

BEFORE THE DUNEDIN CITY COUNCIL

IN THE MATTER OF

the Resource Management Act 1991

AND

IN THE MATTER OF

An application for resource consent
by Peninsula Holdings Trust

STATEMENT OF EVIDENCE OF DR IAN PAUL GRIFFIN

1 March 2017

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INTRODUCTION

Qualifications and Experience

- 1 My name is Dr Ian Paul Griffin. I hold the degrees of Doctor of Philosophy (Astronomy) (University College, London) and Bachelor of Science (Hons) from the University of London.
- 2 I have worked in the field of science and particularly astronomy for the past 25 years, commencing as the Director of Armagh Planetarium before taking up roles with the Astronaut Memorial Planetarium and Observatory in Florida and the Auckland Observatory in New Zealand. In 2001 was appointed the Head of Public Outreach at NASA's Space Telescope Science Institute in Baltimore.
- 3 I have authored more than 20 research papers which have been published in a variety of journals including Nature, Monthly Notices of the Royal Astronomical Society and others. With relevance to this hearing I am the author of "The future is Dark for Dunedin" in the New Zealand Astronomical Yearbook. In 2015 I was awarded the Prime Ministers Science Media Communication Prize.
- 4 I have been the Museum Director at the Otago Museum in Dunedin since 2013 and am a Board Member of Museums Aotearoa and the International Council of Museums NZ (ICOM NZ) National Organising Committee. I am also an Honorary Research Fellow in the Department of Physics at the University of Otago.
- 5 Despite my professional expertise and qualifications I provide this evidence principally in my personal capacity as a resident of Dunedin and as an astronomer and photographer who regularly utilises the area around Hoopers Inlet and Papanui Inlet.
- 6 I should also record that I am the Chair of the Dunedin City Council Dark Sky Advisory Committee which is also a submitter in this matter, however, I confirm that I identified a conflict when this matter was raised at the Advisory Committee and that I took no part in the decision to file a submission. This evidence does not therefore represent the views of the Advisory Committee, who I understand will address you separately.
- 7 I have set out in my submission a number of matters that concern me regarding the proposal before you. These relate to the effects generally on the landscape of the area, the implications for the habitat of the jewelled

gecko and the implications on the environment for the servicing of the lots (septic tanks etc). I do ask that you consider all of those matters.

- 8 My evidence today however will focus predominately on the effects of the proposal on the night sky, a matter which, with respect to the experts involved, is not well understood and as such is not adequately addressed in the information before you.

BACKGROUND

The Night Sky

- 9 Since moving to Dunedin in 2013, I have come to appreciate the special nature of the night sky in this part of the world. Dunedin is one of the very few cities where a world class view of the night sky is accessible to the general public within a 20 minute drive of the city centre. Thanks to the rural nature of the Otago Peninsula back bays, visitors to our city have an almost unique chance to observe a pristine night sky over a landscape of outstanding natural beauty.
- 10 Many people are aware of the phenomenon known as the Northern Lights or *Aurora Borealis* but fewer people seem to be aware (at least at the moment) of the equivalent Southern Lights or *Aurora Australis*, which are regularly visible from dark sky locations in Otago and Southland. The back bays of the Otago Peninsula are renowned sites for aurora viewing thanks to the lack of development (in particular due to the lack of lighting) which allows people with average eyesight a chance to view this remarkable phenomenon.
- 11 It should be noted that there are only two locations (other than Antarctica in winter!) in the southern hemisphere where the *aurora australis* can be seen from land. Those locations are southern New Zealand and Tasmania. The number of sites with views as extraordinary as Hoopers Inlet and Papanui Inlet is very low, and therefore when potentially destroying those views the rarity and significance of the location should be taken into account from an international perspective.
- 12 By way of background, an aurora occurs as a result of material released by the sun interacting with the Earth's magnetic field and making our atmosphere glow.
- 13 While some auroras can be extraordinarily bright, many are dim, barely visible against the background of the night sky. It is these dimmer auroras which will be made invisible, especially from Papanui Inlet if the proposed development is allowed to go ahead.

- 14 Attached as a **Supplement** are a series of photographs I have taken of *Aurora Australis* specifically and the night sky generally to indicate how spectacular views from this part of the world are.

