BEFORE THE CANTERBURY REGIONAL COUNCIL HEARINGS PANEL

In the matter of the Proposed Canterbury Regional Air Plan

Between Environment Canterbury

And Synlait Milk Limited

STATEMENT OF EVIDENCE PRUE HARWOOD

18 September 2015

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Introduction

Qualifications and experience

1 My name is Pure Harwood. I am a Senior Associate – Environmental Engineering, in the firm of Beca Ltd. I have had twenty two years professional experience in air quality resource management. I have a Bachelor of Engineering (Chemical) from the University of Canterbury. I am a Member of the Clean Air Society of Australia and New Zealand and the Resource Management Law Association and the Environment Institute of Australia and New Zealand. I am certified to act as a Hearings Commissioner.

2 Some of my recent experience in assessing the effects of activities that discharge contaminants to air within Canterbury include

a. Preparation of an assessment of effects and application documents for an increase to the discharges to air from Burwood Hospital, which is located within the Christchurch Clean Air Zone 1 and a “polluted” airshed.

b. Preparation of a consent application and assessment of environmental effects report for the renewal of PrimePort’s consent to discharge contaminants to air from the bulk handling facilities at the Port of Timaru.

c. Presentation of evidence to the Environment Court on air quality issues arising from a proposed plan change for Timaru District Council. The Council proposed to change the zoning of an area of rural land to industrial. Residents of the adjoining residential area raised concerns regarding dust.

d. Preparation of an assessment of environmental effects of the odour discharges from the proposed new Akaroa Wastewater Treatment Plant.

e. Presenting evidence to the Environment Court on potential discharges to air associated with the establishment of a quarry near Timaru.

f. Presenting evidence to the Environment Court on potential discharges to air associated with the establishment of a quarry at Wards Road, Rolleston in Canterbury.

g. Preparation of section 42A reports on behalf of Environment Canterbury for a variety of industries throughout Canterbury.

3 In respect of this hearing I have been engaged by Synlait to provide evidence regarding the implications of the Proposed Canterbury Regional Air Plan (pCARP). In particular my evidence will discuss:

a. Best practicable option and how this applies to Synlait

b. The methods used to assess effects on air quality and their reliability and pitfalls

c. The localised effects of Synlait's operations on ambient air quality

4 I was the co-author of the Assessment of Effects report prepared for Synlait to support the application for consent for the discharges to air from the Stage 4 expansion of the Synlait milk processing plant near Dunsandel in Canterbury. My only participation in the preparation of Synlait's submission was to provide brief comments on a draft.

5 In preparing this evidence I have reviewed

a. The submission prepared by Synlait

b. The Proposed Canterbury Air Regional Plan

c. The s32 report

d. The s42A report

e. The evidence of Synlait

f. The evidence of Tim Ensor

g. The Canterbury Regional Policy Statement.

6 Although not necessary in respect of council hearings, I can confirm I have read the Expert Witness Code of Conduct set out in the Environment Court's Practice Note 2014. I have complied with the Code of Conduct in preparing this evidence and I agree to comply with it while giving oral evidence before the hearing committee. Except where I state that I am

relying on the evidence of another person, this written evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

Background

7 The Synlait dairy factory is located in a rural area surrounded by dairy and mixed farms. The area is sparsely populated with some isolated rural residential properties. The nearest houses to the factory are approximately 400 metres to the north and 500 metres to the south east of the dairy plant site boundary. The closest urban area is located at Dunsandel approximately 5 kilometres to the northeast of the plant.

8 The plant was established in 2006 and has undergone several increases in production capacity since that time.

9 Synlait holds a current resource consent for the discharges to air from boilers, dryers, packing plant and the treatment and disposal of treated wastewater. The consent includes conditions requiring regular monitoring of emissions from the combustion plant and dryers and imposes limits on the mass of contaminants discharged. The consent also requires monitoring of complaints and regular maintenance of plant and equipment.

10 Synlait chose the site for their manufacturing plant because it was an area that was sparsely populated and located away from urban areas and land uses that were likely to be sensitive to the discharges from the plant and because it was central to the locations of their supplier farms. The district plan provides for the activity and for rural activities.

