

APPENDIX: CASE STUDY: ACID WETLANDS VS DRY TAPS IN VICTORIA, AUSTRALIA

To illustrate the challenges and benefits of environmental groundwater rights in a real-world context, this appendix presents a case study of a current controversy over the effects of groundwater pumping on GDEs in Victoria, Australia. The surrounding jurisdictional circumstances of the case study make groundwater environmental rights plausible, requiring a smaller step away from existing approaches than in other places. Victoria has an established statutory entity for holding environmental water, legal frameworks for environmental surface water rights are well developed, GDEs are formally recognized as important and rules-based protections for GDEs already exist in the jurisdiction. Australia is recognized to have the world's most comprehensive policy protections for GDEs, and the paradigm for protecting GDEs already promotes an iterative adaptive management framework (Rohde et al. 2017).

The events central to this case help illustrate important challenges noted above: links between groundwater quantity and quality and between groundwater and surface water; and protections for 'regular' GDEs that do not benefit from special status as habitat for endangered species, or a national park or other protective mechanism. The events also have high political salience, pitting municipal groundwater use in a large regional city against wetlands, streams and a major river — and their dependent irrigators — that have suffered from contamination with acidic water and heavy metals connected to municipal groundwater use.

Existing governance framework for water in Victoria

As in other Australian states, water in Victoria is owned by the Crown, which may authorize a person to use that water under an administrative licensing system (Gardner et al. 2018). Legislation provides for groundwater pumping to be authorized mainly using renewable 15-year, volumetric 'take and use' licenses (sections 51, 56, *Water Act 1989* (Vic) ('Water Act')). Licenses are usually issued by a delegate of the Water Minister, being the regionally-based water corporations that also provide revenue-raising rural water services in addition to carrying out regulatory functions with the objective of environmental protection. This creates the theoretical potential for conflicts of interest. A license is associated with a particular parcel of land, and license conditions may specify the purposes of use (section 56, *Water Act*). When considering an application for a take and use license, the delegate of the Water Minister must ensure that aggregate extractions from a basin do not exceed an aggregate cap on pumping known as a 'permissible consumptive volume' for the basin (Minister for Water 2014). The delegate must also consider potential effects on 'high-value' GDEs using a risk assessment approach (Minister for Environment 2015). However, this approach may not apply to areas that have a statutory or informal 'local' management plan in place and only applies to narrow categories of 'high value' GDEs that tend to reflect a surface water focus (e.g. Ramsar wetlands, areas prioritized by waterway managers) (Minister for Environment 2015). Some management plans apply binding rules-based protections for GDEs, such as pumping restrictions near rivers or permissible consumptive volumes (section 22A, *Water Act*), but may rely heavily on assumptions about GDEs from remotely sensed data, and simply note that further investigation of GDEs is required (Goulburn-Murray Water 2012a). Most do not manage surface water and groundwater together, though there is one notable exception in the state's north (Goulburn-Murray Water 2012b).

Surface water is managed differently to groundwater across much of the state. In unregulated surface water systems (those without significant on-stream storages), the same take-and-use licenses apply as for groundwater. In regulated systems, surface water rights are disaggregated

into three types of entitlements that relate to a share of the delivery capacity of a system, a share of the volume of water available in the system, and authorization to use the water on a specific parcel of land (State of Victoria 2016) (for convenience, ‘surface water rights’). An independent, expertise-based state agency, the Victorian Environmental Water Holder, holds surface water rights and actively manages the rights in conjunction with local entities and Aboriginal Traditional Owners to ensure that highly valued wetlands and rivers receive environmentally optimal flows (State of Victoria 2016:, Part 3AA Water Act).

Governance in relation to groundwater in the Otways

Pursuant to a take and use license issued in 2004 (groundwater license No: BEE032496), a state-owned water supplier for the large regional city of Geelong, Barwon Water, operated the Barwon Downs borefield primarily as a drought reserve. Evidence collected since 1999 suggested that pumping was dewatering the hydrologically connected Boundary Creek and a groundwater-dependent wetland known as the Yeodene (Big) Swamp (Barwon Water 2020). This caused soils to oxidize and acidify in the Big Swamp, leading to discharges of acidic water ($\text{pH} < 4$) and mobilizing metals during wetter periods downstream into Boundary Creek, which landholders use for stock watering. This, in turn, triggered significant fish kills and impacted a significant river downstream, the Barwon River (Barwon Water 2020). Other activities also contributed to dewatering the wetlands, for example, fire control works that diverted surface flows, a generally drying climate and the apparently inadvertent non-compliance of the owner of an upstream on-stream private dam to re-release flows released by Barwon Water to supplement river flows to counter the potential for groundwater pumping to dewater the catchment (Barwon Water 2020). An active local farmers’ and residents’ group, Land and Water Resources Otway Catchment (‘LAWROC’), has been involved in lobbying to stop the pumping for decades.

