BEFORE THE SOUTHLAND REGIONAL COUNCIL

UNDER THE the Resource Management Act 1991

IN THE MATTER OF Resource consent applications by Sanford Limited, APP-20157616-V1, APP-203236-V1, APP-203237-V1, APP-203240-V1, APP-203241-V1, APP-203242-V1, APP-207256-V1, seeking coastal permits associated with the operation of a Salmon Farm at Big Glory Bay, Stewart Island.

STATEMENT OF EVIDENCE OF ANDREW STEPEHEN BAXTER
for DIRECTOR-GENERAL OF CONSERVATION

Dated 15 March 2019

Department of Conservation
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1. INTRODUCTION

1.1 My full name is Andrew Stephen Baxter. I am a Technical Advisor (Marine) in the Department of Conservation's Biodiversity Group. I am based in the Department's Nelson office.

1.2 I graduated from the University of Canterbury in 1981 with a BSc with First Class Honours in Zoology.

1.3 I have 37 years experience in coastal and marine science and management, specialising in marine ecology including marine mammals. In 1982 and 1983 I was employed by the Taranaki Catchment Commission as a marine biologist. From early 1984 until October 1987 I worked as a fisheries management scientist for MAF-Fisheries based in Wellington. Since October 1987 I have been employed as a marine ecologist in various roles by the Department of Conservation. I have held my current position since 2011.

1.4 My duties with the Department have included:

(a) technical input on Resource Management Act plans and consents;

(b) technical input on consent applications under the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012;

(c) marine ecology research, survey and monitoring;

(d) marine mammal research and management; and

(e) marine reserve implementation, management and monitoring.

1.5 I have had a close involvement with various significant coastal issues and developments, including:

(a) marine farming;

(b) port developments;

(c) major roading proposals;

(d) various coastal discharges;

(e) commercial fishing issues;

(f) coastal shipping issues;

(g) seabed mining;

(h) seismic surveying;

(i) marine mammal tourism; and

(j) marine biosecurity.

1.6 I am part of a working group currently developing best management practice guidelines (water quality standards and monitoring protocol) for salmon farms in the Marlborough Sounds. In addition to myself, the working group is made up of specialists from Fisheries New Zealand, the National Institute of Water and Atmospheric Research NIWA, Cawthron Institute, Marlborough District Council, Sounds Advisory Group and New Zealand King Salmon Company Limited.

1.7 I present this evidence as a marine ecologist with a broad range of experience in coastal and marine resource management.

1.8 I am presenting this evidence in relation to the Director-General of Conservation's ("D-G") submission on Sanford Limited's application.

2. CODE OF CONDUCT

2.1 I have read the code of conduct for expert witnesses as contained in the Environment Court's Practice Note 2014 ("the Code"). Although this hearing is not before the Environment Court, I have complied with the Code when preparing my written statement of evidence.

2.2 The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence to follow. The reasons for the opinions expressed are also set out in the evidence to follow.

2.3 Unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

2.4 I am authorised to present this evidence for the D-G and to do so in an independent capacity in accordance with the Code.

3. SCOPE

3.1 I have been asked to present evidence on my technical assessment of the application and, in particular, the development of the revised set of conditions dated 18 December 2018 which are now before the hearing committee (see pages 6-10 Environment Southland staff report; and **Appendix AB2** of this evidence). These revised conditions were developed and agreed between the technical advisors for the Department of Conservation (myself and Dr Peter Longdill) and Sanford Limited (Dr Mark James and Dr Neil Hartstein).

3.2 My involvement in this process focussed on benthic ecology issues. While I also contributed to the discussions and agreements on the water quality conditions, Dr Longdill was the Department's key advisor in this regard.

3.3 My evidence, therefore, focusses on benthic ecology matters. Dr Longdill addresses the water quality conditions in detail in his evidence.

3.4 The key documents that I have relied on in forming my opinions are contained in **Appendix AB1**.

3.5 In preparing my evidence I have read, and where necessary refer to:

(a) The resource consent application and supporting documents from Sanford Limited;

(b) The Council Officer's section 42A Report;

(c) The evidence of Sanford consultants for the applicant, notably that of Dr Mark James and Mr Phil Mitchell;

(d) The D-G's submission; and

(e) The evidence of Dr Peter Longdill and Ms Nardia Yozin for the D-G.

