

SOUTH WEST WETLANDS MONITORING PROGRAM REPORT 1977 – 2012



**Report by JAK Lane, AG Clarke & YC Winchcombe
Western Australian Department of Parks and Wildlife
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Cover photograph: Water skiing at Dumbleyung Lake in summer 1984/85. © JAK Lane.

Water skiing is permitted in a central area of Dumbleyung Lake when water depth and condition are suitable¹. A small area near the boat ramp is set aside for swimming. An 8 knot boat speed limit applies to the remainder of the lake in order to limit disturbance to waterbirds. On smaller lakes it could also be appropriate for watercraft to be excluded from one or more 'refuge areas' for waterbirds. Their selection needs to take into account the relevant species' habitat requirements, seasonal movements and habitat availability and arrangement, in addition to the requirements for enjoyable boating. In some cases a nearby wetland might provide adequate refuge.

Tens of thousands of waterbirds congregate on Dumbleyung Lake when conditions are suitable, for example in March 1985 when the water depth was 2.75m and the salinity was marginally above that of seawater².

¹ Visit http://www.transport.wa.gov.au/mediaFiles/marine/MAC-M-WaterSki_InlandWaterDamsLakes3.pdf for maps and other particulars concerning water skiing on Dumbleyung and other lakes.

² For more details see pages 56, 57 & 92 of this report.

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SUMMARY

This report presents data collected from 1977–2012 for the South West Wetlands Monitoring Program (SWWMP) conducted by the Western Australian Department of Parks and Wildlife (DPaW). Since 1997 this program has been funded under the WA Salinity Action Plan / Salinity Strategy as updated by the Government's response to the Salinity Taskforce report. In recent times SWWMP has become increasingly significant in the context of climate change. Rainfall is declining over much of the south-west and this is affecting many wetlands.

In this report we present all routinely-collected September and November water level, salinity and pH data to 2012. These data are presented in graphical form for 99 of the 103 currently-monitored SWWMP wetlands. Data concerning nutrients (not monitored beyond 2007) in these wetlands, and concerning water level, salinity, pH and nutrient concentrations in other, historically-monitored wetlands, may be found in Lane *et al.* (2009a). Administrative information concerning all 156 SWWMP wetlands, their map coordinates, the periods during which each has been monitored, their locations in terms of DPaW Regions and Districts and Local Government Authorities (LGA's), and their tenure, is also presented.

This report provides an up-to-date overview of the data that have been collected over the past thirty-five years and ready-reference lists of the wetlands. This information will be useful for those with a responsibility or interest in the conservation and management of these and other wetlands in south-western Australia. Most of the monitored wetlands are within Nature Reserves or National Parks and DPaW is responsible for their management. Some are also within Natural Diversity Recovery Catchments and 'Ramsar' Sites and many are 'Directory' (nationally significant) Sites.

Researchers will also find the report useful as it identifies wetlands that have long periods of systematic monitoring of physico-chemical attributes, knowledge which will assist in the selection of most-suitable wetlands for study. Pronounced year-to-year or longer-term variations or trends are readily apparent in the graphs of some wetlands, as is the absence of pronounced variations or trends in others. Thus the wetlands of SWWMP demonstrate a wide variety of hydrological responses to landscape setting, surface and groundwater catchment characteristics, local climates and, in some cases, management interventions.

Attention is drawn to a number of wetlands of particular interest or concern. These are Bambun, Broadwater, Byenup, Chandala, Clifton, Coomalbidgup, Corrigin 12900 ('Paperbark Swamp'), Crackers, Davies, Dobaderry, Dumbleyung, Egret, Esperance 26410, Forrestdale, Gore, Guraga, Harvey 12632, Hinds, Jandabup, Jasper, Jerdacuttup, Joondalup, Logue, Maringup, McLarty, Mettler, Mortijinup, Muir, Nine Mile, Noobijup, Noonying, Pillenorup, Pleasant View, Powell, Range Road Yate, Shark, Taarblin, Thomsons, Toolibin, Tordit-Gurrup, Towerinning, Unicup, Walbyring, Wannamal, Warden, Warrinup, Wheatfield, White (Narrogin), Wilson, Yaalup, Yarnup and Yellilup. Regional, District and specialist branch staff of DPaW are encouraged to examine the data for all wetlands in their respective areas of responsibility as other wetlands may also show changes of interest or management concern.

2012 was a year of below to very much below rainfall in western parts of south-western Australia and average to above average in eastern parts. Six SWWMP wetlands experienced their lowest-recorded September and/or November water levels and only one experienced its highest. Twenty-two SWWMP wetlands were dry in both monitoring months of 2012, whereas 12 were dry in 2011. No SWWMP wetlands experienced their lowest-recorded salinities in 2012, whereas 22 experienced their highest.

Between 1997 and 2009 the bathymetries (lakebed and shoreline contours and inflow and outflow channels) of 19 monitored wetlands were mapped under SWWMP, with Department of Environment and Conservation (now DPaW) Regional and District funding support. This work enables water surface areas, water volumes and salt loads to be calculated from SWWMP water level and salinity data. This permits modelling of water and salt balances and will facilitate assessments of likely hydrological and ecological impacts of drainage, diversion, pumping and storage proposals, proposed land use changes and predicted climate change. All 37 SWWMP wetlands known by the authors to have been bathymetrically-mapped are listed in this report, together with the years of mapping, methods employed, products and custodians / sources.

High resolution, low altitude, aerial oblique photography is useful for mapping wetland vegetation, monitoring vegetation condition, planning and conducting biological surveys, planning recreational activities and facilities, and in interpretation and extension. During the period 2008–2012, 152 of the 156 SWWMP wetlands have been flown and photographed and a sample of these photographs and enlargements is presented in this report. Copies of the original, high resolution photographs in digital format may be obtained on request.

During the period 2009–2012, continuous water level recorders and tipping-bucket rainfall gauges have been installed on 14 SWWMP wetlands. This equipment will be kept in place for several years and then moved to other high conservation value SWWMP wetlands of special interest (e.g. for the specially-protected Australasian Bittern *Botaurus poiciloptilus*) and/or under threat. Collection of continuous water level and rainfall data will assist in the development of salt and water balance models for these and other south-western Australian wetlands and will thereby assist in their conservation management. These data will also assist in developing an improved understanding of the likely consequences of predicted climate change, particularly rainfall decline, on the wetlands of south-western Australia.

Facilitation of appropriate recreational activities in natural areas managed by DPaW is a primary focus of the new agency. In this report we detail some past and present activities as a first step in identifying future possibilities. Some existing forms of recreational use could be expanded and other, new activities could be introduced. With appropriate planning and guidance, enhanced recreational benefits could be achieved with limited disturbance of wildlife.

In this report we also detail, for the first time, the occurrence of threatened vertebrate fauna on SWWMP wetlands. Notable is the Australasian Bittern or ‘Bunyip Bird’. This large, superbly camouflaged bird with a booming voice is now largely confined in Western Australia to the rushbeds of a relatively small number of wetlands, mostly SWWMP wetlands, on and near the south coast.

This report is the sixth in a series of annual reports aimed at putting most-recent SWWMP data in front of readers as soon as possible after data collection. It is probable that this is also the penultimate annual report.

1. INTRODUCTION

This report presents data and other information collected from 1977–2012 for the South West Wetlands Monitoring Program (SWWMP) conducted by the Western Australian Department of Parks and Wildlife (DPaW)¹ and its predecessors over more than three decades. Since 1997 this program has been funded under the Western Australian Salinity Action Plan (Government of Western Australia 1996a) and State Salinity Strategy (State Salinity Council 2000a,b) as updated by the Government's response (Government of Western Australia 2002) to the Salinity Taskforce report (Frost *et al.* 2001). A detailed account of SWWMP, including analyses of data to 2000, may be found in Lane *et al.* (2004). Reviews of this and other programs under the Salinity Action Plan have been published (Wallace 2001, Wallace *et al.* 2011).

In this report we present, in graphical form, all September and November water depth, salinity and pH data routinely collected from 99² of the 103³ currently-monitored SWWMP wetlands. Data concerning nutrient concentrations⁴ in most of these wetlands, and concerning water level, salinity, pH and nutrient concentrations in other, historically-monitored SWWMP wetlands, may be found in Lane *et al.* (2009a) and are not repeated here. The locations of all 156 current and historically-monitored SWWMP wetlands are shown in Figure 1. Administrative information concerning these wetlands, their map coordinates, the periods during which each has been monitored, their locations in terms of DPaW Regions and Districts and Local Government Authorities (LGA's), and their tenure, is also presented (Tables 1-3).

The main purposes of this report are to provide an up-to-date visual overview of data that have been collected over the past thirty-five years and ready-reference lists of the wetlands. This information will be useful for those with a responsibility or interest in the conservation and management of these and other wetlands in south-western Australia. Most of the monitored wetlands are within Nature Reserves or National Parks vested in the Conservation Commission⁵ of Western Australia and DPAW is responsible for their management. Some are within Natural Diversity Recovery Catchments (Government of Western Australia 1996a; Wallace & Lloyd 2008) and Ramsar Sites (Government of Western Australia 1990, 2000; Ramsar Secretariat 2013) and many are Directory Sites (Environment Australia 2001) (Tables 4 & 5).

Researchers will also find the report useful as it identifies those wetlands that have long periods of systematic monitoring of physico-chemical attributes, knowledge which will assist in the selection of wetlands most-suitable for study. Pronounced year-to-year or longer-term variations or trends are readily apparent in the graphs of some wetlands, as is the absence of pronounced variations or trends in others. The wetlands of SWWMP demonstrate a wide variety of hydrological responses to landscape setting, surface and groundwater catchment characteristics, local climates and, in some cases, management interventions. Many are also exhibiting pronounced responses to the decline in annual rainfall that has occurred over much of south-western Australia since the mid 1970s.

Facilitation of appropriate recreational activities in natural areas managed by DPaW is a primary focus of the new agency. In this report (Appendices 2 & 3) we detail some past and present activities on SWWMP and other wetlands as a first step in identifying future possibilities. Some existing forms of recreational use could be expanded and other, new activities could be introduced. With appropriate planning, guidance and management, increased and enhanced recreational benefits could be achieved with limited disturbance of wildlife.

The wetlands of south-western Australia provide essential habitat for a variety of threatened species of flora and fauna. In this report we also detail, for the first time, the occurrence of threatened vertebrate fauna on SWWMP wetlands (Appendix 4). Notable amongst these is the Australasian Bittern or 'Bunyip Bird'. This large, superbly camouflaged bird with a booming call is now largely confined in Western Australia to the rushbeds of a relatively small number of wetlands, mostly SWWMP wetlands, on and near the south coast.

¹ DPaW commenced operations on 1 July 2013 following the separation of the former Department of Environment and Conservation (DEC) into DPaW and the Department of Environment Regulation. DEC's predecessors in regard to SWWMP were the Department of Conservation and Land Management (CALM; 1985-2006) and the Department of Fisheries and Wildlife (pre-1985).

² Not Yeagarup nor Yeagarup South, as depth gauges have yet to be installed (though water level measurements area being made) and not Big Boom or Gingilup due to the limited amount of data.

³ Monitoring was discontinued at two wetlands, Hebitons and Goorly, at the end of 2009, thereby reducing the number of 'current' SWWMP wetlands from 103 to 101 and increasing the number of 'historical' wetlands from 49 to 51. At the end of 2010, monitoring was also discontinued at Blue Gum, Frasers and 'Esperance 27985', but in 2011 was resumed at Eneminga and initiated at Yeagarup and Yeagarup South, thus maintaining the number of 'current' SWWMP wetlands at 101 while increasing the number of 'historical' wetlands to 53. In 2012 monitoring was initiated at Big Boom and Gingilup, thereby increasing the number of current SWWMP wetlands to 103 with the number of historical SWWMP wetlands unchanged at 53.

⁴ Total nitrogen and total phosphorus, both filtered and unfiltered. These parameters have not been monitored beyond 2007.