This location

- 15 The “back bays” of the Otago Peninsula (Hoopers and Papanui inlets) are amongst the best and most pristine aurora viewing locations near Dunedin, and the quality of the viewing opportunities there are as good as anywhere in Southern New Zealand. The fact that they are relatively undeveloped makes them excellent locations from which to view and to photograph the night sky.
- 16 I note that in para 42 of the evidence provided by Mr. Cubit he states *“Furthermore, Mr Clearwater has also confirmed that in his experience, the majority of ‘dark sky’ activity occurs in Hoopers Inlet looking south towards Sandymount, which this proposal will not affect.”*
- 17 To the best of my knowledge Mr. Clearwater has no expertise or particular experience of dark sky activity. As someone active in this area I can report that dark sky activity occurs across both inlets on a regular basis, and that Mr. Clearwater’s evidence should not be used as a basis for any decision in this particular matter. Indeed, from my perspective the impact of the proposed development will cause significant adverse effects to the Hoopers Inlet and Papanui Inlet, aurora viewing locations of international importance.
- 18 In the appended photographs (some of which have been published in international journals), it can be seen that the small hills which enclose both inlets act both as a barrier to light pollution from the city and as a barrier to the wind. This makes the site accessible from the city but not adversely affected by it’s light effects. Moreover the site is sufficiently sheltered from the wind to make night sky watching somewhat more pleasant than other more exposed locations.
- 19 In addition, the shallow water level in the inlets makes for quite remarkable reflections; on some windless nights the surface of the inlet creates truly beautiful mirror like reflections of the stars above.
- 20 At present there are very few permanently occupied dwellings in the vicinity. This makes the back bays excellent and almost unique viewing locations for the aurora. Whilst there are a cluster of dwellings located on the eastern side of Papanui Inlet, the majority of these are holiday homes and are generally not occupied during the winter months when night sky views are often at their best

- 21 It should be stressed that a key aspect as to why Hoopers Inlet and Papanui Inlet are so special is the lack of lights. Any additional lighting would significantly impact on the casual observers ability to see the aurora, which can be a subtle phenomenon. An explanation about why lights impact on ability to view the aurora is given later in this submission.
- 22 These attributes combine to make Hoopers Inlet and Papanui Inlet among the best locations in the southern hemisphere for observing the night sky and aurora.
- 23 The quality of the night sky over the back bays is aptly demonstrated by the first image in the graphic supplement to this submission (Photo 1). Photo 2 (taken from the junction of Cape Saunders and Allans Beach Road) looking towards lots 1 and 2 of the proposed development shows a meteor and the Zodiacal Light, a phenomenon which is only visible from some of the darkest sites on Earth. The photograph would not be possible with any ambient lighting from houses on the sites.

The importance of the Night Sky to Dunedin Tourism

- 24 The increasing importance of the night sky to Dunedin can be seen in the establishment of the Dark Sky Advisory Committee and the inclusion (at least in notified form) of protections for the night sky within the Proposed District Plan.
- 25 From my observation many members of the public, the Council and other influential organisations in the city are recognising that the night sky views in the lower part of the South Island are a unique selling point.
- 26 The Otago Peninsula is already recognised as an area of outstanding natural beauty; every day its flora and fauna attract many tourists whose spending is important to the local economy. It is now recognised that Night Sky Tourism has enormous potential to attract additional tourists to Dunedin, especially during the traditional winter low season (when the long nights are better for astronomical observation).
- 27 Night sky tourism can bring in significant numbers of tourists and generate significant employment for a region. I note that at Lake Tekapo the company "Earth and Sky" employs over 80 people and that over 40,000 tourists per year visit the observatory, paying up to \$200 for an opportunity to use a telescope.
- 28 I also note there is considerable local interest in the *Aurora Australis*; the NZ Facebook group has over 15,000 members, and in May 2015, over 900

people attended presentations at Forsyth Barr stadium on how to view the aurora.

- 29 To date, the Otago Museum has held two "equinox star parties" for up to 50 people, who have been willing to pay \$25 to spend an evening under the stars at a local Dunedin Dark Sky location guided by expert astronomers.
- 30 In response to growing interest in the night sky, The Otago Museum has also invested significantly in a new planetarium. Since opening in late 2015, over 30,000 people have paid to see shows at the new facility, which showcases the beauty of the local night sky.
- 31 The Dunedin Dark Sky Committee (appointed by Dunedin City Council to provide input on issues around night sky tourism and lighting) is considering proposals to nominate sites around the city to become UNESCO Night sky reserves. The back bays of the Otago Peninsula are prime candidates for inclusion in this programme. There is considerable evidence that once an area achieves UNESCO Dark Sky reserve designation, night sky tourism at that location increases.

