was granted by the HDC, with new lots being subdivided off the present land owned by the HDC along the Brookvale Road access to TMM. These lots are proposed to be used for a new access way/entrance and Lot 3 is to be used for two buildings by TMM to be used as growing rooms.

TMM made an application to expand an existing IRP activity at the site between the existing buildings and Brookvale Road in 2013. Figure 6 is a drawing from the 2013 application to expand the IRP activities and shows the site layout of the current and proposed mushroom farming buildings.

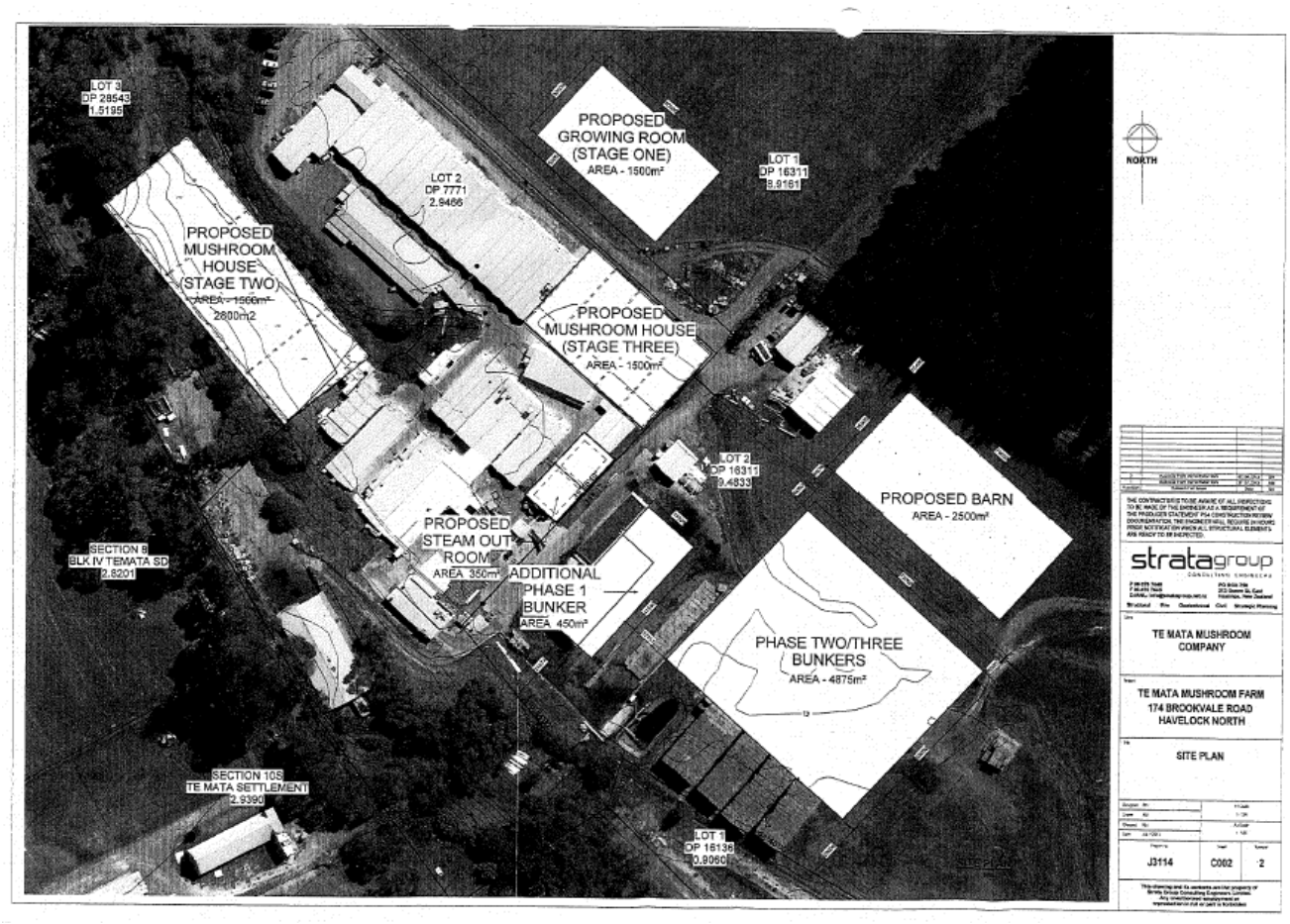

Figure 6 Site layout of the current and proposed mushroom farming buildings (Cheal consent application, additional information, August 2013)

The proposed additional Phase 1 Bunker area is identified by Cheal as being required to meet Condition 12 as described above. The purpose of the bunker is to enclose the composting mix after it has been placed in the phase one bunker such that the compost is aerated and the ventilation air is discharged to a biofilter. Turning of compost was also to be enclosed by March 2015, but HBRC staff advised this has not been met[10].