⁵ To be replaced by the Conservation and Parks Commission.

2. RESULTS

In order to make this report available in a timely fashion, statistical trend analyses to 2012 have not been performed on the physico-chemical data presented here. Trends to 2000 of 41 SWWMP wetlands (those monitored for 20 or more years at that time) have previously been reported (Lane *et al.* 2004) and readers may find it useful to compare the latest data with the results of that earlier work. A report on depth trends of multiple groups of current and historical SWWMP wetlands over decadal and multi-decadal periods from 1981 to 2010 is in preparation and annual updates are proposed.

Without statistical analysis, it would be potentially misleading to present lists of wetlands that appear to show trends, as opposed to those that do not. On the other hand, it is considered useful to draw the reader's attention here to a number of wetlands of particular interest or concern. These wetlands follow below, with the relevant LGA's in brackets. The data referred to are presented in the relevant Graphs (page 61 onwards), which are also arranged alphabetically.

Bambun (Gingin): Bambun's salinities have steadily risen during the past three years. It is now fresh (1<3ppt)¹ whereas throughout most of the preceding 24 years (1986–2009) it was very fresh (<1ppt). From 1979 (when monitoring began) until 1984 it was slightly more saline than at present.

Broadwater (Busselton): The September (4.5ppt) and November (8.4ppt) salinities of 2006 were markedly higher than those of all other monitoring years (1985–2012), including years of similar or lower depths (1987, 2001 & 2010). A probable explanation is that, sometime between November 2005 and September 2006, seawater was allowed to enter the Broadwater via the New River by unauthorised opening of a drainage structure connecting the Vasse River Diversion Drain (VRDD) to the New River. Seawater enters the VRDD when tides in Geographe Bay are high and during summer-autumn when freshwater flows from the VRDD cease.

Byenup (Manjimup): As is the case with nearby (and hydrologically-connected) Tordit-Gurru (see below), there is a pronounced inverse relationship between water levels and salinities, with levels lowest and salinities highest in 1987, 1995, 2001, 2002, 2007 and 2010–2012. In addition to this inverse relationship, there appears to be a long-term trend of rising salinities even at similar depths. The September and Nov 2012 salinities (11.2ppt and 11.4ppt respectively) were the highest recorded since monitoring was commenced 35 years previously.

Chandala (Chittering): September and November 2010 water levels were the lowest for at least 32 years (monitoring began in 1979), yet salinities and pH values were within the normal ranges of 0.5–1.5ppt and 6–8 pH units. In 2012, depths were within their normal range however the November salinity was at a record high level (2.5ppt).

This 120ha, spring-fed, melaleuca — eucalypt swamp previously supported thousands of nesting Straw-necked Ibis *Threskiornis spinicollis* and was considered a candidate for listing as a Wetland of International Importance under the Ramsar *Convention on Wetlands* (Jaensch & Watkins 1999).

Clifton (Mandurah): The trend of increasing salinities and salt loads in Lake Clifton from the early 1990s to 2000 (Knott *et al.* 2003) and onwards continues, with record and near-record high levels in September 2012 and November 2012 respectively. In November 2008 the authors initiated routine sampling at three fixed sites extending from near the shoreline to the end of the boardwalk (jetty), rather than one non-fixed site in this general area, as previously. In November 2008 (at water level 4.24m) the salinity values at these three sites were fairly similar, however in September 2009 (water level 4.14m) and November 2009 (water level 4.02m) the values were very different, due to the influence of freshwater seepage near the shoreline. Substantial salinity differences were also apparent in September 2010 and November 2011. Lower water levels prevented sampling at the 'inner sedge area' sampling site in both sampling months of 2010–2012 and at the 'outer sedge area' site in November 2010.

The pattern of water level change at Clifton is similar in appearance to that of 'Harvey 12632' (12 km south-east) and Nine Mile (11 km east).

Comparison of recent and historical data concerning the composition of the lake's internationally significant thrombolite community indicates a large reduction in relative abundance of cyanobacterial species believed to be fundamental for the thrombolite structure (Smith *et al.* 2010).

Coomalbidgup (Esperance): Depths have declined markedly from a peak of ≈3m in 2000 to <0.5m in 2006, 2008, 2009, 2011 and 2012. Salinities have risen dramatically over the same period. Broadly similar changes in water levels and salinities have occurred at Mortijinup (26 km south-east), but not at Gore (13 km south-east) where water levels have been reasonably consistent (≈1.6m) since 1997.

¹ In this report, the salinity categories 'very fresh' (<1ppt), 'fresh' (1<3ppt), 'brackish' (3<10ppt), 'saline' (10<50ppt) and 'hypersaline' (≥50ppt) are used, as in Lane *et al.* (2004). 'ppt' = parts per thousand.

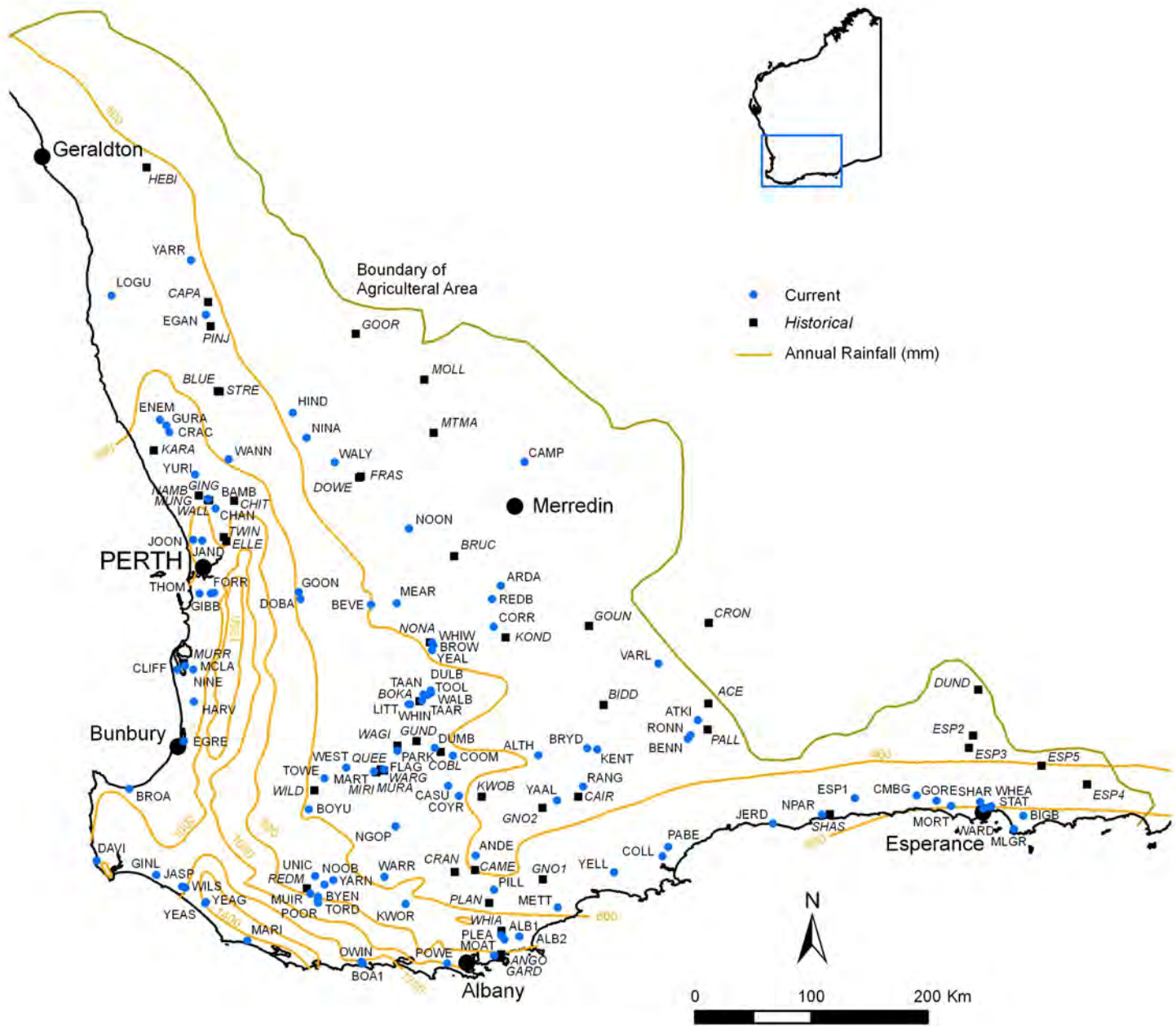


Figure 1. Wetlands currently and previously monitored under the South West Wetlands Monitoring Program

Corrigin 12900, also known as Paperbark Swamp (Corrigin): This wetland has now been dry in September and November each year for six years (2007–2012). This is an exceptionally long period for Corrigin 12900, which has been monitored under SWWMP for three decades.

Crackers (Dandaragan): The statistically-significant upward trend in salinities from 1981 to 2000 (Lane et al. 2004) is continuing, with salinities from 2002 to 2012 being predominantly in the fresh (1<3ppt), rather than very fresh (<1ppt), category. In 2012, September and November salinities reached record high levels (2.6ppt & 2.8ppt respectively). Crackers' extensive lake floor vegetation could be under threat.

Davies (Augusta-Margaret River): Salinities have risen since 2000, after a period of eight years (1993–2000) of little change preceded by an apparent rise in earlier years (monitoring began in 1991). This wetland is now at the high end of fresh (1<3ppt). The possible causes of this rise, and the impacts on flora and fauna, have been the subject of work by Davies (2010). September and November 2012 salinities were at a record high level (≈2.8ppt).

Dobaderry (Beverley): Dobaderry was dry in both September and November of 2010, an event that last occurred in 1980. Much of Dobaderry's lake floor vegetation (≈1m high *Melaleuca lateritia*) appeared severely stressed in September 2010 (compare Photos 52 & 51) and indications were that this was due to drought. In 2011 the lake floor was inundated and by November 2011 the vegetation was recovering. In 2012 Dobaderry was dry again in both monitoring months and the lake floor vegetation was again severely stressed.

Dumbleyung (Dumbleyung / Wagin): Dumbleyung last overflowed in 1983, following the post-cyclonic rains (Cyclone Bruno) of January 1982 and heavy winter rains the following year. Since 1983, there have been only three substantial filling events, in 1988, 1993 and 2005. In most years the waters of Dumbleyung are hypersaline (≥50ppt), but in years of major inflow, September and November salinities may fall as low as 13ppt. In 2012, September and November water levels were very low (<0.5m) and salinities were again hypersaline. Bathymetric surveys arranged and assisted by SWWMP staff in April 2001 indicate that Dumbleyung overflows at 4.42m (258.10mAHD), at which level the stored volume of the lake is ≈190 million cubic metres.

Egret (Harvey): The cause(s) of the exceptionally low (≈3) pH values of this swamp in some periods (1985–1989) and some years (2009) has not been investigated. In most years Egret's pH values are mainly within the range 6-7 pH units. In September 2012 it was again low at 3.7 pH units and its salinity was at a record high level of 4.1ppt.

Esperance 26410 (Esperance): This Flat-topped Yate *Eucalyptus occidentalis* lake has a narrow inner zone of dead trees, with some regeneration (Jaensch et al. 2009, Clarke et al. 2011). The deaths, which have not been mapped or aged, could be due to salinity or perhaps to prolonged inundation, as occurred for example in 1986 & 1987 and 1989 & 1990. 'Similar depth' salinity comparisons made previously (Lane et al. 2010) indicated a very substantial increase in the salt load of this wetland in recent years and salinities in 2009 were higher than all previous records. Water levels were markedly higher (≈1.9m) and salinities markedly lower (≈3ppt) in 2010 than in 2009, but again, 'similar depth comparisons' (2010 and 1986) show that a substantial increase in salt load continues. Water levels have been consistently high over the past three years and salinities have been rising. Further tree deaths seem likely.