3.6 In the main body of my evidence I discuss those parts of the D-G's submission most relevant to benthic effects, the broad benthic effects of salmon farming, and key elements of the Marlborough Best Management Practice guidelines (Best Management Practice guidelines for salmon farms in the Marlborough Sounds: Part 1: Benthic environmental quality standards and monitoring protocol). Later I discuss revised conditions (**Appendix AB2**) to address the concerns raised in the D-G's submission.

4. EXECUTIVE SUMMARY

4.1 Typically, the seabed beneath and in the immediate vicinity of salmon farm cages is significantly degraded. Effects can be mitigated through a range of measures including good site location, specific cage placement, staged/adaptive development, monitoring, stocking levels, feed management, and fallowing.

4.2 The D-G's submission raised concerns about the Sanford Limited application including the assimilative capacity of Big Glory Bay to cope with the increased discharges, the clarity and workability of the proposed conditions, and the absence of staging/adaptive management. With respect to benthic impacts, the D-G's submission sought an approach aligned with the Marlborough Best Management Practice guidelines (Best Management Practice guidelines for salmon farms in the Marlborough Sounds: Part 1: Benthic environmental quality standards and monitoring protocol. MPI Technical Paper No: 2015/01).

4.3 To address these concerns, Sanford and Department of Conservation technical advisors (including myself) drafted and agreed on a revised set of conditions (18 December 2018; **Appendix AB2**). Although the proposed new EQS-seabed condition A4d does not strictly follow the same approach as the Marlborough benthic guidelines, the net result should be similar in my opinion.

4.4 I believe the agreed set of new conditions, subject to a minor amendment agreed to subsequent to the 18 December version of the revised conditions, address the D-G's concerns regarding benthic effects and will result in a clearer and more effective monitoring framework for benthic effects.

5. D-G'S SUBMISSION

5.1 The D-G's submission opposed in part those aspects of the Sanford application "*relating to the assimilative capacity of Big Glory Bay (water quality generally and the benthic environment under and near the farms) to cope with the proposed increases in nutrient loadings and discharges of other contaminants*." The submission raised several concerns about the application including water quality modelling parameters, the clarity

and workability of the conditions (within and between consents), and the absence of staging/adaptive management.

5.2 With respect to benthic effects, the D-G's submission stated: *"The proposed conditions relating to the deposition of total organic carbon and total faeces and solid waste to manage benthic effects are largely impractical and would permit substantial enrichment of the seabed beyond the permit areas. An approach aligned with the Marlborough Best Management Practice guidelines (Best Management Practice guidelines for salmon farms in the Marlborough Sounds: Part 1: Benthic environmental quality standards and monitoring protocol. MPI Technical Paper No: 2015/01) should be used instead."* These "benthic guidelines" are available on the MPI website: [https://www.mpi.govt.nz/dmsdocument/6943-best-management-practice-guidelines-for-salmon-farms-in-the-marlborough-sounds-part-1-benthic-environmental-quality-standards-and-monitoring-protocol-version-1-0-january-2015/loggedin].

5.3 I concur with the concerns raised in the D-G's submission.

6. ECOLOGICAL EFFECTS OF FISH FARMING – BENTHIC

6.1 The ecological effects of salmon farming are well documented based on monitoring and research in New Zealand and from overseas. Forrest *et al.* (2007) provides a comprehensive review and makes the following overall statements with respect to benthic effects:

(a) "*The deposition of uneaten feed and faeces can have pronounced effects directly beneath finfish cages, but there is a rapid improvement in environmental conditions with increasing distance from farm structures (over tens or hundreds of metres)*."

(b) "*Seabed effects are largely reversible, although recovery is likely to take many months or years, depending on water flushing characteristics*."

(c) "*Seabed and water column effects can be reduced by locating farms in well-flushed areas, in areas where species and habitats of special value are not present, or where flushing characteristics alter deposition patterns to a point where adverse effects do not occur*."

