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Dear Ben

TECHNICAL REVIEW OF ASSESSMENT OF EFFECTS ON THE ENVIRONMENT FROM BRICK MANUFACTURING ON A PROPOSED PLAN CHANGE AREA IN DARFIELD

1.0 Background

Baseline Group Limited (BGL) have prepared an application¹ for a private plan change to the Selwyn District Plan (the Plan). The proposed plan change will rezone land located east of Darfield on SH73 from Outer Plains zoned land to Living 1 (L1) zoned land for up to 35 allotments and Business 2 (B2) zoned land. The land parcel proposed for rezoning is adjacent to a brick manufacturing facility, Canterbury Clay Bricks (CCB) on Horndon Street. BGL commissioned an independent air quality assessment of the effects of air discharges from the CCB site on the surrounding environment, particularly on the site to be rezoned, that might have reverse sensitivity effects for sensitive residential activities.

BGL submitted the application for private plan change to SDC in August 2019. An air quality assessment of effects the discharges from the CCB facility was prepared by NZ Air Ltd and included as Appendix 10 of the application document². The air quality report assessed the potential effects of the discharges from the brick manufacturing site using dispersion modelling of the discharges from fuel combustion used to heat the brick kilns. Information about the CCB facility in terms of site layout, stack discharges, and heat rating of the kilns was obtained from an AEE submitted with the original air discharge application for the site³.

Selwyn District Council (SDC) requested an independent assessment from Pattle Delamore Partners Ltd (PDP) of the application, in particular as relates to air quality effects from the brick manufacturing plant on the proposed plan change area.

2.0 Review Process

PDP reviewed the application, including the air dispersion modelling report by NZ Air and issued a Section 92 request for additional information by email to SDC on 30 August 2019. NZ Air provided a response to the S92 request in a letter to SDC dated 4 February 2020⁴.

¹ Baseline Group, *Application for Private Plan Change, Section 1 SO 1227, Darfield*, 4 August 2019.

² NZ Air Limited, *Air Quality Assessment Canterbury Clay Bricks Furnace Operation*, 6 July 2018.

³ Glasdon Potts Fowler Ltd, *W D Boyes & Sons Limited, Horndon Street, Darfield, Resource Consent Variation Application & Assessment of Environmental Effects*, 4 July 2005.

⁴ Letter, *Technical Air Quality Response to Request for Further Information – PC190061*, Donovan van Kekem (NZ Air) to Ben Baird (SDC), 4th February 2020

Having reviewed the application documentation including the dispersion modelling technical assessment and S92 response, we consider that the information provided meets that required for an assessment of this type, scale and significance.

3.0 Description of Proposed Plan Change Area

An aerial image of the proposed plan change area (outlined in red), the brick manufacturing site (in blue), and nearby residences is shown as Figure 1 below. The proposed plan change area will consist of Business 2 Zone across the northern length of the parcel, which will serve as a buffer to the residential zone at the southern end of the parcel.