Under Condition 13 the air consent, the removal of compost and final turning prior to transfer to Phase 2 bunkers is also to be undertaken in fully enclosed building/s that are ventilated to a biofilter with sufficient design capacity by 2017. Cheal identified that the proposed Phase 2 and 3 bunkers will allow compliance with Condition 13 of the air consent.

Cheal identified that the new Phase 2 and 3 bunkers would result in efficiency gains, but the production capacity of 120 tonnes per 7 days, as limited by the air consent would not increase. We understand that an effective increase is allowed for under the consent, as the current production is around 100 tonnes per week.

[10] Pers com, Mike Alenardi, March 2015.

6. TMM's odour performance

6.1 Compliance and complaints

In the consent officer's report the HBRC (2011) summarised odour complaint data from January 2000 to 24 January 2011. There were 42 complaints within that period attributed to TMM. The majority of the complainants were identified as being from the Arataki Road/Brookvale subdivision area. According to the HBRC the most common possible cause of the odour was breaking the bales and transfer and turning of the compost in Phase 1 and 2. The most distant complaint received anecdotally by the HBRC was 1.3 km from the TMM site.

The HBRC (2011) also summarised TMM's consent compliance from 2000 to 2010. Compliance failures had been noted throughout this period due to a failure to comply with the condition related to no offensive or objectionable odour beyond the site boundary. An abatement notice was issued for non-compliance with the odour condition in April 2008.

Figure 7 is a map showing the indicative location and year of complaints received by the HBRC 1999 to 15 January 2015. Note that the coloured dots overlay each other so the total number of complaints are not visible, eg. no green dots are visible although complaints were received in the period 2000 to 2012 as indicated above. It is apparent from Figure 7 that the complaints over time correlate with the plume from TMM when the wind is blowing from the northeast, and also correlate with the underlying landuse, ie the developed area of the Arataki subdivision.

