Supplementary to staff reply report

November 2018

Date: 6/11/2018
Author: Northland Regional Council
Version: Final

Northland
REGIONAL COUNCIL

Purpose of the report

1. The purpose of this report is to provide supplementary information to the *Staff Reply Report* and the *Reply Report Tracked Changes Version of the Plan*.

Supplementary information

Policy D.5.9

Author: Michael Payne

2. In paragraph 293 of the *Staff Reply Report* I expressed concern about how clause D.5.9(2) would apply to existing moorings. My concern was centred on how the 'no more than minor adverse effects test' in clause 2 would affect existing moorings associated with properties that are only accessible by water. It is my understanding that some of these properties, such as those on Moturoa Island (Kerikeri Inlet) have multiple moorings to provide safe access to vessels in a variety of conditions. It is possible that the 'no more than minor adverse effects' test could result in some moorings being removed which could affect safety, in certain weather conditions. In my opinion, this is an undesirable and unintended consequence of the proposed policy. Although this is only likely to affect a small number of moorings I recommend that the policy is amended to provide an exclusion from clause D.5.9(2) where the mooring is required to provide safe access to and from the property.

3. While my concern is for existing moorings I believe a similar approach should be taken for new moorings where they are required for safety reasons.

4. I have drafted amendments to Policy D.5.9(2) for the Hearing Panel's consideration below:

   Moorings outside Mooring Zones
   Moorings outside Mooring Zones that require resource consent must:
   …
   2) not by <u>themselves</u> ~~itself~~ or in combination with existing moorings in the same bay or inlet, result in more than minor adverse effects, unless;

a) the mooring is associated with a property that is only legally accessible by water and the mooring is necessary to provide for the safety of people or the vessel, and[1]

…

Appendix H.3

Author: Michael Payne

5. Submissions from the Bio-energy Association and Fonterra Co-Operative Group sought changes to Appendix H.3 of the Proposed Plan to make calculating chimney heights simpler.

6. The original submission from Fonterra Co-Operative Group stated;

> *Fonterra generally supports the permitted activity rule for discharges of contaminants to air for energy generation.*
>
> *However, Fonterra has concerns about criterion (4) of Rule C.7.1.6 which requires the chimney height to be calculated in accordance with Appendix H.3. The calculation method proposed in Appendix H.3 is overly complex. Fonterra request that a simpler table is used, such as that contained in the Canterbury Air Regional Plan (see page 8-17 of the Canterbury Air Regional Plan).*

7. The original submission from the bio-energy association stated;

> *… some aspects appear unnecessary and are going to result in some very high chimneys indeed. It is a very different approach to other regions such as Nelson and Canterbury for the same thing. It will result in crazy chimneys for natural gas burning equipment. Bioenergy Association would like to see a more common approach across all regions.*

8. I agree that a simpler approach to calculating chimney heights would be beneficial. To that end, staff have been working with Pattle Delamore Partners Ltd (PDP Ltd) to develop a tabular set of chimney heights for the burning appliance specified in rule C.7.1.6.

9. PDP has undertaken a dispersion modelling assessment using a steady state Gaussian plume model (AERMOD) to test potential air quality effects of various burning appliances and fuel types. A copy of PDP's report is included as Appendix A to this report.

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[1] Clarification

10. I recommend the text in Appendix H.3 of the Proposed Regional Plan for Northland be deleted and replaced with the following new text which has been prepared by staff and is based on the modeling assessment undertaken by PDP;

H.3 Stack height requirements

This appendix is sets out the methods complying with the stack height requirements of rule C.7.1.6 Burning for energy (electricity and heat) generation more than 40KW – permitted activity.

Fuel burning devices and building must meet the requirements of one of the following methods to comply with rule C.7.1.6 (4):

Method 1:

The activity must comply with Table 1 and the associated conditions.

Table 1 : Fuel burning devices and building dimensions

Fuel Type	Fuel Combustion Threshold (MW)	Maximum Building Height (m)	Maximum Building Footprint (m^2)	Minimum Stack Height Above Ground Level (m)
Coal[1]	0.04 - 0.5	5	900	18
Wood[2]	0.04 - 0.5	5	900	18
Natural Gas	0.04 -10	5	900	17
LPG	0.04 -10	5	900	17
Diesel / Fuel Oil[3]	0.04 -0.5	5	900	16

Notes:

1. *The SO_2 emission rate was based on a sulphur content of fuel of 1% by weight, and the PM_{10} emission rate was based on an in-stack particulate emission concentration of 250 mg/Nm³ at STP of 0 °C and 1 atmosphere and on a dry gas basis. Stack height based on a building corner location.*
2. *For untreated wood, and based on in-stack PM_{10} emission concentration of 250 mg/Nm³ at STP of 0 °C and 1 atmosphere and on a dry gas basis.*
3. *The SO_2 emission rate was based on a sulphur content of fuel of 0.001% (10 ppm) by weight.*

Conditions:

1. The point of discharge is more than 2.5 kilometres from complex terrain[2]

Method 2

The following requirements are met;

---

[2] Complex terrain is terrain heights above the effective height of the exit point of the stack. Effective stack height is the sum of the physical height of the top of the stack above ground level plus any plume rise due to buoyancy or initial momentum(inertia) of the vertical discharge (minus stack-tip or building downwash.

1. The stack is designed by a suitably qualified and experienced person, and
2. The combustion activity is assessed through air dispersion modelling:
    a. Air dispersion modelling is undertaken in accordance with the relevant Ministry for the Environment best practice guidelines.
    b. Air dispersion modelling concludes that the activity will not result in an exceedance of the Resource Management (National Environmental Standards for Air Quality) Regulations 2004 and the Ministry for the Environment's Ambient Air Quality Guidelines, 2002.
3. The person or organisation initiating the air dispersion modelling must provide a copy of the report detailing how the requirements of clause 2 are met to Council within 3 months of the modelling being completed.

Note:

- Where a Gaussian-plume model is the most appropriate dispersion modelling tool Council will generally expect modelling to be undertaken using AERMOD (EPA) or its replacement.
- Where an advanced model is the most appropriate dispersion modelling tool Council will generally expect modelling to be undertaken using CALPUF (Scire et al., 2000a) or its replacement.

4. The stack heights calculated in accordance with the proposed new wording above are likely to be higher than many of the existing stacks that were built to comply with the permitted activity rules of the Air Quality Plan 2004. This is a result of the different methods of calculating stack height.

5. Applying the new stack height requirements to existing burning appliances is likely to result in non-compliance. The result would be that these businesses would either need to upgrade their stack or apply for resource consent.

6. Advice from Council's Air Quality Scientist indicates that the class of boiler with stacks built in accordance with the Air Quality Plan for Northland present a low risk to air quality. In addition, Council receives less than 10 complaints (less than 5% of air quality complaints) per year on the discharge from these boilers. Given the apparent low environmental impact of these burning appliances and the potential cost of upgrades or resource consents to comply with the new rules, on balance, I recommend amending rule C.7.1.6 as follows

C.7.1.6
Burning for energy (electricity and heat) generation more than 40KW – permitted activity
The discharge of contaminants to air from the burning of coal, oil, natural gas, biogas, liquid petroleum gas or untreated wood in a burning device of more than 40KW for energy generation is a permitted activity provided:

…

<u>4) Either:</u>

a) the stack height is calculated in accordance with the chimney height requirements in H.3 'Chimney height requirements' and the stack vertical efflux velocity is not less than 5m/s, or

b) The discharge was authorised at the operative date of this plan and there is no increase in the scale or change to the type of the discharge, and

~~4) the stack height is calculated in accordance with the chimney height requirements in H.3 'Chimney height requirements', and~~

~~5) the stack vertical efflux velocity is not less than 5m/s, and~~

...

Northport – Significant Ecologial Area

Author: James Griffin

11. Upon reflection, my recommendation in paragraph 306 of the *Staff Reply Report* did not provide a conclusive recommendation on whether Northport's request for removal of part of the Significant Ecological Area (SEA) adjacent to their activities at Marsden Point was supported by evidence from Mark Poynter. Mark Poynter (Ecologist) referred to various ecological values associated with the area concerned, such as eel grass being absent, although no actual ecological evidence/data was provided, and without this there is little of substance to enable the assessment of significance to be changed. I have no concern in principle that new information may prove the values not to be significant in that area. However, without such evidence, I believe any such change would create a precedence that non-ecological factors can trump the significance criteria. Therefore, in the meantime, I cannot support the Northport request and do not recommend the SEA boundary realignment.

Marine Pest Rule C.1.7.7

Author: James Griffin

12. My recommendation in paragraph 276 of the Staff Reply Report to delete C.1.7.1 and C.1.7.6 had an unintended consequence of limiting the ability to issue infringement notices in relation to marine pests under the RMA. To remedy this, I now recommend an amendment to Rule C.1.7.7 and re-introduction of the Marine pathways places maps, as detailed in the attached legal advice (Appendix B), and shown below:

C.1.7.7

Marine pests and biofouling - non-complying activity

Any:

1) Navigation, mooring or anchoring of a vessel or the relocation or placement of a structure with a marine pest present; or

2) vessel or structure entering Northland's coastal marine area that has biofouling exceeding light fouling, or

3) A vessel or structure; or moving from a Marine Pathways Place (refer I 'Maps') to another a Marine Pathways Place (refer I 'Maps') that has biofouling exceeding light fouling, or

that is not authorised the Biosecurity Act 1993, is a non-complying activity.

