Before the Central Otago District Council

In the matter The Resource Management Act 1991

And **A requested change to the Central Otago District Council's Operative District Plan – Plan Change 14 (PC14)**

Statement of evidence of James Dicey

20 May 2020

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1 Introduction

1.1 My full name is James Dicey.

1.2 I am the owner of Grape Vision Limited, a vineyard development, management, brokerage and consultancy business based in Central Otago. I have been involved in the grape and wine industry since 2004.

1.3 I hold a Bachelor of Commerce (1992) and Bachelor of Law (1993) from Otago University and a Graduate Diploma in Oenology and Viticulture from Lincoln University (2005). A copy of my curriculum vitae is attached to this statement of evidence as **Appendix 1**.

1.4 Originally I qualified as a Chartered Accountant gaining experience with Deloitte in New Zealand, Amsterdam and London, prior to working as an independent contractor. My last contractor role was as a financial and IT risk manager with Diageo plc, a British multinational alcoholic beverages company that produces spirits, beer and wine.

1.5 I joined Grape Vision Ltd as an operations manager in 2004 upon moving back to New Zealand. After gaining a Graduate Diploma in Oenology and Viticulture, I continued to work for Grape Vision Ltd before purchasing the business in 2009.

1.6 Through my work with Grape Vision Ltd I have accumulated extensive experience and expertise in the development of vineyards and the production of grapes grown for both clients and myself. Since 2004, I have managed between 250 and 400 hectares of vineyard land in the Central Otago winegrowing region including the following properties close to the land that is the subject of PC14:

(a) Highlands Motorsport Park vineyard;

(b) Serendipity Vineyard (on Ripponvale Road);

(c) Inket Vineyard (on Pearson Road);

(d) A large number of vineyards in Bannockburn;

(e) Wooing Tree vineyard in Cromwell.

1.7 I have also consulted in other New Zealand wine regions, as well as in South Africa and California. I also consult to the Queenstown Lakes District Council regularly on reverse sensitivity issues caused by property development.

1.8 I have previously appeared as an expert witness during arbitration, at the District Court and in the Environment Court.

1.9 Additionally, I have gained a detailed business and economic understanding of the Central Otago wine industry through owning my own brand (Ceres Wines Limited) and through my role as director of Mt Difficulty Wines Limited, a position I have held since 2004 until the company was sold on 3 January 2019.

1.10 Other positions I have held in the wine industry include:

(a) committee member of the Central Otago Winegrowers Association for over 12 years, including acting as President for over five years;

(b) sitting on the New Zealand Winegrowers Research Committee for four years;

(c) being an elected Director of New Zealand Winegrowers Incorporated, the New Zealand wine industry member body, since 2016 (including deputy chair roles on the Finance and Sustainability committees); and

(d) being a nominated Director of New Zealand Winegrowers Research Centre Limited (since its inception in 2017), a wholly owned subsidiary of New Zealand Winegrowers which instigates and oversees research.

1.11 I am a resident of Cairnmuir Road in Bannockburn. I am not financially affected by PC14. The evidence in this document is presented in my capacity as an expert witness, I have also made submissions on PC14 in my capacity as a resident of the district and these will be presented on verbally at the hearing.

2 Code of conduct for expert witnesses

2.1 While this is not a hearing before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2014 and that I have complied with it when preparing my evidence. Other than when I state I am relying on the advice of another person, this 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 that I express.

2.2 I have acknowledged above that I have made a submission on PC14 in my capacity as a resident, and so to that extent I am not fully independent. However, as a resident, it also means that I have an understanding of the local climate and circumstances that assists me in forming my expert opinions on the issues.

3 Scope of evidence

3.1 Generally, my evidence addresses:

(a) the viticultural attributes of the PC14 site;

(b) the productive potential and viticultural viability of the PC14 site;

(c) economic viability of the PC14 site from a viticultural perspective; and

(d) the potential effects of the Proposal, if consented, on viticultural activities both on the PC14 site itself and on nearby sites.

3.2 I have viewed the site from Ripponvale Road and the wider area, and have also considered various documents that I consider to be relevant to this matter. A full list of the documents I have reviewed and considered are set out at **Appendix 2** to my evidence.

3.3 My evidence is structured as follows:

Part 4: Executive summary

Part 5: The productive potential and viticultural viability of the site

Part 6: Economic viability of the PC14 site from a viticultural perspective

Part 7: Effects of the proposal on the residential properties

4 Executive summary

4.1 My evidence outlines that:

(a) From a viticultural perspective, the PC14 site is productive land. Economic quantities of high quality grapes can be fully ripened on a consistent basis. The climate and soils make the site suitable for wine production and the wines that are produced from these grapes will have a distinctive sense of place and the potential to command international acclaim.

(b) There is sufficient water available to plant 87 hectares of the PC14 site using the same methods applied to water requirements on the NZ Cherry Corp site.

(c) The establishment and operation of a commercial winegrowing operation at the PC14 site is economically viable. Such an operation has the potential to command a price commensurate with the yield/quality tier of the grapes grown.

(d) When solely considered as a contract grape growing vineyard, the majority of yield and price scenarios examined result in a satisfactory Return On Investment (**ROI**). In my opinion, the location of the site lends itself to capturing additional value using successful business models that progress further along the value chain, particularly in relation to the Direct to Consumer and tourist business models.

(e) The Proposal will result in the loss of productive viticultural land. The significance of this is material in the context of the Central Otago Winegrowing region. The PC14 site is a significant one when all the components are properly considered, particularly the size of the site, its proximity a labour source, the access to water, the proximity to the state highway and combination of the correct soils to grow grapes and cherries and climatic conditions.

(f) The Proposal will result in reverse sensitivity effects relating to noise, spray drift, tractor and staff activity. The proposed offsets and amenity plantings as proposed are not sufficient to sufficiently mitigate these.

5 The productive potential and viticultural viability of the PC14 site

5.1 When considering the productive potential and the financial viability of a site it is necessary to assess the suitability of both the soil and the associated climate. Soil by itself is only part of the assessment. For the reasons discussed below, I consider that the climate and soils make the PC14 site a very suitable site for wine production. The PC14 site receives and optimal level of the Growing Degree Days as shown in **Appendix 4**, as well as an optimal

level of rainfall, as shown in **Appendix 5**. When compared to other parts of the Central Otago wine growing region, the frost risk on the site is also reduced due to lower altitude and site topography. The soils at the site are suitable for viticulture and have the potential to achieve full ripeness and create distinctive and high quality wines.

Site visit

5.2 I have viewed the PC14 site over a number of years of growing grapes in the Central Otago winegrowing region. I have also more recently, and specifically, viewed the site from Ripponvale Road, examining it from just outside the boundaries. Based on my visit and my general knowledge of the site, I make the following observations:

(a) The area identified in the PC14 application as the Farmland Basin contains flat to gently sloping land (which I have calculated using Google tools as being an average ~5% slope across the identified area). The so called Farmland Terraces contains gently to moderately sloping lands (with a ~11% slope) and the so called East Gully contained moderately sloping lands (~17% slope). Grapes can easily be grown on land up to 13% slope prior to land modification (such as terracing) needing to be undertaken to enable use as a vineyard.

(b) The site is within what I would classify as a low to moderate katabatic zone (meaning cold air does drain onto the property). The catchment area is not large and there is an unimpeded exit pathway for cold air. This data is presented in **Appendix 15** with the red arrows showing air movement and the black lines delineating the source area for the katabatic flow.

(c) Using Google tools I have estimated that the total plantable area on the site (excluding houses, dams and other buildings) is 105ha. This data is presented in **Appendix 6**. This excludes the land called the East Gully to be conservative in assessing plantable land. I acknowledge that to gain an exact plantable area a detailed site survey and analysis would need to be undertaken. This compares to approximately 94ha that Natalie Hampson calculated in her evidence, so is broadly comparable. I am also aware of different planting areas presented by the applicant. The original application mentions an area of 29ha being designated for the orchard (Request for a change of Operative Central Otago District Plan, page 8 and the figure used by Mr Edwards in his evidence at paragraph 20) as well as 22ha (figure used by

Mr Edwards in paragraph 23 and Mr Larsen at paragraph 32). I have used 22ha as the planted figure in my evidence for sake of clarity.

Accumulated heat

5.3 Accumulated heat is a measure of how much heat a grapevine receives during the growing season (above a baseline of 10°C) and is a key consideration when considering the viticultural viability of a site. Growing Degree Days (**GDD**) is the calculation used to measure accumulated heat.

5.4 There is a GDD range which is optimal for economic yields and ripeness to be achieved. For the varieties grown in the Central Otago winegrowing region, this spans from 750 – 1200 GDD. The plantable area of the PC14 site experiences 901-1000 GDD on the area identified as being productive according to the GrowOtago resource (which interpolates GDD based on climate modelling and mapping techniques). This is right in the optimal zone and is sufficient heat to ripen grapes, and to my understanding, cherries even though they are not as high as other areas in the Central Otago winegrowing region. This data is set out in **Appendix 4** to my evidence.

5.5 No weather station data is available from the PC14 site. However, data from the HarvestNZ data from Bannockburn and Suncrest Orchard (located at the southern end of Ripponvale Road) indicates that the PC14 receives sufficient GDD to properly ripen grapes. The GrowOtago data referred to above is included as **Appendix 4** to my evidence and the HarvestNZ data is included as **Appendix 3**.

5.6 An external data source in regard to sugar ripeness and its relationship to accumulated heat in the PC14 site is the VineFacts 2018 data collected by New Zealand Winegrowers. This data shows that, in the last four years, the VineFacts site in Bannockburn achieved sufficient sugar ripeness (well over the industry standard sugar ripeness rejection standard) to commercially harvest the fruit.

5.7 An additional consideration when considering accumulated heat is the altitude that the vineyard is located at. Within the Central Otago winegrowing region, it has been generally accepted that 400 metres above sea level (**masl**) is the upper limit to successfully ripen grapes and, at between 234-325masl, the PC14 site is below this upper limit.

Rainfall

5.8 Rainfall data from the GrowOtago resource indicates that the PC14 will receive between 451 and 500mm of rain per annum. This is a rainfall equivalent to other areas of the Central Otago wine growing region. I note that this rainfall is typically spread across the year and will require irrigation, like all other grape growing areas of the Central Otago wine growing region.

Frost

5.9 It is widely accepted in the grape growing industry that a frost during the growing season can damage the cell tissue of leaves and fruit, and lead to crop loss. It can also compromise vine performance in the following season. All of the Central Otago winegrowing region is subject to frost risk of varying degrees. While this can be partially mitigated by methods such as site selection, wind machines, helicopters or water, none of these completely eliminate the risk from all frost events.

5.10 In the absence of weather data specific to the PC14 site I rely on my experience of growing grapes on the Wooing Tree and Serendipity vineyards which indicates that the PC14 site should receive adequate frost mitigation from wind machines, which can protect the grapes in a frost as cold as -2°C. The lower area of the PC14 site will, due to its topography, receive more frost events and when they occur they will be deeper and potentially more damaging but the NZ Cherry Corp orchard is even lower and has received adequate protection from the frost protection systems in place on that property. This is due to the katabatic drainage of cooler air during a frost event on the lower areas of the PC14 site.

5.11 The relief of the site does aid frost drainage with the gentle south easterly slope and this applies more to the area to the west which is aided by a steeper slope. It should be noted that the damage Mr Larsen refers to in his analysis of climatic suitability at paragraph 40 of his evidence was an area of Shannon Farm that is currently, to my knowledge, not protected from the impact of a frost.

Vines

5.12 Different grape varieties require different environmental conditions to ripen economic yields. A range of varieties are suitable for growth on the PC14 site. The predominant variety grown in the Central Otago winegrowing region is Pinot Noir, although Pinot Gris, Gewürztraminer, Chardonnay and Riesling should also perform well. It is also apparent to me

that cherries do particularly well in the Ripponvale area due to the unique combination of soil, climate, and availability of water, shelter from winds and access to staff.

5.13 Grapes grown in the Cromwell Basin, Ripponvale area and Bannockburn have achieved numerous national and international gold medals and trophies. The region has firmly established itself internationally as a region that grows great Pinot Noir.

Wind

5.14 During the growing season wind gusts can damage the vine canopy and reduce the speed of ripening. Vineyards which are subject to lower velocity gusts of wind are at less risk of damage to shoots and grapes and are better able to ripen higher yields. Data from the GrowOtago resource suggests the site is subject to a lower average annual maximum wind speed compared to other vineyards in the Central Otago wine growing region. The GrowOtago data referred to above is included as **Appendix 8** to my evidence.