Forrestdale (Armadale): September and November water levels have trended downwards since the early 1990s and salinities, though still mainly fresh (1<3ppt), appear to have trended slightly higher. Lower water levels have facilitated the spread of bulrush *Typha orientalis* in shallow parts of the lake. The record high salinity in November 2012 was probably due to the very low water level (near 0.00m) at which the sample was taken, i.e. at maximum evapoconcentration.

Gore (Esperance): Gore's September and November water levels have been more consistent during the past 16 years (1997–2012 inclusive) than in the preceding 18 years (1979–1996 inclusive), whereas Mortjinup's (10 km east) water levels have steadily declined since monitoring began 12 years ago. Gore's September and November salinities have been relatively stable and within a narrower range from 2002 onwards.

Guraga (Dandaragan): September and November water levels have declined since their peak of ≈3m in 1999 and 2000 and have been consistently low (0.65-0.0m) for the past six years (2007-2012). This is the longest period of continuously low water levels since monitoring began three decades ago.

Harvey 12632 (Harvey): Water levels have been trending downwards from a peak of ≈1.6m since the early 1990s and in September and November 2010 'Harvey 12632' was dry for the first time in at least 31 years. September and November salinities have been rising over the same period. In September 2011 a marked change in vegetation was evident. Much of the fringing, wetland-dependent vegetation was stressed, dying or dead, however there were many well-established young shrubs growing on the shallowly-inundated, peaty lake floor (see Photo 53). These grew taller in 2012.

The pattern of water level change at Harvey 12632 since the early 1990s is similar in appearance to that of Clifton (12 km north-west). Nine Mile (27 km north) has shown a similar downward trend over a longer period.

Hinds (Wongan-Ballidu): There was an exceptional filling event (to >4m) in 1999 and it took 2–3 years for water levels to decline to ‘normal’ (for the period 1979–2012). There have been no major filling events since 1999. Note that this wetland was not monitored from 1992 (when recreational duck hunting in Western Australia was banned) to 1996 (when the WA Salinity Action Plan was launched) (See Section 2 of Lane *et al.* 2004 for the relevant history). The 2009–2011 September and November salinities of ≈ 335 ppt were far above those of the flood year of 1999 (≈ 16 ppt). Samples of the still-hypersaline waters were not taken in 2012 due to the treacherous nature of the inundated mud.

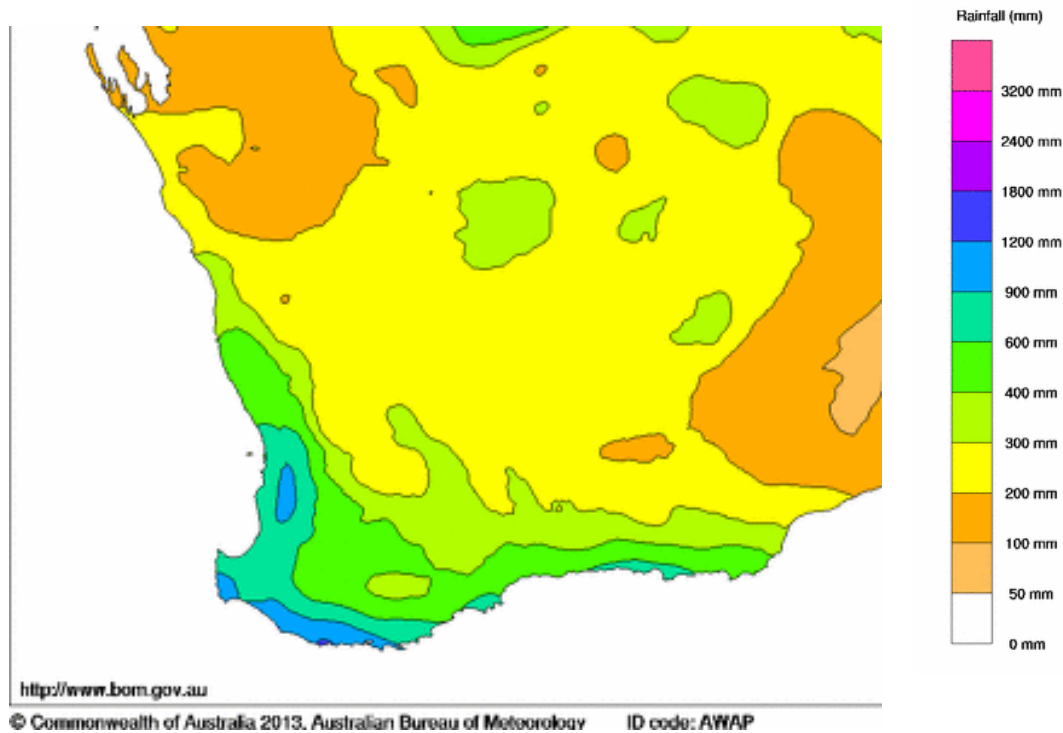


Figure 2. Rainfall (mm) recorded in the 12 month period from 01 Nov 2011 to 31 Oct 2012

Jandabup (Wanneroo): September and November pH values returned to ‘normal’ (for the periods 1983–1997 and 2000–2011) following their fall to low levels (pH 4–5) in 1998 and 1999. This temporary acidification initially followed (lag of one year), and then coincided with, a period of 2–3 years of lower water levels and prolonged drying of the lake bed and is thought to have possibly been due to the oxidation of sulfur compounds from one or more sources (Sommer & Horwitz 2001). Pumping of groundwater was recommenced in summer 1999/2000 (it had ceased in autumn 1996), because minimum water level criteria were not reached during the previous two summers. This prevented the wetland from drying in summer 1999/2000 (Sommer & Horwitz *op. cit.*). The September water level of 0.73m was the lowest since monitoring began 31 years previously.

Jasper (Nannup): Jasper remains very fresh (<1ppt), however salinities have been higher (>0.25ppt) in most years since 2000, the end of a 13 year period of consistently high water levels and lower salinities (<0.25ppt). Similar-depth salinity comparisons (2009 with 1999 & 2000, 2011 with 2002 and 2012 with 1987) suggest that Jasper’s salt load has also increased. The November 2012 water level of 9.09m is the lowest, and the Sept and Nov 2012 salinities of 0.33ppt the highest, since monitoring began in 1985.

Probing of a peat deposit in the south-east corner of Jasper in 1995 by divers with steel rods has revealed that Jasper is, by one estimation (Dortch 1996), at least 16m deep, not 9-10m. In our 1977–2010 report we stated that ‘Whichever measurement / estimate is used, Jasper is the deepest of all SWWMP wetlands and Maringup the second-deepest (Lane *et al.* 2004)’. We have since discovered that this statement is perhaps incorrect. ARL (1992) reported a depth of 10.8m in Yeagarup Lake — without probing the lake floor.

Jerdacuttup (Ravensthorpe): Water levels (0.0–4.5m) and salinities (5–250ppt) of Jerdacuttup continue to oscillate markedly over 5–15 year time periods, there being a strong inverse relationship between these two parameters in this

wetland. The 2011 water levels and salinities of $\approx 0.6\text{m}$ and $\approx 160\text{--}210\text{ppt}$ respectively were markedly different from the flood year values of $\approx 4.3\text{m}$ and 5ppt in 1989. In 2012 the water levels rose to $\approx 2.1\text{m}$ and salinities fell to $\approx 30\text{ppt}$.

Joondalup (Joondalup): September and November water levels have been fairly stable around $2.5\text{--}2.7\text{m}$ since 1998 following earlier periods at $\approx 3.0\text{m}$ (1981–1990 and 1995 & 1996) and $\approx 3.5\text{m}$ (1992 & 1993). The September 2011 water level of $\approx 2.4\text{m}$ was the lowest September level for at least three decades and the September 2011 salinity of 1.0ppt was the highest (the November salinity was the fourth highest). Depths and salinities in 2012 were similar to those of 2011. Salinities have been rising since 2005 and are now borderline between very fresh ($<1\text{ppt}$) and fresh ($1\text{--}3\text{ppt}$).

Logue (Carnamah): This wetland was dry in September and November 2012 and has been dry / near-dry in these months for eight of the past nine years. This is an exceptionally long period for Logue, which has been monitored under SWWMP for more than three decades. There has been no major input of water to this wetland since 1999, when it filled to $\approx 4.0\text{m}$. Healthy *Casuarina* (predominantly) and *Melaleuca* small trees and saplings, previously restricted to the lake margins, have recently appeared in low numbers, widely scattered, on small areas of the lake floor.

Maringup (Manjimup): September and November salinities of this deep wetland have varied within a narrow range ($\approx 0.2\text{--}0.3\text{ppt}$) since monitoring began in 1993. September and November depths have oscillated between 6.0m and 6.6m , with no clear trend.

McLarty (Murray): September and November water levels have fluctuated markedly during the period of monitoring (1993–2012) with the long term trend being downwards. Salinities are mainly $<4\text{ppt}$, with occasional values to $\approx 12\text{ppt}$ when water levels are lowest.

Mettler (Albany): Water levels have declined (from $\approx 1.9\text{m}$ to $<0.3\text{m}$) and salinities have increased (from $\approx 0.05\text{ppt}$ to $>0.6\text{ppt}$ since water levels peaked in 2005).

Mortijinup (Esperance): Depths have declined over the past 12 years of monitoring, from $\approx 3.3\text{m}$ in 2000 to $\approx 1.2\text{m}$ in 2012. Salinities have risen from $\approx 3\text{ppt}$ to $>7\text{ppt}$ over this period. The significance of these changes in a long term (30+ years) context remains to be seen.

Muir (Manjimup): September (0.4m) and November (0.2m) 2010 water levels were the lowest in at least 34 years (monitoring began in 1979–1980) and far below the level ($\approx 4.0\text{m}$) at which this $4,600\text{ ha}$ lake would overflow into the Deep River, an event that is thought to have last occurred around 1900–1901 (pers. comm. Ash Muir via Roger Hearn, 07 August 2009). In 2011 and 2012 water levels recovered somewhat, to $\approx 0.55\text{m}$.

As previously noted (Lane *et al.* 2004), from 1979 to 1989 SWWMP monitoring of Muir was undertaken at the northern end of the lake, near the discharge point of a seasonally-inflowing drain. From 1990 onwards all monitoring has been undertaken at a more satisfactory, deeper-water location near the eastern shoreline, away from surface drainage discharge points.

Nine Mile (Murray): The pronounced downward trend in water levels which began in 1984 has continued to 2010–2012. Salinities, however, remain mainly within the range $0.2\text{--}0.5\text{ppt}$ and are thus ‘very fresh’. ‘Harvey 12632’ (27 km south) has shown a similar downward trend in water levels since 1991 but, unlike Nine Mile, its salinities are rising.

Noobijup (Cranbrook): September and November depths ($\approx 0.25\text{m}$) and pH values (≈ 4.2) remained low in 2012. Similar declines (and recoveries) in pH have been observed at nearby Unicup and Yarnup (see below) and also at distant Jandabup (see above).

Noonying (Tammin): This wetland has been dry or very shallow ($<0.2\text{m}$) in most Septembers and Novembers for the past twelve years (2001–2012). This is an exceptionally long period for Noonying. From 1979 to 1990, and possibly to 1999 (there was a gap in monitoring from 1992 to 1996), Noonying water levels were often in the range $1.0\text{--}1.4\text{m}$.

Pillenorup (Plantagenet): Water levels in this large and relatively pristine wetland on the south side of the Stirling Ranges have fallen from a flood level of $\approx 2.7\text{m}$ in September–November 2005 to 0.0m (i.e. dry) in 2010–2012. As the water levels fell, salinities rose, from 0.2ppt in 2005 to 2.6ppt in 2009. The four or so years of continuous inundation resulted in extensive death of tall and low sedges (*Baumea* spp.?) on the lake floor. In September 2010 some sedge regeneration was occurring, mainly on shallower parts of the lake floor. Most of the melaleucas and eucalypts on the lake floor and margins appeared to have survived the prolonged immersion, however some loss of vigour was apparent. In September 2012, melaleuca seedlings ($\approx 0.1\text{m}$ high) were noticeable over a large area of the central lake floor.