Best practicable option

11 The concept of best practicable option is defined in the Resource Management Act and pCARP as:

"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 to other options; and

c. *The current state of technical knowledge and the likelihood that the option can be successfully applied."*

12 Best practicable option is different to concepts such as "best practice" and "best available techniques" (BAT) as it includes the consideration of factors besides the efficiency of emission controls.

13 The principal discharges to air from the Synlait plant are products of combustion (including particulate matter, sulphur dioxide, nitrogen oxides and carbon monoxide) from the boilers, particulate matter from the dryers and packing plant and odours from the treatment and disposal of wastewater.

14 To put the size of Synlait's plant into perspective Synlait has consent for boilers with a heat output capacity of 85 MW which is approximately equivalent in fuel burning capacity to a 28MW thermal power station capable of providing the electricity requirements for approximately 10,000 average New Zealand households. The dryers and packing plant are capable of manufacturing 28.3 tonnes per hour of a variety of milk powder products.

15 Discharges of particulate matter from equipment such as boilers and dryers can be controlled using a variety of methods including bag filters, electrostatic precipitators, cyclones and wet scrubbers. Bagfilters and electrostatic precipitators are in general the most efficient methods of controlling particulate matter; they are also in general the most expensive. Synlait uses modern and efficient bag filters on the discharges from the boilers, dryers and packing plant to control particulate matter and for some dryer discharges also use cyclones.

16 The discharges of particulate matter from the boilers, dryers and packing plant are measured every year. The performance of the bagfilters on the boilers and dryers and the concentration of oxygen in the combustion gases from the boiler are also continuously monitored.

17 I have reviewed the results of the emission testing undertaken by Synlait in the last five years on the discharges from the boilers and the dryers. The emission rate and concentration of total particulate matter from the boilers and dryers and sulphur dioxide from the boilers are measured each year. The emission testing results demonstrate that the concentrations and mass discharge rates of particulate matter in the discharges are consistently below the limits imposed in the resource consent and the bagfilters are

operating within the manufacturers' specifications for particulate removal efficiency.

18 The boilers discharge sulphur dioxide, which is a by-product of the combustion of coal containing sulphur. The quantity of sulphur dioxide in the discharge is generally proportional to the concentration of sulphur in the coal.

19 Coal is the only practicable fuel for the site. There is no reticulated supply of gas in the South Island and no reliable supply of wood in the quantities that would be required for Synlait and diesel is prohibitively expensive.

20 In recent times Synlait has had difficulty obtaining low sulphur coal due to mine closures in the South Island, however Synlait uses the lowest sulphur coal that is reliably available at a reasonable cost. The concentration of sulphur in the coal delivered to site is measured at least monthly by composite sampling and more frequently during the peak operating season.

21 Emission tests carried out by Synlait on the boiler discharges demonstrate that the mass discharge rate of sulphur dioxide is consistently below the limit imposed in the resource consent.

22 The evidence of Synlait explains the methods and controls that Synlait uses to maximise energy efficiency of the plant, which further minimise the quantity of fuel that is burnt and the mass of contaminants discharged.

23 The wastewater treatment and disposal system has the potential to produce odours. To minimise the generation of odours Synlait continuously aerates the wastewater and typically stores it for a maximum of four hours prior to disposal. Sludge produced in the wastewater treatment plant is taken off-site for disposal generally within 24 hours of being generated. The quality of the wastewater and the operation of the treatment systems are continuously monitored. Consequently the risk of the wastewater and sludge to become anaerobic and odorous is minimal.

24 The treated wastewater is disposed of to land using low pressure nozzles, which minimise the generation of very fine droplets that have the potential to drift downwind.

25 Synlait has an Environmental Management Plan (EMP) that details all the process controls, monitoring and maintenance procedures, which are required by the resource consents for the site and those required by their own management systems. The EMP is regularly updated and revised.

26 Since the plant was established in 2006 Synlait has received only one complaint regarding air discharges. This occurred in December 2012 and was a result of a small fire in one of the dryers.