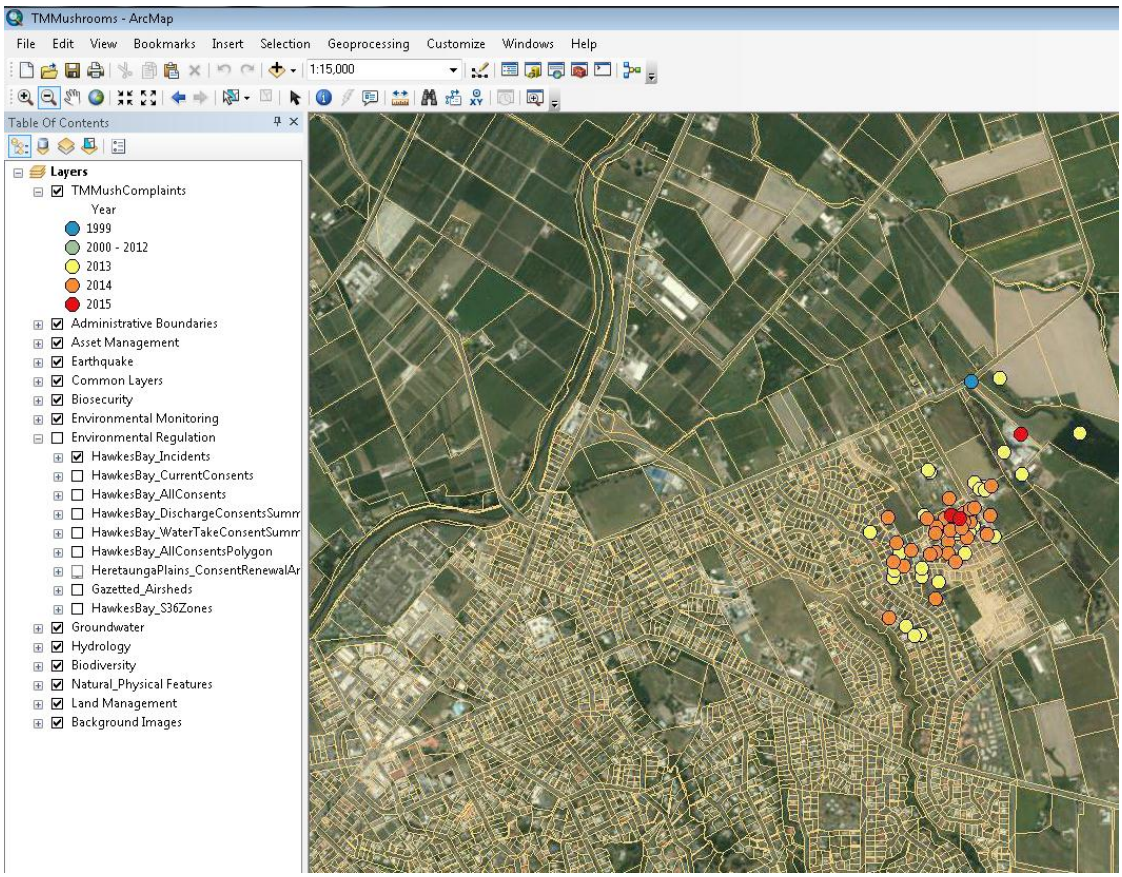

Figure 7 Approximate location of Odour Complaints for TMM (1999 – January 2015) (source HBRC)

More recently, HBRC has advised that for January to December 2014 there were 57 complaints registered as odour from TMM and for 2015 up until 25th of March, there were 52 recorded complaints. This complaint level

represents an increase on the historical levels of complaint. HBRC indicated the drivers for the increased complaints probably include that:

- The residential use has intensified in the Arataki subdivision (in recent times 160 additional dwellings have been constructed within the subdivision and closer to TMM).
- New people have moved in to the area who were not aware of the odours and/or the presence of a mushroom farm
- The community has increased its awareness of the issues through the formation of a residents group
- The community is frustrated that upgrade deadlines required in the air consent have not been achieved.

Breaking down the 2014 and 2015 Te Mata Mushrooms complaints into incident verification by the HBRC:

- 56 were recorded as being a problem (i.e. were validated)
- 27 were recorded only (i.e. for some reason a response was not timely enough to investigate properly)
- 22 were logged as not a problem when the officer was on site such as due to low intensity
- 2 were recorded as not located.

From the HBRC records reviewed the details of activities at TMM that have been identified as being a source of the odour complaint are most often not specified. But over the past year occasions when the investigating officer has linked a problem back to TMM's operations this has included:

- Turning in progress, starting to refill bunker
- Turning wetted bales
- Chook poo and gypsum mix on wetted bales
- Mixed chook poo and gypsum
- Superspice
- Aeration sump.

An abatement notice to require compliance with the odour condition was issued by the HBRC in 2013. Since that time three infringement notices were issued: one in 2013 and two in 2015 resulting in fines to TMM. HBRC staff have advised that targets set in the consent to enclose mixing, turning and transfer activities have not been achieved.

We understand that the HBRC is currently considering its options on the next steps to address what it considers to be ongoing non-compliance.

We understand that TMM is currently considering options for further upgrades to its odour control and management systems, over and above those required by the air discharge consent, in order to achieve compliance with Condition 6 of the consent.

6.2 Performance summary

Overall, it can be concluded that the present TMM operation is not meeting a level of internalisation of its odour that could be considered to be best practicable option ie. the current operation is not minimising emissions to the full extent practicable.

It is also apparent, however, that TMM has already been affected by reverse sensitivity from a receiving environment that has already increased in sensitivity. This sensitivity increase is probably multifactorial, but is likely to be partly due the intensification of the residential activity as well as shifting community expectations given they had expected odour would improve from scheduled upgrades that have not occurred.

In our view, the residential development that has occurred since the air discharge consent was granted in 2011, has essentially increased the level of performance that TMM needs to achieve in order to achieve compliance with Condition 6 of its consent.