6.2 More recently Ministry of Primary Industries (2013) summarised the benthic effects of organic enrichment deposition from finfish farms as follows:

(a) "*Feed and faecal deposition from finfish farms can change well-aerated and species-rich soft sediments in the vicinity of farm cages into anoxic (oxygen-depleted) zones that can be azoic (devoid of life) in extreme cases. Microbial decay of the waste material can dramatically alter the chemistry and ecology of the seafloor. Benthic communities can become highly enriched, infaunal diversity will be significantly reduced and extreme abundances of common opportunistic taxa may occur. Organic accumulation is less at highly dispersive sites, but the sediment chemistry and general composition will be significantly altered. Beneath finfish farms, enrichment effects are usually inseparable from those of farm-derived contaminants (e.g. copper and zinc), which is likely to be a compounding factor.*"

(b) "*Effects most evident directly beneath the cages and exhibit a strong gradient of decreasing impact with increasing distance. The intensity and spatial extent of enrichment is highly site specific, with high flow, deep sites producing larger but more diffuse footprints. Mild enrichment can be detected out to about 100 to 1000m away from the farm, dependent on the site's dispersive properties*."

6.3 Other benthic effects include direct smothering, biofouling drop-off and debris, and shading (Ministry of Primary Industries 2013).

6.4 The effects of salmon farms are very site dependent – i.e. related to feed/stocking levels, depth, currents, and biophysical characteristics of the seabed including the type of benthic community and its resilience to organic enrichment. Low flow sites such as in Big Glory Bay (currents generally weak <5cm/second; see paragraph 17 of Dr James' evidence) have less dispersive qualities, meaning benthic effects will tend to be more localised and intensive than at high flow sites. In contrast, high flow sites tend to have larger but more diffuse footprints, especially when coupled with deep water.

6.5 Effects can be mitigated through a range of measures including good site location, cage placement within a site, staged/adaptive development, monitoring, stocking levels, feed management, and fallowing.

6.6 Dr James' summary statement (paragraph 15 of his evidence) that salmon farm effects are "*generally characterised as benign or minor*" needs to be considered with this context in mind. While any assessment of effects is dependent on scale (e.g. local, bay-wide, regional), typically the seabed beneath and near the cages of a full production salmon farm is significantly degraded. In these cases, I do not believe the benthic effects could be considered benign or minor at a local scale.

7. ALIGNMENT WITH THE MARLBOROUGH BEST MANAGEMENT PRACTICE GUIDELINES – BENTHIC

7.1 The Marlborough Best Management Practice guidelines (Best Management Practice guidelines for salmon farms in the Marlborough Sounds: Part 1: Benthic environmental quality standards and monitoring protocol) were developed for the Ministry for Primary Industries by the Benthic Standards Working Group and were published in 2015 as MPI Technical Paper No: 2015/01. (Note I was not on this working group.)

7.2 Although the benthic guidelines were developed for salmon farming in Marlborough, I believe they provide a very useful foundation for managing the benthic effects of salmon farming elsewhere. They build on international best practice and are founded on several guiding objectives including sustainable management and minimising environmental impacts.

7.3 Environmental Quality Standards (EQS) are a key component of the guidelines – effectively environmental "bottom lines" at certain distances from the cages. Enrichment Stage (ES) underpins the EQS, along a continuum from 1.0 (least enrichment) to 7.0 (highest enrichment). ES is highest under and next to the cages and reduces with distance away from the farm depending on currents (speed and direction) and depth. ES is determined differently for high flow (≥10 cm/second) and low flow sites (<10 cm/second).

7.4 ES is based on multiple physico-chemical and biological variables and calculated quantitatively by a weighted averaging approach. Infauna composition has the greatest influence on the ES score (weighting = 0.7) compared to organic loading (0.1) and sediment chemistry (0.2).

7.5 The Marlborough guidelines use a highly technical and numerical approach to arrive at the ES score. I therefore find Table 3 of the guidelines very useful for understanding descriptively the ES scoring system. E.g. for low flow sites (<10 cm/second, such as Big Glory Bay), the following descriptions are provided for ES4.0, 5.0 and 6.0.

(a) ES4.0: *Diversity further reduced; abundances usually quite high, but clearly sub-peak. Opportunistic species dominate, but other taxa may still persist. Major sediment chemistry changes (approaching hypoxia).*

(b) ES5.0: *Very high numbers of one or two opportunistic species (i.e. Capitellid worms, nematodes). Richness very low. Major sediment chemistry changes (hypoxia, moderate oxygen stress). Bacterial mat usually evident. Out-gassing occurs on disturbance of sediments.*

(c) ES6.0: *Richness and diversity very low. Abundances of opportunistic species severely reduced from peak, but not azoic. Total abundance low but can be comparable to reference stations. %OM can be very high (3–6 × reference).*

7.6 The guidelines recommend ES5.0 as the upper level of acceptable seabed effects beneath salmon farms in the Marlborough Sounds; this is the point where seabed productivity is greatly enhanced and one, or a few, enrichment-tolerant 'opportunistic' species (e.g. Capitellid worms and nematodes) proliferate.