The size of the PC14 site

5.15 Analysis of the New Zealand Winegrowers Vineyard Register Report 2018 indicates that the average size of vineyards in the Central Otago winegrowing region is 8.7 hectares. In my experience larger sites are more economically viable. As such a site the size of PC14 at 105 ha plantable hectares should be more economically viable than similar smaller sites on the market. My experience suggests that an 8 hectare site is more efficient to operate and anything under 4 hectares really starts to add operational cost. Any development of properties less than 2 hectares really should be considered hobby farming and not productive as the costs of production are prohibitive and the returns are unlikely to be positive, unless a unique direct to consumer model (as analysed below) can be created.

5.16 There are efficiency break points in the opposite direction – as properties become larger they become more efficient to farm. My experience in the Central Otago winegrowing region indicates that the first is around 25 planted hectares with another level of efficiency at any planted area bigger than 75 hectares.

Soil

5.17 Soil provides the nutrients and holds the water that grapevines need to grow. Different soils have different physical, biota and chemical characteristics and this variation contributes to differences in the wines that are produced from grapes grown on them. Differences in soil

characteristics contribute to different wine styles and these differences are a valued by growers and makers.

5.18 In my experience the soils of the PC14 site are suitable for viticulture. There are a range of different soils in the Central Otago wine growing region which, in my opinion in combination with the other factors described in this section of my evidence, result in wines with a distinctive character and sense of place. It is a combination of both the yield and this distinctive character which contribute to the value ascribed to grapes grown in Central Otago.

5.19 The soils on the site are described in the GrowOtago resource generally as Annan and Clare soils under the New Zealand Soil Classification. These soils are shown in **Appendix 7**. I also note that different evidence has suggested different soil types – in the evidence of Mr Larsen he notes the presence of Waenga and Ripponvale soil types which I presume he has sourced from the SMap resource. Using the same resource and overlaying my analysis of productive area I also include the Ranfurly soil type. Mr Lynn in his evidence does cite his source as being the SMap resource. Regardless of the mapping source utilised, the soil series noted in this paragraph all have similar characteristics – namely low to moderate water and nutrient holding capability and low to moderate fertility. These characteristics plus the other climatic conditions make them optimal to grow both grapes and cherries on and that is found in the entire Ripponvale Road area.

5.20 I noted that the work undertaken by My Lynn, which was presented in Appendix L of the original application as well as the evidence Ms Hampson presents starting at paragraph 54 of her evidence are the result of a desk based exercise and I note that a formal analysis based on a site visit and Land Use Capability Classification have not been undertaken. I also note that the soil mapping data available in NZ, as referred to in the Land Use Capability Survey Handbook (3rd Edition) is “patchy and varies in age, scale and quality”, and this is supported by Ms Hampson in her evidence at paragraph 54. Reliance on this data to draw conclusions, as he appears to have done regarding whether the soils on the PC14 site are high class soils, is inadequate and may lead to inappropriate conclusions being drawn. I suggest for completeness and accuracy that a site visit be undertaken and a Land Use Classification be undertaken to enable proper analysis to be undertaken by a suitably qualified soil expert.

5.21 I have grown grapes on a number of low to moderate soils in relatively close proximity which experience a similar climate. These include the following vineyards:

(a) Highlands Vineyard

(b) Inket Vineyard

(c) Mansons Farm Vineyard

(d) Wooing Tree Vineyard

(e) Serendipity Vineyard

5.22 From a viticultural perspective the low to moderate vigour soils are valued for their lower water and nutrient holding capacity which enables vigour to be controlled and balance between reproductive and vegetative growth achieved which is a desirable trait when growing quality grapes.

5.23 Currently there is a shortage of viticultural land available on the market and what land has been available is subject to competing rural uses as either cherries and dairy support (depending on sufficient water being available) or urban use as lifestyle blocks.

5.24 In her evidence Ms Hampson goes to some length to analyse the total land available for orchards and vineyards, whilst also identifying the limitations of that analysis based on the potentially poor data on soils as well as acknowledging that she did not take into account all the factors that need to be considered when analysing Highly Productive Land (HPL). Broadly she came to the figure of 94 hectares of HPL on Shannon Farm, where I arrived at 105 hectares, so not materially different.

5.25 Where I differ in my interpretation compared to the analysis prepared by Ms Hampson is the importance of that land in consideration of the overall land available in Central Otago that may be suitable. In my opinion, Ms Hampson has not allocated sufficient weight to the following factors:

(a) The site is a large contiguous property, which leads to operational effectiveness and efficiency

(b) The property is located close to a main highway

(c) There is sufficient access to water for a myriad of uses

(d) The site has a lower wind and frost exposure compared to other properties, as well as a lower altitude

(e) The site is in a very highly sought after area for growing cherries

5.26 Considering these factors and simply comparing the land size based on a desk review which does not take these factors into account, in my opinion, does not properly weight the value of the property. In my opinion this is a significant land resource for orchards and vineyards and as such the loss of this land will be substantial and material. Data contained in Figure 3 of her evidence shows the demand for the land suitable for orchards and vineyards, having grown by 35% between 2001 and 2018. Demand for grasslands by comparison in the Cromwell community has only grown by 5%. Additionally, comparing the land in Ripponvale to all land in the whole of the Otago region and drawing conclusions is specious as there is very little land in Otago that has the right combination of soils, climate, access to water and population to grow cherries or grape vines.

5.27 The document authored by the Agribusiness Group as presented by Ms Hampson in her evidence as Attachment 7 similarly does not account for these factors outlined above and includes land at an altitude (up to 900m) and at a slope of up to 25 percent, which is not feasible, in my opinion to farm so has been excluded both by Ms Hampson and myself. Similarly, the Agribusiness report does not account properly for the ability to access sufficient water, beyond considering the location in regards to aquifers (most of which are over allocated in Central Otago). In my opinion this report has a very minor relevance as a consequence and should be accorded minimal weight.

5.28 The loss of sites such as PC14 will reduce "the primary productive capacity of Otago's existing high class soils to meet the reasonably foreseeable needs of future generations and the avoidance of uses that have the effect of removing those soils or their life-supporting capacity and to remedy or mitigate the adverse effects on the high class soils resource where avoidance is not practicable." (ORC 5.5.2). In my opinion, simply looking at soil classifications and only valuing "high class soils" without considering what can effectively be grown on them in the Central Otago climate will exclude protection from soils which are very suitable for viticulture and orchards. In my experience high quality grapes can be very successfully grown on LUC Class 4-7 soils with few limitations and this is also acknowledged in the Land Use Capability Survey Handbook (3rd Edition).

National Policy Statement on Highly Productive Land (NPS-HPL)

5.29 Although the NPS-HPL is not yet finalised or gazetted (so has no statutory weight), Ms Hampson in her evidence used the proposed NPS-HPL to analyse the relationship between HPL and the LUC classes. I think it is useful to understand the rationale and purpose of the NPS-HPL and consider its impact on PC14.

5.30 The NPS-HPL has been proposed as a consequence of the *Our Land 2018* report from the Ministry for the Environment and Statistics NZ, which identified that HPL is facing two main pressures on the edge of towns:

(a) Expansion of urban areas on the fringes of urban areas, and the accompanying loss of productive land

(b) Change of land use on the fringes of urban areas, in particular the increase of lifestyle blocks.

5.31 The RMA provides the regulatory framework to sustainably manage the use of land, soil, fresh water and the coastal marine area, but there is a lack of clarity on how highly productive land should be managed, with more weight generally being given to the value of other matters and priorities. The absence of considered decision making is contributing to urban expansion over, and fragmentation of, highly productive land when alternative locations and approaches may be available. This is precluding the best use of this finite resource for primary production for the benefit of New Zealand and future generations.

5.32 The NPS has three key objectives:

(a) Recognising the benefits of HPL;

(b) Maintaining the availability of HPL; and

(c) Protecting from inappropriate subdivision, use and development.

5.33 The implications of the first two objectives are obvious whilst the third is subject to additional clarification. It will be achieved by:

(a) Avoiding subdivision and land fragmentation that compromises the use of HPL for primary production

(b) Avoiding uncoordinated urban expansion on HPL that has not been subject to a strategic planning process; and

(c) Avoiding and mitigating reverse sensitivity effects from sensitive and incompatible activities within and adjacent to HPL.

5.34 Criteria to identify HPL have also been identified and include:

(a) Capability and versatility of the land to support primary production based on the LUC classification system,

(b) The suitability of the climate for primary production, particularly crop production; and

(c) The size and cohesiveness of the area of land to support primary production.

5.35 Factors to consider include:

(a) The current or potential availability of water;

(b) Access to transport routes;

(c) Access to appropriate labour markets;

(d) Supporting rural processing facilities and infrastructure;

(e) The current land cover and use and the environmental, economic, social and cultural benefits it provides; and

(f) Water quality issues or constraints that may limit the use of the land for primary production.

5.36 It is also noted that HPL excludes urban areas and areas that have been identified as future urban zones in district plans. The Masterplan exercise recently undertaken by the Cromwell Community Board has not identified the PC14 land as a future urban zone, explicitly the opposite as it has been identified as rural. Additionally, for the factors I articulate in this evidence, it is my opinion that the PC14 land, once the process outlined in the proposed NPS-HPL was followed, would be considered to be HPL and be subject to additional protections. In opinion proposed subdivision of the PC14 land would be considered an inappropriate subdivision.

Irrigation

5.37 As noted above the free draining soils are valued in growing grapes and also for orchards, including cherries. I have also noted that Central Otago also has a low annual rainfall, which reduces disease pressure and enhances the ability for a grower to control vigour and balance vegetative and reproductive growth. However, to ensure appropriate growth sufficient water for irrigation is required to supplement the natural rainfall. Based on my experience for vineyards this needs to be at a rate of 25,000 litres per planted hectare per day. From discussions with local cherry growers this needs to be 60,000 litres per planted hectare per day.

5.38 According to my calculations (contained at **Appendix 16**) there is sufficient water available from the bore located on Shannon Farm and the water available from the Ripponvale Irrigation Company Limited (**RIC**) for 87 planted hectares of cherries. This uses the same ratio of planted hectares to allocated water as the NZ Cherry Corp blocks of 87.5% (calculated on 28 planted hectares on a 32 hectare allocation). It would also require the development of a sufficiently sized dam to act as a buffer, in exactly the same way the NZ Cherry Corp has undertaken.

5.39 Mr Larsen in his evidence dated 13 May 2020 states at paragraph 24 that "*NZ Cherry Corp traditionally has had sufficient availability of water from the RIC*". He then goes on to state at paragraph 39(b) that the proposed 22ha orchard extension would be able to "*source its water supply from the existing groundwater permit*" and refers to advice received from independent experts (namely a local irrigation company known as Waterforce) as the source of this information. Unfortunately this information has not been provided so it can't be analysed for accuracy or completeness, nor can we understand the parameters that Waterforce worked to. He goes on to state in paragraph 39(e) they need to have "*a 'back up', contingency supply of irrigation water to ensure we can reliably service a significantly enlarged orchard operation*". Mr Larsen appears to contradict himself in his own evidence – on one hand that their existing blocks have sufficient water but for the new blocks they only have enough for 22 hectares of additional plantings and want to retain the additional water as a backup. Given the financial returns Mr Edwards has presented in his evidence to possible from fully utilise all the water resource available appears to me to be specious and self-serving to support the maximum planted area and not backed up either by data or by their current established practise.

5.40 Mr Larsen also states in paragraph 39(e) "*you would never increase the size of an enlarging orchard to its absolute legal limit of irrigation water take*". I have used the ratio that the NZ Cherry Corp has been using when I calculated the hectares that could be planted on the same basis as they have already done.

5.41 Mr Larsen also goes on to state that the irrigation water will be used for both irrigation and frost fighting in paragraph 39(b) and also in paragraph 26 (2) where he appears to be suggesting the use of mini-sprinklers. However, in paragraph 24 and 35 (a) he states that frost protection would be achieved through installation of a frost fans. If mini-sprinklers are used then there will be a need for a correctly proportioned dam to enable them to be used for frost fighting, exactly the same as is currently done on the existing NZ Cherry Corp orchards. The presence of the dam will, in my opinion, provide the reliability of water supply that Mr Larsen appears to be seeking.

5.42 If it is accepted that there is additional water available to support planting of cherries then the evidence of both Mr Edwards at paragraph 11(a), 29, 36 and 37 of his main evidence and paragraph 32 of Appendix 1 of his evidence and Ms Hampson (particularly paragraphs 71, 81 and 85 of her evidence) needs to be re-evaluated in this context and the additional economic benefit of expanding the plantings needs to evaluated. Using the numbers Mr Edwards presents in his evidence in paragraph 25 an additional EBITDA of $88,862/ha per annum is achieved which is an additional positive benefit of $5,776,030 per annum (being 87 plantable hectares less the 22 hectares already accounted for by Mr Edwards, or 65 hectares). This is an additional increase of 2018% compared to Mr Edwards calculated 1031%.