Pleasant View (Albany): September and November water levels of Pleasant View have oscillated between $0.1\text{--}2.2\text{m}$ and salinities have mainly been within the range $0.2\text{--}0.9\text{ppt}$ (exceptionally to 1.6ppt) over the past 33 years (monitoring began in 1979). In 2012 water levels were low ($\approx 0.6\text{m}$) and salinities ($\approx 0.4\text{ppt}$) were within the normal range for this wetland.

Powell (Albany): Powell is unusual among SWWMP wetlands in that in most years its water level is higher in November than September. This is presumably a consequence of management arrangements for the surface water drainage network that it lies within. It is interesting that the six recordings of unusually high salinities (2–5ppt) were all made in Novembers, this despite the corresponding November depths being higher than the September depths in four of these six years. All September salinities and most November salinities of the past 31 years are in the range 0.2–1.5ppt.

Range Road Yate (Kent): Despite being located in the inland agricultural region, an area of widespread secondary salinisation, Range Road Yate remains very fresh (<1ppt) in most years, with no indication of September and November salinities trending upwards over the past 13 years of monitoring. Nearby Yaalup (20km south-west) similarly remains very fresh in most years.

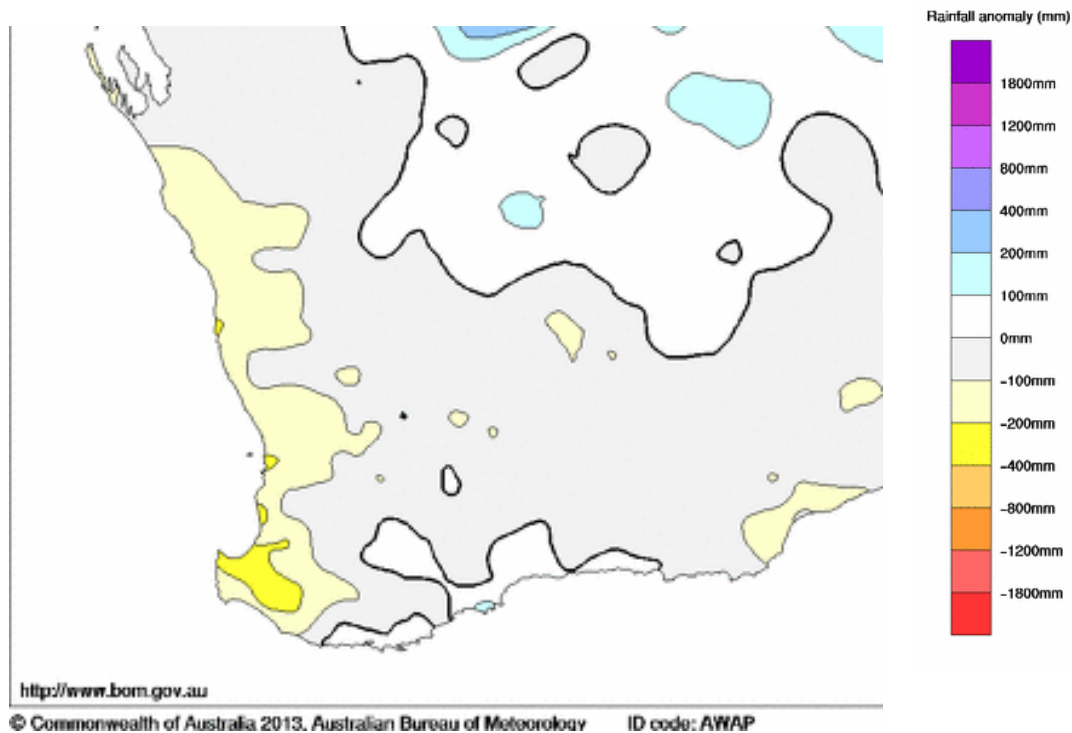


Figure 3. Rainfall anomalies (mm above or below average) in the 12 month period from 01 Nov 2011 to 31 Oct 2012

Shark (Esperance): In our 1977–2010 report we wrote: ‘This lake’s water levels exhibit an unusual pattern ... with considerable variation from 1979 (the start of monitoring) to 1999, and relatively little since’. In 2011 water levels dropped to near the lower end ($\approx 1.75\text{m}$) of the pre-1999 range and the trend of increasing salinities in recent years continued. In 2012 water levels were lower again and salinities were at record levels, moving from fresh (1<3ppt) to brackish (3<10ppt) in November. This wetland has been an important habitat for waterbirds, including species particularly sensitive to the loss of fringing and emergent vegetation (Jaensch *et al.* 2009, Clarke *et al.* 2011).

Taarblin South and Taarblin North (Narrogin): The 1983 filling (to 2.4m) of this large, formerly ‘live-treed’, now mainly ‘dead-treed’ lake near the northern (upper) end of the Blackwood River catchment was a 1 in 34 year — and possibly longer — event. For the remainder of the period 1979–2012, September and November water levels in the southern basin (Taarblin South) have mostly been within the range 0.0–0.5m (0.0m in 2012), though they did reach $\approx 0.9\text{m}$ in September 1996. Recent (2010) high resolution, aerial oblique photography shows long, narrow bands of living trees (Swamp Sheoak *Casuarina obesa*) on elevated ground within this basin. The northern basin (Taarblin North) receives pumped saline groundwater from bores in the bed of Toolibin (Durell *et al.* 2010).

Thomsons (Cockburn): Water supply to this Ramsar-listed wetland has been supplemented by diversion of surface drainage each winter-spring since and including 2004 (DEC 2009). Supplementation is intended ‘... to help ensure that water levels remain adequate for the protection of the reserve’s Ramsar values and water bird habitat, and to enable the fledgling cygnets to survive at the lake until they are able to fly’ (CALM 2005) and is subject to a specific plan (CALM

2004). Supplementation was from 15 July to 30 Nov in 2009, from 14 July to 15 Sept in 2010 and from 18 July to 19 Sept in 2011 (DEC 2012).

The level of public and private compliance with minimum water level criteria for Thomsons Lake, which is impacted by a variety of factors including rainfall, stormwater disposal and groundwater pumping from the Jandakot Mound, is reported annually by the Water Corporation to the EPA (CALM 2005).

Toolibin (Wickepin): This iconic wetland (Hooper & Wallace 1994) has now been dry / near-dry in September and November each year for 13 years (2000–2012). This in an unusually long period for Toolibin (at least in the past 34 years) and is due to a combination of drier years and diversion of higher-salinity surface flows away from the lake (Jones *et al.* 2009). The recent slow spread of casuarinas and melaleucas onto the floor of the mainly fresh (<3ppt) Lake Logue (Carnamah) makes an interesting contrast with the widespread but stressed casuarinas and melaleucas on the floor of Toolibin.

Tordit-Gurrup (Manjimup): As is the case with nearby (and hydrologically-connected) Byenup (see above), there is a pronounced inverse relationship between water levels and salinities of Tordit-Gurrup. September and November 2012 water levels were the lowest ($\approx 0.85\text{m}$) – and salinities the highest (4.8ppt – 6.9ppt) – since monitoring began 35 years ago, in 1977. Depths have been trending downwards and salinities upwards since 2000.

Towerrinning (West Arthur): High water levels (3.0–3.5m) and relatively low salinities (5–10ppt) have been achieved in Towerrinning in most years since remedial engineering works were undertaken in 1993 and 1994 (see Lane *et al.* 2004, pp. 48–49 for more history). This is a popular lake for water-based recreational activities, particularly waterskiing.

Unicup (Cranbrook): pH values rose after the major filling event (to $\approx 2.1\text{m}$) of 1988 and have consistently been within the range 7–9 pH units since 1991. Prior to 1988, values were generally within the range 4–6. Gibson *et al.* (2004) reported a ‘major collapse’ of Jointed Twig-rush *Baumea articulata* in a Unicup (and nearby Yarnup, see below) vegetation monitoring quadrat between October 1997 and October 2002, with cover abundance scores changing from 30–70% to 210%. These authors did not identify the cause of the collapse, but did point to ‘a marked decline in water depth [to $\approx 1.0\text{m}$] — and increase in salinity [to $\approx 10\text{ppt}$] — of Lake Unicup in 2001 and 2002’. Water levels were $\approx 0.25\text{m}$ and salinities 12–21ppt in September and November 2012. These are the lowest depths recorded since the major filling event in 1988.

Walbyring (Wickepin): This wetland has been dry in September and November for the past three years (2010–2012). This is the longest period of being continuously dry in these months since monitoring began at Walbyring 33 years ago.

Wannamal (Gingin): September and November water levels of this wetland are within the range 1.2–1.6m in most years and salinities are usually <15ppt. The 2010 levels of ≈ 0.6 – 0.3m and 26–94ppt were the lowest and highest for at least 32 preceding years (routine monitoring began in 1979). An appallingly nauseating odour encountered by JL while sampling Wannamal in November 2010 seemed to be coming from recently-exposed damp muds near the eastern shoreline. After returning to normal values in 2011, the September water level declined to a record (34 year) low (0.6m) in 2012 and the September salinity rose to a record high (37ppt). In 2012, pH values were at 25 year lows.

Warden (Esperance): Water levels were unusually high (≈ 2.0 – 2.7m) from 1999 to 2009. This was an exceptionally long period for Warden and was due to a combination of catchment clearing (resulting in increased run-off and groundwater rise; Marimuthu *et al.* 2005) and extreme rainfall events (Kusumastuti 2006). Rises in groundwater levels started directly impacting the wetlands by prolonging inundation from about 1986 onwards (Robertson & Massenbauer 2005). Engineering works were considered essential to reduce Warden’s water levels and thereby recover shorebird habitat and degraded riparian vegetation (Walshe & Massenbauer 2008). A pump station and pipeline to the Southern Ocean was proposed, however this is now under review. Water levels declined by $\approx 0.6\text{m}$ from Nov 2009 to Nov 2010 and this is thought to be partly due to artificial lowering of water levels in Wheatfield (see below), to which Warden is hydrologically-connected via Windabout and Woody Lakes (pers. comm. J. Lizamore, 05 January 2011). In 2011, September and November water levels declined further to $\approx 1.0\text{m}$. Salinities increased to $\approx 140\text{ppt}$. In 2012, September and November water levels declined to levels ($\approx 0.75\text{m}$) not seen since the late 1990s and salinities rose to levels (>170ppt) not seen since the early 1980s. The November 2012 salinity of 213ppt was the highest November value since monitoring began in 1979.

Warrinup (Cranbrook): In the eight years prior to the filling event of 1988, September and November water levels did not exceed 0.3m. Since 1988, levels have generally been higher, frequently exceeding 0.4m and occasionally 0.8m, perhaps indicating a shift in the hydrological balance of this still ‘very fresh’ (<1ppt) swamp.

Wheatfield (Esperance): A gravitational pipeline constructed in February–March 2009 is being used to lower water levels in Wheatfield, which is hydrologically-connected (at various cease-to-flow levels) to Woody, Windabout and Warden Lakes. Since construction, the pipeline has been open from April 2009 to January 2010, May 2011 to February 2012 and more-recently (pers. comm. J. Lizamore, 04 July 2012 & 11 September 2013). Water levels have been trending downwards, and salinities upwards, since SWWMP monitoring began in 1999–2000.

White (Narrogin): The filling event (to ≈2m) of 1983 was perhaps a once in three decades event, like that of Taarblin, seven kilometers to the north-east. However, due to a gap in monitoring from 1985 to 1996, this is not known for certain. Since 1997, water levels in spring have not exceeded 0.2m and have mostly been 0.0m, as in 2012.