7.7 ES5.0 provides for the greatest benthic biomass and accordingly the greatest waste assimilation capacity. Despite the benthos being highly degraded at ES5.0, in my opinion this level is advantageous for the salmon farmer (i.e. it provides for maximum waste assimilative capacity) while ensuring the benthos remains "biologically functional". Above ES5.0, seabed communities move towards a state of collapse, waste metabolism declines abruptly, and organic accumulation is exacerbated.

DG CONCERNS

7.8 As noted earlier in paragraph 5.1 of my evidence, the D-G's submission raised concerns about the application and original consent conditions as they would allow substantial enrichment of the seabed beyond the permit

areas. Some of the consent conditions were also considered impracticable.

7.9 I agree with these concerns. For example, the original conditions proposed measuring total organic carbon deposition (>0.73 kg/m^2/year) and total faeces and solid waste deposition (> 5 kg/m^2/year) 100 metres from the boundary of the site. However, measuring these parameters with any accuracy while accounting for spatial and temporal variability would be very challenging. Assessing compliance with these metrics would be equally difficult. Furthermore, "*100 metres from the boundary of the site*" could be interpreted to mean the boundary of the consent rather than the edge of the cages, providing greater uncertainty. Either way, these sorts of depositional quantities would allow for substantial seabed enrichment (>ES5.0) well beyond the cage boundaries (note ES5.0 typically occurs around 6 kg/m^2/yr) (Dr Peter Longdill pers. comm). Such an outcome would be contrary to the Marlborough benthic guidelines.

8. POST SUBMISSION CONDITION DISCUSSIONS WITH SANFORD LIMITED

8.1 Following the submission period, Dr Longdill and I engaged in a series of meetings and discussions with Sanford Limited's advisors with the objective of reviewing the consent conditions to address the concerns raised in the D-G's submission. This process proved very fruitful and ultimately lead to a revised set of conditions being agreed (18 December 2018). These revised proposed conditions are outlined in **Appendix AB2** of this evidence. They are also presented on pages 6-10 of the Environment Southland staff report; note there are numbering differences between these two versions.

8.2 Water quality condition A4(c)(ii) was subsequently amended to avoid a possible issue with "double counting". Dr Longdill discusses this change in Section 10 of his evidence.

9. TERM OF CONSENT

9.1 These discussions and agreements on revised consent conditions were undertaken on the understanding the application was for an amendment to

the existing consent with an expiry in 2025 (not a 20-year expiry as now proposed in the Council Officer's section 42A Report). While the application is for a very large increase in nutrient loadings, the 2025 expiry date created a "degree of comfort" because the consent and conditions could be totally reviewed in six years' time.

10. AGREED CONDITIONS

10.1 I highlight the following key matters in the revised conditions (18 December 2018; **Appendix AB2**) which are most relevant for benthic effects.

10.2 The revised conditions allow for staged increases in nitrogen (conditions A4a and YY).

10.3 Environmental quality standards (EQS) for water and seabed are separated for clarity (conditions A4c and A4d).

10.4 Condition A4d (EQS-seabed) states:

Tier two standard (see condition 4 (e)): Activities authorised by Condition 4(a) shall meet the following Environmental Quality Standards (EQS) for the seabed within 10 metres of the edge of the pens:

i. The benthic community retains a diversity and abundance of marine taxa (other than one or two opportunistic enrichment-tolerant taxa such as Capitellid and Dorvillea worms, and nematodes) at levels which allow for sustained farm waste assimilative capacity and sufficient seabed recovery to support a farm rotation cycle with a fallowing period of not less than 5 years.
ii. No more than 20% of the not less than 5 replicate cores collected have no taxa present (azoic). In any assessment under this condition, the effects of mussel shell substrate on benthic communities are to be ignored.
iii. No obvious, spontaneous out-gassing (H_2S/methane)
iv. Bacteria mat (Beggiatoa) coverage not greater than 50% of the sampled area.

10.5 Thus, the EQS-seabed must be met close to the edge of the pens, not 100 metres from the edge of the site as previously required.