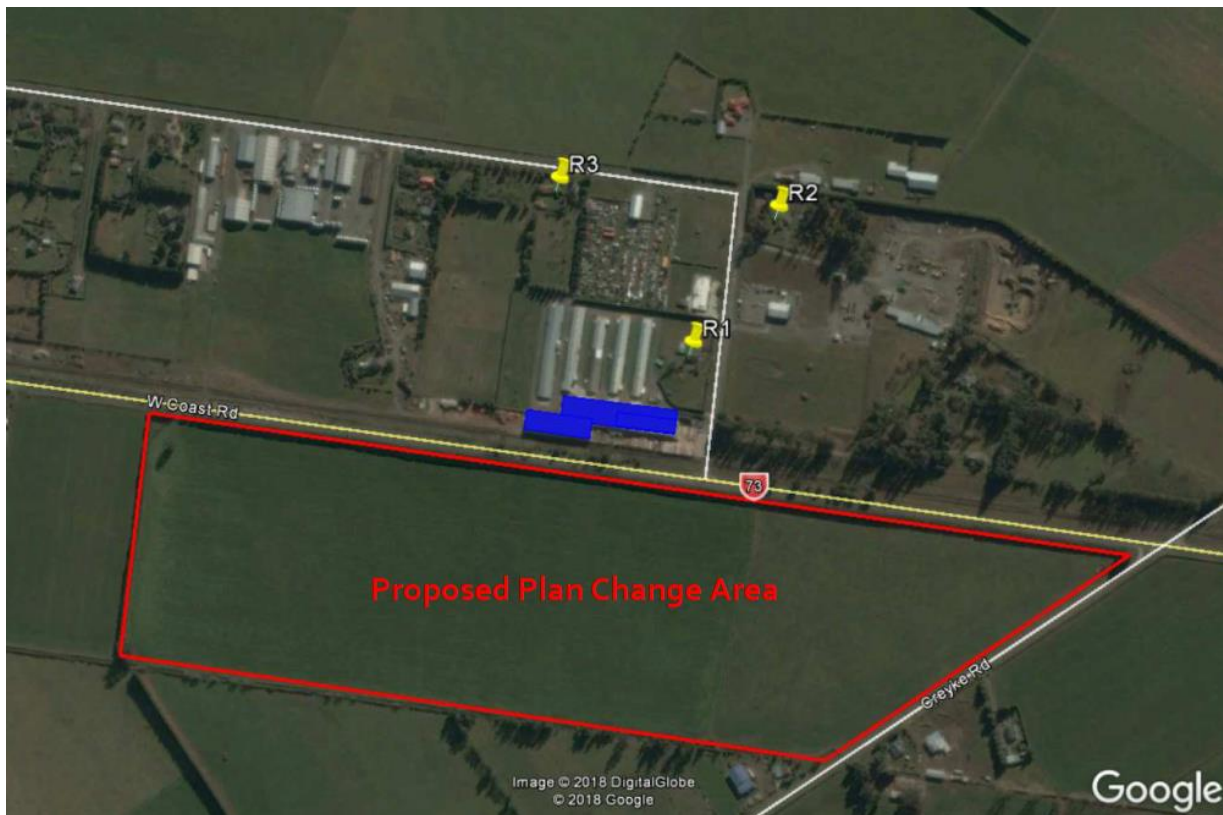


Figure 1 Proposed Plan Change Site in Red

4.0 Description of the Process and Emission of Contaminants

We understand that no site visit was undertaken for the air quality assessment, and that information regarding the layout and the operation was obtained from the previous AEE submitted for the site in 2005. The CCB site consists of two kilns:

- ✧ A tunnel kiln for continuous brick firing, rated at 820 kW; and,
- ✧ A kiln for intermittent batch brick firing, rated at 176 kW.

Discharges to air consist of products of combustion from fuel, which may be coal, re-refined oil, or diesel. In addition, the bricks may emit gases during the firing process that would be discharged to air.

The rate of contaminant emissions were calculated using emission factors for fuel combustion at the maximum rates allowed by the consent. For the majority of contaminants (PM₁₀, SO₂, NO_x and CO), the use of coal presents the worst case emissions scenario. However re-refined oil has the potential to

discharge certain metals (arsenic, cadmium, chromium, and lead) to air. The highest emission rates for each contaminant were used in the air quality assessment. Additionally, it was assumed that the contaminants were discharged continuously over the three-year modelling period. It is not known from the documentation provided what the normal operating hours or production capacity of the brick manufacture are, but it is our understanding that continuous operation would be highly unlikely. The modelling in this respect is therefore conservative, particularly for comparison of model predictions against 24-hour and annual average assessment criteria.

In summary, the applicant has provided a comprehensive and sufficiently conservative assessment of the processes undertaken and the type and amounts of contaminants discharged into air from the brick manufacturing site.

5.0 Modelling Assessment Review

5.1 Model Choice

The air discharges from the brick kilns has been modelled using AERMOD, which is the preferred model for areas where complex terrain is not a concern. Given the relatively flat terrain in the vicinity of the brick manufacturing site, we consider the use of AERMOD to be appropriate for this assessment.

