

GROUNDWATER MANAGEMENT COMPLEXITIES (LATROBE AQUIFER SYSTEM, VIC)

KEY TERMS

Socio-economic:

Human values and investment behaviours

Ramsar:

Commonly used to refer to an international treaty through which Australia has made international commitment to maintaining the ecological character of listed wetlands for the conservation of global diversity.

Depressurizing:

Reducing pressure. In context of hydrogeology, the term refers to the pressure within an aquifer.

Purpose of this case study

This case study helps consider the scenario of unexpectedly finding a remote industry accessing an aquifer system is affecting other aquifer users. The case study is presented as snapshots in time: the situation in 2005 and 2012 from technical, legal and socio-economic perspectives.

Location and scene

The Latrobe Aquifer System is a large sedimentary basin of approximately 42 000km, which underlies south-eastern Victoria and part of the Bass Strait. The System comprises two parts: the Latrobe Valley Group (which requires local dewatering before mining operations can extract Latrobe Valley Coal), and the deeper Latrobe Group (to which the Latrobe Valley Group is hydraulically connected).

The Latrobe Aquifer System passes under the Ramsar listed Gippsland Lakes (just visible on the coastline of Figure 1). This group of river-fed coastal lagoons is separated from the sea by a broad sandy barrier.

The major industry types extracting water from the System are: off-shore oil and gas extraction, coal mining, and agriculture. Table 1 provides a benchmark of water extraction by these groups.

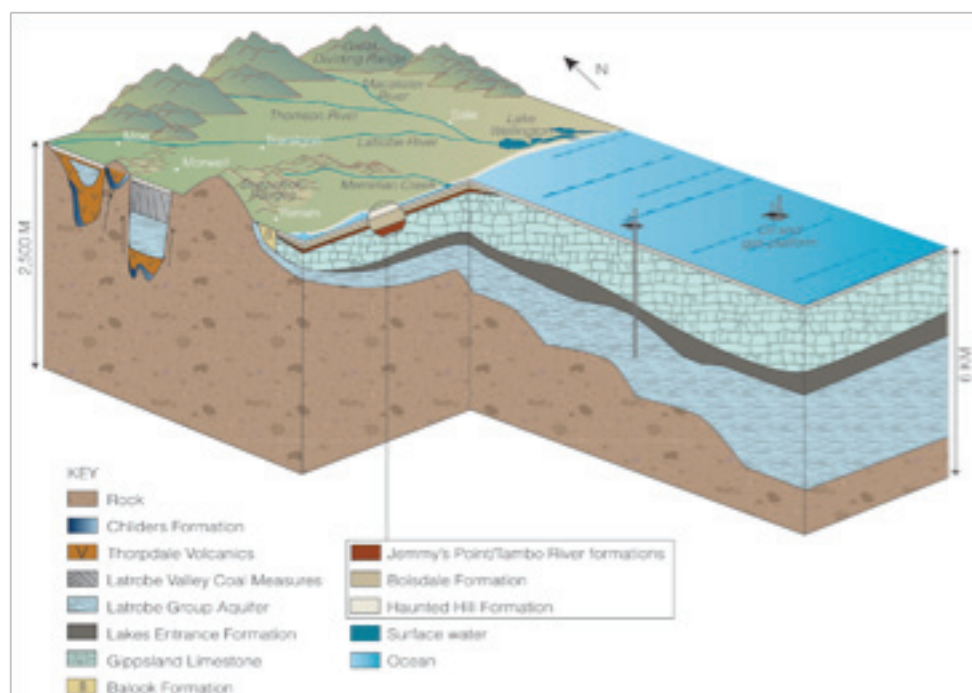
The off-shore oil and gas fields extracting from the Latrobe Aquifer System in the Bass Strait provide Victoria's natural gas, and about 20% of Australia's crude oil.

Gippsland agricultural and tourist economies are relatively small economic units that have on-going dependency on the environmental condition of the Latrobe Aquifer System.

