Parliamentary Commissioner
for the Environment
Te Kaitiaki Taiao a Te Whare Pāremata

PO Box 10 241
Wellington 6143
Tel 64 4 471 1669
Fax 64 4 495 8350
www.pce.parliament.nz

Hon. David Parker
Minister for the Environment
Parliament Buildings
Wellington

Hon. Damien O'Connor
Minister of Agriculture
Parliament Buildings
Wellington

Hon. James Shaw
Minister for Climate Change
Parliament Buildings
Wellington

Hon. Megan Woods
Minister for Research, Science and Innovation
Parliament Buildings
Wellington

22 January 2020

Dear Ministers

I'd like to thank you for your encouraging letter dated 3 July 2019 in response to my *Overseer and regulatory oversight* report. I'm heartened to hear that you agree with the report's recommendations in principle. In addition, I'm pleased to hear that in Budget 2019, through the Productive and Sustainable Land Use package, new funding has been set aside for improving and further developing Overseer and other decision-support tools.

More than a year has passed since I released my report, and while I am pleased to see that some of the recommended pieces of work have been started, I am concerned that progress has been slow. I have, furthermore, some concerns about the sequence in which work may end up being tackled. I am writing to provide you with my assessment of the progress that has been made to date and to offer some suggestions as to how the recommendations best be carried forward.

Reviewing current actions underway to improve Overseer

As I understand it, the following pieces of work have been started:

- *An independent whole-model peer review*. While the review itself has not started, a panel of experts to undertake this review is being set up. I understand that the review is planned to occur in two stages:
    - The first stage is envisaged to be a review of the entire model to answer several questions related to the use of Overseer in a regulatory setting (e.g. estimating the amount of nitrogen that leaves a farm for determining compliance with nitrogen limits) and as a decision-support tool for farmers.
    - The second stage would consist of a detailed review of the individual sub-models that make up Overseer.
- *An uncertainty and sensitivity analysis*. I understand that this piece of work has been initiated by Overseer Ltd and AgResearch and is being undertaken by the model developers. While this work began almost a year ago, progress appears to be slow, with no information available in the public domain to date.
- *A strategic review of regionally specific research.* A reference group (similar to the recommended working group) has been set up. To date, one technical workshop has been held, with the primary focus on field trials needed for the calibration of Overseer.

  Overseer is a largely *empirical* model and is reliant on calibration – a process that enables developers to fine-tune the model's parameters using experimental data. To generate reliable estimates, the model needs to be calibrated in the regions where it is used. Furthermore, calibration trials need to be of sufficient duration to generate useful results. That is because Overseer is a *steady-state* model that assumes average and constant management and site characteristics. As you will appreciate, a meaningful average can't be based on a short time period.

  One of the possibilities discussed at the workshop was funding existing calibration trials for an extended period (e.g. the Bay of Plenty Regional Council calibration trials in the Lake Rotorua catchment). This makes sense because it will ensure that the field trial is long enough to provide useful outputs for Overseer to use.

  However, before setting up any new calibration trials it would be sensible to await the conclusions of the comprehensive evaluation of Overseer (**recommendation 3**).

- *Advice on ownership, governance and funding arrangements.* You state in your letter that advice on Overseer's ownership, governance and funding arrangements is being sought. This advice would "help the Government determine its position on shifting to open source." As I understand it, no decisions have yet been made on Overseer's ownership and governance arrangements.

  I recommended that Overseer be made an open-source model (**recommendation 4**). In my view, the advice that needs to be sought shouldn't be on the pros and cons of shifting the

model to open source. Rather, the advice should focus on the ownership, governance and funding arrangements that would enable Overseer to be mandated as the 'official' model for estimating diffuse nutrient pollution for water management purposes where that is appropriate; and to secure the ongoing resources to maintain and develop the model (**recommendation 5**).

Advice on the work sequence required to effectively implement the recommendations

With these observations in mind, I would like to suggest a logical sequence for the implementation of the recommendations I made in my *Overseer and regulatory oversight* report. This will ensure that the decisions made are appropriately informed, and further investment can be sequenced on the basis of solid analysis as it comes to hand.