10.6 While condition A4d does not follow the same quantitative numerical approach as the Marlborough benthic guidelines and does not directly refer to ES5.0, the net result should be similar in my opinion. It is designed around maintaining the waste assimilative capacity of the seabed under the cages. The reference in A4d to "*a diversity and abundance of marine taxa (other than one or two opportunistic enrichment-tolerant taxa such as Capitellid and Dorvillea worms, and nematodes)*" highlights the need to maintain a benthic community not just dominated by one or two opportunistic species. In this regard, the wording of this condition provides for a benthic community which may be richer and healthier than ES5.0.

10.7 Condition A4d is also worded to recognise and incorporate the farm rotation cycle used by Sanford Limited in Big Glory Bay and ensure seabed recovery occurs within a farm fallowing period of not less than five years to help ensure there is sufficient seabed recovery before a site is farmed again.

10.8 The remaining sub-conditions of A4d (azoic samples, H_2S/methane and *Beggiatoa* mats) reflect ES5.0.

10.9 Any breach of Condition A4d requires a tier 2 response under condition A4e (i.e. destocking and/or fallowing within stated timeframes).

10.10 Conditions A4(g, h and i) and B1-4 detail requirements for monitoring including preparation and application of the Big Glory Bay Salmon Farm Environmental Management Plan. Conditions relating to the technology update report and the annual monitoring report are also specified in part B of **Appendix AB2**.

10.11 The Big Glory Bay farms are all "low-flow" sites, meaning they will have low dispersive qualities. Wastes, therefore, will be concentrated beneath and near the cages affecting the assimilative capacity of the seabed to cope with the proposed increased nutrient loadings. Dr Ken Grange notes reservations about this matter in section 4 of his evidence. These environmental factors reinforce the need for clear and robust conditions as well as a comprehensive monitoring plan to ensure the state of the seabed is not allowed to fall below acceptable trigger levels. I also reiterate the point I made in paragraph 9.1 that the 2025 expiry date creates a "degree of comfort" because the consent and conditions can be totally reviewed in six years' time.

10.12 Further commentary on the revised draft conditions are provided in the briefs of evidence of Dr Peter Longdill (for the D-G) and Dr Mark James and Mr Phil Mitchell (for the applicant).

10.13 I believe the revised conditions (18 December 2018; **Appendix AB2**) adequately address the concerns raised in the D-G's submission regarding benthic effects.

10.14 In closing, I would also stress the critical importance of the Big Glory Bay Salmon Farm Environmental Management Plan and within this the Big Glory Bay Salmon Farm Environmental Monitoring Plan (Appendix 1 in Dr James' evidence). The details of these plans were not part of the D-G's submission and I have not reviewed the content of the monitoring plan in detail. Condition A4(h) requires the monitoring plan to be submitted to Environment Southland for technical approval.

11. CONCLUSION

11.1 The D-G's submission raised numerous concerns about the Sanford Limited application including the proposed consent conditions.

11.2 To address these concerns, Department of Conservation and Sanford technical advisors (including myself) drafted a revised set of conditions (18 December 2018; **Appendix AB2)**. I believe the agreed set of new conditions address the D-G's concerns regarding benthic effects and will result in a clearer and more effective monitoring framework for benthic effects.

Andrew Stephen Baxter

15 March 2019

APPENDIX AB1 - DOCUMENTS CONSIDERED

(a) Sanford Limited, Big Glory Bay Salmon Farms, Change of Conditions Application and Assessment of Environmental Effects, 16 November 2017.

(b) A public guide to Sanford's Big Glory Bay Resource Consents change of conditions application. May 2018.

(c) Aquatic Environmental Sciences, Assessment of ecological effects of expanding salmon farming in Big Glory Bay, Steward Island – Part 1 Description of aquatic ecology, Prepared for Sanford Ltd, 26 April 2018.

(d) Aquatic Environmental Sciences, Assessment of ecological effects of expanding salmon farming in Big Glory Bay, Stewart Island – Part 2 Assessment of effects.

(e) NIWA, Big Glory Bay Salmon Farms – Change of Conditions Application by Sanford Ltd. Technical Review prepared for Environment Southland, Invercargill, May 2018.

(f) Sanford Limited, Sanford Big Glory Bay Salmon Farm Resource Consent Variation – Response to Section 92 Request, 23 May 2018.