27 Environment Canterbury undertakes compliance audits of the site from time to time. The last audit was carried out in July 2013. I have reviewed the audit reports and note that Environment Canterbury has consistently found the plant to be operating within the conditions of the resource consents.

28 In my opinion Synlait uses the best practicable option to minimise the discharge of contaminants to air from its plant and the effects of those discharges on the environment. However, the rules do not currently provide adequate discretion to consider best practicable option[1] and despite Synlait using the best practicable option, the pCARP may impose a significant impediment to further growth. I address this further below.

Methods used to assess the effects of discharges to air

29 The Ministry for the Environment (MfE) Good Practice Guide for Assessing Discharges to Air from Industry (GPG Industry)[2] describes the processes and methods to be used when assessing the effects of discharges to air. Different levels of assessment are recommended depending on the scale and nature of the discharge. The process for the highest level of assessment (Tier 3) is summarised and discussed in the following sections of my evidence:

a. Characterise the nature of the site including sensitivity of surrounding land uses, topography, background air quality and meteorology.

b. Characterise local meteorology using data collected on-site or from nearby monitoring stations whenever possible. Frequently air quality data is not available and estimates of background air quality must be made from data recorded in other similar areas or from the values recommended for use in the GPG Industry. Similarly local meteorological data is frequently not available and data from the nearest NIWA or Meteorological Service climate station has to be used. The closest climate stations are often several kilometres from the subject site and may not provide an accurate representation of the local meteorological conditions.

[1] As recognised in the section 42A report at page 13-8.
[2] Ministry for the Environment "Good Practice Guide for Assessing the Discharges to Air from Industry" 2008

c. Characterise the process and the emission control methods to be used.

d. Characterise the nature and scale of the emissions using emission test results where available or estimate the emissions using published emission factors. Determine the likely worst-case emission scenarios.

e. Identify the receptors that are most likely to be sensitive to the discharged contaminants taking into account the nature of the contaminants and the surrounding land uses.

f. Determine whether the use of dispersion modelling is appropriate. For many fugitive discharges such as dust and odour, dispersion modelling is not always feasible or recommended by the MfE Good Practice Guides for odour and dust discharges[3][4]. For sources such as these a qualitative assessment of effects must be carried out.

g. If modelling is to be used to assess the effects of the discharge, determine which meteorological and dispersion models are the most appropriate using the guidance provided in the MfE Good Practice Guide for Atmospheric Dispersion Modelling[5].

h. Model the dispersion of the discharges to estimate the maximum ground level concentrations of contaminants beyond the boundary of the property, both in isolation and cumulatively with background concentrations and compare the modelling results with the National Standards for Air Quality (NESAQ), Ambient Air Quality Guidelines (AAQG), regional air quality guidelines and other international guidelines if necessary.

i. Assess the results of the modelling to determine the likely scale of any potential adverse effects on health, ecosytems or amenity values taking into account

    i. the scale of the maximum predicted ground level concentrations

[3] Ministry for the Environment "*Good Practice Guide for Assessing and Managing Odour in New Zealand"* 2003
[4] Ministry for the Environment "*Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions"* 2001
[5] Ministry for the Environment "*Good Practice Guide for Atmospheric Dispersion Modelling"* 2004.

ii. the locations where maximum ground level concentrations are predicted to occur and if they exceed the relevant air quality criteria

iii. the likelihood that people or ecosystems may be exposed to ground level concentrations which exceed the relevant air quality criteria

iv. the likely frequency of any exceedances of the relevant air quality criteria

v. the likelihood of peak emission rates coinciding with peak background concentrations, and

vi. the probability that the exceedances will actually occur in practice.

j. If potential risks to human health are identified carry out a health risk assessment.

k. Compare the mitigation methods used on site with the best practicable option and identify if any additional mitigation methods are required.

l. Compare the distances separating the discharge and adjacent sensitive activities with published separation distance guidance, if available. This may be especially useful for discharges which have effects on amenity values such as odours and dust and which may be difficult to quantify and model accurately.

m. For existing activities assess the complaints and compliance history of the plant.

n. Assess the proposal against the relevant statutory documents such as the Resource Management Act, national standards, regulations, regional and district plans.

o. Assess the positive effects the activity may have on the environment.

p. Make an overall judgement of the scale of actual and potential effects taking into account all of the above factors.