In your letter you state that your "preference is to use Overseer as a tool in the regulation of water quality, as a means of supporting an outcome based regulatory system". I understand the ambition to use an approach which is based on modelling and supports achieving desired outcomes, as opposed to imposing input controls. However, I must stress that a meaningful outcome-based regulatory system must focus on the environmental impacts of lost nutrients.

Overseer is designed to model nutrient losses from an individual farm (for example, losses of nitrogen are calculated where it leaves the root zone, 60 centimetres below the surface). The environmental impacts of these losses, however, often occur far beyond the farm boundary in distant receiving waterbodies. So, by design, the Overseer model cannot estimate the environmental impacts of lost nutrients. That said, Overseer-derived nutrient losses provide a good starting point for estimating environmental impacts, since nutrient loss is a major stress on the receiving environment.

Step 1

The first question is: *Do you want to be able to use a model for estimating nutrient losses in a regulatory context?*

Step 2

If the answer to the first question is 'yes', then the second question is: *Is Overseer the right model to achieve this objective?*

A comprehensive evaluation of Overseer as recommended (**recommendation 3**) should provide an answer to this question.

Model evaluation generates information that helps determine whether a model and its analytical results are of acceptable quality to serve as the basis for regulatory decisions. The evaluation needs to be one that has been developed specifically for models used to inform regulatory decisions. The evaluation of a regulatory model must be able to address a more complex set of trade-offs than research or other models used in the public or private sector for non-regulatory purposes.

While the whole-model peer-review, a formal uncertainty and sensitivity analysis, and improving transparency are important, the comprehensive model evaluation shouldn't be limited to these three initiatives. The recommended model evaluation (a detailed assessment of the model) should

cover all twelve elements outlined by the United States Environmental Protection Agency and detailed in my December 2018 report. The twelve elements are: scientific basis; computational infrastructure; assumptions and limitations; peer review; quality assurance and quality control; data availability and quality; test cases; sensitivity and uncertainty analysis; corroboration of model results with observations; benchmarking against other models; model resolution; and transparency.

Completing the comprehensive model evaluation is critical for determining any improvements required for confident use of the model. Caution needs to be taken not to proceed with ad-hoc pieces of work or new calibration trials prior to receiving the results of the comprehensive model evaluation. This would be to put the cart before the horse and could lead to a poor use of public funds.

I believe you need to be open to the possibility that a comprehensive model evaluation may conclude that Overseer is unsuitable for use in a regulatory context, or is only suitable to perform limited tasks in a regulatory setting subject to certain improvements. I raise this possibility because in my December 2018 assessment I was unable to make a comprehensive evaluation of Overseer given the 'black box' nature of the model. The comprehensive evaluation may conclude that Overseer is only suitable to be used as a farm decision support tool and that regulations may need to rely on a different tool. The findings of the comprehensive model evaluation should determine the next steps.

Step 3 – option 1

If the comprehensive evaluation finds Overseer unsuitable for use in a regulatory context, then the next question is: *Does an alternative modelling tool exist which could be used for estimating nutrient losses in a regulatory context?* If not, can it be developed? The costs and benefits of these alternative tools would need to be evaluated.

Step 3 – option 2

If the comprehensive evaluation concludes that Overseer *is* suitable to perform a range of specified tasks in a regulatory context, there may well still be improvements that need to be undertaken. If that is the case, these should be carried out in parallel with my remaining recommendations. The recommended sequence is set out below.

Model ownership arrangements: As emphasised in my December 2018 report, Overseer is a proprietary model, with a proprietary source code, proprietary algorithms and technical manuals, as well as a proprietary user interface.

Gaps in publicly available information mean that Overseer falls short of the transparency required in a regulatory setting. Increasing transparency involves building trust with affected parties, through clear communication of the model's uncertainty, backed up by details of quality assurance tasks.

Achieving full transparency will come from making Overseer an open-source model (**recommendation 4**). An open-source model provides the transparency and legitimacy needed to use Overseer in a regulatory context. Those affected by regulations have a right to understand the basis on which the regulations are made. This reasoning is rooted not in science but good public process. Making the engine of the model transparent has the added benefit of creating an opportunity for scrutiny and improvement by independent experts.