(g) Best Management Practice guidelines for salmon farms in the Marlborough Sounds: Part 1: Benthic environmental quality standards and monitoring protocol. MPI Technical Paper No: 2015/01.

(h) Forrest B, Keeley N, Gillespie P, Hopkins G, Knight B, Govier D. 2007. Review of the ecological effects of marine finfish aquaculture: final report. Prepared for Ministry of Fisheries. Cawthron Report No. 1285. 71p.

(i) Ministry of Primary Industries 2013. Literature review of ecological effects of aquaculture.

APPENDIX AB2 – AGREED CONSENT CONDITIONS BETWEEN SANFORD AND DOC 18 DECEMBER 2018

Sanford Limited
Big Glory Bay Salmon Farm Resource Consent Variation
Proposed Conditions:

A. CONDITIONS PROPOSED IN VARIATION FOR EACH INDIVIDUAL EXISTING CONSENT

Resource Consent AUTH-20157616, relating to MF 246

4. (a) The total nitrogen input from feed at the marine farm site for salmon between 1 July and 30 June each year shall be restricted to 415.1 tonnes provided that:

(i) the total nitrogen input from feed used in Big Glory Bay between 1 July and 30 June each year does not exceed 659 tonnes across all farms in Big Glory Bay, irrespective of ownership; except that

(ii) until such time as the requirements of Condition YY have been satisfied, the total nitrogen input from feed used in Big Glory Bay between 1 July and 30 June each year shall not exceed 583 tonnes across all farms in Big Glory Bay, irrespective of ownership.

Water Quality Objectives:

(b) The marine farm shall be operated in such a way to achieve the following water quality objectives for the water column:

(i) To not cause a shift in the trophic state of the water column (i.e. change towards a eutrophic state), beyond that which is likely to occur naturally.

(ii) To not increase the frequency, intensity, or duration of phytoplankton blooms (i.e. chlorophyll-a concentrations ≥5 µg/l).

(iii) To not cause elevated nutrient concentrations outside the confines of established natural variation for the location and time of the year, beyond 250m from the edge of the farm.

(iv) To not cause reduction in dissolved oxygen concentrations to levels that are potentially harmful to marine biota beyond 250 m from the edge of the farm.

Environmental Quality Standards-water (EQS-water):

(c) Activities authorised by Condition 4(a), in combination with activities authorised by consents [insert all the other consent numbers] shall not result in any one of the following:

(i) Tier one standard (see condition 4 (e)): the monthly median concentrations of chlorophyll-a in the water column within Big Glory Bay (monthly median from a data set of all monitoring sites) being greater than 3.5 µg/l for three consecutive months; or

(ii) Tier two standard (see condition 4(e)): for three consecutive months, the concentration of chlorophyll-a in the water column (monthly median at any sampling site within Big Glory Bay) exceeding 5 µg/L:

a. at two or more sites for two of those three consecutive months; and

b. at one or more sites for one of those three consecutive months.

(iii) Tier two standard (see condition 4 (e)): an increase in the average monthly excess total ammonia nitrogen in Big Glory Bay of more than 30 µg/L at the surface of the water column, when compared with baseline data from the same or comparable sampling sites from the period July 2015 to December 2017; or

(iv) Tier two standard (see condition 4 (e)): the dissolved oxygen saturation in the water column at any sampling point more than 250 metres from the farm falling below 70% for three consecutive months (measured using 1 metre bins to 2 metres from the seabed).

Environmental Quality Standards-seabed (EQS-seabed):

(d) Tier two standard (see condition 4 (e)): Activities authorised by Condition 4(a) shall meet the following Environmental Quality Standards (EQS) for the seabed within 10 metres of the edge of the pens:

- The benthic community retains a diversity and abundance of-marine taxa (other than one or two opportunistic enrichment-tolerant taxa such as Capitellid and Dorvillea worms, and nematodes) at levels which allow for sustained farm waste assimilative capacity and sufficient seabed recovery to support a farm rotation cycle with a fallowing period of not less than 5 years.
- No more than 20% of the not less than 5 replicate cores collected have no taxa present (azoic). In any assessment under this condition, the effects of mussel shell substrate on benthic communities are to be ignored.
- No obvious, spontaneous out-gassing (H_2S/methane)
- Bacteria mat (*Beggiatoa*) coverage not greater than 50% of the sampled area.

(e) Two tiers of responses in support of maintaining the Environmental Quality Standards (EQS) specified in Conditions 4 (c)(i) – (iv) and 4 (d) shall apply.