Note: The Marine Pathway Management Plan for Northland limits biofouling to light fouling on vessels entering Northland or moving between Marine Pathway Plan designated 'places', unless authorised by an exemption under the Biosecurity Act 1993.

The RMA activities this rule covers:

- Deposit a marine pest, in, on, or under any foreshore or seabed in a manner that has or is likely to have an adverse effect on the foreshore or seabed (s12(1)(d).
- Discharge a marine pest into water (s15(1)(a).
- Introduce or plant any marine pest in, on, or under any foreshore or seabed 12(1)(f).
- Bring a marine pest into any coastal marine area (s12(3)).

Farm environment plans

Author: Ben Tait

13. After finalising the reply report, Federated Farmers provided me with their position on the role of farm environment plans (FEPs) with respect to the Proposed Plan (Appendix C). In summary, their position aligns with my recommendation to not mandate the use of FEPs and their regulatory role should be considered at a future date.

C.6.8.2 Discharges from contaminated land

Author: Michael Payne

14. Since the release of the reply report I have given further thought to Mr Proffitt's and Mr Hunt's recommendations in relation to the use of a "lines of evidence" approach for light non-aqueous phase liquids (LNAPL) and dense non-aqueous phase liquids(DNAPL) and the use of a transmissivity threshold LNAPL.

15. I agree with Mr Hunt[3] in that including a transmissivity threshold for LNAPL is useful because it provides a clear, measurable threshold to determine compliance with the permitted activity standard.

16. I also agree with the reasoning Mr Proffitt sets out in Paragraph 1.12 of his evidence which in summary advocates for the flexibility provided by the lines of evidence approach.

17. I recommend that the Proposed Plan provides for both a transmissivity threshold and a lines of evidence approach for LNAPL as set out below:

C.6.8.2 Discharges from Contaminated land

...

3) light non-aqueous phase liquids (LNAPLs[4]) must ~~not~~ have a LNAPL transmissivity of less than ~~0.001~~ 0.07 square metres per day, or a suitably qualified and experienced practitioner must certify that the LNAPL is unlikely to be mobile using a lines of evidence approach, and[5]

...

18. In respect to DNAPL, I had previously recommended deleting the clause relating to DNAPL based on the evidence provided by Mr Proffitt[6]. Having considered the evidence provided by Mr Hunt[7] I see there is some benefit in retaining C.6.8.2(4) and applying a lines of evidence approach to assessing the risk from these substances. I recommend the Hearing Panel adopt Mr. Hunts recommendation with minor amendments, as shown below:

[3] Northland Regional Council, Hunt Para's 29 - 38
[4] Light non-aqueous phase liquids are liquids that are not soluble and have a specific gravity less than 1
[5] Northland Regional Council, Hunt
[6] The Oil Companies, Proffitt. Paragraph 5.43
[7] Northland Regional Council, Hunt Para's 30 - 42

C.6.8.2 Discharges from Contaminated land

...

4) *for dense non-aqueous phase liquids (DNAPL)(7)* [8] *a suitably qualified and experienced practitioner must certify that the DNAPL is unlikely to be ~~are not~~ mobile and in free phase form using a lines of evidence approach, and*[9]

...

[8] Dense non-aqueous phase liquids are liquids that are not soluble and have a specific gravity greater than 1

[9] Northland Regional Council, Hunt

Appendix A – Air Quality Technical Assessment Relating to Proposed Regional Plan

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31 October 2018

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Dear Michael

REPORT: AIR QUALITY TECHNICAL ASSISTANCE RELATING TO PROPOSED REGIONAL PLAN

Pattle Delamore Partners Ltd (PDP) has prepared the following letter to Northland Regional Council (NRC) relating to the 'Proposed Regional Plan for Northland' (the 'PRPN'), which was notified on 6 September 2017, with further submission notified in March 2018.

In our letter dated 18 October 2018, PDP reviewed two of the submissions received by NRC in relation to air discharge plan rules, which are associated with the proposed chimney height and permitted activity status provisions. These submissions were from Fonterra Ltd (Fonterra) and the Bioenergy Association of New Zealand (BANZ) who both seek that the NRC replaces the proposed chimney height requirements (nomographs) with a simpler set of standards similar to those used by other regional councils, such as Environment Canterbury (ECan), Nelson City Council (NCC) and the Bay of Plenty Regional Council (BOPRC). PDP also undertook a screening level dispersion modelling assessment for PM_{10} emissions from a theoretical 0.5 megawatt (MW) coal fired boiler stack. The results from the screening model indicated that a detailed dispersion modelling assessment should be undertaken incorporating local meteorology, topography and appropriate averaging periods to determine the potential adverse effects under the proposed permitted activity rules.

The results of the detailed dispersion modelling assessment are presented in this letter. The dispersion modelling assessment was undertaken using the AERMOD steady-state Gaussian plume model.

1.0 Methodology

PDP has undertaken a dispersion modelling assessment using AERMOD (Version 18081)[1] to test the potential air quality effects associated with emissions from the following theoretical combustion plant or boiler activity classes:

1. Particulate matter emissions (as PM_{10})[2] from a 0.5 MW coal fired boiler stack;
2. Oxides of nitrogen (NO_x) emissions (as NO_2)[3] from a 0.5 MW coal fired boiler stack;
3. Oxides of sulphur (SO_x) emissions (as SO_2)[4] from a 0.5 MW coal fired boiler stack;
4. Particulate matter emissions (as PM_{10}) from a 0.5 MW wood fired boiler stack;
5. NO_x emissions (as NO_2) from a 0.5 MW wood fired boiler stack;
6. Particulate matter emissions (as PM_{10}) from a 10 MW natural gas fired boiler stack;
7. NO_x emissions (as NO_2) from a 10 MW natural gas fired boiler stack;
8. Particulate matter emissions (as PM_{10}) from a 10 MW LPG[5] fired boiler stack;
9. NO_x emissions (as NO_2) from a 10 MW LPG fired boiler stack;
10. Particulate matter emissions (as PM_{10}) from a 0.5 MW diesel/fuel oil fired boiler stack;
11. NO_x emissions (as NO_2) from a 0.5 MW diesel/fuel oil fired boiler stack; and,
12. SO_x emissions (as SO_2) from a 0.5 MW diesel/fuel oil fired boiler stack.

A modelling grid was set-up over a 1 km by 1 km area at a spatial resolution of 10 m (i.e. 10,201 receptors) centred on the boiler stack and terrain data were included.[6] Building downwash effects were accounted for within AERMOD using the BPIP-PRIME module[7]. The building was assumed to be 5 m in height and was 30 m by 30 m (in the x- and y-directions) and the stack was located in the centre of the building. The model was re-run a number of times for each scenario to determine the minimum stack height above ground-level.

Surface and profile meteorological data were input into AERMOD for the period 1 January 2017 to 31 December 2017. The surface and profile meteorological data were generated for the site by Lakes Environmental Software using the Weather Research and Forecasting (WRF) and Mesoscale Model Interface Program (MMIF) Version 3.3, in accordance with US EPA (2018).[8] The WRF grid cell (12 km by 12 km resolution) was centred on the site at latitude 35.74475 °E and longitude 174.3404 °E.

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1 This is the latest version of the AERMOD steady-state Gaussian plume model. AERMOD is supported by the US Environmental Protection Agency (US EPA) and is currently the preferred Gaussian plume model in New Zealand and Australia. AERMOD replaced AUSPLUME as the default regulatory model in Victoria (Australia) on 1 January 2014.

2 PM_{10} is an abbreviation for particulate matter less than 10 microns in size.

3 NO_2 is an abbreviation for nitrogen dioxide.

4 SO_2 is an abbreviation for sulphur dioxide.

5 LPG is an abbreviation for liquefied petroleum gas, which is a propane-butane mix.

6 The theoretical boiler stack (point emission source) was assumed to be located at Port Whangarei at 259500 m E, 6041100 m N (UTM Zone 60 S) or latitude 35.744748 °E, longitude 174.340413 °E. The terrain across the modelling grid was relatively flat, although there was a slight increase in elevation approximately 230 m to the south-west (SW) of the stack.

7 BPIP-PRIME is an abbreviation for Building Profile Input Program (BPIP) Plume Rise Model Enhancements (PRIME).

8 US EPA, 2018. Guidance on the Use of the Mesoscale Model Interface Program (MMIF) for AERMOD Applications, US Environmental Protection Agency, April 2018.

The annual wind rose for 2017 is shown in Figure 1 and indicates that winds blowing from all wind directions are expected to occur from time-to-time at the site. However, the prevailing wind directions were predicted to be from the north-west through to the south-west, as indicated below:

- North-west (NW; 9.6%);
- West-north-west (WNW; 9.6%);
- West (W; 10.4%);
- West-south-west (WSW; 12.0%); and,
- South-west (SW; 10.6%).

The percentage of calm wind conditions (e.g. <0.5 metres per second) was predicted to be low at 0.06% and the annual average wind speed was predicted to be 4.8 metres per second (m/s).