Wilson (Manjimup): Although Wilson remains very fresh (<1ppt), its salinities are slowly increasing like those of nearby Jasper, this despite no downwards trend (at Wilson) in depths. The September (0.21ppt) and November (0.22ppt) 2012 salinities were the highest in at least 20 years, i.e. since monitoring commenced in 1992.

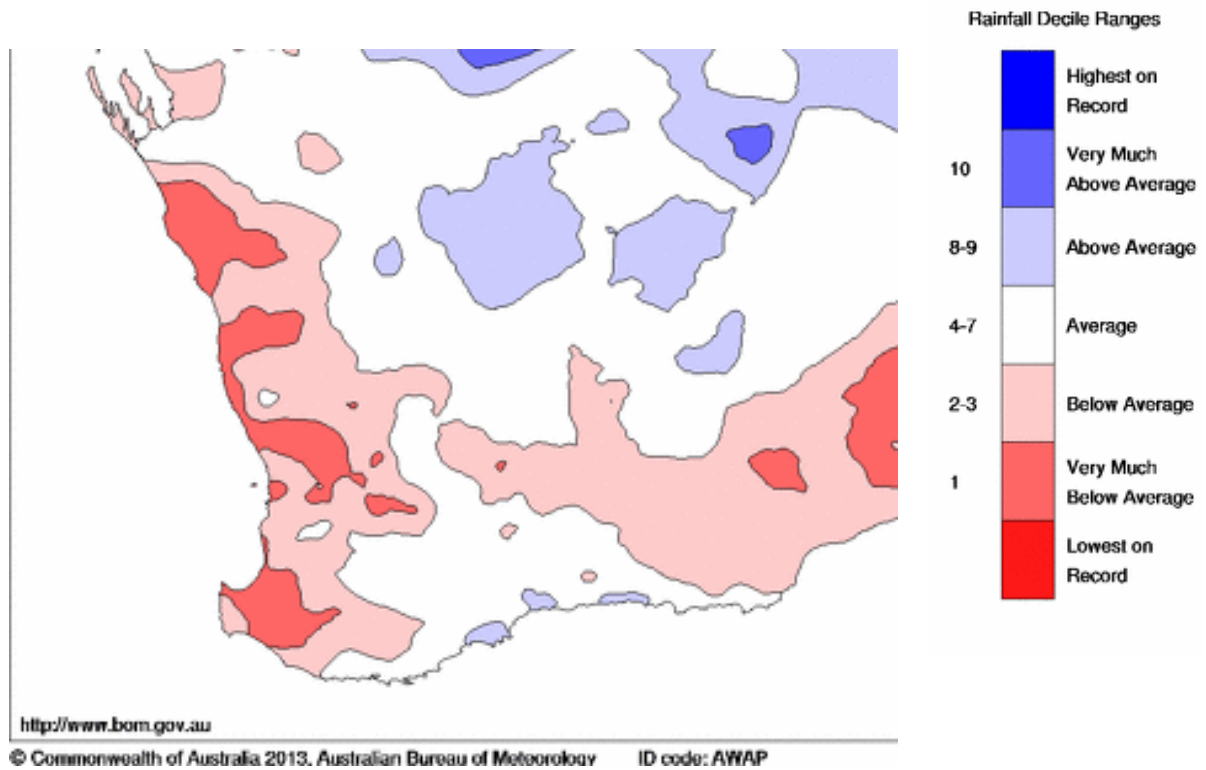


Figure 4. Rainfall deciles for the 12 month period from 01 Nov 2011 to 31 Oct 2012.

Yaalup (Kent): After a record (since 1982) four years of being dry or almost dry each spring, Yaalup’s water level jumped from 0.0m (dry) on 13 September 2011 to ≈1.6m on 08 November 2011. Unusually heavy rainfalls were recorded at the nearby Pingrup South rainfall recording station during 23–26 October (42mm) and 4–6 November (55mm) 2011. The long term (1935–2011) median rainfalls for the entire months of October and November at this station are 22mm and 17mm respectively. The water in Yaalup in November 2011 was ‘very fresh’ (<1ppt) and remained very fresh in September and November 2012 despite a half metre fall in water levels to ≈1.0m. Nearby Range Road Yate (20km north-east) similarly remains very fresh in most years.

Yarnup (Cranbrook): In 2011, Yarnup’s water levels and salinities recovered somewhat after reaching their lowest and highest values respectively (since at least 1980) in 2010 (≈0.35m and 8-13ppt). In 2012 water levels were again low and salinities were back to near-record highs (7–9ppt). Secondary salinisation of this formerly very fresh (<1ppt) wetland is evident from ‘similar-depth salinity comparisons’ (e.g. 1985 & 1990 with 2008;1984, 1991 & 1996 with 2009, and 1987 with 2012).

Yarnup’s pH values, which are normally within the range 6–8 pH units, have been lower (3–5 pH units) during and immediately following some recent years (2001, 2007, 2010) of lower water levels. Despite record low water levels in 2010, they were within their usual range in spring of that year, but dropped to 3.8 pH units in September 2011 and then partially recovered to 5.7 pH units in November 2011, following unseasonal filling. In 2012 they were still below normal.

Gibson *et al.* (2004) reported a ‘major collapse’ of *Baumea articulata* in a Yarnup (and nearby Unicup, see above) vegetation monitoring quadrat between October 1997 and October 2002, with cover abundance scores changing from 30–70% to 2–10%. These authors did not identify the cause of the collapse, but did point to markedly lower water depth

[≈0.46m] and pH [≈4] in 2001, with pH remaining low in 2002, and higher salinities [≈6.2ppt and ≈3.6ppt] in both years. Rising acid saline groundwater is a threat to this and other wetlands in the Muir-Unicup catchment (Smith & Hearn 2006).

Yellilup (Jerramungup): Salinities have risen dramatically since the mid 1990s when water levels began to fall following the exceptional filling event (to >4m) of 1988. The waters of Yellilup Lake (not to be confused with nearby Yellilup Swamp) were predominantly fresh (1<3ppt) prior to 1992, but by 2008 were hypersaline (≥50ppt). ‘Similar depth salinity comparisons’ indicate no change in salt load (tonnes) in this lake from 2000 to 2012 (salinities in both years being ≈15–18ppt) and that the load in 1986, i.e. prior to the major filling event, was much lower (salinities being ≈1ppt).

Prolonged inundation (1988 to 1994 and beyond) is thought to have been the primary cause of the extensive death of Flat-topped Yates *Eucalyptus occidentalis* and melaleucas that once extended over a large part of the lake floor. These changes have had major consequences for use by waterbirds (Jaensch *et al.* 2009, Clarke *et al.* 2011).

Rainfalls in 2012

Rainfalls in the south-west in 2012 ranged from <200mm to >1200mm, with the highest falls being recorded in the northern jarrah *Eucalyptus marginata* forest and near the western south coast (Fig. 2). Falls near the west coast were generally 100–200mm below average, with some parts being 200–400mm below (Fig. 3). Elsewhere rainfalls were up to 100mm above (south coast) to 100mm below (inland) average.

The rainfall deciles map (Fig. 4) shows that falls in the western half of the south west were ‘below average’ (deciles 2–3) to ‘very much below average’ (decile 1) and that ‘above average’ (deciles 8–9) falls were confined to three small areas on the eastern south coast.

Lowest and highest water levels

Six SWWMP wetlands (Jandabup, Jasper, Shark, Tordit-Gurruup, Unicup, Wannamal) experienced their lowest-recorded September and/or November water levels, whereas one SWWMP wetland (‘Boat Harbour 1’) experienced its highest levels. Thirty-two SWWMP wetlands were dry in both monitoring months of 2010 (a very dry year), while 12 were dry in the same months of 2011 and 22 were dry in 2012.

Lowest and highest salinities

No SWWMP wetlands experienced their lowest-recorded September and/or November salinities in 2012, whereas 22 SWWMP wetlands (Bennetts, Brown, Byenup, Chandala, Clifton, Coomalbidgup, Crackers, Davies, Egret, Flagstaff, Forrestdale, Jasper, Little White, Ngopitchup, Poorginup, Shark, Tordit-Gurruup, Wannamal, Warden, ‘West Arthur 5456’, Wilson, Yealering) experienced their highest salinities.

3. CONCLUDING COMMENTS

Readers are encouraged to view all Graphs (Albany 26385 to Yurine) of this report for other changes of possible interest or concern and perhaps for reassurance that, 35 years since commencement of SWWMP, while many wetlands are being impacted by declining rainfall, some clearly remain in good condition, at least in terms of the monitored key parameters.

Regional, District and specialist branch staff of the Department of Parks and Wildlife may find it useful to refer to Table 2 in order to readily identify monitored wetlands in their areas of management responsibility. Requests for data should be directed to jim.lane@dpaw.wa.gov.au.

SWWMP depth gauges at the 53 historically-monitored wetlands (monitored under SWWMP at some time in the past but not currently; see Tables 1–3) are not maintained and many are now totally illegible or missing altogether. Readers with a need to resume monitoring at one or more of these wetlands, even for a short period, are encouraged to contact SWWMP staff to find out details of the legally-protected Landgate¹ Bench Marks (local survey datums) at each of these wetlands so that new depth gauges, if needed, can be installed to the same elevations as those previously installed. Water level data ‘continuity’ can thereby be maintained.

Between 1997 and 2009, SWWMP staff, working with Landgate and contract surveyors, and with significant funding support from several DPaW Regions and Districts, mapped the bathymetry (lakebed and shoreline contours and inflow and outflow channels) of 19 SWWMP wetlands. An additional 18 SWWMP wetlands are known to have been mapped by

¹ Formerly known as the WA Department of Land Information.

others, in two cases (Byenup in 2009 and Tordit-Gurrup in 2011) with field assistance from SWWMP staff. A list of all 37 wetlands, together with their years of mapping, methods employed, products and custodians/sources is provided in Table 6.

Bathymetric mapping enables water surface areas, water volumes and salt loads (tonnes) to be calculated from measured depths and salinities and thereby assists in water balance and salt balance modelling and the assessment of likely impacts on specific wetlands of drainage, diversion, pumping and storage proposals, proposed land use changes and predicted climate change. Requests for bathymetric maps of SWWMP wetlands can be directed in the first instance to jim.lane@dpaw.wa.gov.au. Funded requests to map the bathymetry of additional SWWMP wetlands, particularly wetlands of high conservation value under threat, are welcome. SWWMP Senior Technical Officer Alan Clarke has considerable experience in organising, supervising and conducting bathymetric surveys.

High resolution, low altitude, aerial oblique photography is useful for mapping wetland vegetation, monitoring vegetation condition, planning and conducting biological surveys, planning recreational activities and facilities, and in interpretation and extension. During the period 2008–2012, 152 of the 156 SWWMP wetlands have been flown and photographed with specialised camera equipment to obtain photographs suitable for these purposes. A sample of low resolution prints and enlargements is presented in this report (photos 17–24 & 32–50). Digital copies of original, high resolution photographs of any of the 152 wetlands (see Table 7 for a list) may be obtained by directing requests to jim.lane@dpaw.wa.gov.au

Commencing in June 2009, Clarke and Winchcombe have installed continuous water level recorders and tipping-bucket rainfall gauges on 14 SWWMP wetlands ('Albany 27157', Big Boom, Broadwater, Chandala, Crackers, Davies 'Esperance 26410', Gingilup, Maringup, McLarty, Mettler, Nine Mile, Pillenorup, Pleasant View). We envisage this equipment being kept in operation at these locations for 2–4 years and then moved to other high conservation value SWWMP wetlands of special interest (e.g. for the specially-protected Australasian Bittern, see Appendix 4) and/or under threat. Collection of continuous water level and rainfall data in this manner will assist in the development of salt and water balance models¹ for these and other south-western Australian wetlands and will thereby assist in their conservation management. These data will also assist in developing an improved understanding of the likely consequences of predicted climate change, particularly rainfall decline, on wetlands of south-western Australia.