6.3 Effect of TMM's odour emission on the Arataki Extension

Section 4.2 of this report considers the likely expectations of people regarding odour and amenity if they were living within the residential environment of the Arataki Extension. A high level of amenity is likely to be expected in accordance with the Proposed HDP.

Given the location of the proposed extension on land adjacent to and within 200 metres of the boundary with TMM, and given the discussion above, it is apparent that community expectations for the level of amenity would not be met in the proposed development area. The experience of odour in the current community include descriptors such as: composting odour, strong ammonia smell on occasions and it has been described as smelling like sewage. And the effects are described as affecting the use and enjoyment of their properties including: significant annoyance and a discomfort while at home. People leave when the odour is strong, shut the house up on warm days and alter their lifestyle in order to manage the odour effects.

If TMM was to comply with the upgrade requirements in its consent, the frequency and intensity of the above effects would be reduced, but it is unlikely that an environment in line with community expectations for odour as being a high level of amenity would be achieved. For example, as above we understand the company would still transfer phase 1 compost to the phase 2 bunkers in the open air and the use of odour sprays to control fugitive emissions, which have been identified as a source of objectionable odour on occasions. There is also the probability that there would be residual lower level odours that can become an issue when a dominant source is removed eg. bale break.

7. Separation distances

Table 2 summarises the separation distance guidance for mushroom farming or the closest similar activity specified by jurisdictions in Australia. The jurisdictions require a minimum of 500 m and up to 1000 m with variables including the scale of the operations, nature of materials and type of process.

Table 2 Summary of Separation Distance Guidelines from Australian Jurisdictions for Odour from Composting Operations

State	Separation Distance	Comments[1]	Document
Western Australia	500m-1000 m depending on size	**Mushroom farm** using on-site blended soils or compost. Separation distance is measured from the activity boundary.	Guidance for the Assessment of Environmental Factors (Separation Distances between Industrial and Sensitive Land Uses) No. 3 June 2005, WA
Queensland	500 m	Distance between a sensitive receptor and **agricultural land** or buffer area demonstrated as achieving odour goals.	The State of Queensland, Department of Natural Resources Planning Guidelines: Separating Agricultural and Residential Land Uses, 1997
Victoria	Case by case	"Where the Index specifies "case-by-case", the separation distance should be determined to the satisfaction of EPA." Separation distances are property boundary to property boundary."	Recommended separation distances for industrial residual air emissions, Draft, EPA Victoria, 2012.
Victoria	>500 m	Enclosed and controlled aerobic **composting** with odour capture and treatment. Feedstock including vegetable organics and green waste. >1200 but <14,000 tonnes per annum. For more odorous feedstock, distance may be varied.	Composting Publication number 1577 September 2014 Draft guideline
South Australia	1000 m	**Composting works** > 200t per year. Distances are based on assumed implementation of Best Available Technology Economically Achievable (BATEA[11])	Guidelines for Separation Distances, 2007, EPA, SA

[1] Note that at 120 tonnes per week TMMs production is more than 6000 tonnes per year.

The Australian separation distances are generally based on the assumption that the technology and controls are appropriate and that the separation is designed to mitigate the residual emission from the activity, such as from process upsets or failures.

[11] BATEA is similar to the concept of the best practicable option, which is defined in the RMA as follows:
best practicable option, in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to—
(a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and
(b) the financial implications, and the effects on the environment, of that option when compared with other options; and
(c) the current state of technical knowledge and the likelihood that the option can be successfully applied

According to BECA (2010) the nearest existing residential dwelling was located about 250 m to the southwest from the ridge on the southwestern boundary of the TMM site. Although, we note that, the existing residential development area allows residential dwellings to be within about 200 m to the southwest of the boundary. Figure 8 shows a contour that is 400 m distant from the TMM IRP, which clearly encapsulates the Arataki Extension as well as the existing residential area to the southwest. The proposed Arataki Extension would essentially have zero separation in terms of how the Australian guidance is applied ie boundary to boundary.

