IN THE MATTER of an application for regional resource consents and a land use consent under the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES Soil) in fulfilment of section 88 of the RMA.

EVIDENCE OF DR CATE MACINNIS-NG
ON BEHALF OF SAVE OUR KAURI TRUST
13th February 2020

Qualifications and experience

1. I am a plant eco-physiologist and eco-hydrologist and am an Associate Professor at the School of Biological Sciences at the University of Auckland. I measure and model carbon and water cycling in forests and am particularly interested in the effects of global change processes (like climate change and land use change) on forests and other vegetation.

2. I received my PhD in 2003 from the University of Technology Sydney (UTS). I worked at UTS for seven years as a research fellow researching water use of vegetation in several research groups including the National Centre for Groundwater Research and Training. I have published 46 peer-reviewed journal articles and I have written nine technical reports.

3. Since moving to New Zealand in 2010, I have been working on the physiology of kauri. In 2012, I received a Marsden Fund Fast-Start grant from the Royal Society of New Zealand to study the water use patterns of these iconic trees. In 2014, I was awarded the Early Career Research Excellence Award at the University of Auckland and in 2015, I was awarded a Rutherford Discovery Fellowship by the Royal Society of New Zealand.

4. I have been asked by Save Our Kauri Trust to provide an assessment of the impact of the proposed water treatment plant on protected land bordered by Woodlands Park Rd, Manuka Rd Titirangi.

5. I advise that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and have complied with it in preparing this evidence. I confirm that the issues addressed in this evidence are within my area of expertise and I have not omitted material facts known to me that might alter or detract from my evidence.

6. In this document, I outline the value of the established ecosystems as an essential part of the landscape and a valuable carbon store.

Value of established forest ecosystems

7. Generally, forests provide us with many goods and services that support human life. Forest products include wood and gum (these are often referred to as ecosystem goods). The value of these goods can be easily determined based on market prices.

8. Ecosystem services are more difficult to value because they are less tangible. Carbon uptake and storage is a good example of a forest ecosystem service. Forests absorb CO_2 as they grow and trees store this carbon in their stems, branches, leaves and roots. Forests also play an important role in the water cycle as transpiration is one of the major pathways through which water returns to the atmosphere after rain. Trees are important for flood mitigation because they collect rainfall on their leaves and buffer water flow through the landscape. Tree roots are also important for binding the soil and preventing erosion.

9. Kauri forests are particularly valuable because they are amongst the most carbon dense forests in the world. A single tree can store vast amounts of carbon and will also use large volumes of water each year.

10. The trees within the proposed area to be felled are not particularly large but as there are hundreds of trees to be removed, collectively their carbon storage is considerable. Under a climate emergency, all effort

should be made to protect established forests for the rich carbon reserves they store both above and below ground.

11. There are several kauri trees of a relatively young age at the site but as kauridieback is killing hundreds of trees, all individuals should be protected because we don't know which tree will be the future Tāne Mahuta centuries from now. Ongoing work by one of my PhD students is just beginning to unravel the physiological responses of kauri to kauri dieback disease. Disturbance of the site will likely spread the pathogen due to soil movement by euqipment and hydrological changes due to removal of trees. Established canopy and root systems provide protection of the soil by reducing water reaching the understorey and binding the soil as described below.

12. During a rainfall event, a large canopy of leaves will capture water until the leaf surfaces have been saturated. This process is known as 'wetting up' and it reduces the amount of water reaching the ground because the water stays on the leaves until it evaporates once the rain has cleared. A closed canopy is likely to have a leaf area of 3-4 m of leaves per unit of ground so this surface area has a significant effect on the water cycle.

13. Detailed measurements of rainfall redistribution in kauri forest by Sangster (1986, unpublished MSc thesis, University of Auckland) showed interception loss was 44% of incoming rainfall. This is consistent with other similar forest types around the world and indicates that only 56% of rainfall reaches the forest floor. Removal of trees therefore increases water input onto the land surface and increases water logging and runoff. More runoff can mean more erosion and more frequent and severe floods in addition to movement of soil, potentially spreading kauri dieback.

14. Tree roots are also important for binding soil. Where there is complicated topography, established trees are important for stabilisation of any slopes. As a rule of thumb, a tree stores half its biomass above ground and the other half below ground so the root systems of the vegetation proposed to be removed would be very large.

15. There are several notable larger kauri in the vicinity of the area proposed to be cleared. We are just learning how trees interact below ground through the rhizosphere. In addition to my concerns about soil movement due to earth work equipment and water flow, I am also concerned that the root systems of these trees will be adversely impacted by the vegetation removal. Significant trees need substantial buffers for best protection.

16. Any proposed biodiversity offset will not be a meaningful replacement in a changing climate. Established forests are better placed to survive drought because they have deep root systems to access deep water stores. Seedlings and saplings do not have adequate root structures to allow them to survive dry periods. Under the current drought conditions, we are seeing restorations plantings completely fail across the city because the deveoping soil moisture deficit is killing sensitive seedlings. As droughts are predicted to become more frequent and severe, we cannot predict if on offset planting will survive to a mature age. Established forest has never been more valuable for the carbon it stores, the water it regulates and it’s ability to survive drought.