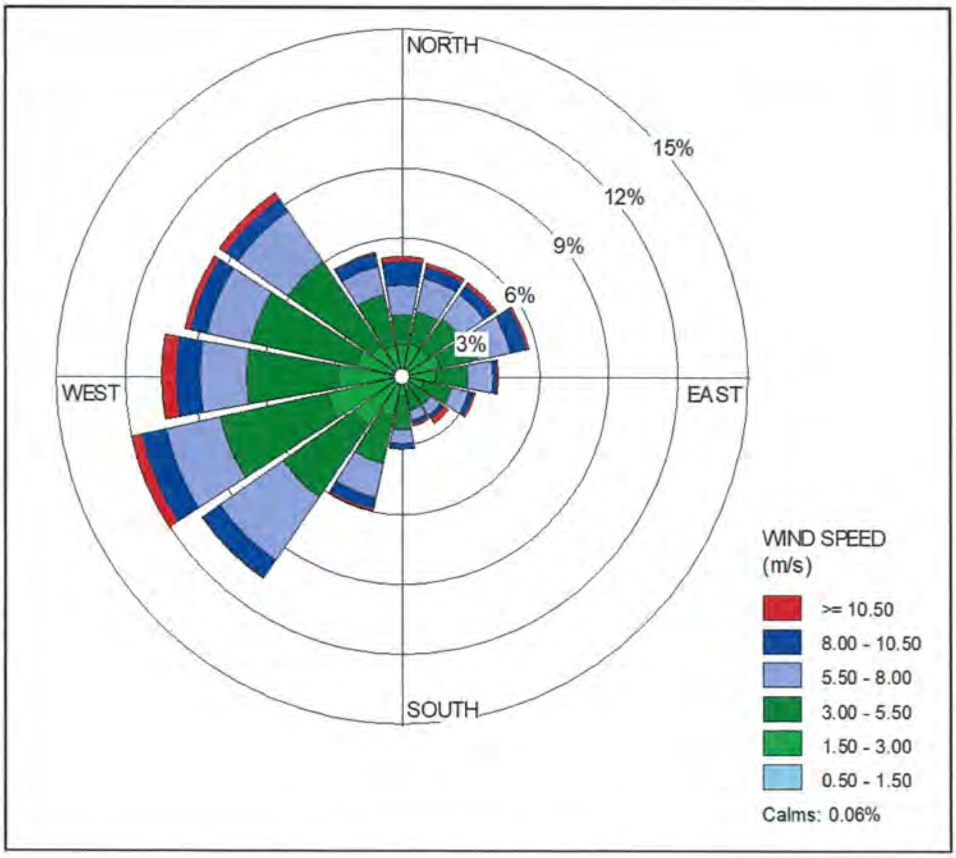

Figure 1: Annual Wind Rose as Predicted by WRF for Port Whangarei for 2017

The hourly wind speed frequency distribution for 2017 is shown in Figure 2 and indicates that the wind speeds were predominantly between 3 m/s and 5.5 m/s (38%). Wind speeds of between 5.5 m/s and 8 m/s were predicted to occur 24% of the time, while wind speeds of between 1.5 m/s and 3 m/s were predicted to occur 21% of the time. The maximum 1-hour mean wind speed was predicted to be 14.4 m/s.

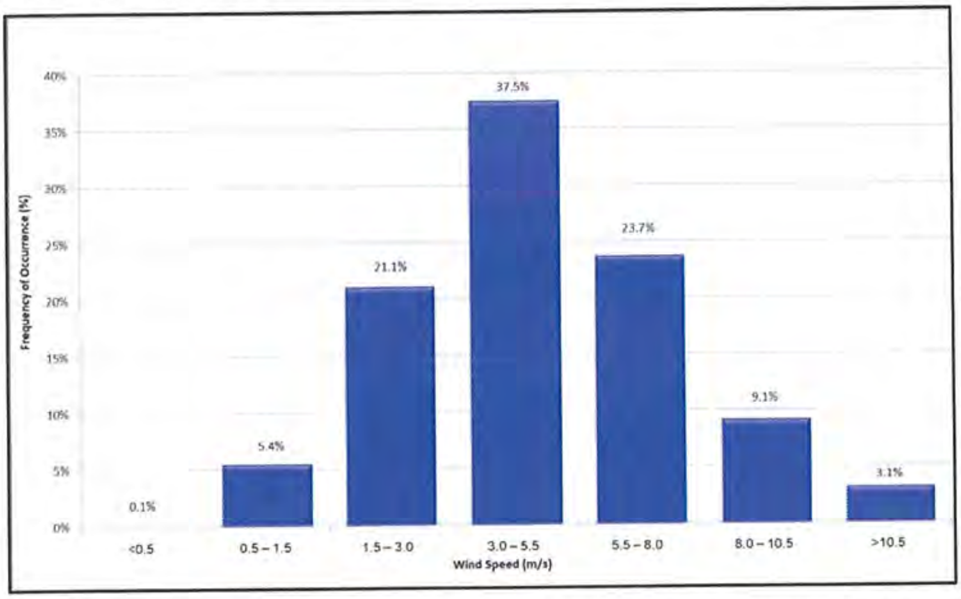

Figure 2: Wind Speed Frequencies Predicted by WRF for Port Whangarei for 2017

The diurnal wind speeds are shown in Figure 3 and indicate that an increase in wind speed occurred during the morning following sunrise, and that the highest wind speeds were predicted to occur in the afternoon.

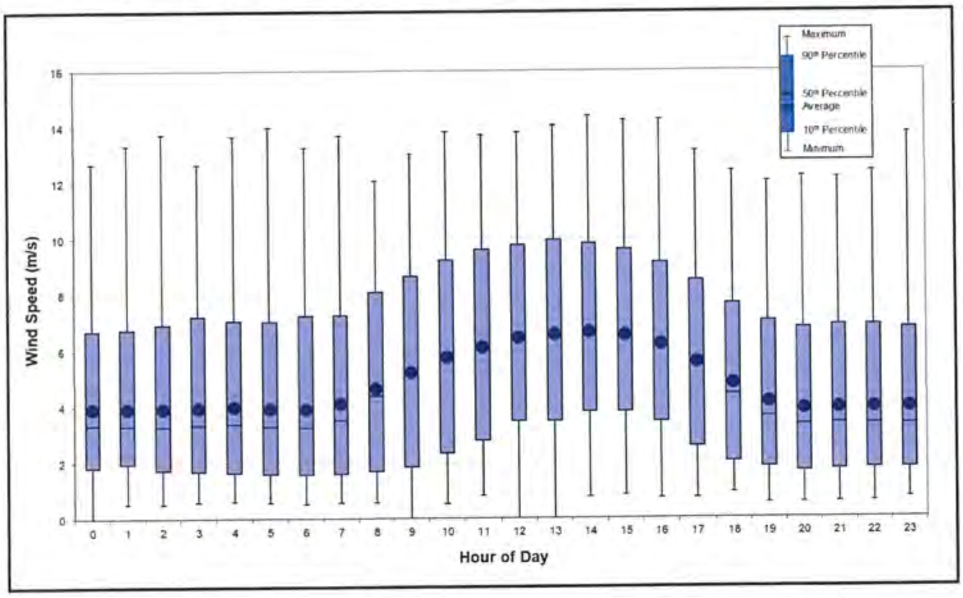

Figure 3: Diurnal Wind Speed Predicted by WRF for Port Whangarei for 2017

The hourly air temperatures for 2017 are shown in Figure 4 as a time-series plot. The figure indicates that, as expected, the lowest temperatures were predicted to occur in winter (June to August) while the highest temperatures were predicted to occur in summer (December to February). The minimum and maximum temperatures were 2°C and 27°C, respectively.

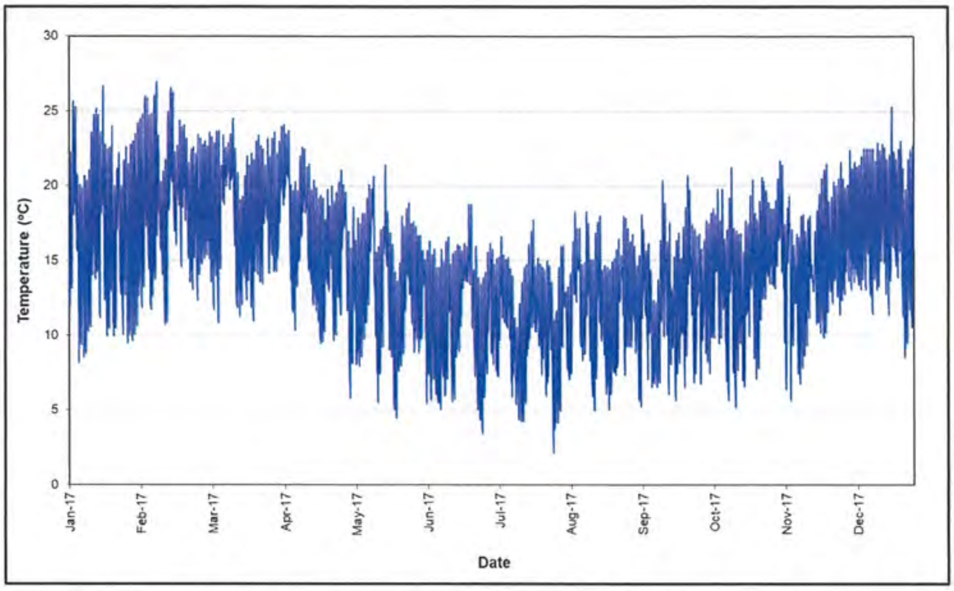

Figure 4: Hourly Air Temperature Predicted by WRF for Port Whangarei for 2017

The diurnal air temperatures are shown in Figure 5 and are similar to the diurnal wind speed shown in Figure 3. Figure 5 indicates that an increase in temperature occurred during the morning following sunrise, and that the highest temperatures were predicted to occur shortly after mid-day and lasted until mid-afternoon.