This report has been prepared as the sixth, and probably penultimate, in a series of annual reports aimed at putting the most-recent SWWMP data in front of readers in un-analysed form as soon as possible after data collection. Results and interpretations of statistical trend analyses are to be presented in other, less frequent reports covering the longer time periods required to assess such trends.

The authors of this report would like to draw readers' attention to the numerous reports and publications (e.g. Cale 2008; Cale *et al.* 2004, 2010; Cale & Halse 2006a-u; Gibson *et al.* 2004; Halse *et al.* 2002; Lyons *et al.* 2007) concerning the fringing and emergent vegetation, waterbirds, aquatic invertebrates, groundwater and detailed water chemistry of the 25 SWWMP wetlands (shown in bold in Tables 1,2,4–7) that have been intensively monitored by other DEC/DPaW scientists and collaborators under the State Salinity Strategy.

Readers' attention is also drawn to Appendices 2 & 3, which relate to recreational use of SWWMP wetlands, and Appendix 4, concerning threatened vertebrate fauna and SWWMP wetlands.

4. ACKNOWLEDGEMENTS

The authors wish to thank the many people who have participated in SWWMP or assisted in other ways over the past three and a half decades.

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¹ See Peck (2000) for an early example using SWWMP data from Coyrecup Lake.

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Photograph credits: Photos 1 & 3 were taken by volunteer John Winchcombe; 2, 4-9, 51-54 and the cover photo by Jim Lane; 10, 16, 25, 26, 28 & 29 by Yvonne Winchcombe; 11-15 & 30, 31 by Alan Clarke; 27 by Saul Cowen. Photos 17-24 & 32-50 were taken by Alf Lorkiewicz of DPaW Bunbury and entirely funded under SWWMP and Jim Lane is custodian of these.

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PHOTOS



Photo 1: DPaW depth gauge 'D' at Lake Muir on 18Sep2008 read 0.74m.



Photo 2: DPaW depth gauge 'E' at Thomsons Lake on 04Aug2008 read 0.70m.



Photo 3: DPaW depth gauge 'A' at Lake Wilson on 03Nov2008 read 3.85m.



Photo 4: DPaW depth gauge 'A' at Parkeyerring Lake on 18Jul2008 read 0.40m.



Photo 5: DPaW depth gauge 'C' at Lake Clifton on 13Sep2008 read 4.30m.



Photo 6: DoW depth gauge at Gibbs Road Swamp on 04Aug2008 read 24.59mAHD

Photographs 1-6: SWWMP Depth Gauges. Each depth gauge consists of one or more 1.00m metal or plastic gauge plates attached to a metal or wooden post. The gauge plate markings are in 0.01m increments, with labelling at 0.10m intervals. Labels 1, 2, 3, etc., at the top of each depth gauge indicate the height in metres (i.e. 1.00m, 2.00m, etc.) at the top of the uppermost gauge plate. Labels A, B, C, etc., where present, identify individual depth gauges at each wetland.

DPaW gauge readings indicate the water depth at the deepest location in the wetland, even though gauges are usually not at the deepest location, but instead are closer to the shore, to facilitate viewing.

Readings are taken from Department of Water (DoW) gauges at several metropolitan wetlands. These DoW gauges indicate height above Australian Height Datum (mean sea level), which SWWMP personnel convert to wetland water depth.

Since 2007, the standard practice of SWWMP personnel when taking gauge readings has been to take a digital photograph of the gauge at the time of reading, so that all records may be checked and verified or corrected back in the office.



Photo 7: 'Munro Datum' (3.00m) at Lake Logue in Sep 2008.



Photo 8: 'Landgate' Bench Mark HZ929 at Thomsons Lake in Aug 2008.



Photo 9: 'Landgate' Witness Plate at Goonaping Swamp in Sep 2008.



Photo 10: 'Landgate' Bench Mark and Witness Plate at Cranbrook 25812 in Nov 2008.

Photographs 7-10: SWWMP Datums and Bench Marks.

Depth gauges installed prior to 1997 were surveyed to a nearby 'Munro Datum'; a block of concrete installed by (then) SWWMP Senior Technical Officer Don Munro (dec.) for data security. Numbers on top of these Datums indicate the height (m) above the deepest location in the wetland.

Since 1997, legally-protected 'Landgate' (WA Department of Land Information) Bench Marks (BM's) have been installed at all except six SWWMP wetlands and the gauges and Munro Datums have been surveyed to them. The BM's have since been surveyed to Australian Height Datum (mean sea level). BM installation and survey was a cooperative program of DEC and 'Landgate'.



Photo 11: An amphibious vehicle is used to traverse the long distances involved in bathymetric survey of large dry or very shallow lakes. Steven Lowth, Lake Campion, 24May2004.



Photo 12: Vegetated lake beds and banks are traversed on foot. Brian Hugessen of Landgate, Byenup Lagoon, 26Mar2009.



Photo 13: Deeper wetlands are traversed by flat-bottomed punt. Lindsey Schuilng of Landgate, Byenup Lagoon, 22Mar2009.

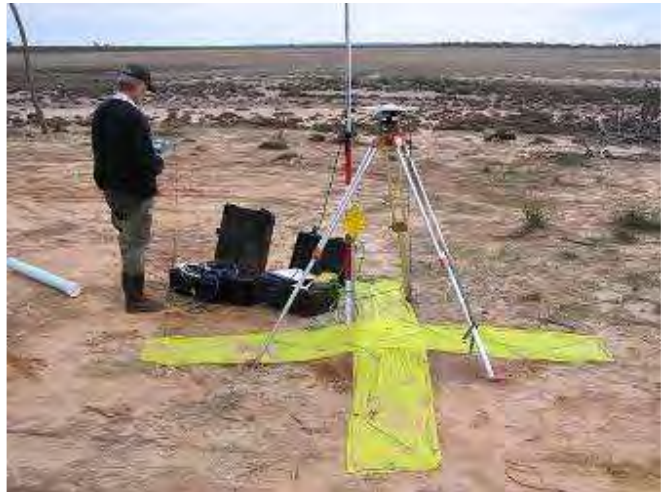


Photo 14: Photogrammetric surveys require targets (e.g. yellow crosses) with accurately-known positions and elevations. Doug Hardman of Landgate, Mollerin Lake, 16Jun2004.



Photo 15: Thick vegetation may pose a challenge for surveyors. Brian Hugessen of Landgate, Byenup Lagoon, 30Mar2009.



Photo 16: Unconventional flotation devices may be needed to reach depth gauges at large flooded wetlands accessible only on foot. Alan Clarke, Pillenorup Swamp, 22Mar2007.

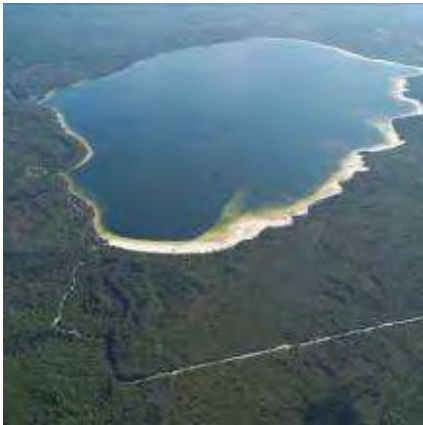


Photo 17: Lake Jasper (Nannup Shire) is the deepest of all SWWMP monitored wetlands, except perhaps Lake Yeagarup. Photo 20May2008.



Photo 18: Yarnup Swamp (Cranbrook) values are threatened by salinisation and acidification. Photo 24May2008.



Photo 19: 'Boat Harbour 1' (Denmark) water levels and salinities have been more variable since 2000. Photo 20May2008.



Photo 20: Lake Muir (Manjimup) is thought to have last overflowed into the Deep River around 1900. Photo 20May2008.



Photo 21: Yellilup Lake (Jerramungup) trees were killed by continuous flooding from 1988 to 1994. Photo 21May2008.



Photo 22: Nine Mile Swamp (Murray), once open water, is now covered by bulrush due to several decades of declining water levels. Photo 19May2008.



Photo 23: Lake Warden (Esperance) water levels were too high for shorebirds and fringing vegetation for more than a decade. Since 2009 they have been lowered by engineering. Photo 16May2009.



Photo 24: Jerdacuttup Lakes (Ravensthorpe) water levels and salinities oscillate markedly over 5-15 yr time periods. Photo 16May2009.

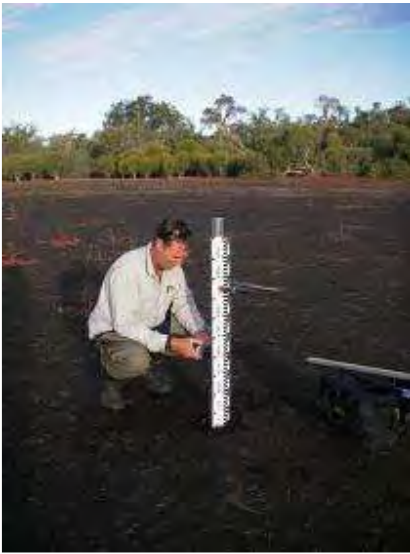


Photo 25: Depth gauge installation. Alan Clarke, Yurine Swamp, 02Jun2010.

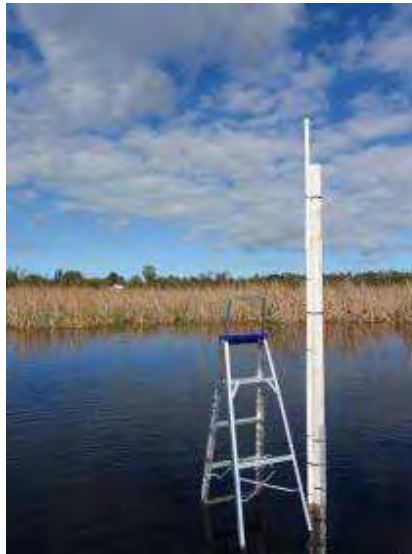


Photo 26: Water level logger, support tube and supporting angle iron. Nine Mile Swamp, 04Aug2009.



Photo 27: Telemetric download of water level logger data to laptop. Alan Clarke, Lake Pleasant View, 10Aug2010.



Photo 28: Tipping bucket rainfall recorders have been installed on 14 wetlands. Alan Clarke, 17Jun2009.



Photo 29: Reading the gauge and collecting water samples. Volunteer John Winchcombe, 'Albany 26385', 07Nov2006.



Photo 30: A kayak is the most efficient method of accessing the water level logger at 'Albany 27157'. 09Aug2010.



Photo 31: Amphibious vehicle and laptop used for downloading data from the Crackers water level logger. 13Oct2009.



Photo 32: Lake Bambun (Gingin) is one of few SWWMP wetlands to have shown a persistent long-term decrease in salinity, though this might be changing. Photo 06Jun2010.



Photo 33: Chandala Swamp (Chittering) is a freshwater, melaleuca – eucalypt swamp that, at times, supports thousands of nesting Straw-necked Ibis *Threskiornis spinicollis*. Photo 06Jun2010.



Photo 34: Crackers Swamp (Dandaragan) salinities are trending upwards and its extensive lake floor vegetation could be under threat. Photo 07Jun2010.



Photo 35: Taarblin Lake (Narrogin), though secondarily salinised, has bands of young, live Swamp Sheoak *Casuarina obesa* on elevated ground in the southern basin. Photo 26May2010.



Photo 36: Mortijinup Lake (Esperance) water levels have been falling and salinities rising since monitoring began in 2000. Photo 16May2009.



Photo 37: Forrestdale Lake (Armadale) depths have trended lower since the early 1990s, facilitating the spread of the introduced bulrush *Typha orientalis*. Photo 06Jun2010.



Photo 38: High resolution aerial oblique photos, e.g. of Atkins Yate Swamp (Lake Grace) are suitable for enlargement. Photo 17May2009.



Photo 39: Enlarged section of Photo 38 (Atkins Yate Swamp), showing vegetation banding, structure, composition and vigour. Photo 17May2009.