5.43 To ensure the full value of the property can be considered, alternate land used such as viticulture should be considered. Vineyards require 25,000 litres per hectare per day for irrigation water in the Central Otago winegrowing region. Using the same calculation I have arrived at a figure of 150.2 hectares that could be planted in grapes, which would utilise more of the land than is available for planting (being 105ha according to my estimate). This calculation is presented at **Appendix 16**. A mixed model could be considered to ensure that all the land is optimally used to generate the most positive return. The economics of viticulture are considered in the next section.

6 Economic viability of the PC14 site from a viticultural perspective

6.1 It is my opinion that, from a viticultural perspective, the PC14 site is economically viable. It has the potential to grow high quality, fully ripe grapes at sufficient yields and will be able to command a price commensurate with the yield/quality tier the site will be able to generate. When solely considered as a contract grape growing site, the majority of yield and price scenarios I have experience with generate in a positive ROI. The location of the site on Ripponvale Road close to State Highway 6 lends itself to capturing additional value using successful business models that progress further along the value chain, particularly in relation to the Direct To Consumer (**DTC**) and tourist business models through vertical integration. In my opinion, the site also has the potential to generate a positive capital gain.

Vineyard Models

6.2 Commercial vineyards have been located in the Central Otago wine growing region since the early 1980s when Alan Brady planted his vineyard in the Gibbston. Almost from the start of viticulture in the Central Otago wine growing region, different business models have been adopted to generate an economic return. To conclusively assess whether a site is economically viable from a viticultural perspective each model should be considered. Other considerations of economic value includes understanding the ROI that can be generated from business models which travel further down the value chain, as this has can generate significantly better returns.

6.3 The arrival of Covid-19 has caused significant economic interruption as a consequence of the lockdown and the consequent partial shut-down of the New Zealand economy. The global economy has similarly been affected, to differing degrees, based on the different approaches countries are taking. The analysis in this evidence is based on a long term economic view which includes the effects of an economic downturn. I have grown grapes, made and sold wine through the Global Financial Crisis as well as during economic booms. I have modified the economic models to take a conservative position to reflect the impact that Covid-19 could have. However, until the effects of Covid-19 actually play out and the long term "new reality" becomes apparent, there is uncertainty in the modelling presented.

6.4 Broadly, business models in the Central Otago wine growing district have broadly included:

(a) Contract grape growing;

(b) Vineyard lease;

(c) Bulk wine;

(d) Wines sold direct or via a distributor to the trade;

(e) Wines sold direct to the consumer; and

(f) Tourism and other activities leveraged off the wine business (bike rental, cheese stores, restaurants, vineyard accommodation etc).

6.5 The vast majority of vineyards are winery owned (although I am not sure of the exact percentage). This demonstrates that across the whole of the Central Otago winegrowing region, pursuit of additional value is key and the pure contract growing model should not be the only manner in which the economic value of viticulture should be assessed.

6.6 I note that there are many combinations of these business models in the Central Otago wine growing region but, for the purposes of my evidence, focus on each of the main models.

Contract Grape Growing

6.7 Contract grape growing is growing grapes for sale to generate a profit from the vineyard. The economics of this business model are driven by the combination of vineyard productivity, price and the cost of production to calculate profitability.

6.8 In my opinion, the site has attributes that are equal to, or superior than, other Central Otago vineyards when solely considered as a contract growing vineyard. Specifically, these attributes include higher GDD, lower rainfall, equal or reduced frost risk, suitable soil, lower average annual maximum wind speed, the ability to be planted with modern clonal material and sufficient size when compared to most other Central Otago vineyards. As a result, the site has the opportunity to generate a positive ROI as a contract growing vineyard.

Vineyard Productivity in the Central Otago wine growing region

6.9 Based on my experience from growing grapes in the Central Otago wine growing region on a range of sites, the following quality and yield tiers apply to the Central Otago wine growing region:

Quality Tier	Cromwell Basin Yield Range
Value (RRP $25-$30/btl)	7-8t/ha (Avg 7.5)
Premium (RRP $35-$45/btl)	5.5-6.5t/ha (Avg 6)
Icon (RRP $65+/btl)	3.5-4.5t/ha (Avg 4)

Pricing

6.10 There is a direct relationship between yield, quality and the prices the grapes command. Different quality grapes are priced at different levels that reflect their quality.

6.11 Demand for Central Otago grapes is currently strong. As part of my business I regularly field requests for grape purchases and in the 2018-19 season had well over 400t of opportunities for purchase of Pinot noir that I was unable to fulfil from all sub-regions. The same occurred, although to a more muted level due to the Covid-19 pandemic, in the 2019-20 season.

6.12 Major global companies such as Constellation Brands, Treasury Wine Estates and Louis Vuitton Moët Hennessy have purchased or developed vineyards in the Central Otago winegrowing region to ensure they can secure continued supply of grapes.

6.13 Demand growth is also shown when the trend in average price for grapes is examined, including a rising premium for Central Otago compared to the NZ price for Pinot Noir. In my opinion, given its attributes, it is reasonable to assume that the site will be used to grow Premium quality fruit.

6.14 Data from New Zealand Winegrowers is available in $50 price increments (as set out in **Appendix 10** to my evidence) which reflects the pricing typically used in Central Otago. These data shows the stretch around the median price and tiered pricing. This trend continued during the 2019-20 season. Additionally, in my experience in recent years, spot priced fruit on the open market has been significantly higher than the average price with most recent pricing being in the ranges outlined below:

Quality Tier	Price Range
Value (RRP $25-30/btl)	$3,650 – $3,850 (Avg $3,750)
Premium (RRP $35-45/btl)	$3,850 – $4,250 (Avg $4050)
Icon (RRP $65+/btl)	$4250+

6.15 During the period post the Global Financial Crisis these values dropped considerably for a period of time and to be conservative I would use the lower end of the pricing to reflect the new reality of grape pricing for the foreseeable future.

6.16 The following income matrix shows the full range of potential revenue per hectare using different fruit quality, taking into account a range of yields and pricing. This income range can then be compared to costs of production to gain an understanding of potential profit:

		Pricing		
		Value	Premium	Icon
Yield		3750	4050	4250
Lower	4	15000	16200	17000
Average	6	22500	24300	25500
Upper	7.5	28125	30375	31875

Profitability

6.17 The price per hectare to grow the grapes in the in Central Otago (called the Costs of Goods Sold or COGS) also has a range. Comparing the COGS to revenue results in the following per hectare profitability matrix:

	COGS	Profitability		
Lower	15500	-500	700	1500
		7000	8800	10000
		12625	14875	16375
Middle	16700	-1700	-500	300
		5800	7600	8800
		11425	13675	15175
Upper	21000	-6000	-4800	-4000
		1500	3300	4500
		7125	9375	10875

6.18 In summary, the above analysis shows that a range of returns are possible and that it is possible to cover the costs of production and other off-vineyard costs. This will provide a positive return in ~78% of the scenarios considered and, in my opinion, is an acceptable ROI.

Again, to account for Covid-19 I would suggest the lower end of the scenario analysis should be used to be conservative – this however, still generates a positive result when costs are more controlled.

Capital gain as a method of calculating return on investment

6.19 Another dimension of ROI is the likely capital gain that will be achieved by redeveloping the vineyard. Developed and producing grafted vineyards are valued between $185,000 and $220,000 per hectare. At the more modest range this equates to a capital gain of between 31% and 146% based on the data and calculation contained in **Appendix 9**. Again, I suggest that the lower gains be used to account for the short to medium impact of Covid-19.

Vineyard lease

6.20 A vineyard lease is an alternate contract grape growing business model. It effectively transfers control and most of the risk to the lessee. In exchange, a lower return to the lessor is offered. Leases typically generate returns of between 2-4% of capital value and I am aware of a number of vineyard leases in the Central Otago wine region which are generating this range of return. This is a relatively risk free option for generating returns and would still enable the lessor to benefit from capital gain.

Bulk wine

6.21 This model looks at making the grapes into bulk wine which is then sold. In my experience, there is currently strong demand for Central Otago bulk wine. I have developed a scenario for the PC14 site to test the economic viability of bulk wine sales for a planted area close to 29ha. This scenario is set out in **Appendix 11** to my evidence. Analysis of the scenario shows selling grapes from the PC14 site as bulk wine would be likely to achieve around an 8% return.

6.22 I also note that the pricing for wine making in the model is based on the assumption that a winery is built on the PC14 site. However, if this does not occur, the wine making price would increase from $2.50 a litre to $3.20 a litre (which is the current commercial cost of wine making on contract). Running the scenario on this basis would drop the return to 0.6% which is an unacceptably low return and demonstrates the value of building a winery on the PC14 site.

Wines sold direct using a sales manager or via a distributor to the trade

6.23 The majority of wineries in the Central Otago wine growing region include a component of the business model where branded bottled wine is sold directly to the wine trade directly (**direct sale**) by an employed sales manager or via a distributor (**distributor model**).

6.24 I have developed two scenarios for the PC14 site to test the economic viability of wine sold in this manner. The scenarios and my calculations are set out in **Appendices 12** and **13** to my evidence. The scenarios presented show all the wine produced at the PC14 site in one year sold direct to trade customers either by an employed sales manager or via a distributor. The models that I have produced exclude indirect overhead costs (administration, tax, depreciation, debt servicing, rates, accountancy fees etc) but in my opinion do include all likely direct costs.

6.25 From the models that I have developed, I consider that the estimated returns for direct sales from the site could range significantly from 35% for distributor to 51% for a direct to trade model (or 32% for distributor to 48% for a direct to trade model if no winery building is constructed on site, which I estimate to increase winemaking costs to $3.20 a litre). The returns in these models is commensurate with my direct experience with other wine businesses. Performing a break even analysis, yields would need to drop to below 2t/ha before this business model became uneconomic.

Wines sold direct to the consumer

6.26 The DTC model is viewed in the wine industry as the optimal business model due to its profitability, and is typically predicated on access to a large number of visitors via a cellar door. The 2017 Deloitte Wine industry benchmarks and insights report specifically noted that the Central Otago winegrowing region contains an almost equal number of wineries and cellar doors as Marlborough, despite only producing ~2% of the national production of grapes (compared to Marlborough's ~79% of production).

6.27 I have developed the scenario at **Appendix 14** to my evidence, which assumes 100% sales to consumers and 3.5 Full Time Equivalent staff to host and prepare platter food to enable an on premise license. Food is assumed to be zero margin so is excluded from calculations. This model shows a very healthy return on investment of 65% (or 64% if the wine is made on contract for $3.20 a litre and the building is only used as a cellar door). A breakeven analysis using this model indicates that yields would need to drop to below 1t/ha before becoming

uneconomic. The model also excludes ongoing direct sales from customer data collected at the cellar door, website sales, merchandise sales, private cellar door tastings, wine clubs etc which can contribute significantly to profitability.

6.28 A number of the brands in the Central Otago winegrowing region have established cellar door operations in the Central Otago win growing specifically for the purpose of DTC sales. Until New Zealand is open again for global tourists a more conservative view should be taken of the returns – although it should be noted that from the data I have been able to access a significant proportion (>60%) of visitors to the region are New Zealand or Australian based so this model should not be rejected.

6.29 Given the potential returns projected by the analysis presented I question the conclusion Mr Larsen arrives at in paragraph 50 of his evidence that other summerfruit developments are marginal and do not delivery sufficient return on investment. I also question the conclusion Mr Edwards reaches that cherry orchards are the most economically viable use in this location (paragraph 50(d) of his evidence). I have demonstrated that grape will deliver equivalent and more consistent returns than cherries and should also be considered, particularly given they have a much lower water requirement compared to cherries.

Tourism and other activities leveraged off the wine business (functions, bike rental, local produce, restaurants, vineyard accommodation, etc)

6.30 Other activities can be vertically integrated from the winery/tasting room and this provides an opportunity to generate additional profit. For example, bike park (Gibbston Valley), Restaurant (Gibbston Valley, Waitiri Creek), functions (Peregrine, Gibbston Valley, Waitiri Creek, Winehouse), brewery (Waitiri Creek), local produce (Gibbston Valley), vineyard accommodation (Peregrine, Kinross), wine cave (Gibbston Valley), pub (Rockburn).