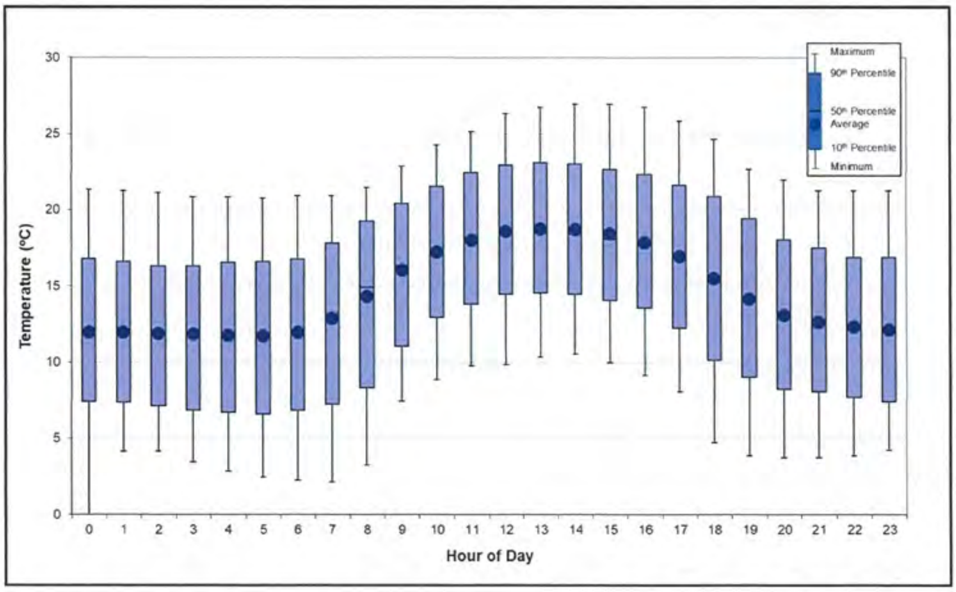

Figure 5: Diurnal Air Temperature Predicted by WRF for Port Whangarei for 2017

The diurnal mixing heights are shown in Figure 6 and also indicate that an increase in the mixing height occurred during the morning, due to the onset of vertical mixing following sunrise. The figure indicates that the maximum mixing heights generally occurred in the mid to late afternoon, due to the growth of the convective mixing layer. The maximum height of the convectively-generated boundary layer was predicted to be 1,936 m, while the maximum height of the mechanically-generated boundary layer was predicted to be 3,509 m.

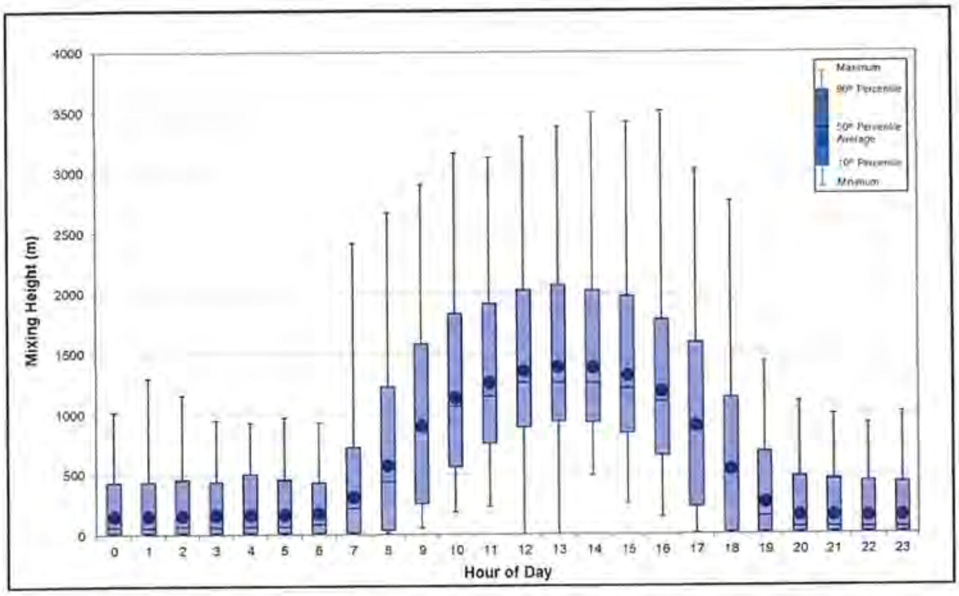

Figure 6: Diurnal Mixing Height Predicted by WRF for Port Whangarei for 2017

1.1 Assessment Criteria

As mentioned in our letter dated 18 October 2018, the basis behind the minimum stack height requirements for the Nelson and Bay of Plenty regional air plans appear to be from dispersion modelling assessments undertaken by NIWA in 2004[9], 2012a[10], 2012b[11] and 2013[12]. The ground-level concentration (GLC) ambient air quality assessment criteria used by NIWA (2013) were adopted in this assessment and were as follows:

- PM_{10} — 2.5 µg/m³ (as a 24-hour mean) or 5% of the NESAQ;[13]
- NO_2 — 40 µg/m³ (as a 1-hour mean) or 20% of the NESAQ; and,
- SO_2 — 70 µg/m³ (as a 1-hour mean) or 20% of the NESAQ.

It is important to note that the maximum ground-level concentrations predicted by the model were assessed against the above assessment criteria, not the 99.9th percentile or ninth highest 1-hour mean concentrations (for NO_2 and SO_2) to allow for a conservative assessment. It is also noted that the maximum predicted concentrations may well fall within the boundary of the activity site.

9 NIWA, 2004. ALK2002-037-R1, National Institute of Water and Atmospheric Research (NIWA), August 2004.
10 NIWA, 2012a. Potential Impacts of Discharges to Air, NIWA, 2012.
11 NIWA, 2012b. Recommended Chimney Heights for Southland, NIWA, 2012.
12 NIWA, 2013. Applicability of the Recommendations to Other Regions, NIWA, 2013.
13 NESAQ is an abbreviation for the National Environmental Standards for Air Quality and are ambient air quality standards that were set for the protection of human health. The NESAQ for PM10, NO2 and SO2 relevant to this assessment are 50 µg/m³ (as a 24-hour mean), 200 µg/m³ (as a 1-hour mean) and 350 µg/m³ (as a 1-hour mean), respectively.

The basis behind the assessment criteria used by NIWA (2013) is not fully understood. However, the criterion for PM_{10} does equate to the MfE (2008)[14] significance criterion for PM_{10} (albeit for land transport emission sources) in addition to Regulation 17 of the National Environmental Standards for Air Quality.[15] However, the MfE significance criterion for 1-hour mean NO_2 is actually set at 20 µg/m^3 or 10% of the NESAQ and no criteria have been set for SO_2. It is noted in MfE (2008) that:

> *"These thresholds are not intended to define an acceptable or insignificant increase in actual ambient air quality. Instead, they are intended to provide an indication of the likely significance of predicted ground-level concentrations. These thresholds are suggested in the context of a Tier 2 assessment, which is conservative and based on worst-case scenarios."*

It is possible that the minimum stack heights schedules in other regional plans (e.g. Auckland Unitary Plan) may have been based on much higher assessment criteria (e.g. New South Wales EPA, 1993),[16] which may account for some of the variations in the stack heights schedules across the country.

1.2 Coal Fired Boiler

The actual volumetric flow rate for a theoretical 0.5 MW coal fired boiler stack was estimated to be 0.4524 cubic metres per second (m^3/s), while the exit temperature was assumed to be 300 °C (or 573.15 K). For an exit stack diameter of 0.24 m, the vertical efflux velocity was assumed to be 10 m/s.

The PM_{10} emission rate was estimated to be 0.051 grams per second (g/s) for an in-stack PM_{10} emission concentration of 250 milligrams per cubic metre (mg/Nm^3) at Standard Temperature and Pressure (STP) of 0 °C and 1 atmosphere and on a dry gas basis.

Using the relevant emission factors from the US EPA AP-42 Emission Factors Database[17], the NO_x and SO_x emission rates were estimated to be 0.098 g/s and 0.422 g/s, respectively, for a 0.5 MW coal fired boiler (e.g. spreader-stoker boiler firing on sub-bituminous coal) and assuming a coal heating value (calorific value or CV) of 22.53 megajoules per kilogram (MJ/kg) and a 1% sulphur content by weight. In order to carry out a robust assessment, it was conservatively assumed that the total NO_x and SO_x emissions were present as NO_2 and SO_2, respectively.

1.3 Wood Fired Boiler

The actual volumetric flow rate for a theoretical 0.5 MW wood fired boiler stack was estimated to be 0.3676 m^3/s and the exit temperature was assumed to be 180 °C (or 453.15 K). For an exit stack diameter of 0.216 m, the vertical efflux velocity was assumed to be 10 m/s.

The PM_{10} emission rate was estimated to be 0.053 g/s for an in-stack PM_{10} emission concentration of 250 mg/Nm^3 at STP of 0 °C and 1 atmosphere and on a dry gas basis.

Using the relevant emission factors from the US EPA AP-42 Emission Factors Database[18], the NO_x emission rate was estimated to be 0.105 g/s for a 0.5 MW dry wood-fired boiler. In order to carry out a robust assessment, it was conservatively assumed that the total NO_x emissions were present as NO_2.