5.2 Meteorological Data

PDP understand that the MM5 meteorological model was used to generate the meteorological datasets for use with AERMOD. Three years of meteorological data were developed for use with the dispersion model.

A wind rose of the modelling dataset is provided as Figure 2 below. For comparison, a wind rose of actual meteorological data collected at the Darfield EWS meteorological station approximately 1.5 kilometres to the east-southeast is provided as Figure 3. The modelled meteorological data differs from the measured winds in that the strongest winds in the modelling data occur from the west, whereas they occur from the northwest and northeast in the observed data.

The higher frequency of northerly wind directions measured in Darfield compared to what was modelled could potentially result in an underprediction of concentrations within the proposed plan change area to the south of the brick manufacturing site. However, given that the assessment used three years of meteorological data to model the discharges, and the discharges were modelled on a continuous 24-hour basis over this period, it is probable that worst-case meteorological conditions for dispersion from the northerly directions would be observed and accounted for in the modelling.

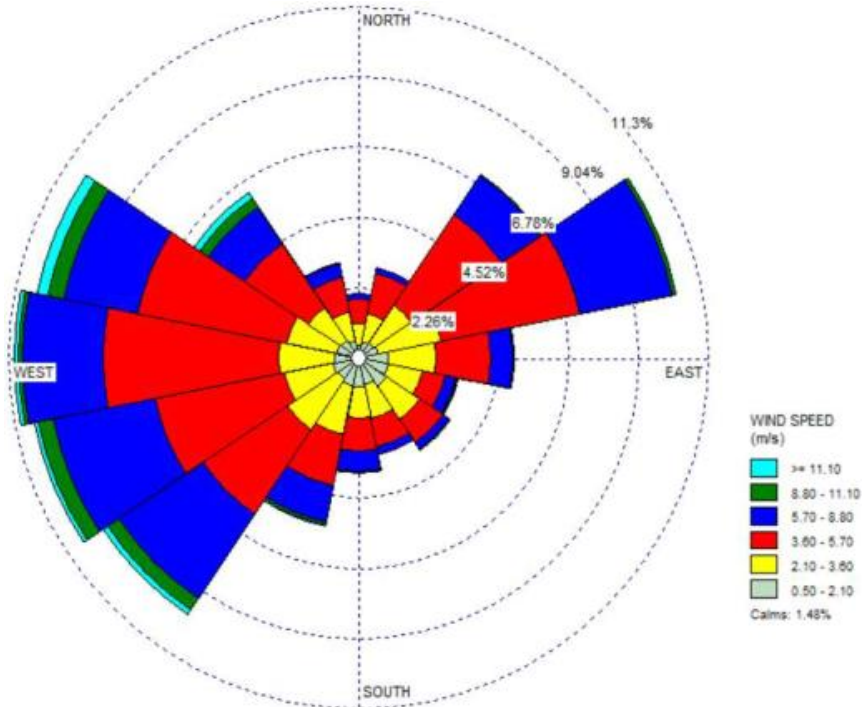


Figure 2 Modelled meteorological dataset for use with AERMOD, 2015-2017

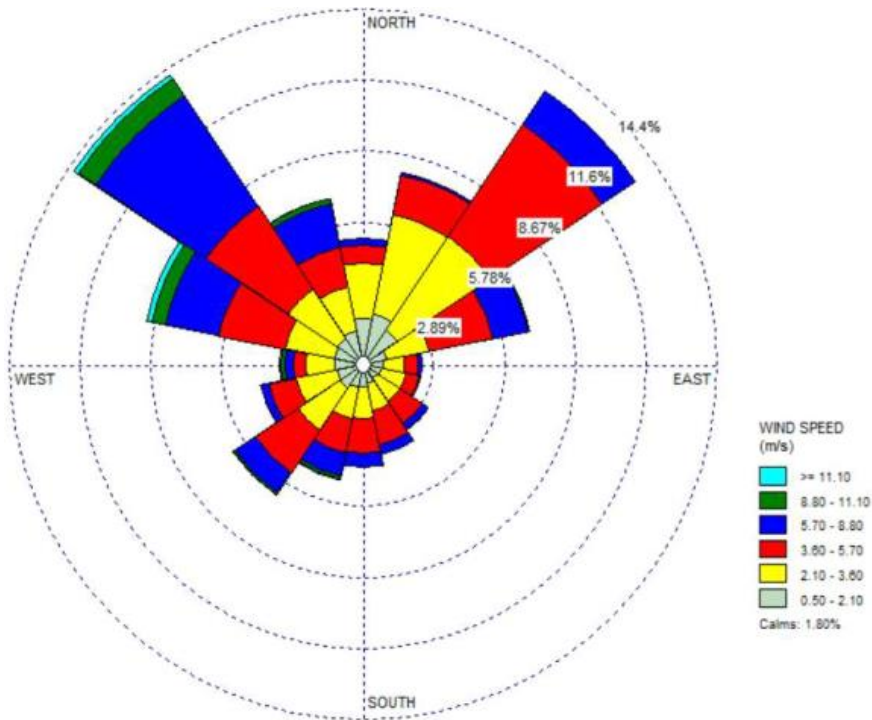


Figure 3 Meteorological dataset for Darfield meteorological station, 1999-2004

5.3 Emission Data

We understand that emission factors based on fuel combustion were used to estimate contaminant emission rates from the brick manufacturing site. Process-specific emission factors, i.e. emission factors specific to brick kilns are based on the amount of bricks fired, were not used as they are based on production rate data which NZ Air did not have access to as it is considered commercially sensitive. However in the s92 response letter, NZ Air back-calculated the quantity of bricks that would need to be produced over a given time in order to have an equivalent PM₁₀ discharge rate, and then compared this to the quantity of bricks that would have to be produced in order to exceed the relevant air quality assessment criteria. The quantity of bricks required to be produced to breach the consent would be significantly greater than what was estimated from the actual PM₁₀ discharge rate (e.g. the amount of bricks produced on a 24-hour basis would need to be double the current estimate for the 24-hour PM₁₀ standard of 50 µg/m³ to be exceeded). In the absence of other information about brick production rates, and given the conservative approach taken with the modelling, we consider that the use of emission factors based on fuel consumption rates to be a reasonable assumption.