7 Effects of the proposal on the residential sections

7.1 This section of my evidence addresses the reverse sensitivity effects on the proposed residential activities from the orcharding activities. The reverse sensitivity issues with vineyards and orchards are materially the same, so I believe that I am qualified to express my expert opinion. I have also confirmed with orchard owners statements I have made in this section. My evidence addresses reverse sensitivity issues relating to spray drift and noise from the proposed orchard to the residential properties. For the reasons listed below, I am of the opinion that locating residential properties contiguous to an operating orchard will

result in reverse sensitivity effects that will not be easily mitigated against without appropriate buffer zones and planting a shelter belt prior to development commencing.

Spray drift

7.2 In my experience, the placement of residential activities proposed by PC14 in close proximity to an operational orchard is likely to result in reverse sensitivity effects. The most significant of these is related to spray drift. Spraying agrichemicals is an activity regularly performed during the year to effectively prevent or eradicate diseases in orchards and vineyards. Agrichemicals are discharged to air and are a permitted activity under the Otago Regional Council Air Plan (16.3.9.2), providing:

(a) The agrichemical and any associated additive are authorised for use in New Zealand and are used in accordance with the authorisation; and

(b) The discharge is carried out in accordance with the manufacturer's directions; and

(c) The discharge does not exceed the quantity, concentration or rate required for the intended purpose; and

(d) The application does not result in any ambient concentrations of contaminants at or beyond the boundary of the property that have noxious or dangerous effects.

7.3 The management of effects of spray drift in the Otago Regional Council Air Plan is based on NZS 8409:2004 Management of Agrichemicals (the **Standard**). The Standard sets out the practical and specific guidance on the safe, responsible and effective management of agrichemicals. Conforming to this standard may also satisfy the requirements of the Resource Management Act and the requirements of the Otago Regional Council Air Plan. Section 5 of the Standard outlines the requirements and guidelines for the application of the relevant fungicides.

7.4 Suppliers and users are required to manage any risks associated with the use of Fungicides. Responsibilities depend on the user category (supplier or user) and the hazards associated with the agrichemical being used. The Standard sets out several responsibilities for the user, which include:

(a) Obtaining from the supplier all information necessary to enable safe use of the product;

(b) Taking note of the information provided and taking appropriate action to manage risks;

(c) Suitable procedures to ensure adequate notification of the intention to undertake agrichemical application where that is required;

(d) Proper procedures and contingency plans to handle adverse events;

(e) Proper storage, documentation, mixing, application equipment, and disposal;

(f) Decisions on the continuation or cessation of field operations (for example, if there is exposure to persons not involved in the operation or spray drift outside the target area);

(g) Compliance with all relevant local authority plans.

7.5 The Standard states that in all cases the person applying agrichemicals must be appropriately qualified and familiar with the requirements of the Standard and any relevant local authority air plan. In terms of managing off site effects, the Standard provides for the notification of anybody who is likely to be directly affected by the application of agrichemicals, and for the minimisation (but not elimination) of spray drift. The intent is to minimise harm, which is the standard adopted by the ORC Air Plan.

Notification

7.6 Anybody who is likely to be directly affected by the application of agrichemicals has a right to the information about the operation. The Standard provides for the provision of an Agrichemical Spray Plan on at least an annual basis. Prior notification should be given where applied next to dwellings.

7.7 In my opinion this requirement will become an onerous and ultimately impractical and unachievable requirement with a high number of residential neighbours. Given the vagaries of weather in Central Otago, particularly in relation to wind, a significant degree of flexibility is required to enable timely application of agrichemicals – this may involve starting at early hours (including in the hours of darkness) where notification is not practical or amending the spray timing to take advantage of calm weather. With the number of residential properties proposed on the PC14 site, the notification requirement will compromise the ability to effectively farm the orchard as complete notification of all residential properties will be unable to be effectively and efficiently completed in a reasonable time.

Spray Drift

7.8 Spray drift can occur as either primary drift (movement of spray as fine droplets directly from the application equipment) or as secondary drift (movement of spray contaminated

dust, soil or sand particles and movement of spray as vapour). The applicator is responsible for primary drift because it occurs at the time of spraying and the means of minimising primary drift are largely within control of the applicator. The applicators must identify sensitive areas (which includes residential properties) and the spray plan must identify measures to be taken to avoid the drift hazard.

7.9 Hazardous substances in New Zealand are grouped into nine classes depending on their hazardous property (which can be more than one). Class 6 substances are toxic to people and Class 9 substances are toxic to the environment. I have been in contact with a local orchard owner of the neighbouring orchard and the following chemicals are permitted to be used that have class 6 or class 9 ratings:

Chemical trade name	Purpose	Class
Alto	Fungicide	6.4A, 6.8A, 6.9B, 9.1A, 9.3C
Botran	Fungicide	6.1D, 6.4A, 6.9B, 9.1A, 9.3C
Apollo	Miticide	6.9B, 9.3C
Bravo	Fungicide	6.1B, 6.3B, 6.4A, 6.5B, 6.7B, 6.9A, 9.1A, 9.2B, 9.3B
Chorus	Fungicide	6.1E, 6.9B, 9.1A
Copper	Fungicide	6.1D, 6.4A, 6.5B, 6.9B, 9.1A, 9.3C
Folicur	Fungicide	6.4A, 6.9A, 9.1A
Pyrinex	Insecticide	6.1C, 6.3A, 6.4A, 6.8B, 6.9A, 9.1A, 9.2B, 9.3A, 9.4A
Malathian	Insecticide	6.1D, 6.3B, 6.4A, 6.8B, 6.9A, 9.1A, 9.3B, 9.4A
Mavrik	Insecticide	6.1D, 6.9B, 9.1A, 9.3C
Megastar	Fungicide	6.1D, 6.3B, 6.4A, 6.7B, 6.8A, 6.9A, 9.1C, 9.3C
Mit E Mec	Miticide	6.1E, 6.3B, 6.4A, 9.1A, 9.2C, 9.3C, 9.4B
Mizar	Fungicide	6.1D, 6.4A, 6.5B, 6.9B, 9.1A, 9.3C
Octave	Fungicide	6.1E, 6.4A, 6.9B, 9.1A, 9.3C
Omite	Miticide	6.1D, 6.4A, 6,7B, 6.1E
Captan	Fungicide	6.3B, 6.5B, 6.7B, 9.1A
Pirimor	Aphidicide	6.1C, 6.1D, 6.3B, 6.4A, 6.9B, 9.1A, 9.3A, 9.4B
Pristine	Fungicide	6.1D, 6.9B, 9.1A
Protek	Fungicide	6.5B, 6.6A, 6.8A, 6.9B, 9.1A, 9.2B
Rovral	Fungicide	6.9B, 9.1A
Saprol	Fungicide	6.1E, 6.3A, 6.4A, 6.8A, 6.9A. 9.1D, 9.3C
Score	Fungicide	6.1E, 6.3A, 6.4A, 6.8A, 6.9B, 9.1A
Sevin Flo	Insecticide	6.1C, 6.7B, 6.9B, 9.1A, 9.2B, 9.3B, 9.4A
Sumisclex	Fungicide	6.8A, 6.9A, 9.1A
Thiram	Fungicide	6.1B, 6.1C, 6.4A, 6.5B, 6.9B, 9.1A, 9.3B
Topsin	Fungicide	6.1D, 6.5B, 6.6B, 9.1A, 9.2B

7.10 The codes used in the table have the following meanings:

Class	Explanation
6.1B	May be fatal if inhaled

6.1C	Toxic if swallowed
6.1D	Harmful - may be harmful if swallowed, inhaled or absorbed through the skin
6.1E	May be harmful if swallowed, inhaled or absorbed through the skin
6.1D	Acute Toxicity (Oral)
6.3A	May cause skin irritation
6.3B	May cause skin irritation
6.4A	Eye Irritation
6.5B	May cause sensitisation from prolonged skin contact
6.6A	Toxic - may cause genetic defects
6.7B	May cause cancer
6.8A	May damage fertility or the unborn child
6.8B	Harmful - may cause reproductive/development damage from repeated oral exposure
6.9A	May cause kidney damage from repeated oral exposure at high doses
6.9B	Specific Target Organ Toxicity
9.1A	Very toxic to aquatic organisms
9.2B	Toxic to the soil environment
9.3A	Substances that are very ecotoxic to terrestrial vertebrates
9.3B	Toxic to terrestrial vertebrates [birds]
9.3C	Ecotoxic to terrestrial vertebrates
9.4A	Toxic to bees

7.11 It should be noted that the level risk is at its highest with the concentrated agrichemical. When sprayed on to the orchard it will be diluted with water and the risk will be lower. These agrichemicals are sprayed regularly (>15 times per year) through the year (both during the growing season and during dormancy depending on the type of agrichemical). The users will have appropriate personal protection equipment when handling the concentrated agrichemicals and when they spray they will be in an air conditioned tractor which has activated charcoal filters to remove any chemicals from the air they are breathing, or use a spray suit with an activated charcoal respirator. Residents who may be affected by spray drift will have no protection so although the risk is lower repeated doses without protection presents significant risk.

7.12 The Standard includes Table G1 that summarises the main factors which assist in determining whether spray drift will be a high or low hazard. The Standard is based on risk management principles where agrichemical users are responsible for managing the risks associated with that use. Spray drift will always result whenever spraying occurs, even if such spraying is being conducted in compliance with the relevant Standards and rules. The question is therefore whether there will be any adverse effects from that spray drift. Table G1 from the Standard is included below:

Table G1 – Drift hazard guidance chart

Potential drift hazard scale			
Factor	**High hazard**	**Low hazard**	**Comment**
Wind speed	Zero/very low (less than 1 m/s) or greater than 6 m/s	Steady (1 – 3 m/s)	Measure or estimate using smoke
Wind direction	Unpredictable	Predictable, and away from sensitive areas	Use smoke to indicate
Humidity	Low (delta T > 8 °C)	High (delta < 4 °C)	Measure, using whirling psychrometer
Atmospheric stability	Inversion layer present	No inversion layer	Use cold smoke to indicate
Maximum height of release of agrichemical	> 1.5 m above the target	< 0.5 m above the target	Application technique See 5.3.4.2
Particle (droplet) size	< 50 microns diameter	> 250 microns diameter	See Q1
Volatility of agrichemical	High (vapour pressure > 10 mPa)	Low (vapour pressure < 0.1 mPa)	Check product label, SDS, or PSC
Sensitive area	Close (< 100 m) away	None, or more than 1 km distant	Identify on property protocol (see M4)
Buffer zone	None	Yes (> 100 m)	Guideline only
Shelter belts	No shelter	Live shelter, > 3 m high and 1 m thick	Not for herbicides
Toxicity	Class 6.1A, B, C, D	Class 6.1E	Check label

7.13 As noted above a number of the agrichemicals are class 6.1B, C or D which are deemed to be high hazard. It is not feasible to remove all these agrichemicals from the annual spray plan as this will compromise the orchards ability to control disease and to farm. Therefore, I consider that given the nature of the risks associated with these chemicals a conservative approach to managing risk from spray drift should be utilised.

7.14 Although Table G1 indicates that the spray drift of agrichemicals are class 6.1E have a low hazard when all factors are in place to mitigate risk, this does not mean that there is no hazard. The Standard is designed on a risk mitigation basis to address adverse effects. In my opinion, a low hazard may still create an adverse effect on a sensitive use or with people who are sensitive to a particular chemical.

7.15 A sensitive area, which include residential buildings, within 100m of spraying is considered to be a high hazard.

7.16 The Standard provides guidance for when buffer zones are to be used to minimise spray drift hazard to sensitive areas. The width of the buffer zone depends on the application technique, agrichemical used and the physical nature of any shelter belts planted which serve as a physical barrier between the area being sprayed and the sensitive area (being a residential dwelling in this case).

7.17 This is set out in Table G2, which sets out suggested minimum distances between the downwind edge of the target area and the dwelling. This is listed below:

Table G2 – Buffer zones

Application method	**Distance** (metres)	
	With shelter	**Without shelter**
Boom sprayer	2	10
Air blast sprayer	10	30
Aerial application	100	300

NOTE –
These distances are subject to:

(a) The equipment used (boom, air blast, aircraft) being calibrated and operated correctly.

(b) All other appropriate strategies being observed to reduce spray drift hazard (table G1).

(c) Shelter should be complete and without gaps at the base.

7.18 Additional guidance for Table G2 from the Standard is set out below:

G6 Buffer Zones and Shelter Belts

Off-target movement of spray is affected by a large number of interrelated factors including weather conditions, spray characteristics and application technique. A buffer zone between the application site, and a sensitive area may reduce the hazard to that sensitive area. The buffer zone works by allowing the agrichemical to disperse to concentrations low enough not to present a risk (i.e. not exceed any Environmental Exposure Limit (EEL) set). The use of shelter belts to intercept and retain the agrichemical may effectively reduce the width of the buffer zone required. However for herbicides, particularly those used for total vegetation control, live shelter will also be affected by the spray so it will not be useful in those situations.