30 Rules 7:17 and 7:18 as originally proposed in the pCARP rely solely on compliance or otherwise with the AAQG to determine the potential for an

activity to cause adverse effects and to determine whether or not an activity should be able to be granted consent. The proposed rules do not allow for any consideration of the other factors I have described, which in my opinion should also be taken into account when making assessments. I therefore consider that Rules 7:17 and 7:18 are deleted and later in my evidence I discuss further reasons to support this recommendation.

Reliability of dispersion modelling results

31 Dispersion modelling results have a number of inherent uncertainties. These result from the use of numeric algorithms to simulate the complex interactions between the discharge, terrain, buildings, and atmospheric conditions combined with uncertainties in the inputs to the model which include:

a. **Emission parameters**. Measured emission rates, temperatures and flowrates are often unavailable and estimates must be used. Even when measured emission parameters are available these provide only a brief snapshot of what may be variable emission parameters.

b. **Meteorological data**. On-site meteorological data is not often available and data collected from another location or locations must be used which may not provide an accurate representation of actual meteorological conditions in the area of a discharge. Meteorological data may be derived from synoptic or regional scale meteorological models without the use of local meteorological data but these introduce another level of uncertainty to the overall accuracy of the model results.

32 Dispersion models predict the maximum ground level concentration of a contaminant that may occur if worst case emission conditions coincide with worst case meteorological conditions and worst case background concentrations. In many circumstances the probability that these conditions will coincide is remote. Consequently modelling results often overestimate measured maximum ground level concentrations.

33 To reduce the uncertainty in modelling studies, sensitivity analyses can be carried out to test which inputs have the greatest influence on results. Model runs can then be carried out simulating the highest and lowest boundaries of the inputs as well as the best estimate. Such sensitivity

analysis can improve the confidence in the assessment. However, even with the most accurate inputs the results of a modelling assessment are still only an estimate of the actual maximum concentrations that may result from a discharge.

34 In many situations dispersion modelling studies predict that the highest ground level concentrations occur in a small area relatively close to the source, with concentrations decreasing rapidly with distance from the source. The dispersion contours for the modelling assessment undertaken for Synlait demonstrates this type of distribution. Copies of the 1-hour average sulphur dioxide contour plot and the 24-hour average PM_{10} contour plant prepared for the Synlait plant are attached to my evidence as **Attachment 1.**

35 When determining activity classifications (or the granting or declining of consent) based solely on whether or not maximum predicted ground level concentrations exceed standards and guidelines at the boundary of the site (as is proposed in the pCARP) the precise location wof the predicted peak ground level concentrations in relation to the boundary of the site becomes critical and could result in a range of perverse outcomes.

36 With respect to the modelling results for Synlait the peak off-site 1-hour ground level sulphur dioxide concentrations were predicted to occur in a small area of rural land immediately adjacent to the southern boundary of the site. The predicted peak off-site 1-hour sulphur dioxide concentrations were within 93% of the National Environmental Standard for Air Quality (NESAQ) and the AAQG thresholds. Peak concentrations within the plant site were predicted to exceed the NESAQ and AAQG thresholds in a small area of the site just within the southern site boundary.

37 For example, if by chance Synlait's southern boundary was moved 10 metres further to the north, the current operation would likely be considered as a non-complying activity or, if it was a new discharge, a prohibited activity under proposed Rules 7:17 and 7:18 of the Proposed Canterbury Regional Plan (pCARP). However, if the Synlait boundary was moved 10 metres further south, the current operation would be classified as discretionary. In either scenario the actual effects on ambient air quality within the airshed and on the nearby receptors where people are more likely to be exposed to emissions will be the same.

38 Similarly if the emission sources on the Synlait site were located in slightly different areas within the site, the same differences in potential activity

status may arise, again with no changes to the actual effects of the discharge on ambient air quality.

39 Any minor variations to the inputs to the model such as the meteorological data used or emission parameters may also be sufficient to change the outcomes of the modelling results and the status of the activity. The use of a different dispersion model may also produce results that are sufficiently different to prevent the discharge being granted consent.