We consider that the method used in the NZ Air report to estimate emissions from fuel combustion to be appropriate, and the modelling at maximum continuous rating for the entire modelling period to be conservative scenario.

5.4 Summary of Dispersion Model Setup

We have reviewed the model input parameters and consider them to conform to good modelling practice and adequately reflect the conditions at the site as described in the air quality report. Key points are:

- ✧ Discharges from the brick manufacturing facility are generated primarily from the combustion of fuel to heat the two kilns onsite. Fuel may be diesel oil, recycled (or re-refined) oil, or coal;
- ✧ The discharges were modelled as point sources from the two kiln stacks using the AERMOD dispersion model;
- ✧ Buildings were included in the model to account for downwash effects;
- ✧ Emissions from both stacks were modelled on a 24-hour per day, 365 days per year basis, which we understand is conservative compared to actual operations; and,
- ✧ Worst-case emission rates were determined to be from combustion of re-refined oil for metals, and from combustion of coal for all other contaminants.

6.0 Potential Effects of Discharge

The key conclusions of the air quality assessment are that:

- ✧ The highest modelled MGLC of PM₁₀ within the proposed plan change area was 14.4 µg/m³ excluding background, and 33.2 µg/m³ including background concentrations. The maximum predicted contribution within the plan change area are 66% of the relevant assessment criterion and in practice will likely be lower as the kilns are unlikely to operate at maximum capacity 24 hours per day;
- ✧ The conservatively predicted SO₂ concentrations (assuming maximum operation of the kilns fired by coal combustion with the highest permitted percentage of sulphur of 1.8%) do not exceed the 1 hour or 24-hour average criteria within the proposed plan change area. The highest predicted concentrations within the proposed plan change area are 202 µg/m³ as a 1-hour average and 81 µg/m³ as a 24-hour average (inclusive of the assumed background concentrations);

- ✧ The highest predicted concentrations of NO₂ and CO are well below the evaluation criteria for all averaging periods;
- ✧ The highest predicted concentrations of metals within the proposed plan change area are well below the relevant guideline values for all averaging periods.
- ✧ The deposition of metals within the proposed plan change area is not expected to result in exceedances of the New Zealand NES soil contaminant standards for health.