Other factors that affect the width of a buffer zone include:

(a) Application technique (e.g. projecting spray into the air);

(b) The agrichemical used (e.g. volatility);

(c) The physical nature of the shelter belt.

G6.1 Buffer zone guidelines

It is vital that the guidelines given below are regarded as that – guidelines, which represent the best estimate for three typical application types. Buffer zones, with or without shelter belts, merely provide an opportunity for concentrations of agrichemical to fall sufficiently so that the risk to sensitive areas beyond the buffer zone becomes acceptable (i.e. environmental exposure levels are not exceeded). Depending on the particular circumstances however, there is no guarantee that this can be achieved. Therefore buffer zones are only one of many methods to manage and reduce drift hazard.

Table G2 gives suggested minimum distances between the downwind edge of the target area and the sensitive area. These are for guidance. There are spray droplet drift models that can be used to give more detailed information for specific situations.

7.19 There is no guarantee that a shelter belt will be effective in reducing the risk to a sensitive area to an acceptable level. In my opinion, for the buffer/shelter approach to appropriately mitigate hazard risk, all other factors listed in Table G1 need to be low hazard before becoming an effective risk mitigation. With the permitted use of high hazard agrichemicals as noted above in my opinion a conservative approach to buffer zones should be used, meaning a buffer zone of at least 100m should be used.

7.20 The most common form of application is an air blast sprayer. From discussions with a local orchard owner, although they have rarely used aerial application of agrichemicals, they would retain the ability to do this in the future. This suggests that even with appropriate shelter the minimum buffer distance needs to be 100m.

7.21 The types of planted proposed for amenity planting shelter on the orchard boundary have not been articulated. As such it will be not be possible to identify whether the shelter meets the guidelines for shelter in the Standard. This suggests that the buffer zone needs to be extended to 300m or the proponent needs to plan adequate shelter to reduce the buffer zone to 100m. The guidance in the Standard indicates:

(a) Natural (live) shelter is more effective than artificial shelter;

(b) Shelter should have a minimum thickness of 1m and porosity of approximately 50%;

(c) A width to height ratio of about 3.5 is recommended

7.22 I consider that this shelter needs to be established prior to any residential properties being built to ensure the residential properties are not subject to risk from spray drift. I do not accept Mr Larsens supposition at paragraphs 30 and 35(b) of his evidence that spray drift is unlikely to exceed 10m from their boundary. My experience indicates that the drift can "hang" in the air and travel considerable distances, as anticipated by the Standard.

Restricted Entry Intervals (REI)

7.23 Restricted Entry Intervals is the period that needs to elapse after the application of agrichemicals before staff re-enter the area being sprayed. Typically these are after the agrichemical has dried but for more toxic chemicals this period is extended to allow the concentration to decrease to safe levels. New Zealand currently does not require chemical supply companies to include on their labels information regarding appropriate REI. However, there is significant alignment between New Zealand and Australia in regard to the approach used to the classification and management of agrichemicals. This information is available from Australia in the "Agrochemicals registered for use in Australian viticulture 18/19" booklet published by the Australian Wine Research Institute (AWRI Booklet). I am unaware of a similar resource for orchards so have used this booklet in conjunction with the active ingredient of the agrichemicals.

7.24 The AWRI Booklet provides data for some, but not all, of the active ingredients that are able to be used on orchards, so this list should be considered to be incomplete. The REI for three agrichemicals are listed below:

(a) Captan – 7 days;

(b) Sumisclex – 9-24 days depending on the activity being performed;

(c) Folicur – 4 – 23 days depending on the activity being performed.

7.25 This indicates to me that even once the spray has dried any that has drifted will present risk to residents of the dwelling within the buffer zone and is another reason why the buffer zone should be extended to the maximum recommended.

Noise

7.26 Noise is a factor that must be considered when considering the appropriate proximity for residential activities to an operational orchard.

7.27 As previously noted in my evidence, wind machines are one of the frost mitigation options. Noise from wind machines is covered by the Central Otago District Plan, Section 4: Rural Resource Area, Rule 4.7.6E (c). I have reproduced this section below:

(c) Wind machines for Frost Control

Any wind machine used for frost control shall be so constructed and operated that any noise emission measured at a distance of 300 metres shall not exceed 65 dBA L10 provided that:

1. the wind machine will be allowed to operate during the frost danger period until the leaves of the plant are dry and the air temperature has reached 1oC.

2. the speed of the wind machine must be governed such that the top speed of the rotor does not exceed the speed of sound.

3. the wind machine is located no closer than 300 metres to any Residential or Rural Settlement Resource Area, or within 100 metres of a dwelling house not located on the property

7.28 This means if PC14 is granted the wind machines located on the proposed orchard will not comply with the rule if they are located within 100m of a Residential Area. Noise data from the model of wind machine is presented in **Appendix 17**. This indicates that the model will breach the 65dBA L10 limit at approximately 100m.

7.29 Rule 4.7.6E (d) states:

Where any new activity locates within any part of the Rural Resource Area and that activity includes any noise sensitive activity, the activity or any building associated with the noise sensitive activity shall be sited, oriented and constructed so as to ensure that habitable spaces within the building shall be adequately isolated from any noise source on another site within the class of sources described in sub-clauses (b) – (c) of this rule. Adequate sound isolation shall be achieved by siting and constructing the building to achieve an indoor design sound level of 45 dBA Lmax within any habitable room where the exterior noise source is within the class of sources described in sub-clauses (b) – (c) of this rule. The indoor design level shall be achieved with windows and doors open unless adequate alternative ventilation means is provided, used, and maintained in operating order.

Reason

The noise standards selected reflects the historic noise levels permitted in the District. Temporary short duration noises (such as those created by frost fighting wind machines, bird scaring devices, harvesting at night etc) have been exempt from these restrictions so as not to unduly restrict seasonal agricultural operations. It is also considered appropriate that where a new activity that may be noise sensitive locates in the rural environment next to an activity that generates noise then the developer of the new activity should take steps to mitigate the effects of that noise. The cost should not be borne by the existing activity unless it does not meet the 70dBA standard.

7.30 If PC14 is approved then this will require that the affected houses need to have adequate insulation to meet the 45 dBA LMax level. The location of the frost fan is such that is will not exceed the 70dBA standard so this would need to build in the minimum design specifications for the dwelling.

7.31 Wind machines are governed by resource consents and their noise managed under the RMA process. In some situations (such as when a wind machine has broken down or the wind machines need to be supplemented to fight a deep frost or one with a high inversion layer) the orchard manager may have to fight frosts using a helicopter. Additionally, helicopters are used to dry cherries as well. I should point out in my experience the helicopters are not only used first thing in the morning as noted by Mr Larsen in paragraph 28 of his evidence but are typically used at the conclusion of any material rain event during the key ripening phase. Their noise is much more significant than wind machines. According to the report I was able find analysing helicopters this was in the range of 76.5 – 85.5 dBA L_{MAX}. The reference for this report is listed in **Appendix 2**. Frosts can last all night and typically a series of three frosts are experienced. Orchards typically fight frosts from September to the end of November. The key ripening phase of mid-December to the end of January could see up to 10 rain events fought during the day light hours so the daytime amenity effects of the noise from helicopters should also be considered, and insultation and the shape of houses will not materially lessen the impact this noise has on the occupants outside amenity.

7.32 To address the need to get sprays on in the typically windy spring tractor drivers often start very early (2am starts are typical) and vineyard staff often start at day break to get the work done in the cooler morning hours during the peak of summer. A local orchard owner also informs me that they use noisy equipment regularly, including chainsaws, mowers, mulchers

and auto firewood processors. Additional they use heavy machinery regularly with external contractors and this includes 20 ton diggers, high reach tree trimmers, large wood mulchers and dump trucks, all of which generate significant noise.

7.33 The sort of noise described above could impact the wellbeing of those living in the proposed residential dwellings. Further, complaints relating to these activities have the potential to compromise the ability to effectively and efficiently grow crops on the orchard.

Effects on the vineyard from the proposed residential activities

7.34 In my experience, residential activities in close proximity to an operational orchard can also result in adverse effects on the orchard. In particular unintentional damage can be caused to trees by broadleaf sprays used on lawns. These are typically available in supermarkets or applied by contractors. Trees are sensitive to these sprays and it is difficult to identify the causative location or police their use. The effects can be persistent and can travel considerable distance.

James Dicey

20 May 2020

Appendix 1
James Dicey Curriculum Vitae

1) PROFESSIONAL EXPERIENCE

a) Grape Vision Limited

Viticultural Development & Management Sep. 04 – present
Owner/Viticulturalist

Development and implementation of viticultural program for 40 vineyards spread over ~310ha. Recruitment, training and management of staff, including ~40 permanent New Zealanders in specialist roles and 40-110 seasonal Ni-Vanuatu via the RSE scheme. Client management. Budgeting and capital expenditure planning. Management of vineyard budgets with a combined value of >$5m. Materials procurement. Management of machinery operations. National and international viticultural and wine business consultancy. Fruit and wine brokerage. Vineyard development in all regions of Central Otago. Consultancy on reverse sensitivity issues in property development and expert witness

Ceres Wines Limited

Wine Brand 2005 – present
Owner

Development of wine brand. Creation of website and associated social media. Securing and managing NZ, UK, US and Australian distribution.

b) Diageo plc

Premium drinks, London, Feb. 03 – Jul 04
Manager, Business Risk

Deliver IS based risk activities globally. Recent work includes assessing the project risks within SAP implementations as well as the managing the post implementation audit work on the GB, Ireland and Project Sheriff (US) SAP implementations. Development and maintenance of network with senior IS community to identify key IS risks that drives work. Influence the IS agenda to embed appropriate risk culture.

- Work identification and planning – using an extensive network of IS contacts identify key IS risks and develop work programs to assess, mitigate and audit these risks.
- Risk Consulting – risk assessment and mitigation planning for key IS and market risks. Risk consulting on projects and markets to improve the quality of the control environment.
- Risk Auditing – performed financial and IS audits primarily focussed on SAP enabled back offices.

c) Quickstart Consulting Limited

Project management (self employed), London, Oct. 99 – Oct. 02

Contracts included:

Saudi Aramco (contracted to Deloitte & Touche)

Oil Producer: Dhahran (Saudi Arabia) Aug. 02 – Oct. 02, period 3 months

Contracted by Deloitte & Touche South Africa to project manage a post implementation SAP R/3 review for Saudi Aramco. Complex environment (FI, CO, MM, IS Oil, PS, IM, AM, HR, QA, BW and PM) with high number of users (20,000).

- Project Management - Identification of project requirements, project planning and delivery of report against plan and budget. Staff management (16 staff/10 nationalities), resource allocation, mentoring and assessment.
- Control Frameworks – Identification and documentation of business processes and the development of control frameworks.
- Reporting – Development of reporting standards. Regular status updates to senior management.

d) Shell Marine Products

Marine Fuel and Lubricants Supplier: London (United Kingdom) Jul. 01 – Feb. 02, period 7 months

Contracted by Shell Head Office to project manage the development and support of core business applications that are used internationally (in over 25 countries, by over 300 users), including changing software suppliers to reduce costs.

- Project Management: development/rollout of a core business application (Rapid Lubricants Analysis 2) internationally, management of pilot phase, development of support model and integration to SAP (focussing on international VAT issues).
- Management of RFP process: managed change of 3rd party software developer.
- Third Party Management: contract drafting, service level negotiation, process/procedure definition and implementation.
- Strategic: Contribution to IT strategy, IT steering committee (business case/project definitions), staff management including project manager mentoring.
- Business Continuity Planning (BCP): Creation and implementation of Shell Marine Products BCP. Shaping the Shell BCP strategy and approach.

e) WebPerform Group

Internet Performance Services: London (United Kingdom) Nov. 00 – Jul. 01, period 9 months

Assisted Internet start up company (focussed on online performance assessment and improvement) to obtain £7m funding. Reporting directly to the Product Development Director, working as a Programme Manager developing the development and implementation of core business applications (including £1m budgetary control). Promotion to Information Manager with sole responsibility for the development of the business intelligence layer, reporting directly to the WebPerform executive.

- Programme Management: co-ordination and implementation of multiple software and organisational projects. Project management of the following projects:
  - SAP Implementation (FI/CO, Logistics, CRM/SM, and HR). Responsibilities included solution assessment, training, configuration and change management.
  - Bespoke Application Development – specification, analysis and implementation of a core database driven business intelligence layer including an ASP based front end for configuration. Responsibilities included managing testing (including UAT), user training and documentation.
  - Operational Process Development – Creation of pan-organisational operational processes and structures.
- Business Intelligence Layer: scoping, designing and implementing the Business Intelligence Layer

IPC Electric (part of IPC Media)

Publisher: London (United Kingdom) Oct. 99 – Jul. 00, period 10 months

Reporting directly to the Director of Product Development, with sole responsibility for the development, implementation and operation of a B2C e-commerce solution to provide multiple websites with e-commerce functionality, based on a single catalogue.

