

2020 Eyre Peninsula Groundwater Dependent Ecosystem Report Cards

Overview

Why are we checking on the health of Groundwater Dependent Ecosystems?

One of the objectives of the [Water Allocation Plan \(WAP\) for the Southern Basins and Musgrave Prescribed Wells Areas \(PWAs\) \(2016\)](#) is to minimise the impact of the licenced take of groundwater on ecosystems that depend on the prescribed groundwater resource. The WAP aims to maintain these ecosystems, collectively known as Groundwater Dependent Ecosystems (GDEs), at a low level of risk, in the condition and at the locations and extents they occurred in 2016. The Eyre Peninsula Landscape Board has therefore developed a program to establish a baseline and monitor changes in flora condition, groundwater level and salinity, at a group of GDEs within the Southern Basins and Musgrave Prescribed Wells Areas. Results from this monitoring program form the basis for the set of GDE report cards.

A number of studies (found [here](#)) have identified two types of representative GDEs as priority for monitoring on the EP. The first, Red Gum (*Eucalyptus camaldulensis*) woodlands, are entirely or partially reliant on groundwater. These are deep rooted plants, which are able to switch between water sources depending on availability, using surface or soil water during wet conditions and being entirely dependent on groundwater during drought conditions. The second type of GDE, wetlands, receive seasonal, intermittent or continuous groundwater contribution and are often dominated by plants such as Tea-Trees (*Melaleuca spp.*) and reeds. These ecosystems are relatively well understood, and there are established methods for monitoring them.

What are Groundwater Dependent Ecosystems?

GDEs rely on groundwater to meet all or some of their water requirements to sustain the diverse communities of plants, animals, fungi and microbes which live in them. Some GDEs are entirely dependent on groundwater. Other GDEs only need groundwater seasonally or episodically (irregular or occasional water). Even so, groundwater still provides a vital and reliable source of water to these ecosystems. This is particularly true on the Eyre Peninsula because of the generally low rainfall environment and the lack of watercourses in the region.

What affects GDE health?

Changes in groundwater quantity (e.g. depth, extent, duration) and quality (e.g. salinity) affect the condition and survival of GDEs. The GDE monitoring program therefore aims to relate the condition of GDE vegetation to groundwater levels and quality. Changes in groundwater can be caused by factors we cannot control, such as changes in rainfall and temperature, but also by factors we can control, such as the extraction of groundwater. In the Prescribed Wells Areas, groundwater extraction is controlled through implementing the [Water Allocation Plan](#) (WAP). The WAP sets out the principles governing how groundwater should be shared fairly to benefit communities, GDEs and economic development. To make sure the WAP is working, it is reviewed every five years. The results of the GDE monitoring program are one factor taken into account during these reviews. If we find the extraction of groundwater is negatively impacting the GDEs, then the rules governing extraction will be modified.

Selection of monitoring sites

The GDE monitoring program has been designed so that the effects of factors we can control (water extraction) can be distinguished from those we cannot (climate variability). We therefore monitor licenced extraction sites, located in the areas that can be influenced by water extraction activities, and also monitor control sites. Control sites are located where conditions are similar to those at the licenced extraction sites, except they are located outside the areas that can be influenced by water extraction. We can identify the effects of uncontrollable influences at the control sites. Comparing the control sites to the licenced extraction sites, we can distinguish any additional effects that are caused by water extraction. Five Red Gum GDE sites (three licenced extraction and two control) and two wetland GDE sites (one licenced extraction and one control) have been selected for monitoring.



Location of GDE monitoring sites

How is GDE condition measured?

To monitor the condition of Red Gum GDEs, the condition of individual Red Gum trees is measured using a method developed by Nick Souter (2018). Characteristics of each tree are assessed visually and given a score using a standard system. The characteristics scored include leaf extent and density, leaf die off, leaf damage, growth at branch tips, growth of new shoots along tree trunks, the presence of flowers and seeds, the presence of mistletoe, and bark condition. The characteristic scores are used to calculate a Red Gum Condition Index (RCI) score for each tree. At each site 50 trees are assessed, and the average RCI score is calculated for the site. The same 50 trees are assessed annually at each site, and the site RCI score is compared to that from previous years. We can thus determine whether there has been a change in Red Gum condition at the site over time. The program for monitoring wetland GDE condition is also underway, and will be reported on in future.

At both wetland and Red Gum GDE sites, monitoring wells with data loggers and rainfall gauges have been installed. These are used to monitor groundwater levels and rainfall amount and intensity at the sites. Regional climate data such as maximum daily temperatures and historic rainfall data from nearby weather stations is also analysed.

What do we do with the monitoring data?