14 MfE, 2008. Good Practice Guide for Assessing Discharges to Air from Land Transport, Ministry for the Environment (MfE), June 2008.
15 Resource Management (National Environmental Standards for Air Quality) Regulations 2004.
16 New South Wales EPA, 1993. Guidelines for Estimating Chimney Heights for Small to Medium Size Fuel Burning Equipment. New South Wales Environment Protection Authority, February 1993.
17 US EPA AP-42: Compilation of Air Emission Factors, Fifth Edition, Volume I, Chapter 1: External Combustion Sources, Section 1.1 Bituminous and Subbituminous Coal Combustion.
18 US EPA AP-42: Compilation of Air Emission Factors, Fifth Edition, Volume I, Chapter 1: External Combustion Sources, Section 1.6 Wood Residue Combustion in Boilers.

1.4 Natural Gas Fired Boiler

The actual volumetric flow rate for a theoretical 10 MW natural gas fired boiler stack was estimated to be 6.925 m^3/s, while the exit temperature was assumed to be 200 °C (or 473.15 K). For an exit stack diameter of 0.939 m, the vertical efflux velocity was assumed to be 10 m/s.

Using the relevant emission factors from the US EPA AP-42 Emission Factors Database[19], the NO_x and PM_{10} emission rates were estimated to be 0.39 g/s and 0.03 g/s, respectively, for a small (10 MW) boiler with uncontrolled emissions and assuming a fuel CV value of 41 MJ/m^3. In order to carry out a robust assessment, it was conservatively assumed that the total NO_x emissions were present as NO_2.

1.5 LPG Fired Boiler

The actual volumetric flow rate for a theoretical 10 MW LPG fired boiler stack was estimated to be 7.4356 m^3/s, while the exit temperature was assumed to be 240 °C (or 513.15 K). For an exit stack diameter of 0.973 m, the vertical efflux velocity was assumed to be 10 m/s.

Using the relevant emission factors from the US EPA AP-42 Emission Factors Database[20], the NO_x and PM_{10} emission rates were estimated to be 0.626 g/s and 0.034 g/s, respectively, for a 10 MW boiler and assuming a fuel CV value of 26.44 megajoules per litre (MJ/l). In order to carry out a robust assessment, it was conservatively assumed that the total NO_x emissions were present as NO_2.

1.6 Diesel Fired Boiler

The actual volumetric flow rate for a theoretical 0.5 MW diesel/fuel oil fired boiler stack was estimated to be 0.3836 m^3/s, while the exit temperature was assumed to be 250 °C (or 523.15 K). For an exit stack diameter of 0.221 m, the vertical efflux velocity was assumed to be 10 m/s.

Using the relevant emission factors from the US EPA AP-42 Emission Factors Database[21], the NO_x, PM_{10} and SO_x emission rates were estimated to be 0.029 g/s, 0.01 g/s and 0.0002 g/s, respectively, for a small (0.5 MW) boiler firing on number 4 fuel oil and assuming a fuel CV value of 41 MJ/l. In order to carry out a robust assessment, it was conservatively assumed that the total NO_x and SO_x emissions were present as NO_2 and NO_2, respectively. It was also assumed that the sulphur content of the fuel was 10 ppm (0.001%) by weight.

2.0 Results

2.1 Coal Fired Boiler

For a 17 m stack height, an efflux velocity of 10 m/s and with flat terrain, urban dispersion coefficients and building downwash invoked, the maximum ground-level concentrations predicted for a 0.5 MW coal fired boiler were as follows:

- PM_{10} 2.3 $\mu g/m^3$ (as a 24-hour mean) at 259480 m E, 6041080 m N (30 m SW of stack);
- NO_2 11.4 $\mu g/m^3$ (as a 1-hour mean) at 259570 m E, 6040980 m N (140 m SE of stack);
- SO_2 49.1 $\mu g/m^3$ (as a 1-hour mean) at 259570 m E, 6040980 m N (140 m SE of stack).

19 US EPA AP-42: Compilation of Air Emission Factors, Fifth Edition, Volume I, Chapter 1: External Combustion Sources, Section 1.4 Natural Gas Combustion.

20 US EPA AP-42: Compilation of Air Emission Factors, Fifth Edition, Volume I, Chapter 1: External Combustion Sources, Section 1.5 Liquified Petroleum Gas Combustion.

21 US EPA AP-42: Compilation of Air Emission Factors, Fifth Edition, Volume I, Chapter 1: External Combustion Sources, Section 1.3 Fuel Oil Combustion.

Under the above scenario, the results of the model indicate that there are unlikely to be any adverse air quality effects associated with PM_{10}, NO_2 and SO_2 emissions from the operation of a ≤0.5 MW coal fired boiler, as the maximum ground-level concentrations were predicted to be below the relevant assessment criteria.

2.2 Wood Fired Boiler

For an 18 m stack height, an efflux velocity of 10 m/s and with flat terrain, urban dispersion coefficients and building downwash invoked, the maximum ground-level concentrations predicted for a 0.5 MW wood fired boiler were as follows:

- PM_{10} 1.7 µg/m^3 (as a 24-hour mean) at 259610 m E, 6040970 m N (170 m SE of stack);
- NO_2 17.8 µg/m^3 (as a 1-hour mean) at 259630 m E, 6041160 m N (140 m NE of stack).

Under the above scenario, the results of the model indicate that there are unlikely to be any adverse air quality effects associated with PM_{10} and NO_2 emissions from the operation of a ≤0.5 MW wood fired boiler, as the maximum ground-level concentrations were predicted to be below the relevant assessment criteria.

2.3 Natural Gas Fired Boiler

For a 17 m stack height, an efflux velocity of 10 m/s and with flat terrain, urban dispersion coefficients and building downwash invoked, the maximum ground-level concentrations predicted for a 10 MW natural gas fired boiler were as follows:

- PM_{10} 0.5 µg/m^3 (as a 24-hour mean) at 259630 m E, 6041000 m N (160 m SE of stack);
- NO_2 9.9 µg/m^3 (as a 1-hour mean) at 259590 m E, 6041020 m N (120 m SE of stack).

Under the above scenario, the results of the model indicate that there are unlikely to be any adverse air quality effects associated with PM_{10} and NO_2 emissions from the operation of a ≤10 MW natural gas fired boiler, as the maximum ground-level concentrations were predicted to be below the relevant assessment criteria.

2.4 LPG Fired Boiler

For a 17 m stack height, an efflux velocity of 10 m/s and with flat terrain, urban dispersion coefficients and building downwash invoked, the maximum ground-level concentrations predicted for a 10 MW LPG fired boiler were as follows:

- PM_{10} 0.5 µg/m^3 (as a 24-hour mean) at 259630 m E, 6041000 m N (160 m SE of stack);
- NO_2 16.1 µg/m^3 (as a 1-hour mean) at 259590 m E, 6041020 m N (120 m SE of stack).

Under the above scenario, the results of the model indicate that there are unlikely to be any adverse air quality effects associated with PM_{10} and NO_2 emissions from the operation of a ≤10 MW LPG fired boiler, as the maximum ground-level concentrations were predicted to be below the relevant assessment criteria.

2.5 Diesel Fired Boiler

For a 16 m stack height, an efflux velocity of 10 m/s and with flat terrain, urban dispersion coefficients and building downwash invoked, the maximum ground-level concentrations predicted for a 0.5 MW diesel/fuel oil fired boiler were as follows:

- PM_{10} 1.6 µg/m^3 (as a 24-hour mean) at 259520 m E, 6041080 m N (30 m SE of stack);
- NO_2 6.1 µg/m^3 (as a 1-hour mean) at 259520 m E, 6041080 m N (30 m SE of stack);
- SO_2 0.04 µg/m^3 (as a 1-hour mean) at 259520 m E, 6041080 m N (30 m SE of stack).

Under the above scenario, the results of the model indicate that there are unlikely to be any adverse air quality effects associated with PM_{10}, NO_2 and SO_2 emissions from the operation of a ≤0.5 MW diesel/fuel oil fired boiler, as the maximum ground-level concentrations were predicted to be below the relevant assessment criteria.

2.6 Sensitivity Study

The model was re-run to test the sensitivity of a number of parameters, including the effect of terrain (i.e. re-running the model using the US EPA regulatory default options with the elevated terrain option switched on), building height and building shape (i.e. to determine the influence of building downwash effects).

The first test involved assessing the potential effects associated with PM_{10} emissions from a 0.5 MW coal fired boiler with a stack height of 20 m (above ground-level) and a 10 m/s efflux velocity. For this scenario, the maximum 24-hour mean ground-level PM_{10} concentration was predicted to be 3.6 µg/m³ (i.e. in exceedance of the assessment criterion of 2.5 µg/m³) and the location of the exceedance was 230 m SW of the stack in an area with receptor terrain elevations of around 43 m and 46 m and receptor hill heights of 51 m (i.e. in an area with complex terrain).[22] In other words, the boiler stack plume is likely to have impinged onto the terrain and it is likely that an unrealistically high stack would be required to meet the assessment criterion for this scenario. In other words, it is likely that a condition of the new permitted activity rule should exclude a proposed activity which is located within a 2.5 km radius of complex terrain, unless it has been demonstrated by means of a dispersion modelling assessment that there will be no adverse air quality effects at or beyond the boundary of the site as a result of the proposed activity.