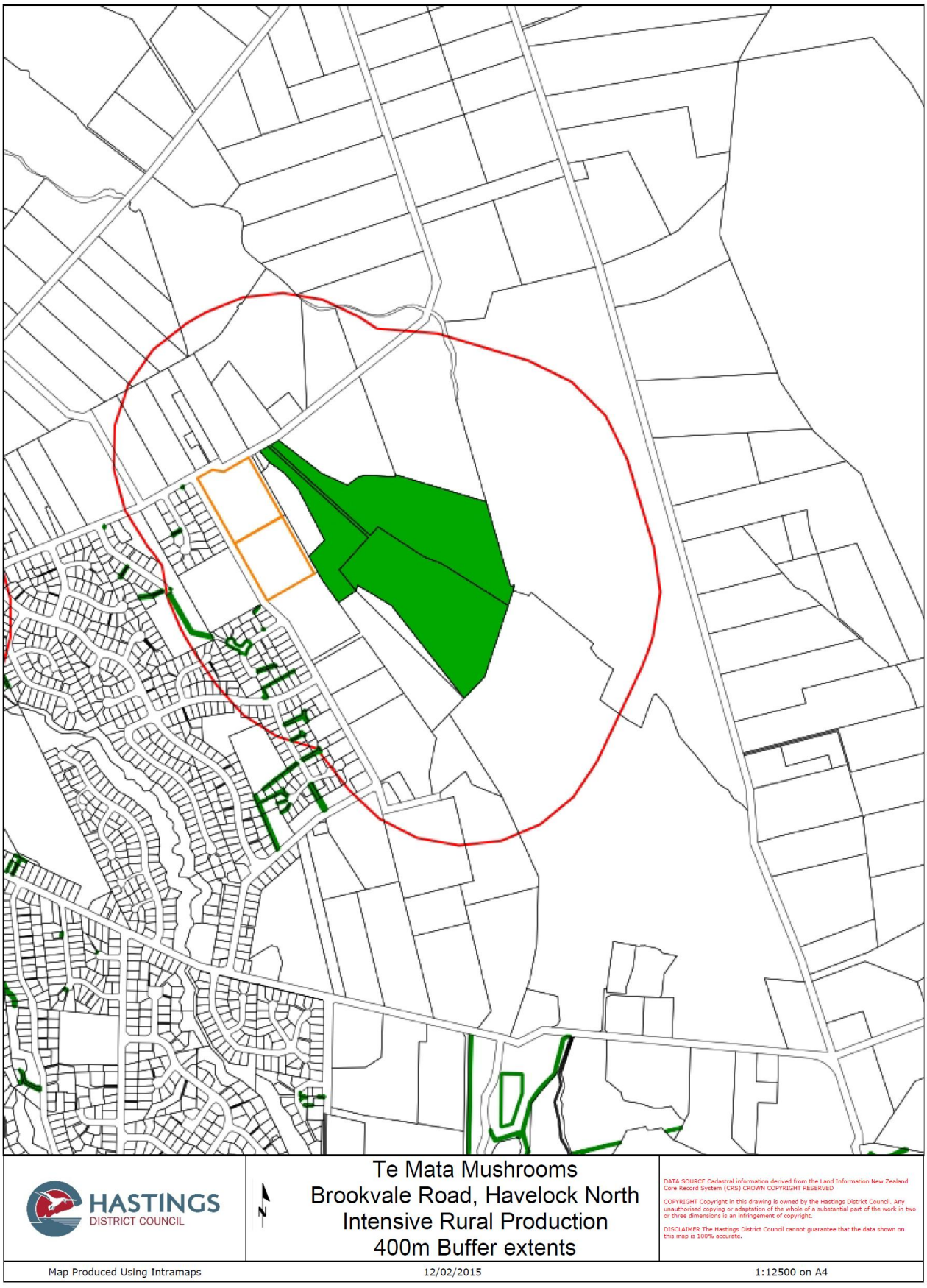

Figure 8 400 m buffer distance contour around TMM IRP area

8. Reverse Sensitivity Odour Assessment

8.1 Initial assessment

It is apparent that there is an existing issue with adverse effects beyond the site boundary from odour from TMM's present operations, in the existing environment ie the current situation is already considered unsatisfactory by the community. There is a partially developed residential subdivision 200 metres distant from TMM where the exposure pattern has changed since the air discharge consent was granted in 2010. New residential dwellings have been constructed in the area in that time. This has meant that further controls on TMM's operations are likely to be required for TMM to achieve the compliance requirement relating to odour effects. We understand further controls are currently being investigated by TMM ie there has already been a reverse sensitivity effect on TMM which is continuing due to construction of dwellings in the existing residential zone.