40 Consequently it is my opinion that due to the inherent uncertainties in dispersion modelling results the AAQG should not be used as the sole pass/fail criteria for determining the activity status of a discharge and for determining whether or not it should be granted consent.

Reliance on AAQG

41 The AAQG are intended primarily as a means for managing air quality in air sheds and not for controlling individual air discharges. They are intended to be used as tools to trigger further investigation rather than as absolute thresholds. The AAQG outline how they should be applied as follows:

- *"should not usually be used as limits to pollute up to by one industry*
- *should not be applied without taking into account the sensitivity of the receiving environment*
- *should not be applied without considering background concentrations and potential cumulative effects*
- *should only be used as part of a full assessment of environmental effects as required under the RMA"*

42 The guidelines also recommend that other factors should be considered including

- *"the best practicable option for reducing emissions*
- *the accuracy of dispersion modelling results*
- *community views*
- *the need for a full health risk assessment and*
- *any other RMA or regional plan requirements"*

43 Consequently it is appropriate for an assessment of effects to give consideration to AAQG but the context of each case should be taken into account and consent should be able to be granted if adverse effects are acceptable within the particular receiving environment. AAQG should

therefore not be used in isolation as pass/fail tests as promoted in rules 7:17 and 7:18.

Potential impact of Rules 7:17 and 7:18 on Synlait

44 For the reasons set out above, proposed rules 7:17 and 7:18 if adopted as originally proposed in the pCARP may impose a significant impediment to any further growth of industries such as Synlait, which use the Best Practicable Option and do not result any significant adverse effects on ambient air quality. This may have the unfortunate result of forcing industries such as Synlait to establish new sites, which would be a significant additional cost to industry and create the potential for more people to be adversely affected by their operations. This is undesirable from a district planning perspective and also for the efficient provision of the services and infrastructure required for industries. I therefore support the recommendation in the section 42A report to delete these rules. However I do not agree with the recommendation in the section 42A report that revised versions of rules 7:17 and 7:18 are required.

45 I agree with the intent of Rules 7:17 and 7:18 that different management approaches should be applied in areas where air quality is degraded and where it is generally high. It is my opinion, however that Rules 7:15 and 7:16 (as modified in the section 42A report) achieve this already by applying a more stringent expectation of particulate control in areas where air quality is degraded. Rule 7.27 combined with the NESAQ provide sufficient means for controlling the effects of other contaminants. As particulate matter is the contaminant of most concern in the region in my opinion no other rules are required to achieve this aim

Localised impacts of Synlait's discharges on ambient air quality

46 For a new discharge it is not possible to forecast absolutely the scale of potential effects. In order to provide a conservative estimate of potential effects the assessment and modelling studies usually use worst-case emission scenarios as model inputs. Once a plant is established some of the assumed values for model inputs (such as emission parameters) can be compared with measured values and the accuracy and degree of conservatism of the modelling predictions can be tested. Monitoring of ambient concentrations of contaminants downwind of the site can also be carried out.

47 Synlait has measured the emissions from the boilers, dryers and packing plant each year as required by the conditions of the resource consent. I have reviewed the results of the tests and have found that all emission test results demonstrate that the measured emission rates are less than those assumed in the dispersion model and some significantly less (ie 20% of modelled rates for particulate matter). Consequently actual maximum ground level concentrations downwind of the plant will be less than those predicted by modelling.

48 The air quality within an airshed is influenced by the cumulative impacts of all sources of contaminants within the airshed and the meteorology and topography of the area. Individual discharges within the airshed create localised impacts and contribute to overall ambient concentrations within the airshed depending on their discharge characteristics, meteorology and topography.

49 Synlait is located beyond the airsheds gazetted by Environment Canterbury under the NESAQ and beyond the Clean Air Zones defined in the Natural Resources Regional Plan (NRRP). It is therefore located within the airshed comprised of the remainder of the region which is predominantly rural. The closest urban area is Dunsandel, which is a small rural village located approximately 5km from the plant.