The second test involved increasing the building height from 5 m to 14 m, whilst keeping the building shape (footprint) the same (i.e. 30 m by 30 m). The potential effects over flat terrain associated with PM_{10} emissions from a 0.5 MW coal fired boiler with a stack height of 17 m (above ground-level) and a 10 m/s efflux velocity were assessed. In other words, the stack height was only 3 m above the roof height (as opposed to 12 m above roof height, as assessed above). The maximum 24-hour mean ground-level PM_{10} concentration was predicted to be 16.8 µg/m³ (i.e. in exceedance of the assessment criterion of 2.5 µg/m³) and the location of the exceedance was 20 m west of the stack. The model was re-run for a building height of 6 m and the maximum 24-hour mean ground-level PM_{10} concentration was predicted to be 12.7 µg/m³ (i.e. in exceedance of the assessment criterion of 2.5 µg/m³) and the location of the exceedance was 30 m SW of the stack. In other words, it is likely that a condition of the new permitted activity rule should also exclude building heights above 5 m, unless it has been demonstrated by means of a dispersion modelling assessment that there will be no adverse air quality effects at or beyond the boundary of the site as a result of the proposed activity.

The third test involved positioning the stack in the north-east (NE) corner of the building (as opposed to the centre of the building). The height of the building was 5 m and the footprint (shape) of the building was 30 m by 30 m (in the x- and y-directions). The stack was positioned approximately 7 m from the NE corner of the building at a height of 17 m (above ground-level). The potential effects were assessed over flat terrain for PM_{10} emissions from a 0.5 MW coal fired boiler with a stack efflux velocity of 10 m/s. The maximum 24-hour mean ground-level PM_{10} concentration was predicted to be 2.6 µg/m³ (i.e. in exceedance of the assessment criterion of 2.5 µg/m³) and the location of the exceedance was 100 m NE of the stack. However, for an 18 m stack, the maximum 24-hour mean ground-level PM_{10} concentration was predicted to be 1.5 µg/m³ (i.e. below the assessment criterion) at a location 190 m south-east (SE) of the

[22] Elevated terrain is defined as terrain heights equal to or less than the effective height of the exit point of the boiler's stack (i.e. the stack release height), whereas complex terrain is defined as terrain heights above the effective height of the exit point of the boiler's stack. The effective stack height is defined as the sum of the actual physical height of the top of the stack above ground level plus any plume rise due to buoyancy or initial momentum (inertia) of the vertical discharge (minus stack-tip or building downwash).

stack. Therefore, PDP recommends a minimum stack height of 18 m for a 0.5 MW coal fired boiler, based on the dispersion modelling results.

The fourth test involved reducing the overall footprint of the building to 10 m by 30 m (in the x- and y-directions). The potential effects were assessed over flat terrain for PM_{10} emissions from a 0.5 MW coal fired boiler with a stack height of 17 m (above ground-level) positioned in the centre of the building, a 10 m/s efflux velocity and a building height of 8 m. In other words, the stack release height was 9 m above the roof height. The maximum 24-hour mean ground-level PM_{10} concentration was predicted to be 4.4 $\mu g/m^3$ (i.e. in exceedance of the assessment criterion of 2.5 $\mu g/m^3$) and the location of the exceedance was 90 m SW of the stack. The model was re-run for a building height of 7 m and the maximum 24-hour mean ground-level PM_{10} concentration was predicted to be 2.3 $\mu g/m^3$ at a location 160 m SE of the stack (i.e. just below the assessment criterion). The model was then re-run for a building height of 5 m and a footprint of 50 m by 50 m (in the x- and y-directions) and the maximum 24-hour mean ground-level PM_{10} concentration was predicted to be 25 $\mu g/m^3$ at a location 40 m SW of the stack (i.e. well above the assessment criterion). In other words, it is likely that a condition of the permitted activity rule may also need to exclude building footprints that exceed 30 m by 30 m (as well as a height of 5 m), unless it has been demonstrated by means of a dispersion modelling assessment that there will be no adverse air quality effects at or beyond the boundary of the site as a result of the proposed activity.

The results of the dispersion modelling assessment clearly show that building dimension (in particular its width and height) has a significant influence on building downwash (as predicted using the PRIME algorithm)[23] and thus the ground-level concentrations predicted by AERMOD. PDP understands that the PRIME algorithm was developed for buildings with a width-to-height ratio (W/H) of <4.4 and for stack heights that were below the Good Engineering Practice (GEP) stack height.[24] The W/H ratio of a building 30 m wide and 5 m tall is therefore 6 (i.e. above the 'design' ratio of 4.4). Similarly, the W/H ratio of a building 10 m wide and 5 m tall is 2 (i.e. below the 'design' ratio), while the W/H ratio of a building 10 m wide and 7 m tall is 1.4 (i.e. again below the 'design' ratio). Therefore, it is possible that building downwash and the potential ground-level ambient air quality concentrations have been over-predicted by AERMOD for a 30 m by 30 m by 5 m building (in the x-, y- and z-directions). NRC may therefore wish to further test the sensitivity of the dispersion model by undertaking a revised assessment incorporating additional building dimensions and stack configurations, particularly as a maximum 900 m^2 building footprint may well result in a large number of new combustion activities failing to meet the proposed permitted activity criteria and thereby requiring a dispersion modelling assessment or resource consent.

The final sensitivity test involved running the model for a 10 m by 30 m building (in the x- and y-directions) and a building height of 7 m (i.e. a W/H ratio of 1.4), a stack height of 17 m (above ground-level) and an efflux velocity of 10 m/s for PM_{10} emissions from a 0.5 MW coal fired boiler. The stack was positioned 5 m from the northern, eastern and western building edges. After accounting for stack-building base elevation difference, the stack formula height was calculated by the input program for PRIME (Building Profile Input Program or BPIP) to be 18.42 m (i.e. above the actual stack height of 17 m), which is expected to result in less building downwash and better atmospheric dispersion conditions. The maximum 24-hour mean ground-level PM_{10} concentration was predicted to be 2.1 $\mu g/m^3$ at a location 170 m SW of the stack (i.e.

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23 PRIME is an abbreviation for Plume Rise Model Enhancements and was developed by Schulman *et al.* (2000) to incorporate enhanced plume dispersion coefficients due to the turbulent wake and reduced plume rise caused by a combination of the descending streamlines in the lee of the building and the increased entrainment in the wake (building downwash).

24 The GEP stack height is defined as the maximum of 65 m or building height (H) plus 1.5 times the length (L) of the lesser of the height or projected width (which is the 'formula height'), or a height demonstrated from a computation fluid dynamics (CFD) model that does not result in "excessive concentrations" (e.g. >40% of the ambient air quality standard at ground-level). The formula height also accounts for any stack-building base elevation differences. So the GEP formula height for a 5 m building height and a stack-building base elevation difference of -0.92 m would be 13.42 m (i.e. an 18 m stack is above formula height but below 65 m, which has the potential to exacerbate the PRIME building downwash predictions, according to Schulman and Scire (2012).

just below the assessment criterion). Re-running the model for the same scenario (7 m building height) but with a 30 m by 30 m building footprint (i.e. the stack was positioned 5 m from the northern building edge and equidistant from the eastern and western building edges) resulted in a maximum predicted 24-hour mean ground-level PM_{10} concentration of 15.3 µg/m³ at a location 30 m SW of the stack (i.e. above the assessment criterion). Re-running the model again for the same scenario but with a 5 m building height and a 17 m stack height resulted in a maximum predicted 24-hour mean ground-level PM_{10} concentration of 2.0 µg/m³ at a location 160 m SE of the stack (i.e. below the assessment criteria).

3.0 Maximum Boiler Activity Classes and Building Dimensions

The recommended permitted activity boiler activity classes (or thresholds for combustion plant), minimum efflux velocities, minimum stack heights and building dimensions are summarised in Table 1 and are based on the results of the dispersion modelling assessment presented in Section 2.

Table 1: Boiler Activity Classes and Building Dimensions

Fuel Type	Fuel Combustion Threshold (MW)	Minimum Vertical Efflux Velocity (m/s)	Minimum Stack Height Above Ground Level (m)	Maximum Building Height (m)	Maximum Building Footprint (m²)
Coal[1]	0.5	10	18	5	900
Wood[2]	0.5	10	18	5	900
Natural Gas	10	10	17	5	900
LPG	10	10	17	5	900
Diesel / Fuel Oil[3]	0.5	10	16	5	900

Notes:

1. *The SO_2 emission rate was based on a sulphur content of fuel of 1% by weight, and the PM_{10} emission rate was based on an in-stack particulate emission concentration of 250 mg/Nm³ at STP of 0 °C and 1 atmosphere and on a dry gas basis. Stack height based on a building corner location.*
2. *For untreated wood, and based on in-stack PM_{10} emission concentration of 250 mg/Nm³ at STP of 0 °C and 1 atmosphere and on a dry gas basis.*
3. *The SO_2 emission rate was based on a sulphur content of fuel of 0.001% (10 ppm) by weight.*

The permitted activity thresholds suggested in Table 1 are similar to BOPRC's Proposed Plan Change 13:

- Coal, wood and diesel / fuel oil — permitted up to 0.5 MW; and,
- Natural gas / LPG — permitted up to 10 MW.

4.0 Recommendations

Adopting a simpler set of standards similar to those used by other regional councils, such as BOPRC's Proposed Plan Change 13 (PPC13, as notified on 27 February 2018), certainly has its merits and the results of the dispersion modelling assessment presented in Section 2 indicate that there are unlikely to be any adverse air quality effects associated with the criteria proposed in Table 1. The proposed fuel combustion thresholds are largely based on PPC13, except for the proposed minimum stack height and building dimension provisions.