Photo 40: Shallowly-inundated eastern floor and distant shoreline of Dumbleyung Lake (Dumbleyung / Wagin). Photo 26May2010.



Photo 41: Enlarged section of Photo 40 (Dumbleyung Lake), showing shoreline vegetation structure, composition and vigour. Photo 26May2010.



Photo 42: Dulbinning Lake (Wickepin) is immediately upstream of Toolibin and has also been affected by secondary salinisation. Photo 26May2010.



Photo 43: Enlarged section of Photo 42 (Dulbinning Lake), showing live *Casuarina obesa* on elevated banks of old dam and dead trees on lake floor. Photo 26May2010.



Photo 44: 'Harvey 12632' (Harvey Shire) water levels have trended lower since the early 1990s. Photo 19May2008.



Photo 45: Towerrinning (West Arthur) water levels have been higher and salinities lower since flow diversion and other works in the early 1990s. Photo 24May2008.



Photo 46: Egret (Harvey) is the rectangle of trees in foreground, adjacent to Leschenault Inlet. Egret's pH values have, at times, been very low (≈ 3 pH units). Photo 19May2008.



Photo 47: Red (Bruce Rock) is usually dry or very shallow, hypersaline and acidic (pH 3-4). Photo 07Jun2010.



Photo 48: Joondalup (Joondalup) water levels in 2012 were among the lowest recorded for 30+ years. Photo 06Jun2010.



Photo 49: Jandabup (Wanneroo) was temporarily acidic (pH ≈ 4) in the late 1990s. Photo 06Jun2010.



Photo 50: Wannamal (Gingin) produced a nauseating odour when the water level was exceptionally low in Nov 2010. Photo 06Jun2010.



Photo 51: Dobaderry (Beverley) lake floor vegetation (*Melaleuca lateritia*) appeared healthy in late 2009. Photo 13Nov2009.



Photo 52: Dobaderry vegetation (same photo site and direction as in Photo 51) was drought-stressed in 2010, partially recovered in 2011 and severely stressed again in 2012. Photo 16Sep2010.



Photo 53: Shrubs are establishing on the floor of 'Harvey 12632' following two decades of declining water levels. Photo 14Sep2011.



Photo 54: Casuarinas and melaleucas are advancing onto the floor of Logue (Carnamah) following a decade of drought. Photo 16Sep2011

TABLES

Table 1. Monitored wetlands, codes, coordinates, tenure, Local Government Authorities and monitoring periods. This Table includes all wetlands ('current' and 'historical') regularly monitored at any time since commencement of the South West Wetlands Monitoring Program in 1977, sorted alphabetically by wetland name.

Wetland Name ¹	Code	Easting ²	Northing ²	Zone	Tenure ³	Local Government Authority	Period monitored ^{4,5,6}
<i>Ace</i> ⁷	ACE	758029	6344741	50	CCWA	Lake Grace	7/80 - 5/85, 4/00
Albany 26385 ⁸	ALB1	606041	6148594	50	CCWA	Albany	5/81 - 5/85, 9/98 onwards
Albany 27157	ALB2	618826	6147490	50	CCWA	Albany	3/80 - 5/85, 9/08, 9/09 onwards
Altham ⁹	ALTH	634562	6302593	50	CCWA	Kent	7/80 - 11/91, 4/00 onwards
Anderson	ANDE	588666	6217158	50	CCWA	Tambellup	5/81 - 3/92, 9/00 onwards
<i>Angove</i>	ANGO	605850	6132590	50	CCWA	Albany	11/79 - 5/85, 9/90, 4/00
Ardath	ARDA	609068	6448377	50	CCWA	Bruce Rock	9/99 onwards
Atkins Yate	ATKI	750023	6330530	50	Private	Lake Grace	4/00 onwards
Bambun	BAMB	394880	6522829	50	CCWA	Gingin	5/79 onwards
Bennetts	BENN	742440	6314572	50	CCWA	Lake Grace	9/92 onwards
Beverley ¹⁰	BEVE	514297	6432612	50	CCWA / LGA	Beverley / Brookton / Quairading	6/78 onwards
<i>Biddy</i>	BIDD	682152	6344888	50	CCWA	Lake Grace	7/82 - 5/85, 9/91 - 1/93, 4/00, 7/09
Big Boom	BIGB				UCL	Esperance	9/12 onwards
Blue Gum	BLUE	401231	6615183	50	Private	Moora	11/99 - 11/10
Boat Harbour 1	BOA1	508245	6124962	50	CCWA	Denmark	8/91 onwards
<i>Bokan</i>	BOKA	549253	6349883	50	CCWA	Narrogin	7/79 - 5/85, 11/08
Boyup Brook 18239 ¹⁰	BOYU	469777	6257199	50	CCWA	Boyup Brook	9/80 onwards
Broadwater	BROA	341176	6273426	50	CCWA	Busselton	11/85 onwards
Brown	BROW	559606	6397735	50	CCWA	Corrigin	7/79 - 11/91, 9/97 onwards
<i>Bruce Rock 30969</i>	BRUC	575133	6473941	50	CCWA	Bruce Rock	5/82 - 5/85
Bryde	BRYD	669625	6308051	50	MWR	Kent	6/79 onwards
Byenup	BYEN	476449	6182437	50	CCWA	Manjimup	6/77 onwards
<i>Cairlocup</i>	CAIR	662520	6266817	50	CCWA	Kent	9/80 - 5/85, 4/00, 5/09
<i>Camel</i>	CAME	588033	6204762	50	CCWA	Cranbrook	8/80 - 5/85, 4/00
Campion	CAMP	627676	6554227	50	CCWA	Nungarin / Merredin	3/79 - 11/91, 5/99 onwards
<i>Capamaura</i>	CAPA	393132	6691441	50	CCWA	Carnamah	7/80 - 5/85, 3/90, 11/09
Casuarina	CASU	569525	6277315	50	CCWA	Katanning	5/78 onwards
Chandala	CHAN	400545	6514425	50	CCWA	Chittering	5/79 onwards
<i>Chittering</i>	CHIT	414089	6521328	50	CCWA	Chittering	4/78 - 11/86
Clifton	CLIF	374037	6376139	50	CCWA	Mandurah / Waroona	11/85 onwards
<i>Cobline</i>	COBL	564476	6306117	50	CCWA	Dumbleyung	6/79 - 11/91
Collets Road	COLL			50	CCWA	Jerramungup	9/01 onwards
Coomalbidgup	CMBG	349163	6267892	51	LGA	Esperance	11/99 onwards
Coomelberrup	COOM	573060	6303130	50	CCWA	Dumbleyung	5/78 - 5/85, 3/93, 9/97 onwards
Corrigin 12900 ¹⁰	CORR	603415	6413294	50	CCWA	Corrigin	7/82 onwards
Coyrecup	COYR	577072	6268374	50	CCWA	Katanning	5/78 onwards
Crackers	CRAC	365586	6579519	50	CCWA	Dandaragan	7/80 onwards
<i>Cranbrook 25812</i>	CRAN	573707	6203482	50	CCWA	Cranbrook	8/80 - 8/85, 4/00, 11/08
<i>Cronin</i>	CRON	760036	6413700	50	CCWA	Kondinin	4/81 - 5/85, 11/95, 4/01, 07/09
Davies	DAVI	318852	6211560	50	CCWA	Augusta-Margaret River	4/91 onwards
Dobaderry	DOBA	463077	6437224	50	CCWA	Beverley	9/80 onwards
<i>Dowerin</i>	DOWE	505689	6541494	50	LGA	Dowerin	6/79 - 5/81, 9/99
Dulbinning	DULB	557418	6359015	50	CCWA	Wickepin	7/79 onwards

Table 1 continued.

Wetland Name	Code	Easting	Northing	Zone	Tenure	Local Government Authority	Period monitored
Dumbleyung	DUMB	560071	6309876	50	CCWA / LGA	Dumbleyung / Wagin	6/79 onwards
<i>Dundas 33113</i>	<i>DUND</i>	<i>391998</i>	<i>6359382</i>	<i>51</i>	<i>CCWA</i>	<i>Dundas</i>	<i>11/79 – 11/91, 4/00</i>
Eganu	EGAN	391567	6680556	50	CCWA	Coorow	7/78 onwards
Egret	EGRE	379666	6314855	50	CCWA	Harvey	5/85 onwards
<i>Ellen Brook</i>	<i>ELLE</i>	<i>408758</i>	<i>6486521</i>	<i>50</i>	<i>CCWA</i>	<i>Swan</i>	<i>7/79 – 11/84</i>
Eneminga	ENEM	358697	6590178	50	CCWA	Dandaragan	7/80 – 11/91, 09/08, 9/11 onwards
Esperance 26410	ESP1	304849	6265010	51	CCWA	Esperance	11/81 onwards
<i>Esperance 27768</i>	<i>ESP2</i>	<i>388786</i>	<i>6319769</i>	<i>51</i>	<i>CCWA</i>	<i>Esperance</i>	<i>6/81 - 5/85, 4/00</i>
<i>Esperance 27985</i>	<i>ESP3</i>	<i>385963</i>	<i>6309342</i>	<i>51</i>	<i>CCWA</i>	<i>Esperance</i>	<i>6/81 – 11/91, 4/00 -11/10</i>
<i>Esperance 32128</i>	<i>ESP4</i>	<i>471180</i>	<i>6278570</i>	<i>51</i>	<i>CCWA</i>	<i>Esperance</i>	<i>7/82 - 5/85</i>
<i>Esperance 32776</i>	<i>ESP5</i>	<i>438274</i>	<i>6294596</i>	<i>51</i>	<i>CCWA</i>	<i>Esperance</i>	<i>6/81 - 5/85, 4/00</i>
Flagstaff	FLAG	523642	6291467	50	CCWA	Woodanilling	6/79 – 11/91, 9/97 onwards
Forrestdale	FORR	400062	6442240	50	CCWA	Armadale	11/77 onwards
Frasers ¹⁰	FRAS	507236	6542443	50	Private	Dowerin	11/99 – 11/10
<i>Gardner</i>	<i>GARD</i>	<i>605828</i>	<i>6129943</i>	<i>50</i>	<i>CCWA</i>	<i>Albany</i>	<i>5/81 - 5/85, 9/89, 9/90, 4/00, 9/08</i>
Gibbs	GIBB	397627	6441667	50	CCWA	Armadale	9/92 onwards
Gingilup	GINL				CCWA	Nannup	9/12 onwards
<i>Gingin 31241</i>	<i>GING</i>	<i>387922</i>	<i>6525676</i>	<i>50</i>	<i>CCWA</i>	<i>Gingin</i>	<i>6/79 - 5/85, 9/08</i>
<i>Gnowangerup 26264</i>	<i>GNO1</i>	<i>636100</i>	<i>6196278</i>	<i>50</i>	<i>CCWA</i>	<i>Gnowangerup</i>	<i>3/80 – 11/91, 9/08</i>
<i>Gnowangerup 26569</i>	<i>GNO2</i>	<i>636830</i>	<i>6257497</i>	<i>50</i>	<i>CCWA</i>	<i>Gnowangerup</i>	<i>7/82 - 5/85, 4/00</i>
Goonaping	GOON	461797	6443309	50	CCWA	Beverley	11/99 onwards
<i>Goorly</i>	<i>GOOR</i>	<i>503350</i>	<i>6664801</i>	<i>50</i>	<i>UCL</i>	<i>Dalwallinu</i>	<i>9/00 – 11/09</i>
Gore	GORE	363166	6263536	51	CCWA	Esperance	11/79 onwards
<i>Gounter</i>	<i>GOUN</i>	<i>672878</i>	<i>6413022</i>	<i>50</i>	<i>CCWA</i>	<i>Kondinin</i>	<i>7/80 – 11/91, 5/98, 7/09</i>
<i>Gundaring</i>	<i>GUND</i>	<i>546974</i>	<i>6315587</i>	<i>50</i>	<i>CCWA</i>	<i>Wagin</i>	<i>5/78 – 11/91</i>
Guraga	GURA	363476	6585412	50	LGA	Dandaragan	9/82 onwards
Harvey 12632	HARV	386550	6348919	50	CCWA	Harvey	8/80 onwards
<i>Hebitons</i>	<i>HEBI</i>	<i>345831</i>	<i>6806160</i>	<i>50</i>	<i>Private</i>	<i>Mullewa</i>	<i>9/00 – 11/09</i>
Hinds	HIND	456859	6596884	50	CCWA	Wongan-Ballidu	6/79 – 11/91, 9/97 onwards
Jandabup	JAND	390937	6486982	50	CCWA	Wanneroo	4/78 onwards
Jasper	JASP	379737	6190394	50	CCWA	Nannup	11/85 onwards
Jerdacuttup	JERD	246655	6241791	51	CCWA	Ravensthorpe	11/79 onwards
Joondalup	JOON	384352	6487435	50	CCWA	Joondalup	4/78 onwards
<i>Karakin</i>	<i>KARA</i>	<i>354428</i>	<i>6563848</i>	<i>50</i>	<i>WRC</i>	<i>Gingin</i>	<i>5/79 - 5/85, 9/87</i>
Kent 29020 ¹⁰	KENT	676818	6307259	50	CCWA	Kent	9/80 - 5/85, 4/00 onwards
<i>Kondinin</i>	<i>KOND</i>	<i>612045</i>	<i>6404006</i>	<i>50</i>	<i>CCWA</i>	<i>Kondinin</i>	<i>6/79 – 11/91, 4/00</i>
<i>Kwobrup</i>	<i>KWOB</i>	<i>593500</i>	<i>6267648</i>	<i>50</i>	<i>Private</i>	<i>Kent</i>	<i>6/79 – 11/91, 4/00</i>
Kwornicup	KWOR	538575	6176168	50	CCWA	Plantagenet	11/79 onwards
Little White	LITT	541357	6347281	50	CCWA	Narrogin	7/79 – 11/91, 9/97 onwards
Logue	LOGU	321114	6695888	50	CCWA	Carnamah	5/79 onwards
Maringup	MARI	426553	6144690	50	CCWA	Manjimup	6/91 onwards
Martinup	MART	516363	6289934	50	CCWA	Woodanilling	6/79 – 11/91, 9/97 onwards
McLarty	MCLA	379489	6379596	50	CCWA	Murray	11/93 - 11/94, 9/96 onwards
Mears	MEAR	533098	6433941	50	CCWA	Brookton	6/78 – 11/91, 9/97 onwards
Mettler	METT	646369	6172015	50	CCWA	Albany	9/82 onwards
<i>Miripin</i>	<i>MIRI</i>	<i>518066</i>	<i>6288832</i>	<i>50</i>	<i>CCWA</i>	<i>Woodanilling</i>	<i>6/81 - 5/85, 5/92, 9/09</i>

