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Committee Secretary
Senate Standing Committees on Environment and Communications
PO Box 6100
Parliament House
Canberra ACT 2600

Dear Committee Secretary,

Submission to Senate Committee Inquiry into Water Use by the Extractive Industry

I am an aquatic ecologist and staff member at Macquarie University. I study the impacts of environmental change, including water level change and contamination, on groundwater (aquifer) ecosystems.

Based on my experience I submit that:

1. Groundwater ecosystems should be afforded the same regulatory consideration and recognition as surface freshwater, marine and terrestrial ecosystems.
2. Research to better understand the impacts on and resilience and recovery of groundwater ecosystems to changes in groundwater quality and quantity as a result of extractive activities should be prioritised.
3. In line with the precautionary principle, regulatory guidance should recommend the highest level of protection for groundwater ecosystems until such time as the responses and resilience of groundwater ecosystems to changes in groundwater quality and quantity are known.

Background

Groundwater ecosystems are those that occur in aquifers below ground. They contain a unique suite of microbes, invertebrates and occasionally vertebrates that are not found in surface environments. Groundwater invertebrates, often referred to as 'stygofauna', are particularly diverse in Australia (Hose et al., 2015a,b, Guzik et al., 2010) and thus have immense biodiversity value. Groundwater ecosystems provide valuable ecosystem services (Griebler & Avramov 2015); microbes break down pollutants and 'self-purify' groundwater making it fit for human use. Stygofauna burrow and maintain the storage and flow of water through an aquifer, and hence a valuable water distribution service. Impacts to groundwater ecosystems through changes in groundwater quality and quantity can mean the loss of these valuable services.

Groundwater ecosystems are of immense importance in Australia. Groundwater is the only reliable water supply for many communities. Groundwater microbes and stygofauna are key to providing clean groundwater on which those communities depend. Extractive industries threaten the viability of groundwater communities and hence the ability of the ecosystems to provide clean groundwater. **Greater consideration of groundwater ecosystems in the regulation of water use by extractive industries is needed.**

a. The environmental impacts of extractive projects' take and use of water;

Extractive industries frequently intersect aquifers. Groundwater enters mine voids and is removed to facilitate mineral extraction. The removal of groundwater can result in localised depletion which is manifest as lower water tables or lower groundwater pressure. For groundwater organisms this means a loss of habitat and changed environmental conditions in remaining habitat. Changes in groundwater levels and pressure can be predicted by hydrological models and such predictions are commonly required for regulatory approvals. However, the assessments of ecological risk associated with groundwater depletion generally focus on surface ecosystems (e.g. Serov et al 2012), or lack specific detail on groundwater systems (e.g. Chambers et al 2013). In a review of the current state of knowledge of groundwater ecosystems, Larned (2012) listed 'ecological response to groundwater depletion' as a key knowledge gap and as the highest research priority.

A small number of studies have highlighted the potential impacts of groundwater extraction on groundwater ecosystems (e.g. Stumpp & Hose 2013, Andersen et al.

2016), yet a mechanistic understanding of these impacts is currently lacking. The consequence of this knowledge gap is that regulatory decisions are based on a paucity of robust scientific evidence and as such may lead to unsustainable and undesirable ecological outcomes, or conversely, overly restrictive regulations and unnecessary expense for industry.

Research to better understand the impacts on and resilience and recovery of groundwater ecosystems to changes in groundwater quality and quantity as a result of extractive activities should be prioritised to inform regulation.

b. *Existing safeguards in place to prevent the damage, contamination or draining of Australia's aquifers and water systems*;

Despite the rarity of most stygofauna due to their limited distributions, few species are explicitly protected under EPBC legislation because they are not listed as matters of national environmental significance, i.e., as threatened species or as part of threatened ecological communities. This situation is a consequence of the difficulties associated with stygofauna taxonomy and the relatively recent recognition of the significance of groundwater fauna in Australia and globally. As a consequence of there being few stygofauna species listed for protection, there is no mandate for environmental assessments related to extractive industries to consider groundwater biota as they might do for rare and threatened flora and fauna.

Groundwater ecosystems and fauna should be afforded the same recognition as terrestrial and aquatic ecosystems in any regulatory framework.

Mechanisms for the protection of groundwater resources are recognised in the National Water Quality Management Strategy (NWQMS 2013) *Guidelines for Groundwater Quality Protection in Australia*. This document highlights the lack of water quality guidelines specifically for the protection of groundwater ecosystems and recommends that 'where stygofauna communities have been identified, they should be accounted for in...setting water quality objectives'.

The ANZECC/ARMCANZ (2000) guidelines for the protection of surface aquatic ecosystems may not protect groundwater ecosystems (Hose 2005; 2007). Indeed, the ANZECC/ARMCANZ (2000) guidelines state that 'underground aquatic ecosystems and their novel fauna…should be given the highest level of protection'.

Critically, the *Significant impact guidelines 1.3:Coal seam gas and large coal mining developments—impacts on water resources*, which provides guidance for the EPBC water trigger, recommend using water quality trigger values for '*moderately to slightly disturbed systems'* that provide 80% to 95% ecosystem protection. **This means that the regulatory guidance is NOT providing the level of water quality protection needed for groundwater ecosystems.**

A great deal more research is needed to understand the direct and indirect impacts of water extraction on groundwater ecosystems and enable management responses to mitigate these impacts and the loss of ecosystem services. Until greater knowledge is attained, groundwater ecosystems should be afforded the highest level of protection in line with the precautionary principle.

Sincerely,

A/Prof Grant Hose

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