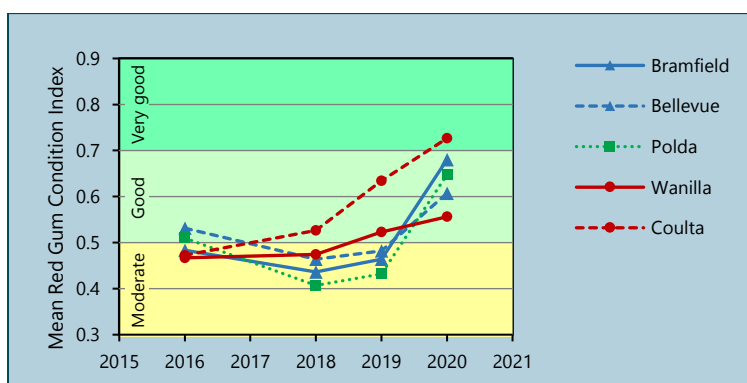
For each of the GDE sites, report cards are produced annually and published on the Eyre Peninsula Landscape Board website. These report cards present the results of the GDE monitoring program, evaluating any changes and trends in GDE vegetation condition, groundwater level and rainfall at the site. The Red Gum GDE report cards presenting the results of monitoring are published annually. Report cards for the wetland GDEs are under development and will be published soon.

The findings from the monitoring program are interpreted to determine the likely causes of any changes in GDE condition. If it is found that there is a decline in groundwater levels and a decline in GDE condition at the licensed extraction sites, but not at the control sites, then it is possible the decline is caused by extraction of groundwater. If this occurs, then this will trigger further investigation, a review and possible amendment of the Water Allocation Plan to ensure the objective to maintain the health of GDEs is achieved.

Summary results of 2020 Red Gum GDE monitoring

Monitoring results for 2020 show that in both the Musgrave and Southern Basin PWAs there has been no negative impact of licensed groundwater extraction on the Red Gum GDEs between 2016 and 2020. There has been an increase in the average condition of Red Gums at both the control and extraction sites during this period (see table and figure). This improvement in Red Gum condition has occurred despite a continued decline in groundwater levels at all sites from 2016 to 2020 (approx. 13 cm in Southern Basins PWA to 30 cm in Musgrave PWA from 2019 to 2020).

Analysis of rainfall data shows that although total annual rainfall increased in 2020, it was probably of lower intensity and duration than usual. This, combined with an increase in maximum daily temperatures, could result in water being available in the upper soil profile, but NOT infiltrating deeper to contribute to groundwater recharge. The increased water in the upper soil profile would be immediately available to the Red Gums, likely resulting in improved tree condition despite a decline in groundwater levels. Under such conditions, the Red Gums would not be entirely dependent on groundwater for their survival and growth. However, when climate conditions are more severe, these ecosystems would likely be entirely reliant on groundwater and could be impacted by a lowering of the groundwater levels, caused either by water extraction or climate variability.



Change in Red Gum Condition Index, 2016 to 2020, at all monitored Red Gum GDE sites

Overview of monitoring results at Red Gum GDEs

Site	RCI Score 2020	Condition 2020	Change 2019-20	Trend 2016-20	Type of Site
Musgrave PWA					
Bellevue	0.61	Good ²	+13%	+8%	Control for Bramfield ¹
Bramfield	0.68	Good	+22%	+20%	Licensed extraction
Polda	0.65	Good	+22%	+14%	Licensed extraction
Southern Basins PWA					
Couлта	0.73	Very good ³	+9%	+25%	Control for Wanilla ¹
Wanilla	0.56	Good	+3%	+9%	Licensed extraction

¹ No licensed extraction

² Good - RCI of 0.50 to 0.69

³ Very Good - RCI of ≥ 0.70

For more information

Follow the links below to access other key documents:

- [Water Allocation Plan for the Southern Basins and Musgrave Prescribed Wells Areas](#)
- [A Guide to the Water Allocation Plan. Southern Basins and Musgrave Prescribed Wells Areas, Eyre Peninsula](#)
- [Monitoring, Evaluation and Improvement Plan for the Southern Basins and Musgrave Prescribed Wells Areas Water Allocation Plan](#)
- Access the full report on assessment of Red Gum condition in 2018 [here](#):

Muller K. L., N.J. Souter and Australian Water Technology (2019). *Eyre Peninsula Groundwater Dependent Ecosystem Data Analysis: Red Gum tree condition data (five sites)*. A report for Natural Resources Eyre Peninsula, Department for Environment and Water, Port Lincoln, South Australia.

Links to other supporting scientific reports can be found [here](#).

Contact: **Manager – Planning and Engagement:** P (08) 8688 3111