SUMMARY OF EVIDENCE OF DR. ZAC BEECHEY-GRADWELL

SOIL CONTAMINANTS

DATED: 4 MARCH 2024

My name is Dr. Zac Beechey-Gradwell. I am an agricultural scientist employed at AgResearch Limited. I prepared a statement of evidence on behalf of the Applicant regarding the potential for leaching of soil contaminants from solar panels that could result from the proposed solar array on Buckleys Road, Brookside (the Proposal).

The following is a brief summary of my evidence dated 16 February 2024 and responds to the evidence of Sharn Ainsworth dated 23 February 2024 and the evidence of Hadee Thompson-Morrison's evidence dated 23 February 2024.

A description of the Site and the Proposal are set out in my evidence and the application, and I will not repeat these here.

My evidence covers the potential for leaching of soil contaminants from solar panels and possible negative downstream effects on pasture growth created by the proposed Buckleys Road solar farm. Estimates of these effects are based firstly on my soil and plant measurements from a replicated agronomic field trial at an existing Kea Energy Limited solar array in Wairau Valley, which has been operational for three years, and secondly on soil measurements provided by Nick Keeler from the Coombe farm solar array in the United Kingdom which has been operational for twelve years.

The underlying solar panel technology and panel configuration in the Proposal is similar to that used at the Wairau Valley site. At both sites, the panels are bifacial and silicon-based, with each solar cell surrounded by an encapsulant within glass and surrounded by edge seals (See evidence of Campbell McMath). For this reason, measurements of soil contamination and pasture growth made at the Wairau Valley site can be used to estimate expected effects at the Buckley's Road site.

Encapsulated solar cells are manufactured for durability which prevents exposure of internal components to rainwater, hence negligible leaching is expected under normal operating conditions. As panel breakages are very rare and regular maintenance checks will ensure that any broken panels will be replaced in a timely manner, my evidence relates to the possibility of soil contamination from operational panels and the support frames they are mounted on.

Replicated soil measurements at the KeaX Limited solar array in Wairau Valley showed no statistically significant increase in the concentration of 7 potential topsoil contaminants (Total recoverable Cadmium, Cobalt, Lead, Nickel, Zinc, Fluoride, Chromium) below solar panels compared to corresponding control sampling points outside the solar array (which were selected such that they would not be impacted by rainwater runoff or shading from the array). A further 3 potential topsoil contaminants (Total recoverable Mercury, Molybdenum, Selenium) were consistently below detectable limits.

Replicated pasture growth measurements at sampling points corresponding with the solar panel dripline showed similar pasture growth rates to control sampling points situated away from rainwater runoff from the panels at the KeaX Limited solar array in Wairau Valley. Given that driplines are where potential leached contaminants would be expected to concentrate, this indicates that any potentially unmeasured contaminants in the rainwater which runs off operational panels have no negative impact on pasture production.

Soil measurements provided by Nick Keeler from the Coombe farm solar array in the United Kingdom, which has been operational for 12 years, show that there was no increase in the concentration of 7 potential topsoil contaminants (Cadmium, Copper, Fluoride, Selenium, Lead, Zinc and Chromium), below solar panels compared to corresponding control sampling points outside the solar array. A further 3 potential topsoil contaminants (Molybdenum, Nickel, and Mercury) were consistently below detectable limits.

On the basis of this evidence, it is extremely unlikely that the Proposal will lead to leaching soil contaminants over the long-term. With regards pasture growth,

spatial variation in pasture growth below solar arrays can be expected but this is better explained by the varied and dynamic light, rainfall, and microclimatic environment under the array, rather than soil contamination.

The evidence of Sharn Ainsworth suggests that there is a 'Risk of contamination from where panels crack, and stormwater is incorrectly managed'. However, an IEA report on solar panel breakage risks (Human health risk assessment methods for PV Part 2) states 'Annual field breakage rates estimated based on warranty return data are low (~0.04%), and due to use of laminated glass in PV modules, field breakages mainly consist of stress and impact fractures in which modules remain intact albeit with a number of cracks in the protective outer glass'. The report further states that 'In the case of field breakage, exposure of module components to rainwater is therefore limited to the surface area of the crack or the perimeter of the broken module piece.' Therefore, the risk of soil or water contamination from cracked panels is very low (because breakages are very rare), and when they do occur in the field, generally do not expose the potentially toxic internal components of the solar cells to rainwater. This IEA report can be provided to the commissioner.

The evidence of Hadee Thompson-Morrison involves a comparison of soils in the vicinity of solar panels at 56 Buckleys Road and the surrounding dairy pasture. I agree with Hadee Thompson-Morrison's summary statement that comparison (of these soils) 'was confounded by the fact that the soils in the vicinity of solar panels were non-irrigated and very dry while the soils under surrounding pasture were irrigated'. In my expert opinion, the inability to control for this important confounding factor (irrigation), means that the comparisons made by Hadee Thompson-Morrison are biased and inconclusive, and therefore not relevant to understanding the potential for changes in soil properties that could result from the proposed solar array. This is generally acknowledged by Hadee Thompson-Morrison in her summary statement.