In 2011, the HBRC officer [12] also indicated that the existing area of subdivision had already had a reverse sensitivity effect on TMM[13].

While required upgrades of TMM's operations to address odour sources with a high odour potential rating, as required in the consent, have not yet occurred, it is in our view, unlikely that the existing requirements would be sufficient to reduce effects to an acceptable level in the existing community.

Even if all practicable measures are put in place by TMM there will be residual odour sources and because of the nature of the activities and the potential for failures, intermittent uncontrolled odours with the potential to impact beyond the boundary will remain. For example, such as during biofilter maintenance. In our view, separation of the TMM activities from highly sensitive land uses is the only practicable mitigation that remains for the residual emissions likely to occur from a mushroom farm in order to avoid adverse effects from objectionable or offensive odours.

Regardless of TMM's current performance, good practice for a locating a new mushroom farm involves selecting a site that is compatible with adjacent land uses and has adequate separation distances to allow for process upsets ie separation is needed to cater for non-routine emissions that may arise.

Routine residual odours from a mushroom operation, principally ammonia and a musty compost earthy odour from Phase 1 and 2 composting are more likely to be accepted as characteristic of a rural environment, but in our view are less likely to be considered acceptable in a residential environment. Currently there is at least some buffer of lower sensitivity land use (Plains Zone) available to dissipate low and moderate potential odour sources from TMM.

Low level rural type odours if frequently experienced in a residential environment, even at a low level, are more likely to be assessed as having an adverse effect. Thus the proposed land use change is highly likely to negatively impact on TMM through further increases in complaints and subsequent increased pressure on TMM to further control its activities.

It can be concluded that further encroachment and intensification of residential land use in the Arataki Extension will have a reverse sensitivity effect on TMM.

8.2 Options for further assessment

The assessment of odour effects from TMM in this report is based on a subjective assessment methods, as correspond to the odour compliance condition, which is by nature also subjective.

[12] Paragraph 8.7, page 28.
[13] Para 9.26, page 44.

Quantitative and semi-quantitative methods for odour assessment include: dilution dynamic olfactometery to directly estimate odour emission rates in odour units per second (OU/s); odour dispersion modelling; observations from odour scouts as to odour frequency, intensity, duration and nature; odour survey; odour diaries.

These methods could be applied to the TMM site to provide more objectivity around the extent and level of the odour effects but ultimately such methods are only useful to better inform an assessment of performance (or possible performance) against the odour condition.

Following discussion of our initial findings, should HDC want to consider further investigation, we would prepare further advice on the indicative costs and advantages or disadvantages of particular approaches or combinations of assessment approaches and their effectiveness in being able to further assess the extent of reverse sensitivity effects and if they can be mitigated.

9. Mitigation of reverse sensitivity effects

A preliminary discussion of potential options for mitigating reverse sensitivity effects is provided in Table 3. At this stage, we consider that no option or combination of options is likely to fully mitigate the reverse sensitivity effects from the land use change.

Table 3 Discussion of potential mitigation options for reverse sensitivity effects

Potential option	Discussion
Separation distance to dwellings	Based on the recommended separation distances discussed in Section 6 a minimum of 500 m is required for an effective buffer. A smaller distance can only be justified on a case-by-case basis if there are specific circumstances such as state-of-the-art controls.
Lot size limitations	A lower intensity residential land use will reduce the scale of the reverse sensitivity effect, but will not eliminate reverse sensitivity and would have disadvantages associated with not achieving planning requirements for intensification of urban areas.
Vegetation screening	Vegetation has not been demonstrated to be an adequate mitigation for odour as air travels up and over physical barriers. There is already planting in place and the terrain of the TMM site is below that of the Arataki area.
Orientation of outdoor areas for dwellings	Not an effective measure for odour because under low wind speeds air will tend to pool and swirl around structures. Once a property is built people will want to place their outdoor area in the location most sheltered from wind and/or oriented to the sun, regardless of any formally constructed area.
Covenants and/or consent notices	These tools have the possibility of reducing the reverse sensitivity effect by potentially removing the right to complain. There could be complications in administering this if odours could be considered to be unreasonable (eg above that of a well-run mushroom farm) for extended periods. It would result in people living with an amenity value that is lower than generally expected in a residential area.
Financial assistance to TMM to reorientate particular activities	Offsets some of the reverse sensitivity effects by paying for upgrades that would not otherwise be economically achievable. Could achieve state of the art control, but may still have residual odours due to failures and breakdowns. Could work best with covenants to deal with residual odour.
Buying out TMM	Would fully mitigate reverse sensitivity effects the proposed residential land use. Likely to be very high cost and costs may be unlikely to outweigh the benefits.