As with the operative Auckland Council Unitary Plan (dated 29 September 2016), PDP suggests that the conditions of the permitted activity criteria should also allow for the potential adverse effects associated with a proposed combustion activity to be assessed by means of a dispersion modelling assessment to demonstrate compliance with the permitted activity criteria if one or more of the criteria are not met (e.g. efflux velocity, stack height or building dimensions), or if the stack is free-standing but is still likely to be wake-affected. If the results of a dispersion modelling assessment has demonstrated that there will be no adverse air quality effects (i.e. an exceedance of the relevant air quality standards) at or beyond the site boundary, the proposed activity could be considered to be a permitted activity providing it meets the other permitted activity criteria (and other relevant rules in the proposed plan). This is assuming that the dispersion modelling assessment has been completed to the NRC's satisfaction and in accordance with MfE (2004)[25], and has incorporated terrain, building downwash effects and local meteorological data.

It is also acknowledged that the proposed permitted activity rule may require an advice note to assist in the interpretation of the building to which the minimum height applies. It would be advisable to consider all buildings (both onsite and offsite) within a 20 m radius of the stack (or based on the calculations from PRIME), and in some situations a boiler may be free-standing and situated on a site where the combustion plant building height is <5 m, but the stack emissions could still be subject to building downwash effects from other onsite or offsite buildings. It would pay to check the other rules in the PRPN to ensure there are no conflicts or contradictions associated with the proposed building height and stack height criteria. The modelling results also indicate that a stack release height of 3 m above a tall building has the potential to result in exceedances of the assessment criteria and therefore this criterion is not recommended.

PDP also suggests that the permitted activity criteria may need to exclude any combustion activities from the permitted activity status if they are located within a 2.5 km radius of complex terrain (unless compliance can be demonstrated by dispersion modelling) in order to avoid potential terrain impingement effects. It is also noted that under certain situations (e.g. complex terrain or coastal setting) it may be more appropriate to use the CALPUFF atmospheric dispersion model than AERMOD.

5.0 Limitations and Assumptions

Unfortunately, due to time constraints, PDP was unable to review the previous NIWA reports which formed the basis of the NIWA (2013) work. Whilst it would have been useful to have undertaken a review of the AUSPLUME modelling undertaken by NIWA in 2012, particularly given the discrepancy between the AERMOD and AUSPLUME model predictions and minimum stack height requirements, the following limitations to PDP's assessment are noted:

- AERMOD (Version 18081) was used in PDP's study, which is the latest version of the dispersion model. It is possible that building downwash effects were overestimated by AERMOD and/or underestimated by AUSPLUME. It is noted that AUSPLUME (Version 5.4) was used by NIWA, however, AUSPLUME Version 6 replaced Version 5.4 in April 2004 and it is not known why this particular version was selected for their study. It is also noted that under Model Change Bulletin #4 (AERMOD Version 11059) dated 28 February 2011, the subroutine 'WAKFLG' was modified to no longer ignore potential downwash effects for stack heights that equal or exceed the EPA formula height—previous policy was to only model downwash effects for stacks less than GEP formula height. For the most part, PDP also used a conservative building shape of 30 m by 30 m, whereas NIWA used a building shape of 10 m by 30 m. It is noted that AUSPLUME (Version 6) contained four different building downwash options: PRIME, Schulman-Scire, Huber-Snyder and Hybrid Schulman-Scire/Huber-Snyder, whereas AERMOD (Version 18081) only allows for PRIME.
- PDP assumed a conservative PM_{10}: total suspended particulate (TSP) ratio of 1 (i.e. 100%) in deriving the estimated emission rates for input into the dispersion model. It is possible that NIWA used lower emission rates as input into the model (e.g. based on a PM_{10}: TSP ratio of between 70% and 90% depending on boiler type).

[25] MfE, 2004. Good Practice Guide for Atmospheric Dispersion Modelling, Ministry for the Environment (MfE), June 2004.

- PDP also based the PM_{10} emission rates for solid fuel boiler stacks on an in-stack emission concentration of 250 mg/Nm^3 (at STP), whereas it is possible that NIWA used a lower in-stack emission concentration in their assessment. Furthermore, PDP used the US EPA AP-42 emission factors for the remaining fuel types (which are likely to be conservative) and, once again, it is possible that NIWA used lower emission rates in their assessment, which may have been based on actual emission monitoring data as opposed to the AP-42 emission factors. However, given the uncertainties associated with the boiler operating conditions and emission control methods in place at the time of the emission testing, the use of the AP-42 emission factors in PDP's assessment is considered to be justified and allowed for a conservative assessment.
- PDP also predicted the maximum ground-level concentrations for each pollutant for assessment against the same assessment criteria used by NIWA. However, it is not known whether NIWA applied a small buffer distance around the stack (point emission source) in their assessment in which case only the maximum ground-level concentrations beyond the buffer distance may have been reported. However, this would seem unlikely given that the assessment criteria themselves are stringent and take into account the potential for cumulative effects.

6.0 Closing Statement

Thank you for the opportunity to provide air quality technical assistance to NRC relating to the proposed chimney height and permitted activity status provisions in the PRPN. PDP has undertaken a dispersion modelling assessment for combustion emissions from theoretical boilers firing on different fuel types (e.g. coal, untreated wood, natural gas, LPG and diesel/fuel oil). The results of the modelling assessment indicate that it is unlikely that there will be any adverse effects under the proposed permitted activity combustion thresholds and minimum stack heights above ground level (AGL), which are:

- Coal and wood — permitted up to 0.5 MW and a minimum stack height of 18 m AGL;
- Diesel and fuel oil — permitted up to 0.5 MW and a minimum stack height of 16 m AGL; and,
- Natural gas and LPG — permitted up to 10 MW and a minimum stack height of 17 m AGL.

In addition, a minimum vertical efflux velocity of 10 m/s should be achieved at all boiler stacks and the maximum building heights and dimensions should be 5 m and 900 m^2, respectively. It is acknowledged that building downwash may have been overestimated, which may have led to higher minimum stack heights being recommended in this report. However, this will allow for a more conservative approach to be taken by NRC in its review of the submissions from Fonterra and the BANZ, and the actual ground-level concentrations downwind of a 'permitted' boiler may be slightly lower than those presented in this report.

If NRC considers that the proposed maximum building height and footprint criteria are too onerous to be adopted into the PRPN, a revised additional dispersion modelling assessment could be undertaken to determine the minimum stack heights for each boiler size and fuel type. However, this is likely to result in higher minimum stack heights than those recommended in this report (unless overly wide buildings are ignored due to their potential to overestimate building downwash, and if the criteria can incorporate maximum building width-to-height or width-to-length ratio thresholds instead of a maximum building height and footprint).

NRC may also wish to consider adding a condition into the new permitted activity rule to allow any boiler stack (or a boiler up to a certain heat output threshold depending on fuel type) built prior to the date that the PRPN was first notified (6 September 2017) to be 'grandfathered' and exempt from the new rule.

If you require any additional information or if you would like to discuss any aspect of our report, please do not hesitate to contact Doug Boddy on +64 9 529 5858 or +64 21 977 810.

We look forward to hearing from you soon.

Yours faithfully

PATTLE DELAMORE PARTNERS LIMITED

Prepared by

Dr Doug Boddy

Senior Air Quality Scientist

Reviewed and approved by

Dr Steve Pearce

Technical Director

Appendix B – Legal Advice Memo

MEMO

To: James Griffin, Ben Lee & Sophia Clark

From: Karenza de Silva

Date: 5 November 2018

Re: PROPOSED REGIONAL PLAN – RULE C.1.7.7. - MARINE PESTS & BIOFOULING

ISSUES

1. On 2 November 2018, James Griffin asked for advice on Rule C.1.7.7. in the Proposed Regional Plan. I discussed the issues by telecom and email with James and Sophia Clark on 2 and 5 November.

2. The Biosecurity Act 1993 (**BSA**) provides for infringement offences. However, regional councils are not able to issue infringement notices under the BSA because there are currently no regulations in place that allow this. NRC want to use Rule C.1.7.7. to issue infringement notices in relation to marine pests under the RMA.

3. James told me that Rule C.1.7.7. as currently worded is the same highlighted text as clause 2) below. James suggested clause 1) with the BSA exemptions, either to replace or be added to clause 2).

> ***C.1.7.7***
> ***Introduction of marine pests - non-complying activity***
>
> *Any:*
>
> 1) *navigation, mooring or anchoring of a vessel or the relocation or placement of a structure that contains, or is likely to contain any marine pest, or*
> 2) *introduction of any marine pest into coastal waters that is not a discretionary activity under rule C.1.7.5 'In-water vessel hull and niche area cleaning – discretionary activity',*
>
> *that is not authorised or subject to an 'exemption' or a 'notice of direction' under the Biosecurity Act 1993, is a non-complying activity.*
>
> *The RMA activities this rule covers:*
>
> - *Deposit a marine pest, in, on, or under any foreshore or seabed in a manner that has or is likely to have an adverse effect on the foreshore or seabed (s12(1)(d).*
> - *Discharge a marine pest into water (s15(1)(a).*

- *Introduce or plant any marine pest in, on, under or over any foreshore or seabed 12(1)(f) and 12(3)(a).*
- *Introduce a marine pest into coastal waters (s12(3)).*

ADVICE

4. We discussed the word "introduction". I agree with Ben's view that inclusion of the word "introduction" in the Rule will cause difficulties. The dictionary definition of "introduction" includes *"bring (something, …..) into use or operation for the first time*". If the marine pest is already present or likely to be present in the area, then the Rule is not enforceable.