However, an open-source approach is in conflict with the business model that has been adopted by Overseer Ltd. My report acknowledged this and led to my recommendation that advice is sought on ownership, governance and funding arrangements that would enable Overseer to be mandated as the 'official' model where appropriate (**recommendation 5**).

Currently Overseer has tripartite ownership arrangements whereby the Ministry for Primary Industries, the New Zealand Phosphate Company Ltd, and AgResearch each owns a one-third share in Overseer intellectual property. Further, a limited liability company (Overseer Ltd) was established in 2016 to manage the day-to-day running and development of the model, while the owners retained existing and new intellectual property.

Making Overseer an open-source model, and one that is officially supported by the Government as the model of choice for estimating nutrient losses to water where appropriate, would clearly signal a public good purpose for Overseer's maintenance. But in this case, Overseer's ownership and governance would need to be aligned with this purpose.

This raises the question of whether it is appropriate for a trade association – owned by the two major New Zealand manufacturers of superphosphate and nitrogen fertilisers (Ballance Agri-Nutrients Ltd and Ravensdown Ltd) – to be part owners of the intellectual property of Overseer if it is to be mandated for use as the official model for regulatory purposes? If the answer to that question is 'no', then it would be an option for the Government to find appropriate ways to compensate the Fertiliser Association for its ownership stake in the intellectual property.

As I have outlined in my report, this would leave the Overseer intellectual property jointly owned by AgResearch and the Government. Given AgResearch's ultimate ownership by the Crown, and its statutory requirement to undertake research for the benefit of New Zealand, reaching agreement on open sourcing the model would be more straightforward.

Model ownership, governance and funding arrangements are at the heart of public confidence in Overseer's use in a regulatory context. Seeking advice as recommended, grappling with the ownership and governance arrangements and making public announcements would send a clear signal that the Crown means business.

Guidance: Once the results of the comprehensive evaluation are available, work to develop guidance for councils on designing plan provisions that use Overseer (**recommendation 7**) should start. It is critical that the findings of the comprehensive model evaluation (the suitability of Overseer to perform a range of tasks in the regulatory context, in particular) steer the development of the guidance.

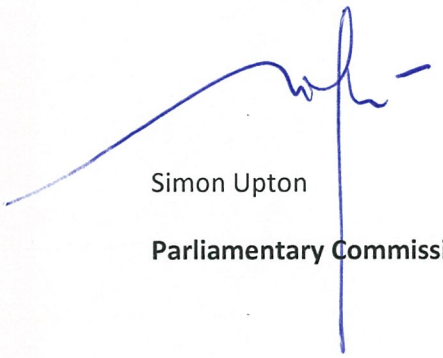
Developing best practice guidance for the development, evaluation, and application of environmental models in regulation (**recommendation 2**) is a piece of work that is not directly related to Overseer so it can be developed at any time. Given that more than a year has passed since I released my report, this guidance should have already been developed, or at least started.

Further, a strategic review of resourcing (**recommendation 6**) needs to be undertaken. In addition, a working group should be set up to undertake a strategic review of regionally-specific research (**recommendation 8**). Care needs to be taken to ensure that this review is guided by the results of the comprehensive model evaluation.

Review of other models and databases: Finally, Overseer is only one piece of the puzzle for managing water quality across catchments. New Zealand needs much better collaboration between organisations maintaining public models and datasets on which catchment-scale assessments and management rely. My last two recommendations (**recommendations 9 and 10**) concern the ownership, use and development of the many models and databases that inform our understanding of catchment-scale dynamics. While many useful datasets exist, their coverage and management are currently fragmented. I've recommended that the Crown's ongoing investment in these models and databases should be made in a joined-up way. As I understand it, Budget 2019 has set aside some funding for extending the coverage of S-map. It is important to emphasize that this investment shouldn't be made in isolation.

I hope this letter provides a useful overview of some of the issues that remain to be resolved and, in particular, an optimal sequencing of them. My colleagues and I would be happy to discuss with you any matters arising from this letter.

With kind regards



Simon Upton

Parliamentary Commissioner for the Environment