- Programme Management – Co-ordination of multiple project e-commerce and infrastructure requirements. Management of resource (financial and human) allocation and prioritisation.
- Project Management – Simultaneous project management (up to 4 concurrent projects) from conceptualisation to implementation/project close-down (budgets exceeding £1.5m).
- Other responsibilities – Policy development, third party management (contract/service), E-Commerce strategy development, business process design, front/back end design integration, software requirements specification, testing, operational management of processes (including logistics and fulfillment), international fulfillment and VAT implication analysis, design of support

processes, staff selection/training/management, development of project management methodology.

f) Deloitte & Touche

Professional Services: Feb. 94 – Sep. 00 (New Zealand, Netherlands, United Kingdom)

Senior manager with a professional career starting in financial audit, progressing to IT audit (including significant security training). Transfer to Europe to focus on SAP assurance and implementation (primarily security and business process controls).

- Project Management – Identification of business requirements, project planning and delivery of product against plan and to budget.
- Business Process Mapping – Identification and documentation of business processes and integration to SAP R/3.
- Business Control Identification – Identification and documentation of SAP R/3 functional controls and development of manual controls to mitigate business risk.
- Security Configuration – Identification of security settings. Design, implementation and rollout of security matrix
- Clients included – Philips Luminaires, ASM Lithography, Delphi Automotive, Philips Automotive, Telecom NZ.

2) PROFESSIONAL QUALIFICATIONS

- Grad. Dip Viticulture & Oenology – Lincoln University, 2005
- Chartered Accountant – Institute of Chartered Accountant of New Zealand, 1997
- Barrister and Solicitor – High Court of New Zealand, 1993
- Bachelor of Law (LLB) – Commercial Law Major (University of Otago, NZ), 1993
- Bachelor of Commerce (BCom) – Accounting Major (University of Otago, NZ), 1992

DIRECTORSHIPS

- New Zealand Winegrowers: 2016 – Present
- New Zealand Winegrowers Research Centre Limited: 2017 – Present
- Mt Difficulty Wines Limited: 2004 – 2019
- Seasonal Solutions Co-operative Limited: 2006 – 2016

INDUSTRY COMMITTEES

- 2016 – Present: NZ Winegrowers Finance Committee (Deputy Chair)
- 2016 – Present: NZ Winegrowers Sustainability Committee (Deputy Chair)
- 2006 – Present: Committee Central Otago Winegrowers Association, including 5 years as President (past role)
- 2010-2014: NZ Winegrowers Research Committee
- 2014: Lincoln University Bachelor of Viticulture and Oenology course review committee member
- 2014-2016: Alternate Director for NZ Grape Growers Council

MAJOR AWARDS/TROPHIES

- Ceres Black Rabbit Riesling (2017) – Royal Easter Show Wine Awards Champion Riesling trophy
- Ceres Composition Pinot Noir (2016) – Decanter World Wine Awards New World Pinot Noir Best in Show
- Ceres Composition Pinot Noir (2010) – International Wine and Spirit Competition Bouchard Finlayson Pinot Noir trophy
- Remarkable Wines Pinot Noir (2006) – Decanter World Wine Awards New World Trophy
- Gourmet Traveller Wine 2018 New Zealand Viticulturalist of the Year

TRAINING

- Institute of Directors – Introduction to Governance, Invercargill 2009
- Risk Management Concepts – Diageo, London 2003
- SAP R/3 – Security Review and Implementation, South Africa, 1999
- SAP R/3 – HR module courses, SAP Training Academy, Manchester, 1998
- Computer Assurance – Basic/Advanced IS technical and audit training, Malaysia/Sydney, 1996/1997

Appendix 2

List of documents reviewed in preparing this evidence

Application to the Council

(a) Evidence of Paul McGregor Edwards dated 13 May 2020;

(b) Evidence of Natalie Dianne Hampson dated 12 April 2020;

(c) Evidence of Ricky Paul Larsen dated 13 May 2020;

(d) Section 42A Planning Report Ref 52/3/88;

(e) New Zealand Cherry Corp: Request for a Change to the Operative Central Otago District Plan dated 28 May 2019;

(f) Appendix L: Landcare Research Soil Investigation dated 9th May 2019;

Planning documents

(g) Otago Regional Council Regional Plan: Air for Otago dated 1 January 2009;

(h) Otago Regional Council Regional Policy Statement for Otago 1998 (partially operative as of 14 January 2019);

(i) Central Otago District Council Operative District Plan 2008;

Other relevant material

(j) NZS 8409:2004 Management of Agrichemicals;

(k) Hazardous Substances Classification Codes (https://www.epa.govt.nz/industry-areas/hazardous-substances/rules-for-hazardous-substances/hazardous-substances-classification-codes/)

(l) Land Use Capability Handbook – a New Zealand handbook for the classification of land 3rd Ed;

(m) Agrochemicals registered for use in Australian viticulture 18/19 (https://www.awri.com.au/wp-content/uploads/agrochemical_booklet.pdf)

(n) Helicopter Noise Measurements Data Report: Volume 1 Report No. FAA-RD-77-57, 1 (April 1977), https://rosap.ntl.bts.gov/view/dot/10026, p197

(o) VineFacts for Season 2017-2018 published by New Zealand Winegrowers;

(p) Harvest.com weather station data for Suncrest Orchard and MacMuir Vineyard (Bannockburn);

(q) 2018 Interim Incremental Grape Price Data published by New Zealand Winegrowers;

(r) Wine Tourism Tourist Special Interest February 2014 published by Tourism New Zealand;

(s) Wine Tourism Tourist Activity September 2009 published by the Ministry of Tourism (now Ministry of Business, Innovation and Employment);

(t) New Zealand Wine Tourism Insights published by New Zealand Winegrowers;

(u) Wine Tourism: New Zealand Wine Tourism at a glance published by New Zealand Winegrowers;

(v) International Visitor Survey September 2017 published by Ministry of Business, Innovation and Employment;

(w) Wine industry benchmarks and insights 2017 published by Deloitte;

(x) Queenstown Airport Statistics published by Queenstown Airport October 2018;

(y) New Zealand Tourism Forecasts 2018 – 2024 (May 2018) published by the Ministry of Business, Innovation and Employment;

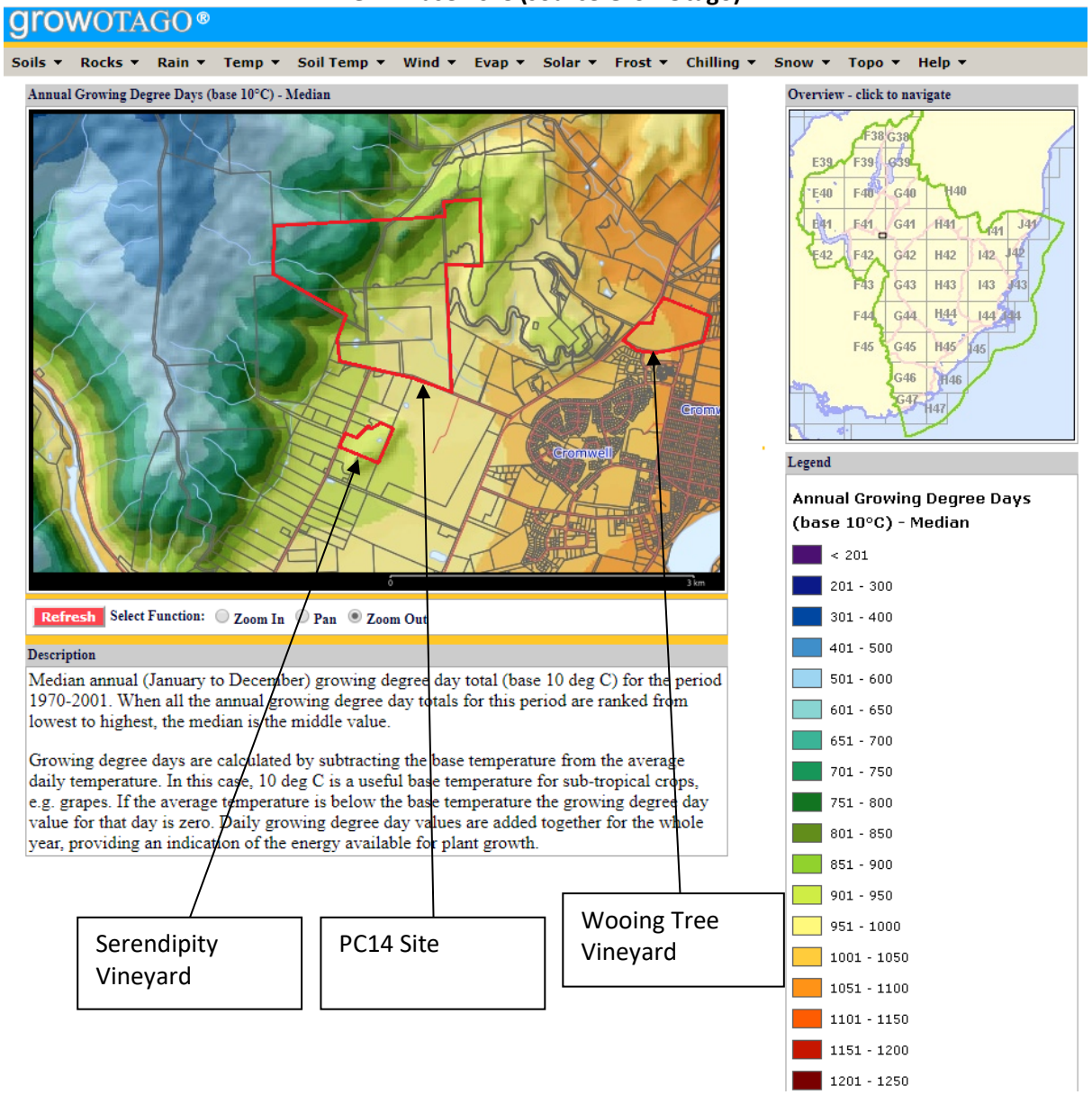
(z) The New Zealand Soil Classification published by LandCare Research (https://webcast.gigtv.com.au/Mediasite/Play/592c330cdb6045e596a54d5e2b6be5861d?catalog=cf98d83053764395b5e48ae171db49e621)

Appendix 3
GDD data (source HarvestNZ Weather Stations)

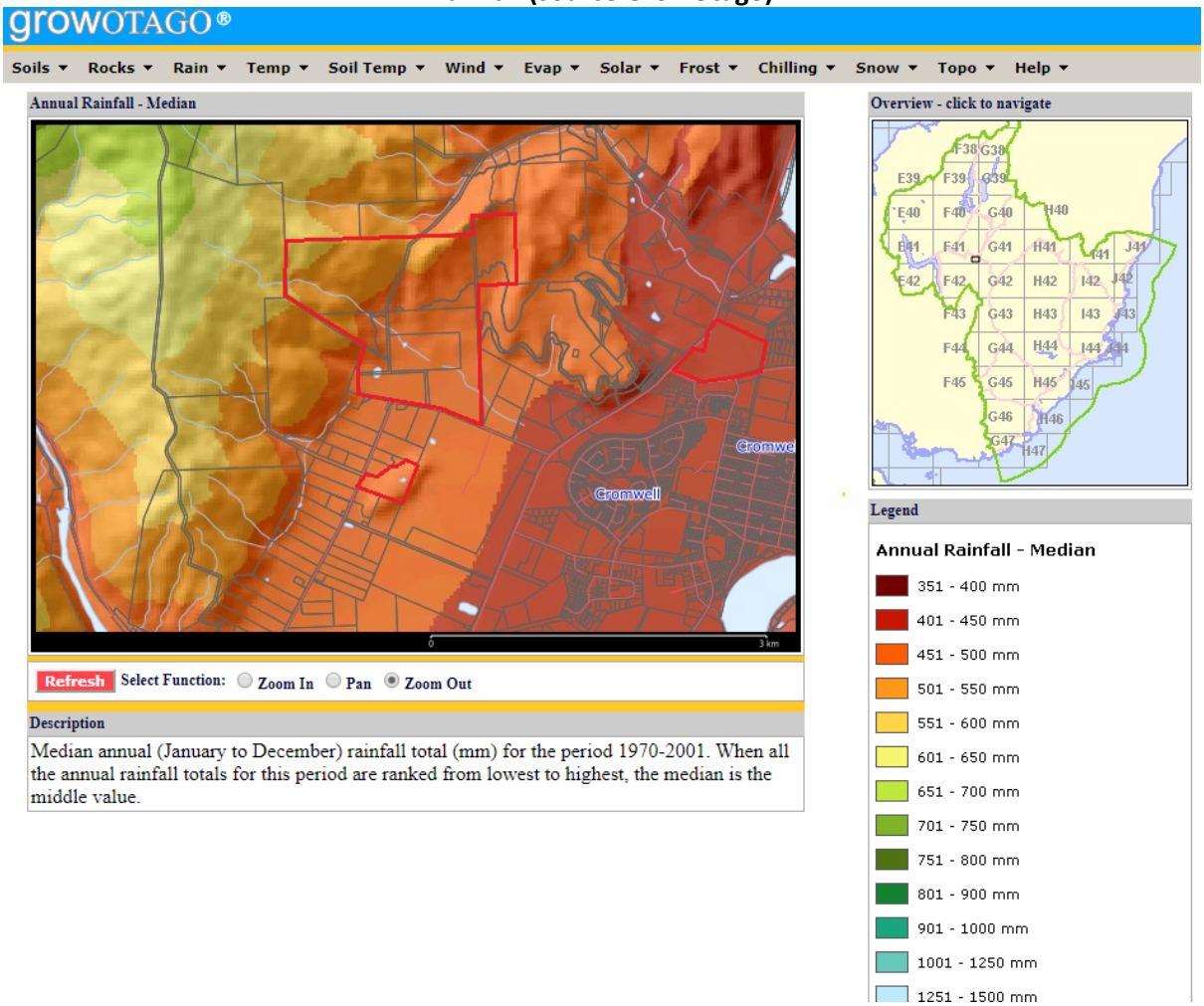
Weather Station	2018 GDD Base 10°C	2017 GDD Base 10°C
Suncrest Orchard (southern Ripponvale)	1088	757
MacMuir Vineyard (Bannockburn)	1330	950