(i) Tier one: a breach of Condition 4(c)(i) shall trigger further water quality monitoring, consideration of the wider environment, and investigations aimed to determine any contributing effect from farm operations on chlorophyll-a levels. Where relevant, this Tier one response shall also include the consideration of, and planning for, future management responses to avoid further breaches.

(ii) Tier two: a breach of any of the Tier two standards (Conditions 4 (c)(ii), (iii) and (iv), and 4(d)) shall require reduced stocking and/or fallowing of the marine farm following the next harvest of salmon on that farm to achieve full compliance with the EQS-water or EQS-seabed within 24 months of the date the consent holder receives confirmed notice of such a EQS result through its monitoring. A substantive improvement within 12 months of that date is required.

(f) Water quality monitoring will be detailed in the Big Glory Bay Salmon Farm Environmental Management Plan ("BGBSFEMP") required by the conditions of this consent and shall include monthly sampling of nutrients (total ammoniacal nitrogen, NO_3-N, NO_2-N, DRP, TN and TP), chlorophyll a, phytoplankton composition (reference sites), temperature, dissolved oxygen (DO), water clarity, salinity at the locations specified in the BGBSFEMP. A new "Reference" site outside Big Glory Bay shall be established.

(g) Seabed monitoring will be detailed in the BGBSFEMP and shall include annual monitoring at the locations specified in the BGBSFEMP for sediment grain size, total organic matter (TOM), total organic carbon (TOC), copper and zinc, appearance of sulphide depth and general colour, depth of redox layer, obvious outgassing, mat forming bacteria, epifauna and infauna. If any benthic sample contains a large number of mussel shells or the grab is prevented from closing due to the presence of mussel shells, the sample shall be retaken. In the event that three grab samples at any one location all contain a large number of mussel shells or the grab is prevented from closing due to the presence of mussel shells the sampling location shall be relocated approximately 10 metres distant.

(h) Notwithstanding any other condition of this consent, a suitably qualified, experienced and independent person shall prepare a monitoring plan, the purpose of which is to enable compliance with the standards in Conditions 4(c) and 4 (d) to be assessed.
The monitoring plan shall be submitted to Environment Southland for approval in a technical certification capacity two months before the total nitrogen input from feed in Big Glory Bay authorised by consents [list to come] is increased above 483 tonnes/year.

(i) In addition to the requirements of conditions 4(f) and (g), the BGBSFEMP shall set out the details of:

(i) Possible responses to a Tier one standard breach requiring further monitoring and/or analysis to determine whether the operation of the marine farm is causing the relevant EQS-water not to be achieved; and

(ii) Possible management responses to a Tier two standard breach requiring a clear decision process and plan of action, with clear timeframes to reduce effects on the water column or seabed and achieve full compliance with the EQS-water or EQS-seabed in accordance with Condition 4(e)(ii).

Advice note: This consent expires in 2025, following which the on-going efficacy of the conditions of this consent, and especially Conditions 4 (b), 4 (c) and 4 (d), will need to be reassessed, having particular regard to the monitoring undertaken in accordance with Condition XXX.

DETAILS OF THE OTHER FARM SPECIFIC CONSENTS HAVE BEEN DELETED – TO AVOID REPITITION.

B. ADDITIONAL CONDITIONS PROPOSED TO BE INCLUDED ON EACH INDIVIDUAL CONSENT

Big Glory Bay Salmon Farm Environmental Management Plan

1. Notwithstanding any other conditions of this consent, the consent holder shall, no later than [insert date], submit to Environment Southland, a Big Glory Bay Salmon Farm Environmental Management Plan ("BGBSFEMP") for approval in a technical certification capacity.

2. The BGBSFEMP required by Condition 1:

   a. May be updated by the consent holder at any time; and

   b. Shall be updated by the consent holder at least once in every two year period;

   c. Address relevant matters identified in the latest Technology Update Report;

   provided that any updated provisions shall only apply, once the updated BGBSFEMP has been approved in a technical certification capacity by Environment Southland.