Forced air ventilation of dwelling, air filtration	Offsets some of the potential reverse sensitivity effect because it could be expected that people would be less inclined to complain as a result of odours indoors. Relies on systems being operated and maintained. Adds expense to the operation of a home. Likely to maintain a preference for having doors and windows open, especially in summer. May work better in combination with covenants.
Specifying odour emission guidelines/standards applicable to the area consistent with the current use	Any limits are likely to be subjective in nature and thereby difficult to enforce. Potential methods to provide a quantitative threshold would be expensive to monitor and enforce.

One option that could be considered to offset the reverse sensitivity effect, perhaps in combination with other measures could be to require a financial contribution to be paid to TMM by the developer/land owner of the residential subdivision to mitigate the reverse sensitivity effect, ie allow investment in “state of the art” controls that would go beyond those considered to be BATEA.

At this stage, we do not have information as to what would constitute ‘state of the art’ control for mushroom farming activities. ‘State of the art’ requires definition as it could mean the latest technology being adopted versus what is technically possible. This could be investigated through a literature review and benchmarking of recent plants built or upgraded in New Zealand and overseas. It is difficult to define the level of odour that would be experienced from a “state of the art” system until this has been defined for the industry at his point in time. Most likely any residual odour from a ‘state of the art’ system would be linked to failure of equipment eg fans, pumps or pipes, or during maintenance. There may also be potential odour sources that cannot be eliminated such as a truck arriving with chicken manure. Odour could be expected to be intermittent and of generally shorter duration for a fully enclosed facility but would still be unlikely to result in an area of high amenity generally expected for a new residential environment.

While, other combinations of mitigation options may be possible to partially mitigate the reverse sensitivity effect, they would all result in an amenity within the Arataki Extension that is lower than generally accepted amenity for residential use and could create a legacy of compliance costs, particularly for the HBRC, who would still be required to investigate to ensure odours were not unreasonable eg above the baseline acceptable for a rural environment.

If the HDC was of the view they would like to peruse mitigation as an option for offsetting reverse sensitivity effects, then we would recommend a more detailed assessment of the economics ie a cost-benefit approach or using a costs effectiveness frame work.

10. Conclusion

Regardless of the current performance status of TMM, if the company was to control odour to the extent practical, sources of odour would still remain. Even if it was a “state of the art” mushroom facility, which fully enclosed and controlled odour, the operation would still be subject to failure and residual odours. A suitable separation distance is the only practicable mitigation for TMM to dissipate residual odours.

The location (or land use sensitivity) is one factor that is considered when assessing compliance with the odour performance condition. By nature of the condition, a change in land use sensitivity directly affects the interpretation of the odour performance, and the ability of a discharger to comply. An increase in the sensitivity of the receiving environment, through the removal of an existing Plains Zone buffer to develop the Arataki Extension, will directly impact on TMMs compliance, having a reverse sensitivity effect. We consider the reverse sensitivity effect would be significant given there is evidence that the current separation distance to sensitive development is already less than necessary.

We consider the only option available to fully mitigate the reverse sensitivity effects of the Arataki Extension would be purchase of TMMs operations and/or transfer to another location.

Other combinations of mitigation options may be possible to partially mitigate the reverse sensitivity effect, however, they would all result in an amenity within the Arataki Extension that is lower than generally accepted amenity for residential use and could create a legacy of compliance costs for regulators.

Appendix A. Section 6.1.4 of the RMMP

INTERPRETATION OF NOXIOUS, DANGEROUS, OFFENSIVE AND OBJECTIONABLE EFFECTS

6.1.4.1 Several rules in this Plan use the terms 'noxious', 'dangerous', 'offensive', and *'*objectionable*'*, particularly rules relating to the discharges of contaminants into air. These terms are also included in section 17 of the RMA. Whether an activity is 'noxious', 'dangerous', 'offensive' or 'objectionable' depends upon an objective assessment. A Regional Council enforcement officer's views will not be determinative but may trigger further action and will be one factor considered by the Court if formal enforcement action is taken.