50 Within the area included in the "rural" airshed, air quality is likely to vary considerably from location to location and from day to day depending on local influences such as weather, isolated industries, domestic heating, quarries, agricultural activities and rural roads. As noted earlier in my evidence maximum ground level concentrations of contaminants resulting from Synlait's discharge decrease rapidly with distance from the site and have only localised effects on ambient air quality. For example in the vicinity of the closest houses, which are approximately 400 metres from the Synlait site, maximum annual average concentrations of fine particulate matter (PM_{10}) are predicted to be approximately 1µg/m^3 above background levels. At locations approximately 2km from the site maximum annual average PM_{10} concentrations are predicted to be no more than 0.05µg/m^3 above background concentrations. The effects of Synlait's discharges on air quality are therefore localised and unlikely to cause any cumulative effects with other discharges in the airshed. Any increases in ambient concentrations of PM_{10} (and the other contaminants discharged from the Synlait plant) within the airshed due to the discharges from Synlait are therefore negligible.

51 For this reason I support the changes recommended by Mr Ensor to Policy 6.20 which focuses on managing localised air quality effects within rural areas (outside of any clean air zone).

52 The above discussion also highlights that the potential effects of a discharge on air quality should be assessed at sensitive receptors, especially in sparsely populated rural areas and that it is inappropriate to rely solely on estimates of contaminant concentrations at the property boundary to determine whether or not a consent can be granted.

Comments on s42A Report

53 On page 10-3 of the s42A report under the heading Policy 6.2 and Policy 6.3 it is noted that submitters (including Synlait) sought that Policies 6.2 and 6.3 should apply to "ambient" air quality as distinct from "local' air quality and that this was inconsistent with the approach taken in the pCARP for reasons that have been set out in Appendix 1 of the s42A report. From my reading of Appendix 1 of the s42A report it is my impression that the aim of the pCARP is to ensure that cumulative effects and not just local effects are taken into account when managing air quality within an airshed and when assessing a discharge. I am therefore of the opinion that the addition of "ambient" to Policies 6.2 and 6.3 assists to clarify the stated intention of the policies and is consistent with them. I therefore disagree with the conclusion in the s 42A report and continue to support the inclusion of "ambient" in Policies 6.2 and 6.3 as proposed in Synlait's submission and the evidence of Mr Ensor

54 The second paragraph on page 10-4 of the s42A report relates to the relief sought by Synlait regarding the wording of Policy 6.2. Synlait is concerned that the wording of policies 6.2 and 6.3 makes it clear that Policies 6.2 and 6.3 relate to air quality management rather than to specific air discharges. Synlait submitted that "minimise" is replaced by "manage" in Policy 6.2. The use of "manage" rather than "minimise" puts more emphasis on the overall management of ambient air quality rather than "minimise" which implies a more individual consent-based approach. The proposed changes to Policies 6.2 and 6.3 included in Mr Ensor's evidence clarify in my opinion the intent of the policies, which is to signal when further work is required to manage air quality within an airshed and to scrutinise consent applications.

55 The second to last paragraph of page 13-7 of the s42A report provides reasons for rejecting Synlait's submission to include the words "at sensitive receptors" in Policy 6.21. The stated reason is that guidelines do take into

account exposure times for receptors. I agree that this should be the case if the guidelines are correctly interpreted and applied. However for clarity I recommend the inclusion of “at sensitive receptors” in the policy and support the wording suggested by Synlait in their submission and in Mr Ensor’s evidence.

Conclusions

56 In my opinion Synlait uses the best practicable option to control the discharges to air from their milk processing facility in Dunsandel.

57 In my opinion dispersion modelling results should not be seen as providing anything more than an indication of maximum ground level concentrations that might result if worst case atmospheric and discharge conditions combine. When assessing the effects of a discharge of contaminants to air the results of dispersion modelling should be taken into consideration along with all the other factors for assessing the potential for an activity to cause adverse effects.

58 It is therefore my opinion that the use of AAQGs in policies and rules as pass/fail tests (to applied without regard to human exposure) in determining whether or not a discharge can be consented is inappropriate. This may result in industries such as Synlait being declined consent even though they use the best practicable option to control their discharges, are located appropriately and are unlikely to have any effects that more than minor on the environment.