- The data for 2018 was chosen as it was an unusually hot season in the Central Otago wine growing region
- The data for 2017 was chosen as it was an unusually cool season in the Central Otago wine growing region

Appendix 4
GDD Base 10°C (source GrowOtago)



Appendix 5
Rainfall (source GrowOtago)



Appendix 6
PC13 site productive area map (source Google Tools)

Output : Current Area

1133932.13 m² | 1.13 km² | 280.20 acres | 113.39 hectares | 12205543.93 feet² | 0.44 square miles | 0.33 square nautical miles

Output : Current Area

3711.63 m² | 0.00 km² | 0.92 acres | 0.37 hectares | 39951.64 feet² | 0.00 square miles | 0.00 square nautical miles

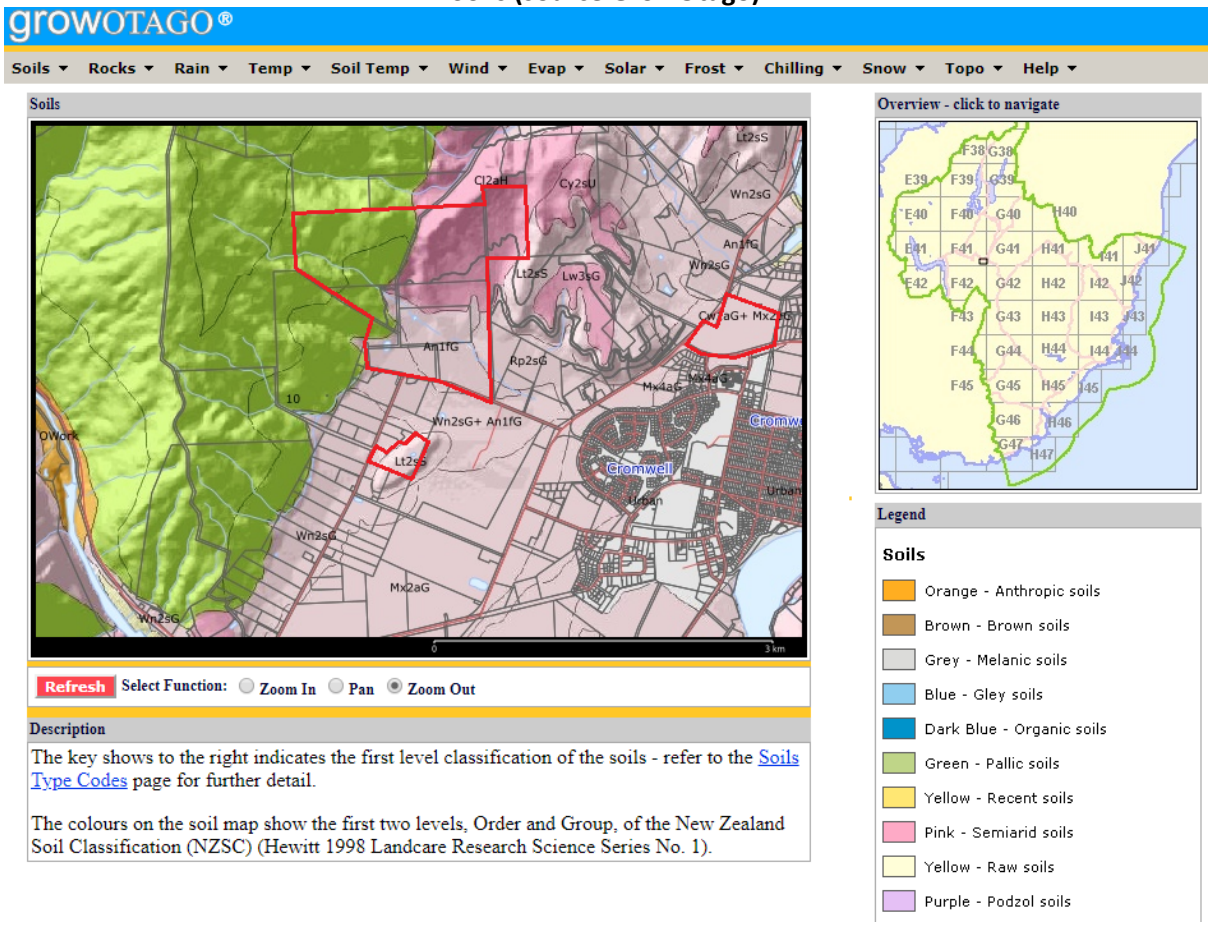
Current Perimeter

250.368m OR 821.417feet

Output : Total Area(s)

31562.90 m² | 0.03 km² | 7.80 acres | 3.16 hectares | 339740.25 feet² | 0.01 square miles | 0.01 square nautical miles

Appendix 7
Soils (source GrowOtago)



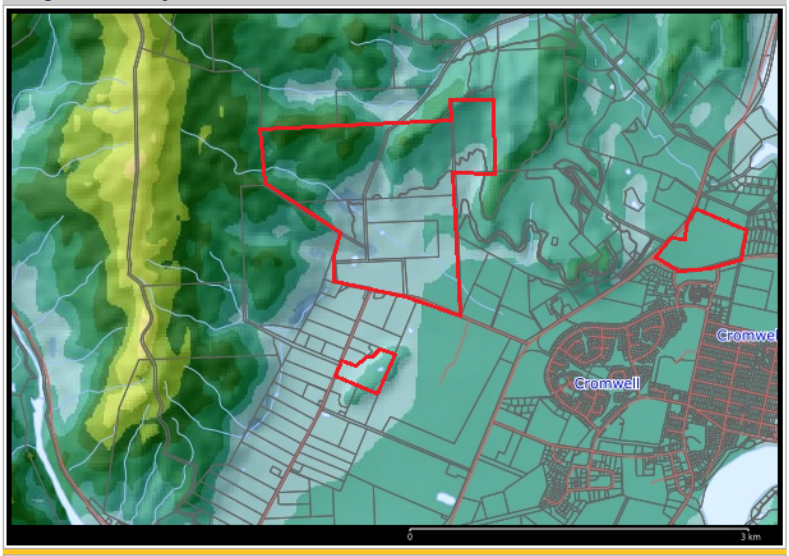
Appendix 8

Average Annual Wind Speed (source GrowOtago)

growOTAGO®

Soils ▾ Rocks ▾ Rain ▾ Temp ▾ Soil Temp ▾ Wind ▾ Evap ▾ Solar ▾ Frost ▾ Chilling ▾ Snow ▾ Topo ▾ Help ▾

Average Annual Wind Speed



Refresh Select Function: Zoom In Pan Zoom Out

Description

Average annual (January to December) wind speed (km/hr) at 10 m above the ground over tussock or rough grass for the period 1970-2001.

These wind speeds are 10-minute averages. Higher speeds occur over smooth surfaces and lower speeds near buildings or trees.

Overview - click to navigate

Legend

Average Annual Wind Speed

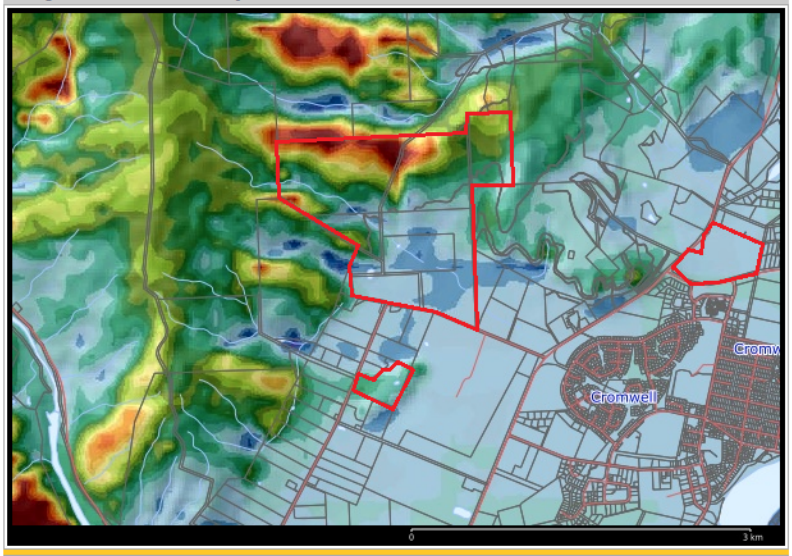
- 0.1 - 2.0 km/hr
- 2.1 - 4.0 km/hr
- 4.1 - 6.0 km/hr
- 6.1 - 8.0 km/hr
- 8.1 - 10.0 km/hr
- 10.1 - 12.0 km/hr
- 12.1 - 14.0 km/hr
- 14.1 - 16.0 km/hr
- 16.1 - 18.0 km/hr
- 18.1 - 20.0 km/hr
- 20.1 - 22.0 km/hr

Average Annual Maximum Wind Speed (source GrowOtago)

growOTAGO®

Soils ▾ Rocks ▾ Rain ▾ Temp ▾ Soil Temp ▾ Wind ▾ Evap ▾ Solar ▾ Frost ▾ Chilling ▾ Snow ▾ Topo ▾ Help ▾

Average Annual Maximum Wind Speed



Refresh Select Function: Zoom In Pan Zoom Out

Description

Average annual (January to December) maximum wind speed (km/hr) at 10 m above the ground over tussock or rough grass for the period 1970-2001.

These wind speeds are 10-minute averages. Higher speeds occur over smooth surfaces and lower speeds near buildings or trees.

Overview - click to navigate

Legend

Average Annual Maximum Wind Speed

- 30.1 - 35.0 km/hr
- 35.1 - 40.0 km/hr
- 40.1 - 45.0 km/hr
- 45.1 - 50.0 km/hr
- 50.1 - 55.0 km/hr
- 55.1 - 60.0 km/hr
- 60.1 - 65.0 km/hr
- 65.1 - 70.0 km/hr
- 70.1 - 75.0 km/hr
- 75.1 - 80.0 km/hr
- 80.1 - 85.0 km/hr
- 85.1 - 90.0 km/hr

Appendix 9
Rate of Return on Capital Investment Calculation

To calculate a rate of return the land value should be included into the calculation. In my opinion the site valued as undeveloped bare land (excluding any lifestyle value or value attributed to a residential house platform) would range from $25,000 to $50,000 a hectare.

	Low land value, re-use infrastructure	**Low land value, full development**	**High land value, re-use infrastructure**	**High land value, full redevelopment**
Land Value	25000	25000	50000	50000
Development Cost	64400	91500	64400	91500
Total Investment	**89400**	**116500**	**114400**	**141500**
3% Rate of Return	2682	3495	3432	4245

A 3% return on investment in an agricultural context is about average in my experience – the scenarios presented show a return higher than this in 60% of the modelled scenarios.