The situation came to a head when Victoria’s Water Minister, who has supervisory control over waters in the state, issued an emergency order in September 2018 (under section 78, Water Act) to prevent further pumping, except for emergency and maintenance purposes, and formulate a remediation plan (Southern Rural Water 2018). Remediation will involve the ‘continual wetting of Big Swamp through controlled release of water to Boundary Creek and the installation of hydraulic barriers to maintain surface water flows and groundwater levels within Big Swamp’ (Barwon Water 2020:2). The protective force of the emergency order was supplemented by a rules-based constraint on increased pumping from the aquifer in the form of amendments to the permissible consumptive volume. This capped extractions at current levels, precluding resumption of municipal pumping (Minister for Water 2019). The underlying groundwater take and use license has since expired, and Barwon Water withdrew a license renewal application (Barwon Water 2019), but has not ruled out applying for another in the future, since it is concerned about secure water supplies for Geelong in future droughts.

The existing rule-based legal mechanisms that protect the Big Swamp and its hydrologically connected streams have notable weaknesses. The emergency Ministerial order is temporary, and though it requires remediation of the damaged GDEs, there is no requirement for transparency or public participation, nor quantified requirements for protection: the required remediation is described broadly as ‘controls and actions that could be practicably carried out to achieve improved environmental outcomes’ (Southern Rural Water 2018:[2.3]). The order provides for a secondary management plan that also omits any requirement for public consultation. Though consultation is taking place as a voluntary matter in practice, the community, the Minister’s delegate and Barwon Water disagree about the fundamental matters

of exactly what needs to be protected, and to what extent, and whether environmentally damaging municipal pumping should be allowed in the case of future drought (Barwon Water 2020).

The rules-based permissible consumptive volume caps the aggregate level of extraction, thereby constraining the grant of groundwater licenses. It is not a direct goal for protecting any specific GDEs, does not require review, does not provide for any adaptive approach, and can be altered or revoked by Ministerial order without any community consultation or scientific justification (section 22A Water Act).

What would a groundwater environmental right look like and what benefits would it have?

In the context of this case study, the Victorian Environmental Water Holder could be granted a groundwater license to the remaining volume of water in the aquifer supporting the GDEs of concern, or a right to enforce a certain groundwater level at the relevant locations at risk of forming acid-sulphate soils, as a form of environmental groundwater right. This would offer the potential to coordinate with existing environmental surface water rights, more sustainable resourcing, and better responsiveness to new information. The Victorian Environmental Water Holder, which collaborates with local catchment management authorities to deliver environmental flows, already holds environmental surface water rights to the Barwon River (WSE000032 and WSE0260002: Minister for Water 2013, 2018), which was affected by acid pollution. Holding rights over groundwater that discharges to this river could also provide scope for coordination with surface water rights intended to benefit the same body of water. There may also be potential to grant a license to an Aboriginal entity, responding to calls for greater Aboriginal Traditional Owner involvement in environmental water decision-making and in groundwater in Victoria (O'Donnell et al 2021), though there appears to have been no investigation of this option in the context of the Big Swamp. This approach would help avoid the potential for past problems of insecurity of environmental water held by the Victorian Environmental Water Holder in the form of rights, during drought (O'Donnell 2012).

Protecting the relevant GDEs has so far fallen to LAWROC, a single NGO with few resources and predominantly older members. The involvement of the Victorian Environmental Water Holder as an independent agency could institutionalize and make permanent advocacy for the affected GDEs. This is particularly important in light of multiple claims about contributions to the problem (pumping for municipal purposes, peat fire control works, and non-compliance of the upstream dam owner with passing flow rules), which raises the possibility that disputes over attributing blame obstruct efforts to reach GDE-focused solutions. The potential for conflicting incentives between revenue raising (i.e. permitting new pumping) and environmental protection (i.e. restraining new pumping) in the Minister's delegate also supports the involvement of an independent entity.

Institutionalizing protection for the GDEs would help with data gathering and stewardship in the longer term, noting that significant scientific investment in understanding the groundwater dependence of the GDEs (by the water authority) only happened after environmental damage was catastrophic, and now may require decades to remediate (Barwon Water 2020). Public trust in scientific data about groundwater can be low more generally, since groundwater modelling is often perceived to involve 'black box' models, possibly to an even greater extent than surface water (Voss 2011, Moran 2016, Middlemis et al. 2019). An independent voice could also help to increase public trust in the science underlying actions to protect Big Swamp

and Boundary Creek, particularly with the need for pursuing actions flexibly in light of a climate that is predicted to dry in future due to climate change (Barwon Water 2020).

A legal ecosystem for GDE protection

Introducing an environmental groundwater right for GDEs would not require significant legal change, and could be accompanied by other regulatory tools that provide different benefits, especially where potential links between rights, rules and institutions are clear. While significant discussion of these lies outside the scope of the present work, other tools are available. These include plans for ‘special areas’ that can impose conditions on land use that might be able to encompass groundwater pumping (ss 27, 28, 34 *Catchment and Land Protection Act 1994* (Vic)). These plans are administered by catchment management authorities, which are also involved in environmental watering decisions by the Victorian Environmental Water Holder, paving the way for forging links between groundwater environmental rights held by that statutory entity and management of the special area plan. Other options include a statutory water plan that could impose rules-based constraints on others’ use of groundwater to protect the environmental groundwater right (Pt 3 Div 3, Water Act); declaration of a protected area, such as a national park, over areas important to protect the relevant GDEs (though this would not, of itself, constrain groundwater pumping due to the siloed nature of Australian water law, which separates land and water management); or even special-purpose legislation with the potential to integrate land and water management across the whole catchment, as has been advanced in relation to other urban rivers in Victoria (Nelson 2020).