3. The purpose of the BGBSFMP required by Condition 1, or any updated BGBSFEMP prepared in accordance with Condition 2, is, as a minimum, to set out:

   a. The procedures and practices to by implemented by the consent holder in order to ensure compliance with Conditions 4(c), 4(d) and 4(e) of consent AUTH-20157616 [and the other consents having the same requirement];] of this consent; and

   b. The proposed layout of each salmon farm site and how this is expected to change over each two year period; and

   c. The maintenance procedures to be followed to ensure the ongoing efficacy of all salmon farm structures; and

   d. The procedures and practices to be implemented to minimise, to the extent practicable, the interactions of marine mammals and seabirds with the farm site; and

e. The procedures, practices and monitoring to be implemented to meet the objective of reducing historically elevated concentrations of copper and zinc in sediments beneath the farm site to those that satisfy the ANZECC (2000) Interim Sediment Quality Guidelines; and

f. How the results of the monitoring required by the conditions of this consent will be utilised to adapt, as quickly as practicable, operational farming practices, including but not limited to the fallowing of individual sites, in the event that monitoring indicates that unforeseen environmental effects may arise;

g. Any changes in salmon farming technology and/or farm management practices identified in the Technology Update Report required by Condition 5 that the consent holder proposes to implement: and

h. Provide robust environmental data to inform the applications for replacement consents once these consents expire in 2025.

4. When determining practicability for the purposes of Condition 3 f), the following factors will be considered:

a. The requirements of Conditions 4(c), 4(d) and 4(e) of consent AUTH-20157616 [and the other consents having the same requirement]; and

b. Fish should be allowed to grow to market ready size before being harvested; and

c. Salmon cage relocation to allow fallowing should not compromise fish health or the scheduling of fish harvesting.

Technology Update Report

5. At three yearly intervals during the term of this consent, the consent holder shall engage an appropriately qualified and experienced professional to prepare a Technology Update Report and, following consultation with Environment Southland, provide it to Environment Southland.

The purpose of the Technology Update Report is to:

a. Evaluate and report on any new developments in salmon farming technology and/or farm management practices that have the potential to reduce the deposition on the seafloor of:

i. Uneaten salmon feed; and
ii. Salmon faeces.

b. Any environmental benefits that could be expected by adopting that technology and/or farm management practice; and

c. The feasibility of adopting that technology and/or farm management practice, including, but not limited to financial implications.

Advice Note

Conditions 1 – 4 are included on each of the consent holder's salmon farming resource consents in Big Glory Bay. It is envisaged the one BGBSFEMP and one Technology Update Report will be prepared that addresses all the consent holder's salmon farms in Big Glory Bay, rather than having a number of individual documents.

Add the Following to the Monitoring Condition of each Consent

X. The annual monitoring report required by Condition [y] of this consent shall include:

a. A comparison with the results of previous monitoring at the same salmon farm site;

b. Identification of any potential environmentally significant monitoring trends, at both the site and Big Glory Bay scales; and

c. Identification of any proposed additional monitoring, including the rationale for it, and the proposed scale, extent and timeframes involved.

d. An evaluation of the potential implications of the monitoring results from all salmon farming operations undertaken in Big Glory Bay by the consent holder on the environmental quality of Big Glory Bay;

e. The extent to which the monitoring results indicate that farming practices may need to be adapted in order to address unforeseen environmental effects indicated by the monitoring results.

Add the Following to the Review Condition of each Consent

e. Adding or amending conditions in order to address any matter raised in:

i. The annual monitoring report insofar as it relates to Condition [X immediately above]; or
ii. The Technology Update Report required by Condition 5.

Add the Following Condition to each Consent

Staging

YY. The total nitrogen input from feed used in Big Glory Bay between 1 July and 30 June each year shall not exceed 583 tonnes across all farms in Big Glory Bay, irrespective of ownership until:

a. At least 1 July 2021; and

b. The total nitrogen in feed used in Big Glory Bay between 1 July and 30 June in each of three successive years has been at least 466 tonnes; and

c. The relevant farm(s) has operated for a period of three successive years at levels of between 85- 100% of its allowable individual nitrogen input; and

d. Monitoring results of the past two successive years for both seabed and water quality are not indicating results and/or statistically significant trends towards progressively greater environmental effects of the farms.

e. A suitably qualified, experienced and independent person has confirmed, in writing, that the increased input of nitrogen in feed should meet the requirements of Conditions 4(c) and 4(d) of consent AUTH-20157616 [and the other consents having the same requirement] and that the requirements of a – d above have been satisfied; and

f. Environment Southland certifies that the requirements of clause b and c of this condition have been satisfied.