Using the total investment to redevelop the vineyard it is further possible to calculate a capital gain on investment by calculating the capital gain on the development scenarios presented above. This is calculated by:

(Sale price – Total Investment) = Capital Gain (expressed as a percentage)
Total Investment

Sale Price	185000	185000	185000	185000
Capital Gain %	106% (185,000 – 89,400)/ 89,400	59%	62%	31%
Sale Price	220000	220000	220000	220000
Capital Gain %	146%	89%	92%	55%

Appendix 10

$50 Incremental pricing 2018 Interim (source NZ Winegrowers)

Inc/Range $50		# tonnes	Sales Value	Average Price
1801	1850	2.65	4876	1840
1851	1900			
1901	1950			
1951	2000			
2001	2050			
2051	2100			
2101	2150			
2151	2200			
2201	2250			
2251	2300			
2301	2350			
2351	2400	6.928	16412	2369
2401	2450			
2451	2500			
2501	2550			
2551	2600			
2601	2650			
2651	2700			
2701	2750			
2751	2800	2.65	7415	2798
2801	2850			
2851	2900			
2901	2950			
2951	3000	50.661	151983	3000
3001	3050			
3051	3100	28.736	89082	3100
3101	3150			
3151	3200	126.742	404211	3189
3201	3250			
3251	3300	98.968	326594	3300
3301	3350			
3351	3400	78.851	268093	3400
3401	3450	90.97	313847	3450
3451	3500	392.769	1374692	3500
3501	3550			
3551	3600	237.571	852183	3587
3601	3650	1087.75	3969259	3649
3651	3700	4.15	15355	3700
3701	3750	160.337	597790	3728
3751	3800	412.17	1566246	3800
3801	3850	253.31	975200	3850
3851	3900	118.681	462856	3900

Inc/Range $50		# tonnes	Sales Value	Average Price
3901	3950	11.723	46306	3950
3951	4000	331.525	1326100	4000
4001	4050	42.632	172660	4050
4051	4100	12.019	49278	4100
4101	4150	13.284	55129	4150
4151	4200	176.056	739435	4200
4201	4250	58.673	249360	4250
4251	4300			
4301	4350	2.2	9570	4350
4351	4400	58.788	258667	4400
4401	4450			
4451	4500	48.11	216495	4500
4501	4550			
4551	4600			
4601	4650			
4651	4700	18	84600	4700
4701	4750			
4751	4800			
4801	4850			
4851	4900			
4901	4950			
4951	5000			
5001	5050			
5051	5100			
5101	5150			
5151	5200			
5201	5250			
5251	5300			
5301	5350			
5351	5400			
5401	5450			
5451	5500			
5501	5550			
5551	5600			
5601	5650			
5651	5700	9.786	55312	5652
5701	5750			
5751	5800			
5801	5850			
5851	5900			
5901	5950			
5951	6000	1.128	6768	6000

Appendix 11
Bulk Wine Scenario Calculation

BULK MODEL					
	Planted Ha	T/ha	Litres/T (finished)		
Yield	28.60	6	630	108,108	Litres
Projected Revenue (Incl)			11.5	1,243,242	
Less GST				162,162	
Projected Revenue Gross (Excl)				1,081,080	
Excise/ALAC Levy (NA on bulk wine)		Litres			
Excise	0	108,108		-	
ALAC Levy	0	108,108		-	
				-	
Cost of Goods Sold					
Vineyard Costs - Growing		16700		477,620	
Vineyard Costs - Lease		0		-	
Vineyard Costs - Deprectaion		775		22,165	
Winery Costs	2.5	108,108		270,270	
Barrel Depreciation	1.6	108,108		172,973	
Direct Costs (Bottling, Labelling, Packaging)	0	12,012.00		-	
Total COGS				943,028	
				138,052	13%

Appendix 12
Direct Trade Scenario Calculation

TRADE MODEL					
	Planted Ha	T/ha	Litres/T (finished)		
Yield	28.60	6	630	108,108	Litres
Projected Bottles Produced				144,144	Bottles
Trade Price Per Bottle				28.30	Trade
Projected Revenue (Incl)				4,079,275	
Less GST				532,079	
Projected Revenue Gross				3,547,196	
Excise/ALAC Levy		Litres			
Excise	2.9432	108,108		318,183.47	
ALAC Levy	0.035385	108,108		3,825.40	
				322,009	
Cost of Goods Sold					
Vineyard Costs - Growing		16700		477,620	
Vineyard Costs - Lease		0		-	
Vineyard Costs - Deprecation		775		22,165	
Winery Costs	2.5	108,108		270,270	
Barrel Depreciation	1.6	108,108		172,973	
Direct Costs (Bottling, Labelling, Packaging)	20	12,012.00		240,240	
Total COGS				1,183,268	
				2,041,919	58%
Distribution			$/bottle		
A&P/Market Activation			0.40	57,658	
Freight Out			0.32	46,126	
Relabelling/Packing			0.03	4,324	
Admin Overhead			0.60	86,486	

Sales Manager (Salary and expenses)				145,000	
				194,594	
GM After Direct Costs				1,847,325	52%
Per hectare				64,592	

Appendix 13
Distributor Trade Calculation Scenario

DISTRIBUTOR MODEL					
	Planted Ha	T/ha	Litres/T (finished)		
Yield	28.60	6	630	108,108	Litres
Projected Bottles Produced				144,144	Bottles
Distributor Price Per Bottle				21.50	Trade
Projected Revenue (Incl)				3,099,096	
Less GST				404,230	
Projected Revenue Gross				2,694,866	
Excise/ALAC Levy		Litres			
Excise	2.9432	108,108		318,183.47	
ALAC Levy	0.035385	108,108		3,825.40	
				322,009	
Cost of Goods Sold					
Vineyard Costs - Growing		16700		477,620	
Vineyard Costs - Lease		0		-	
Vineyard Costs - Deprectaion		775		22,165	
Winery Costs	2.5	108,108		270,270	
Barrel Depreciation	1.6	108,108		172,973	
Direct Costs (Bottling, Labelling, Packaging)	20	12,012.00		240,240	
Total COGS				1,183,268	
				1,189,589	44%
Distribution			$/bottle		
A&P/Market Activation			0.40	57,658	

Freight Out			0.32	46,126	
Relabelling/Packing			0.03	4,324	
Admin Overhead			0.60	86,486	
				194,594	
GM After Direct Costs				994,995	37%
Per hectare				34,790	

Appendix 14
Direct to Consumer Calculation Scenario

DIRECT TO CONSUMER						
	Planted Ha	T/ha	Litres/T (finished)			
Yield	28.60	6	630	108,108	Litres	
Projected Bottles Produced				144,144	Bottles	
Retail Price Per Bottle				47.50	Retail	
Projected Revenue (Incl)				6,846,840		
Less GST				893,066		
Projected Revenue Gross				5,953,774		
Excise/ALAC Levy		Litres				
Excise	2.9432	108,108		318,183.47		
ALAC Levy	0.035385	108,108		3,825.40		
				322,009		
Cost of Goods Sold						
Vineyard Costs - Growing		16700		477,620		
Vineyard Costs - Lease		0		-		
Vineyard Costs - Depreciation		775		22,165		
Winery Costs	2.5	108,108		270,270		
Barrel Depreciation	1.6	108,108		172,973		
Direct Costs (Bottling, Labelling, Packaging)	20	12,012.00		240,240		
Total COGS				1,183,268	8.21	per bottle
				4,448,497	75%	
Cellar Door Costs						

Staff		45,000	3.50	504,504		
Food				-		
				504,504		
GM After Direct Costs				3,943,993	66%	
Per hectare				137,902		

Appendix 15
Katabatic Drainage

Appendix 16
Irrigation Calculations

Irrigation Calculation	**ORCHARDS**			
Irrigation requirements				
1 Oct - 31 Jan	60000	litres per hectare per day		
1 Feb - 31 Mar	30000	litres per hectare per day		
Month	**Days**	**Total**	**Litres per hectare**	
Oct	31			
Nov	30			
Dec	31			
Jan	31	123	7,380,000	
Feb	28			
Mar	31	59	1,770,000	
Total water per season required			9,150,000	litres
Ripponvale Irrigation Company				
Litres/season/hectare	7,500,000	litres		
Utilisation Percentage - NZ Cherry Corp				
Allocated	32			
Planted	28	87.5%		
Shannon Farm				
Available Water				
RIC	28	210,000,000	litres	* Tim Jones, phone call
Shannon Bore		699,840,000	litres	*Edwards para 33
Total Available		909,840,000	litres	
Water Per Season Required		9,150,000	litres/ha	
Hectares to plant		99.4	ha	
Utilisation Percentage		87.5%		
Total Plantable		87.0	ha	

Irrigation Calculation	**VINEYARDS**			
Irrigation requirements				
1 Oct - 31 Apr	25000	litres per hectare per day		
Month	**Days**	**Total**	**Litres per hectare**	
Oct	31			
Nov	30			
Dec	31			
Jan	31			
Feb	28			
Mar	31			
Apr	30	212		
Total water per season required			5,300,000	litres
Ripponvale Irrigation Company				
Litres/season/hectare	7,500,000	litres		
Utilisation Percentage - NZ Cherry Corp				
Allocated	32			
Planted	28	87.5%		
Shannon Farm				
Available Water				
RIC	28	210,000,000	litres	* Tim Jones, phone call
Shannon Bore		699,840,000	litres	*Edwards para 33
Total Available		909,840,000	litres	
Water Per Season Required		5,300,000	litres/ha	
Hectares to plant		171.7	ha	
Utilisation Percentage		87.5%		
Total Plantable		150.2	ha	

Appendix 17
Wind Machine Noise Data

HEGLEY ACOUSTIC CONSULTANTS

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24 March 2016

Andrew Roff
New Zealand Frost Fans Ltd
1429 Omahu Road
HASTINGS 4175

Dear Andrew

C59 FROST FAN

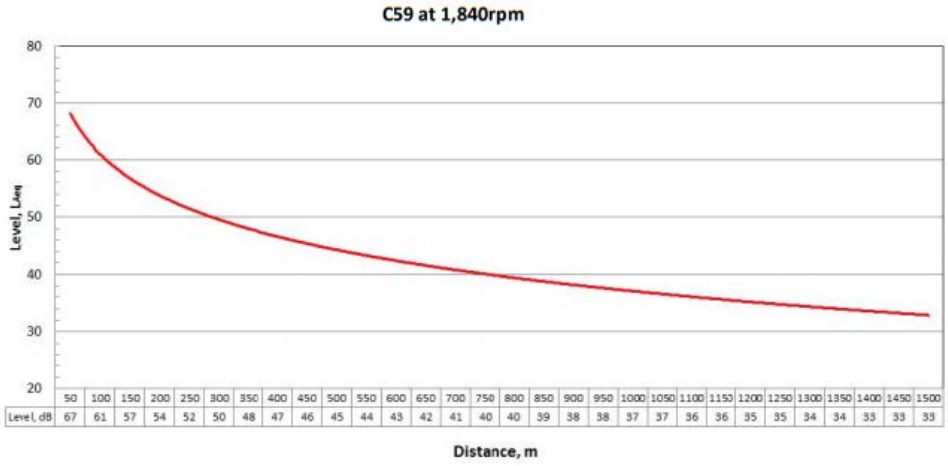
As requested I have predicted the noise from a C59 Frost Fan operating at an engine speed of 1840rpm and fan speed of 365rpm for distances from 50m – 1,500m. To determine the noise at the different distances field measurements were undertaken at 180m and 300m from the frost fan and from these measurements a computer based noise model was built using the Brüel & Kjær Predictor program version 11.00. This is a powerful environmental noise calculation software package that uses a digital terrain model with the typical ground conditions and the C59 frost fan added to the model. The noise was then calculated at various distances from the C59 in accordance with the requirements of *ISO 9613-1/2 Acoustics – Attenuation of Sound during Propagation Outdoors*. A temperature inversion has been assumed with ground factor of 0.7. The model predicted a level of 55dB L_{Aeq} at 180m and 50dB L_{Aeq} at 300m, which is the same as measured in the field[1] so this provides the confidence the model is predicting the noise accurately.

Based on the above, Figure 1 was developed for a single C59 frost fan assuming relatively flat ground conditions.

Should you have any questions regarding the above please do not hesitate to contact me.

Yours sincerely
Hegley Acoustic Consultants

Nevil Hegley


C59 at 1,840rpm
80
70
60
50
40
30
20
Level, LAeq
50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200 1250 1300 1350 1400 1450 1500
Level, dB 67 61 57 54 52 50 48 47 46 45 44 43 42 41 40 40 39 38 38 37 37 36 36 35 35 34 34 33 33 33
Distance, m