Before Southland Regional Council

APP-20157616-V1

under: the Resource Management Act 1991

in the matter of: Applications by Sanford Limited to change the conditions of various resource consents that authorise the farming of salmon in Big Glory Bay, Stewart Island

by: **Sanford Limited**
Applicant

Summary of evidence by Dr Neil Hartstein on behalf of Sanford Limited

Dated: 25 March 2019

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SUMMARY OF EVIDENCE BY DR NEIL HARTSTEIN ON BEHALF OF SANFORD LIMITED

1 My full name is Neil David Hartstein

2 I am currently a senior oceanographer at Aquadynamic Solutions (ADS). I undertook the detailed modelling of Big Glory Bay with specific focus on the release of nutrients from the proposed farm into the water column, flushing, oxygen dynamics and faeces and feed waste to the seabed.

3 My full qualifications and experience, and agreement to comply with the Environment Court's Code of Conduct for Expert Witnesses, are set out in my statement of evidence dated 11 March 2019.

4 I have no corrections or updates to add to my evidence.

5 I have modelled the environmental effects on water quality and the seabed expected as a result of an increase in nitrogen input in Big Glory Bay up to a maximum of 659 tonnes per year. The results of this modelling are explained in the Assessment of Environmental Effects and in my statement of evidence.

6 The hydrodynamic model that we used for the study was the DELFT3D, which is a commonly used and well-understood suite of modelling tools that has undergone over 30 years of development. We used two models grids – one larger-scale regional model and a local model covering the south-east of Stewart Island. The model was calibrated against current speed and directions measured at two locations within the bay and water level from tidal harmonics in Paterson Inlet. For validation, the model was then run and compared against data collected in 2010. Overall I consider the model is well calibrated and fit for purpose. We added extra modules to the model in order to then determine the concentrations of nitrogen released from fish farming.

7 Big Glory Bay has generally weak currents (5cm s^{-1}) across much of the bay but stronger flows towards the mouth of the bay. Flushing models indicate that after 7 days, the bay is approx. 30% flushed and after 14 days the bay is approx. 60% flushed. After 28 days only 10-15% of the original water remains in the bay.

8 Turning now to the modelling results, oxygen levels in the water are predicted to reach minimum values of close to 6 mg L^{-1}, this being the level needed to maintain healthy farmed salmon. Dissolved oxygen reductions are expected to reach 0.25mg L^{-1} inside the Bay and up to 1.5mg L^{-1} within the cages.

9 The depositional footprints around the farm sites were predicted using the software newDEPMOD, which is a widely-used and internationally recognised particle tracking model specifically designed for predicting salmon farm deposition. We modelled three farm locations (MF246, LI320

and LI339), each with varying amounts of feed input to consider mid-level and higher-level stocking scenarios.

10 The deposition models show that faeces and solids deposition will generally remain within the pen boundaries, with only limited deposition outside pen boundaries.

11 Excess Total Ammonia Nitrogen (TAN) levels in the bay are predicted to increase up to 30µg L^{-1} with additional N inputs from feed of 659 tonnes, resulting in 381.2 tonnes of released TAN in the higher production scenario. Assuming all excess released TAN is converted to phytoplankton biomass, chlorophyll-a levels are predicted to increase by up to 4 µg L^{-1}. These values are worst case.

12 It is important to note that my modelling is conservative because I have made no allowance for nitrogen uptake by mussels in the Bay.

13 The monitoring that my firm has undertaken over the last four years shows that benthic recovery within BGB occurs within 3-4 years of fallowing.

14 I am happy to answer any questions from the Panel.