The impact of this proposal on the night sky

- 32 To understand the impact of this proposal on the night sky it is important to first gain an understanding of the physiological aspects of viewing the night sky. From the information referred to date, it is clear there is a lack of understanding about why any additional lights will cause a big problem for stargazers both the Hoopers and the Papanui Inlet. This is not surprising, since considering the impact of lighting on viewing the night sky is a relatively new planning issue, so I thought it might be helpful to explain the issue in simple terms.
- 33 We are all generally aware that if we head outside and look towards the night sky we are at first able to see only a few stars, even on a relatively clear night. Once our eyes adjust to the darkness however our ability to see more and more stars improves. This is not because there are suddenly more stars in the sky but because our eyes have adapted to the darkness.
- 34 If there is any ambient light from housing, the human eye can not fully adjust to the darkness and will therefore not be able to see the most subtle auroral phenomenon.
- 35 As can be seen by comparing Figures 2, 3 and 4 of Mr Moore's Graphic Supplement with pictures I have taken from Hoopers and Papanui Inlet as illustrated in photo 3 of my graphic supplement, the dwellings on Lots 7, 4, 2

and 1 will have significantly negative impact on views from popular night sky observing viewpoints.

- 36 It's important to realise that it's not just upward lighting that will be a problem in these locations. Reflections from any lighting from the water of the inlet will in effect double the impact of the development. As can be seen in Photo 3 of my graphic supplement lights from existing dwellings in Papanui Inlet are already having significant impact, with their reflections adding to the impact on the night sky environment.
- 37 It is my expectation that a typical dwelling in the location identified in Lots 1, 2 and 4 will have significant impact on views of the *Aurora Australis* and Milky Way when looking South across Papanui Inlet a typical dwelling on Lot 7 will have enormous impact on the visibility of the Milky Way rising across the inlet and also create more reflections on the inlet. Cumulatively I would expect the result to be that the *aurora australis* not being visible with the human eye from the inlet any more, especially during dimmer displays. Lights, and their reflections from the waters of the inlet would also ruin the aesthetics of photographing the night sky against an unspoiled landscape which is already recognised as being of outstanding natural beauty.
- 38 Therefore, although I wish to acknowledge the decision of the Applicant to reduce the number of houses applied for down to four, to respond to concerns raised around dark sky issues, unfortunately that change does not sufficiently resolve the concerns that I hold regarding the adverse effects of this proposal.
- 39 It is my strongly held view that any additional dwellings in this location will adversely affect the night sky to a significant extent. I am aware that expert witnesses in resource management matters refer to matters as being minor or more than minor and I record that from my assessment the adverse effects on night sky viewing will be significantly more than minor. In my view not being able to see the *aurora australis*, or the Zodiacal light is something of immense importance that would have significant impact on Dunedin's stated goal to be a night sky city.
- 40 Although I appreciate that owners of land should within reason be able to use their land as they see fit, I believe that the protections in the planning documents are there for a reason. The applicant has confirmed in the application that the farm is a viable concern and it is against that background that I make my comments.
- 41 In my view the landscape in this location is a critical consideration and once developed it will not be possible to turn back the clock. On my assessment

the very unique characteristics of this location do render development here inappropriate as a result of adverse effects on the night sky. I also think such development would be contrary to the intention of the proposed District Plan which seeks to improve understanding of these issues and provide some (albeit fledgling) protection of night sky views.

Possible Mitigation

- 42 Having read the evidence of Mr Cubitt I have turned my mind to whether there are conditions that could be imposed to avoid or mitigate adverse effects on the night sky. I have two comments to make in that regard.
- 43 First, I noted with some concern in the Planners Report that the applicant appears to have a history of breaching consent conditions. In such circumstances I would be concerned as to whether any conditions imposed would in fact be upheld over time. In this regard I note that on a recent visit to the inlets it appears that building platform work appears to have started on some of the sites.
- 44 Secondly, I am not satisfied that it is possible to adequately mitigate the effects of dwellings in this location. There are certainly types of lighting and light fittings that create a lesser impact and the use of shielded fittings, a prohibition on outdoor lighting of any type could be considered. However unless a condition is imposed whereby the houses don't have windows facing North or South, it seems there is little that could be done to mitigate the problem of light pollution which will undoubtedly arise when the houses are inhabited.
- 45 However, in remote locations without close neighbours it is likely that residents will want to enjoy views or will not feel constrained in closing curtains etc and accordingly light from the dwellings will inevitably 'leak' out. As previously explained, every additional light source and its reflections on the inlets will diminish the night sky views.

CONCLUSION

- 46 Despite the amendments made to the proposal I remain firmly opposed to additional development at this location. Like an outstanding mountain range or pristine lake frontage, Hoopers Inlet and Papanui Inlet have qualities that elevate them above the ordinary. This area is truly outstanding and deserves the utmost standard of protection. Any development in this location will significantly and adversely affect night sky viewing. Once the location is lost for this purpose it will be extremely hard to regain it, and the chances of Dunedin being able to harness the tourism and scientific potential

will be lost with it. For these reasons, and the other reasons I have outlined in my submission, I consider that this consent should be declined.

Ian Griffin

1 March 2017