5. It is important that Rule C.1.7.7 is consistent with the Regional Pest and Marine Pathway Management Plan (**P&M PMP**).

6. Sophia referred me to the attached Rules 10.1.1 and 10.1.2 in the P&M PMP which include the following wording:

> *…..*
>
> *Definition: 'Lightfouling' is defined as: small patches (up to 100 millimetres in diameter) of visible fouling, totalling less than five percent of the hull and niche areas. A slime layer and/or any species of barnacles are allowable fouling.*
>
> *A breach of Rules 10.1.1 and 10.1.2 will create an offence under section 154N(19) of the Act. However, if these Rules are breached and the following three criteria are each met, the Council will not prosecute and instead will issue a notice of direction pursuant to s122 of the Act;*
> *1. There is a current Antifouling Declaration for the craft; and*
> *2. The owner or person in charge of the craft provides documents to Council that confirm application of antifouling paint to the craft in accordance with manufacturer's instructions within the preceding 12 months of the date the declaration was made; and*
> *3. Macrofouling or filamentous algae does not exceed 15% of the visible hull surface.*
>
> *Exemptions to rules 10.1.1 and 10.1.2 are listed below……*

7. The term "Light fouling" is defined in the PRP as "*A slime layer, and any extent of barnacles and small patches (up to 100mm in diameter) of visible macrofouling totalling less than 5% of the normally wetted hull and niche areas.*" I note that this definition is not identical to the definition in the P&M PMP. I think the definition in the PRP is clearer than the definition in the P&M PMP. Therefore, I do not think the PRP definition of "Light fouling" should be amended.

8. I will leave James and Ben to discuss with Sophia the correct wording for references in the PRP to the P&M PMP. I note that:
   (a) The title of the P&M PMP is "Regional Pest and Marine Pathway Management Plan".
   (b) The P&M PMP is referred to in the PRP as "Marine Pathway Plan".

(c) The P&M PMP is referred to in my amended wording below as “Marine Pathway Management Plan for Northland”.

9. My view is that the following amended wording (drafted with input from Sophia and James) for Rule C.1.7.7 is enforceable and is consistent with the P&M PMP.

C.1.7.7

Marine pests and biofouling - non-complying activity

Any:

1) vessel or moveable structure with a marine pest present; or
2) vessel or structure: entering Northland; or moving from one designated 'place' and entering a separate designated 'place' in Northland as prescribed in the Marine Pathway Management Plan for Northland (*ref maps)*, that has biofouling, exceeding “light fouling”, or
3) activity that is not a discretionary activity under rule C.1.7.5 ‘In-water vessel hull and niche area cleaning – discretionary activity’,

that is not authorised under the Resource Management Act 1991 or the Biosecurity Act 1993, is a non-complying activity.

Note: The Marine Pathway Management Plan for Northland limits biofouling to light fouling on vessels entering Northland or moving between Marine Pathway Plan designated ‘places’, unless authorised by an exemption under the Biosecurity Act 1993.

The RMA activities this rule covers:

- Deposit a marine pest, in, on, or under any foreshore or seabed in a manner that has or is likely to have an adverse effect on the foreshore or seabed (s12(1)(d)).
- Introduce or plant any marine pest in, on, or under any foreshore or seabed 12(1)(f).
- Bring a marine pest into any coastal marine area (s12(3)).
- Discharge a marine pest into water (s15(1)(a)).

Appendix C – Federated Farmers letter

FEDERATED FARMERS
OF NEW ZEALAND

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Dear Ben,

Thank you for your phone call regarding the inclusion of Farm Environment Plans ("FEPs") in the Northland Region Proposed Regional Plan ('PRP').

<u>Inclusion of FEPs in Regional Plans</u>
Federated Farmers supports the idea of FEPs in principle as a means of promoting the use good management practices ('GMP') on farms. However, our experience in other regions makes us wary of supporting the inclusion of compulsory FEPs in the PRP.

Like Farm Plans (which were their precursors), FEPs potentially enable farm-specific planning in a way that reflects farm practice and type. No two farms are alike. For an FEP to be effective, it needs to have clear and robust mechanisms in place to accommodate changes in farming practice. What farmers think they will do at the start of the year/season could change multiple times as a result of weather disruptions, market shifts, or other factors that require farmers to adapt and quickly change plans. There needs to be a scope for various pathways in which changes can be accommodated, that reflects farm type, soil, location, topography, climate and farming system.

Furthermore, FEPs may be particularly useful if they're targeted towards critical source areas of diffuse discharge contaminants or nutrients (including from intensive farming activities). In this regard, FEPs would be more effective if their subject matter were limited in scope so that they do not crossover with Permitted Activities ('PA').

We do not support *farming by consent*. There are many aspects of farm development and use that can be permitted without a significant risk of adverse effects on the environment, such as: farm buildings, vehicle access tracks, fencing, provision of stock drinking water, pasture management, fodder cropping, vegetation trimming, minor earthworks such as farm quarries etc. The environmental effects of these can all be managed by way of suitable PA conditions specified in the regional plan. Subjecting such activities to a whole-of-farm FEP is not warranted.

Consultation
We would be far more comfortable with FEPs being included through a separate plan change process, rather than as a result of submissions on the PRP. FEPs are a fundamental change in direction from the notified version of the PRP, such that further consultation with landowners is needed. We do not consider that the PRP as notified gives the Council scope to introduce FEPs as a result of matters raised in submissions. The issues surrounding FEPs are too complex to be incorporated into the PRP in this way.

We think the standards in the PA rules and catchment plans for the PRP (in particular, around erosion control, stock exclusion and cultivation setbacks) have not been drafted with individual (or collective catchment) FEPs in mind. If FEPs were to feature in the PRP, we would expect the PA rules relating to those same aspects of activities to have been drafted so that they truly reflect an FEP regime. A robust plan preparation process is needed to ensure effective regulatory outcomes and integration with the regulatory methods throughout the PRP.

Collective FEPs
We find the idea of collective FEPs appealing. These are being discussed in other regions where we are involved in regional plan preparation processes. Collective FEPs are potentially better suited to being targeted to address priority catchment-management issues, where there may be a specific nutrient, sediment or pathogen problem.

Collective FEPs can be tailored to better suit the scale and characteristics of the receiving environment for the catchment in question, rather than being focused on individual farm properties that might not reflect a suitable frame of reference for management. This concept fits with our preferred policy approach (expressed in our submission on the Waikato regional Plan Variation 1) for an approach that is effects-based, rather than ownership-based.

An additional advantage, is that FEP collectives can potentially be organised to deliver issue-targeted FEPs in ways that that the farmers within a collective are capable of. This includes an opportunity for groups of farmers to align themselves in order to pool mitigation strategies to tackle a particular issue.

We believe that providing this sort of flexibility would be more appropriate than simply including a generic schedule of minimum FEP requirements. It could also be more cost-effective because instead of being 'whole-of-farm', it would focus on critical source areas/activities. So for example, if e-coli (ruminant) is an issue in a particular catchment, then stock exclusion might be the focus of FEPs in that catchment, whereas if sediment is the issue, the FEPs could look quite different.

We think that this sort of approach would better reflect the intent of the NPS-FM to support a 'bottom-up' planning approach to freshwater where problems are defined and managed by communities of interest according to particular needs. Collective FEPs offer a tool that is more consistent with this intent, as these could encourage farmers/communities to work together to address issues.

Organisational capability to assess FEPs:
In addition, we believe further work is needed to lay the foundations for Council capability to manage the approval of FEPs. Our experience in other regions is that regional councils get overwhelmed in approving massive tranches of FEPs that they get flooded with when these sort of provisions are introduced, with long delays in getting FEPs approved. This is not fair on

FEP applicants, who have to outlay thousands of dollars preparing FEPs. It is unreasonable for applicants to be expected to have to comply, if the consenting authority cannot cope with its own regulatory process it has put in place.

Other regional councils have found that they lack both the resources and knowledge to assist/approve FEPs, and that a larger than anticipated amount of farmers required FEPs (e.g. because of how the rules cascaded). Lengthy implementation delays resulted (e.g. Hawkes Bay, Canterbury).

To help avoid these delays, we recommend that the Council:

- Take time to consider how FEPs should be properly incorporated within the regional plans' resource management framework. Do not rush into this. There are many inter-related and complex issues to consider. The PRP has some great ideas and suggested rules, that just need a bit of tweaking. Don't toss the baby out with the bathwater.
- Consider the use of industry-approved FEP templates (i.e. in order to prevent farmers from wasting time and resources on an FEP that is subsequently considered inappropriate).
- Consider ways in which FEPs could be accepted for PAs without having to get Council approval through a *de facto* consent process (i.e. by allowing FEPs to be signed-off by Council-approved industry associations or experts).
- Use fair and achievable compliance timeframes.
- Avoid duplication and keep costs/hassle low i.e. don't require a separate erosion control plan and FEP as this is a waste of everyone's time.
- Include sensible and necessary reporting requirements. Be specific about what farmers have to do and what the information will be used for.
- Avoid vagueness by defining those aspects that need to be included within the management scope of an FEP in order to address a specific identified catchment problem.

If you have any questions or queries, please feel free to contact me.

Yours faithfully

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