Attachment 1 - modelling Contour plots

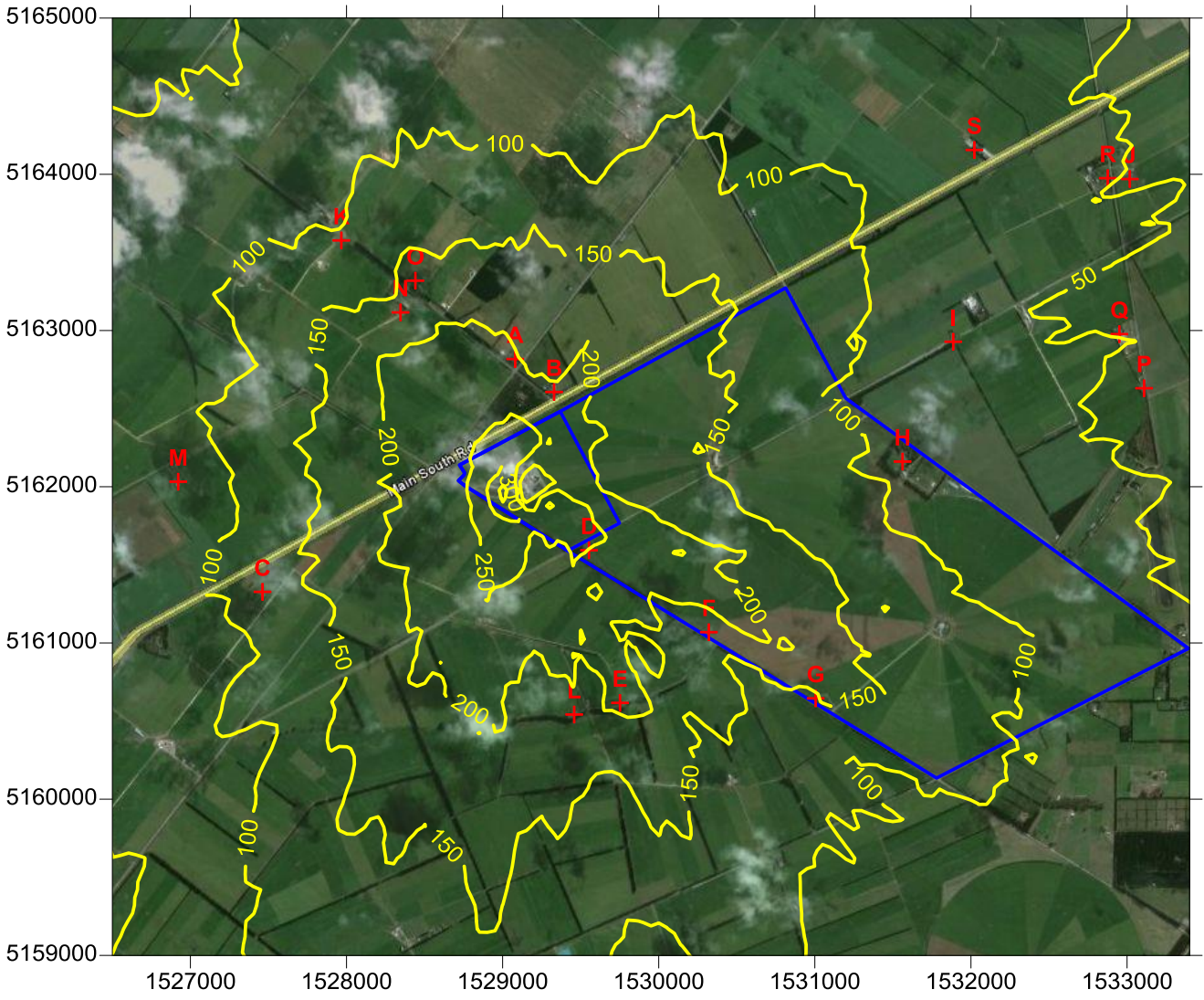

Figure 1. Predicted maximum 1-hour average SO_2 concentrations ($\mu g/m^3$) associated with all discharges from all plant sources when the proposed Stage 4 expansion has occurred (excluding background levels)