TABLE 1 WATER EXTRACTION ESTIMATES, THE LATROBE AQUIFER SYSTEM 2000-01 (ADAPTED FROM HATTON ET AL, 2004)

Industry type	Extraction (ML)	Part of system accessed
Off-shore oil and gas extraction	85 000	Latrobe Group
Coal mining (dewatering)	23 000	Latrobe Valley Group
Others including irrigation	12 000	Both of above

FIGURE 1 CROSS SECTION OF LATROBE AQUIFER SYSTEM (SOURCE: DEPT OF SUSTAINABILITY AND ENVIRONMENT, 2011)



Australian Government
National Water Commission



Teacher Earth Science Education Program

GROUNDWATER MANAGEMENT COMPLEXITIES (LATROBE AQUIFER SYSTEM, VIC)

KEY TERMS

Subsidence:

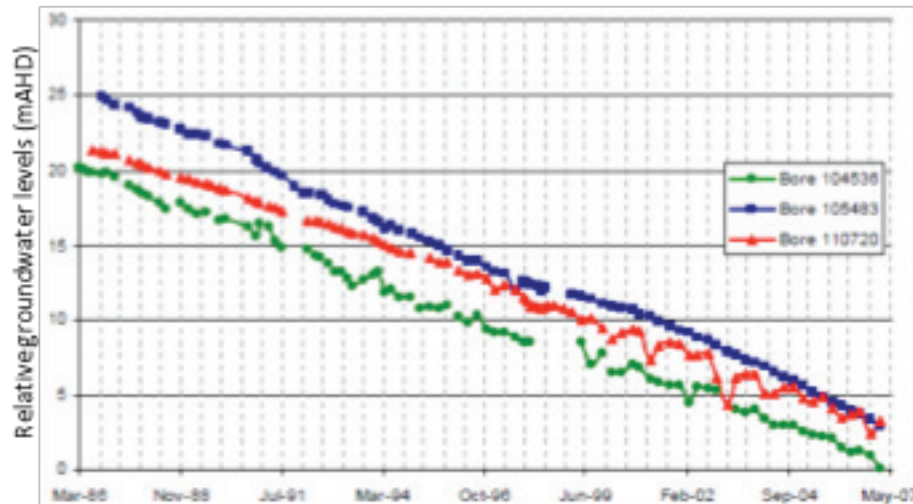
The groundwater in pores help support the weight of the overlying soil. As groundwater is pumped, it reduces the capacity of the water to hold weight. This allows the soil to compact (sink). If the soil particles compact enough, the surface of the ground can "sink". This is subsidence.

The challenge

Water levels in parts of the Latrobe Group accessed by on-shore users have been falling at a rate of approximately 1 metre a year (see Figure 2).

On-shore Gippsland communities have been expressing concern about the declining water levels for the past four decades.

FIGURE 2 LATROBE GROUP OBSERVATION BORES
(SOURCE: SOUTHERN RURAL WATER 2010)



This decline of water levels is concerning because:

- Loss of water pressure may impact springs and other environmental features dependent on the System
- Accessing water becomes more expensive as bores need to be deepened and water pumped from greater depths;
- depressurizing the System could result in land subsidence, resulting in sea water inundation of the Gippsland Lakes.
- regional freshwater resources could be polluted by saline intrusion from offshore or surrounding formations if the decline continues.¹⁴
- Unclear cause and effect is an impediment to management



Australian Government
National Water Commission



Teacher Earth Science Education Program

GROUNDWATER MANAGEMENT COMPLEXITIES (LATROBE AQUIFER SYSTEM, VIC)

Technical Snapshot:

Table 2 provides a snapshot of the technical status quo in 2005, and how things had developed in the period to 2012.

TABLE 2 2005 AND 2012 SNAPSHOTS OF THE TECHNICAL SITUATION OF OFF-SHORE IMPACTS ON GIPPSLAND WATER LEVELS

2005	2012
<p>In response to on-going debate about cause and effect, Hatton et al (2004) used a process of elimination to demonstrate off-shore activity was the only identified extraction of large enough volume to account for the rate and distribution of declining groundwater levels.</p> <p>A number of projects considering subsidence had been undertaken. A consistent conclusion was that additional data and longer term monitoring would enhance model and prediction confidence.</p>	<p>Further research into subsidence monitoring around the Gippsland Lakes has been funded.</p> <p>In 2007, a four-year survey ended without having detected conclusive subsidence along the Gippsland coast.</p> <p>The Victorian Government has committed to a pilot study into monitoring of subsidence using radar satellite imagery.</p>

In the period between 2005 and 2012, technical developments have directly lead to:

- Off-shore activity being accepted as the major contributor to declining Gippsland groundwater levels
- Storm surges being recognised as a more pressing risk to the Gippsland Lakes, although subsidence remains a concern.
- Recognition that further information is needed about the impact of declining groundwater levels on groundwater dependant ecosystems

Research is also been undertaken to look into the off-shore carbon storage potential of the Latrobe Group. This could help alleviate depressurisation caused by oil and gas extractions.