The applicant did not specifically assess cumulative impacts of other sources in the area. However, given the nature of the discharges from the site, the way in which the site discharges were assessed, and the activities undertaken in the surrounding area, PDP do not consider an assessment of cumulative effects would change the conclusions reached by the applicant.

In summary, PDP conclude that potential effects of the discharged of contaminants to air from the brick manufacturing site have been appropriately considered and described.

7.0 Fugitive Dust and Odour

Potential effects of fugitive dust and odour were addressed in the S92 response letter from NZ Air. Key points are as follows:

- ✧ Dust from the brick manufacturing process itself including screening, mixing and extruding is unlikely to result in offsite effects as the raw material is damp clay, and most of the process occurs under shelter from strong winds
- ✧ There is a row of established trees adjacent to the southern boundary of the CCB site and a large pine hedge the runs the length of the proposed PC61 development land. These established trees will reduce windspeeds across the surface of the site and help to capture some of the fugitive dust emissions entrained in the airflow.
- ✧ The separation distance between nuisance dust emissions and the proposed residential portion of the proposed plan change area is greater than 200 m. Generally, nuisance dust effects do not occur greater than 100 - 200 m of a significant dust emission source¹ (i.e. quarries, bulk material handling, unsealed roads, etc
- ✧ Odour effects may occur from the discharge of products of fuel combustion. However, as the health-based effects of the discharges are generally lower than odour nuisance thresholds for the relevant contaminants, and the effects of the discharges are below the health-based criteria, odour effects may be considered to be below nuisance levels.

PDP agrees with NZ Air's assessment that the effects of fugitive dust and odour from the CCB site are likely to have a low level of effects on the surroundings and will be at an acceptable level in the plan change area.

8.0 Conclusion on the Effects of the Discharge

PDP's review of the information supplied by the applicant leads us to concur with the conclusions drawn in the air quality report. In summary PDP conclude that the effects of the discharge of combustion products are less than minor within the plan change area. The discharge of dust and odour are also expected to be at levels that are less than minor.

9.0 Summary of Review Outcomes

PDP has undertaken a technical review of the air quality assessment of discharges of contaminants to air from the manufacture and bricks on a nearby parcel of land which is proposed for rezoning. Matters of particular relevance to the review included the methods, data and guidelines used to undertake the assessment, potential human health effects of the discharge of contaminants to air from the brick manufacturing process. The key findings of PDPs review are:

- ✧ The applicant's approach to the assessment of effects matches accepted good practice for the scale and potential adverse effects of the proposed activity;
- ✧ The potential effects of the proposed discharge of contaminants to air from the brick manufacturing facility on the plan change area have been appropriately considered and described; and,
- ✧ The effects of the proposed discharge of combustion products and metals from the operation of the brick manufacturing facility will not have significantly adverse effects on the plan change area.

Based on the technical review of the applicant's assessment of the effects air discharges from the discharges of contaminants to air from the CCB site, PDP agree with the applicant that there will be no reverse sensitivity effects on CCB from the proposed plan change.

10.0 Closing

Thank you for the opportunity for PDP to assist SDC with this review. We trust the review meets SDC's needs, expectations and will be helpful to the decision-making process. Please let us know if you have any questions or comments on the review.

11.0 Limitations

This report has been prepared by PDP on the specific instructions of Selwyn District Council for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

Yours sincerely

PATTLE DELAMORE PARTNERS LIMITED

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