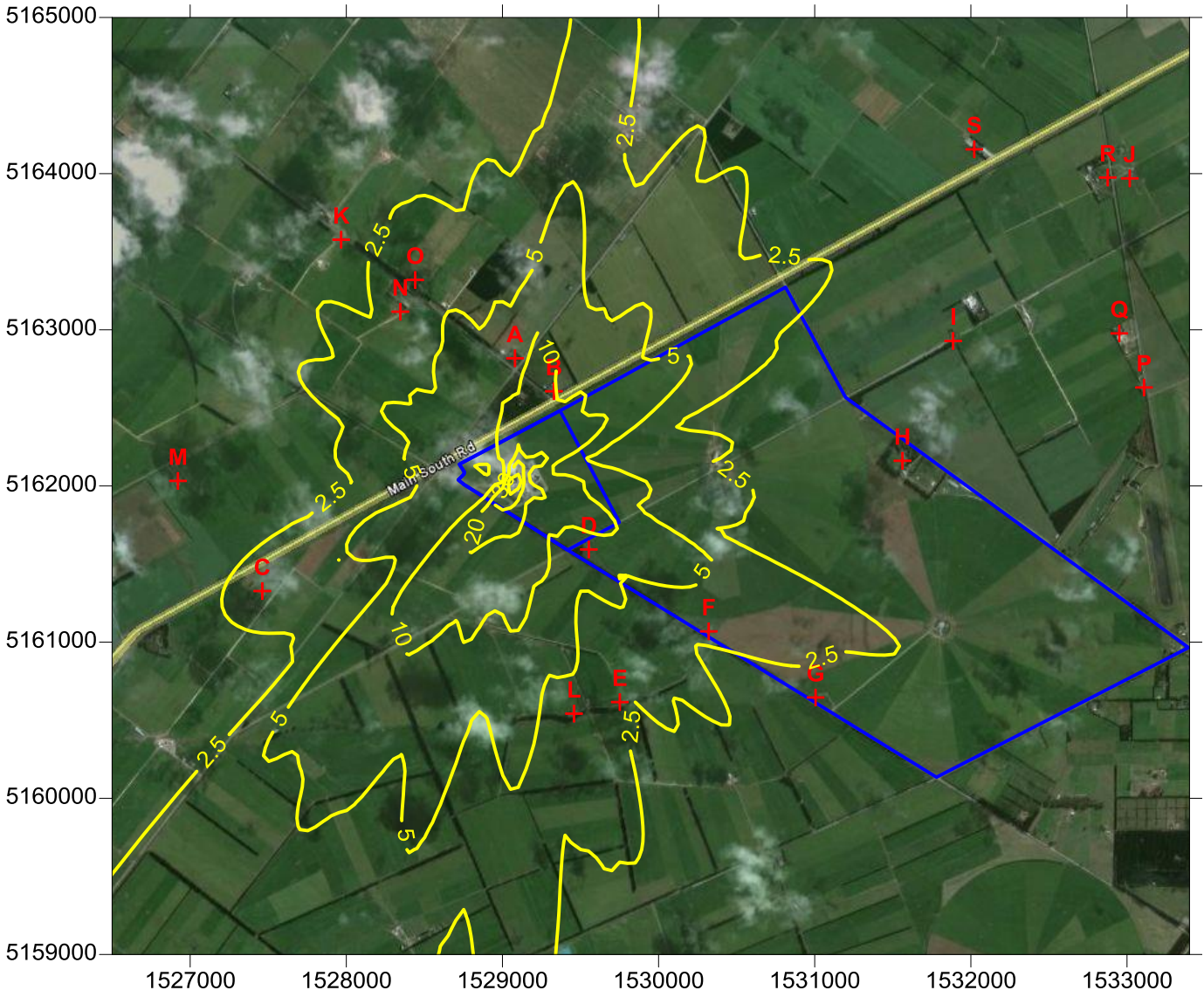

Figure 2. Predicted maximum 24-hour average PM10 concentrations (µg/m3) associated with all discharges from all plant sources when the proposed Stage 4 expansion has occurred (excluding background levels)