Going further

Risk of subsidence is a particularly difficult issue to base decisions on. Why might that be?

Legal Snapshot

Table 3 provides a snapshot of the legal status quo in 2005, and how things had developed in the period to 2012.

The general legal advancement is having clear institutional pathways to raise concerns about on-shore impacts of off-shore oil and gas extractions from the Latrobe Aquifer System.

TABLE 3 2005 AND 2012 SNAPSHOTS OF THE LEGAL SITUATION OF OFF-SHORE IMPACTS ON GIPPSLAND WATER LEVELS

2005	2012
<p>On-shore water extraction and use was and is managed under the Victorian Water Act 1989. The intent is, where possible, for areas to manage declining water levels through water management plans.</p> <p>Victoria is responsible for oil and gas approvals in Victorian waters (within three nautical miles of the coast). Beyond this boundary, oil and gas extraction operations were licensed under the Commonwealth Petroleum Submerged Lands Act 1967; jointly administered by Victoria and the Commonwealth. The Act did not require consideration of onshore impact: offshore extraction was legally independent of on-shore water impacts.</p> <p>The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 has responsibilities in relation to Ramsar sites. To come into effect, this Act requires a clear relationship between environmental damage (or risk thereof) and individual off-shore licenses.</p>	<p>Since 2000, all new oil and gas projects accessing the Latrobe Aquifer System have been in Commonwealth waters. The new Commonwealth Offshore Petroleum and Greenhouse Gas Storage Act 2006, requires new projects have environmental plans that consider environmental risks an put measures in place to mitigate them. These regulations can be required of existing projects.</p> <p>The Victorian Government has undertaken to advocate for revision of environmental plans where significant risks associated with off-shore operations (such as on-shore groundwater availability or subsidence) are identified.</p> <p>New on-shore mining and other earth resource projects are also subject to tighter legislative measures that seek consistent consideration of impact to water resources, and appropriate mitigation of any risks.</p>



GROUNDWATER MANAGEMENT COMPLEXITIES (LATROBE AQUIFER SYSTEM, VIC)

Gippsland socio-economic snapshot

Table 3 provides a snapshot of the socio-economic concerns in 2005, and how things had developed in the period to 2012.

TABLE 4 2005 AND 2012 SNAPSHOTS OF THE SOCIO-ECONOMIC SITUATION OF OFF-SHORE IMPACTS ON GIPPSLAND WATER LEVELS

2005	2012
Mistrust in governments' ability to recognise and/or address issues	Legal developments indicate clear government intent to recognise and seek to address concerns
Concerns about capacity of agriculture to meet rising groundwater costs	Funding support has been established to help irrigators maintain access to groundwater in priority areas

The general socio-economic advancement is confidence that issues of groundwater decline are recognised and being acted on. Parallel to these concerns, governments have also been funding research into the feasibility of carbon storage in the Latrobe Group.

Notwithstanding most developments bring specific environmental risks, a possible lateral benefit of carbon storage in the Latrobe Group could be to increase pressure within the System.

Going further

There is often friction in the relationship between the structure required for management, and the organic nature of environmental function. Where do you see this coming into play, and what options do you think there are?

Conclusion

The groundwater challenges represented by this case study are long term and on-going. Groundwater management is often labeled as 'technical'. A key message of this case study is that change requires both technical information and management structures that can engage with the broader social, economic and political context.

Going further

You can look into carbon storage at these sites:
www.co2crc.com.au
www.dpi.vic.gov.au/earth-resources/carbon-capture-and-storage

References and further reading

Hatton T, Otto C, and Underschultz J (2004). **Falling water levels in the Latrobe Aquifer, Gippsland Basin: Determination of cause and recommendations for future works.** CSIRO Report (Wealth from Oceans Flagship Program), 13 September 2004.

Department of Sustainability and Environment (2011) **Gippsland Region Sustainable Water Strategy**, Victorian Government

Freij-Ayoub R, Underschultz J, Li F, Trefry C, Hennig A, Otto C, McInnes K, (2007) Simulation of Coastal Subsidence and Storm Wave Inundation Risk in the Gippsland Basin. CSIRO Petroleum Report 07-003, November 2007

Southern Rural Water (2010) Groundwater Management Plan: Yarram Water Supply Protection Area

Gippsland Region Sustainable Water Strategy, Vic Govt Dept of Sus and Env, Nov 2011; available at: <http://www.water.vic.gov.au/initiatives/sws/gippsland/final-gippsland-region-sustainable-water-strategy>