6.1.4.2 Reference to the terms 'noxious', 'dangerous', 'offensive' and 'objectionable' are made in the glossary to this Plan. The glossary refers plan users to this section. There is no standard definition of these terms because of the need to take account of case law precedent as it develops, i.e. the Plan cannot override interpretations decided by the judiciary. However, the following notes are intended to provide some guidance for interpreting these terms:

(a) **NOXIOUS, DANGEROUS -** The Concise Oxford Dictionary defines 'noxious' as "harmful, unwholesome". At the time of writing this Plan, the term 'noxious' did not appear to have been defined or considered in case law pertaining to the RMA. Noxious effects may include significant adverse effects on the environment (e.g. on plant and animal life) even though the effects may not be dangerous to humans.
'Dangerous*'* is defined as *"*involving or causing exposure to harm*"*. Dangerous discharges include those that are likely to cause adverse physical health effects, such as discharges containing toxic concentrations of chemicals. The Workplace Exposure Standards (Occupational Safety and Health Service, 1994) provide guidelines for those involved in occupational health practice, and can be used for interpreting the terms 'noxious' and 'dangerous'. The concentration of any contaminant specified in the Workplace Exposure Standards should not exceed one thirtieth of the time weighted average standard on adjacent properties or public land. Although human health cannot be assured by compliance with this guideline, it can be used as a guide for protection of the general population.

(b) **OFFENSIVE, OBJECTIONABLE –** 'Offensive' is defined as "giving or meant to give offence disgusting, foul-smelling, nauseous, repulsive". 'Objectionable' is defined as "open to objection, unpleasant, offensive". Case law has established that what may be offensive or objectionable under the RMA cannot be defined or prescribed except in the most general of terms. Each case will depend upon its own circumstances. Key considerations include:
(i) **Location of an activity and sensitivity of the receiving environment –** For example, what may be considered offensive or objectionable in an urban area, may not necessarily be considered offensive or objectionable in a rural area.

(ii) **Reasonableness -** Whether or not an activity is offensive or objectionable should be determined by an ordinary person who is representative of the community at large and neither hypersensitive nor insensitive, in deciding whether the activity is disgusting, nauseous, repulsive or otherwise objectionable.

(iii) **Existing uses -** It is important to consider what lawfully established activities exist in an area, i.e. if a new activity requires a permit, the effect of existing discharges of contaminants into air should be considered.

Each investigation of a complaint concerning offensive or objectionable discharges will depend upon the specific circumstances. However, for odour, the approach will be as follows:
(a) An assessment of the situation will be made by a council officer who has experience in odour complaints and has had his/her nose calibrated using olfactometry. This assessment will take into account the FIDOL factors - frequency, intensity, duration, offensiveness, location; and those matters identified as key considerations in 6.1.4.2 (b) (i), (ii), and (iii).

(b) If the discharge is deemed to be offensive or objectionable by the council officer, the discharger will be asked to take whatever action is necessary to avoid, remedy or mitigate the effects of the discharge.

(c) If the discharger disputes the council officer's assessment or the problem is ongoing, then a number of approaches may be taken, including one or more of the following:

(i) assessments by more council officers
(ii) asking people living and working in the subject area to keep a diary which notes details of any offensive or objectionable odours
(iii) promoting the use of community working groups and other means of consultation between the affected community and the discharger
(iv) using the services of an independent consultant to carry out an investigation, and/or community survey
(v) using the services of the Council's odour panellists who have all had their noses calibrated by olfactometry and are deemed to have an average sense of smell
(vi) undertaking an odour assessment using an olfactometer, or other appropriate technology
(vii) leaving the matter to be determined by the Environment Court.

(d) If the discharge is found to be offensive or objectionable, then enforcement action may be taken. This could be in the form of an abatement notice, infringement notice, enforcement order or prosecution, pursuant to the Resource Management Act 1991. In the case of a permitted activity, failure to comply with the conditions would also mean that the activity was no longer permitted, and would thus require a resource consent application to be lodged.