Table 1 continued.

Wetland Name	Code	Easting	Northing	Zone	Tenure	Local Government Authority	Period monitored
Moates	MOAT	600908	6131536	50	CCWA	Albany	11/79 onwards
<i>Mollerin</i>	<i>MOLL</i>	<i>554214</i>	<i>6625482</i>	50	CCWA	<i>Koorda</i>	<i>7/80 – 5/85</i>
Mortjinup	MORT	373710	6259469	51	CCWA	Esperance	4/00 onwards
Mount Le Grand	MLGR	419066	6240163	51	CCWA	Esperance	9/00 onwards
<i>Mount Marshall 26687¹⁰</i>	<i>MTMA</i>	<i>560937</i>	<i>6579648</i>	50	CCWA	<i>Mt Marshall</i>	<i>7/81 – 11/91, 5/99</i>
Muir	MUIR	471032	6185028	50	CCWA	Manjimup	11/79 onwards
<i>Mungala</i>	<i>MUNG</i>	<i>395151</i>	<i>6521364</i>	50	CCWA	<i>Gingin</i>	<i>6/79 – 5/85</i>
<i>Murapin</i>	<i>MURA</i>	<i>517681</i>	<i>6289397</i>	50	CCWA	<i>Woodanilling</i>	<i>6/81 – 5/85</i>
<i>Murray 24739</i>	<i>MURR</i>	<i>378784</i>	<i>6382052</i>	50	CCWA	<i>Murray</i>	<i>9/80 – 5/85, 8/08</i>
<i>Nambung</i>	<i>NAMB</i>	<i>394607</i>	<i>6521821</i>	50	CCWA	<i>Gingin</i>	<i>6/79 – 5/85</i>
Ngopitchup	NGOP	531747	6242644	50	WRC	Broomehill	4/00 onwards
Ninan	NINA	467029	6575597	50	CCWA	Wongan-Ballidu	7/78 – 11/91, 9/97 onwards
Nine Mile	NINE	385536	6376505	50	CCWA	Murray	6/81 onwards
<i>Nonalling</i>	<i>NONA</i>	<i>557243</i>	<i>6400132</i>	50	CCWA	<i>Corrigin</i>	<i>7/79 – 5/85</i>
Noobijup	NOOB	480867	6192653	50	CCWA	Cranbrook	9/99 onwards
Noonying	NOON	542507	6497744	50	CCWA	Tammin	6/79 – 11/91, 9/97 onwards
North Parriup	NPAR	281562	6250268	51	CCWA	Ravensthorpe	4/00 onwards
Owingup	OWIN	507258	6126756	50	CCWA	Denmark	7/91 onwards
Pabelup South	PABE	725800	6222286	50	CCWA	Jerramungup	4/00 onwards
<i>Pallarup</i>	<i>PALL</i>	<i>756890</i>	<i>6322416</i>	50	CCWA	<i>Lake Grace</i>	<i>7/80 – 11/91, 4/00, 11/08, 7/09</i>
Parkeyerring	PARK	533156	6307263	50	CCWA	Wagin	5/78 – 11/91, 9/97 onwards
Pillenorup	PILL	601412	6187773	50	CCWA	Plantagenet	4/00 onwards
<i>Pinjarrega</i>	<i>PINJ</i>	<i>395416</i>	<i>6670552</i>	50	CCWA	<i>Coorow</i>	<i>5/79 – 11/91</i>
<i>Plantagenet 25386</i>	<i>PLAN</i>	<i>597710</i>	<i>6176617</i>	50	CCWA	<i>Plantagenet</i>	<i>11/79 – 5/85, 11/93 – 11/96, 6/98, 11/08</i>
Pleasant View	PLEA	608357	6145314	50	CCWA	Albany	11/79 onwards
Pooginup	POOR	476447	6177128	50	CCWA	Manjimup	6/77 onwards
Powell	POWE	567497	6125091	50	CCWA	Albany	6/81 onwards
<i>Queerearrup</i>	<i>QUEE</i>	<i>521251</i>	<i>6291518</i>	50	LGA	<i>Woodanilling</i>	<i>10/78 – 5/85, 9/88, 11/08</i>
Range Road Yate	RANG	666083	6275186	50	MWR	Kent	4/00 onwards
Red (Bruce Rock)	REDB	602548	6437065	50	CCWA	Bruce Rock	7/81 – 5/85, 9/00 onwards
<i>Red (Manjimup)</i>	<i>REDM</i>	<i>468592</i>	<i>6189580</i>	50	UCL	<i>Manjimup</i>	<i>11/81 – 11/91, 4/00, 9/08</i>
Ronnerup	RONN	744169	6317786	50	CCWA	Lake Grace	4/00 onwards
Shark	SHAR	394568	6263073	51	CCWA	Esperance	11/79 onwards
<i>Shaster</i>	<i>SHAS</i>	<i>287219</i>	<i>6250710</i>	51	CCWA	<i>Ravensthorpe</i>	<i>11/79 – 11/91, 5/09</i>
Station	STAT	402615	6259237	51	CCWA	Esperance	3/80 onwards
<i>Streets</i>	<i>STRE</i>	<i>402493</i>	<i>6614985</i>	50	Private	<i>Moora</i>	<i>10/78 – 11/91, 9/08</i>
Taarblin North ¹¹	TAAN			50	CCWA	Narrogin	9/04 onwards
Taarblin South ¹¹	TAAR	551258	6350395	50	CCWA	Narrogin	5/78 onwards
Thomsons	THOM	389516	6441482	50	CCWA	Cockburn	11/78 onwards
Toolibin	TOOL	557650	6357248	50	CCWA	Wickepin	5/78 onwards
Tordit-Gurru	TORD	476135	6179406	50	CCWA	Manjimup	6/77 onwards
Towerrinning	TOWE	480708	6283950	50	CCWA	West Arthur	12/77 onwards
<i>Twin Swamps N-W</i>	<i>TWIN</i>	<i>406579</i>	<i>6490175</i>	50	CCWA	<i>Swan</i>	<i>7/79 – 11/84, 7/09</i>
Unicup	UNIC	474399	6200082	50	CCWA	Cranbrook	9/80 onwards
Varley	VARL	722520	6379843	50	CCWA	Kulin	9/81 – 11/91, 4/00 onwards

Table 1 continued.

Wetland Name	Code	Easting	Northing	Zone	Tenure	Local Government Authority	Period monitored
<i>Wagin 2088</i>	WAGI	533281	6311808	50	CCWA	<i>Wagin</i>	7/82 – 5/85
Walbyring	WALB	555534	6355214	50	CCWA	Wickepin	7/79 onwards
<i>Walling</i>	WALL	395706	6521624	50	CCWA	<i>Gingin</i>	7/81 – 5/85, 9/08
Walyormouring	WALY	488021	6554454	50	CCWA	Goomalling	7/78 – 11/91, 9/97 onwards
Wannamal	WANN	409642	6556691	50	CCWA	Gingin	7/78 onwards
Warden	WARD	396947	6257428	51	CCWA	Esperance	11/79 onwards
<i>Wardering</i>	WARG	523381	6290253	50	CCWA	<i>Woodanilling</i>	5/78 – 11/91
Warrinup	WARR	523495	6199485	50	CCWA	Cranbrook	3/80 onwards
West Arthur 5456	WEST	496510	6293047	50	CCWA	West Arthur	8/80 – 11/91, 9/97 onwards
Wheatfield	WHEA	401069	6258818	51	CCWA	Esperance	11/99 onwards
<i>White (Albany)</i>	WHIA	606407	6152434	50	CCWA	<i>Albany</i>	6/81 - 5/85, 9/98, 9/08
White (Narrogin)	WHIN	542630	6347335	50	CCWA	Narrogin	6/81 - 5/85, 9/97 onwards
White Water	WHIW	558770	6399914	50	CCWA	Corrigin	6/81 - 11/91, 9/97 onwards
<i>Wild Horse</i>	WILD	473637	6273462	50	CCWA	<i>West Arthur</i>	6/81 - 5/85, 4/00, 9/09
Wilson	WILS	382325	6189429	50	CCWA	Manjimup	5/91 onwards
Yaalup	YAAL	647443	6263830	50	CCWA	Kent	7/82 onwards
Yarnup	YARN	487368	6196543	50	CCWA	Cranbrook	9/80 onwards
Yarra Yarra	YARR	379957	6726980	50	CCWA	Carnamah	7/81 - 5/85, 9/97 onwards
Yeagarup	YEAG			50	CCWA	Manjimup	9/11 onwards
Yeagarup South	YEAS			50	CCWA	Manjimup	9/11 onwards
Yealering	YEAL	558587	6393389	50	LGA	Wickepin	6/78 onwards
Yellilup	YELL	686899	6201353	50	Private	Jerramungup	11/85 onwards
Yurine	YURI	385171	6543598	50	CCWA	Gingin	5/79 - 11/91, 5/09 onwards

Notes:

1. Wetlands without official names at the commencement of monitoring are identified by Local Government Authority and Reserve Number (e.g. Albany 26385).
2. Coordinates (eastings and northings) are of depth gauge Bench Marks (local survey datums). These have been installed on higher ground at or near the edge of each monitored wetland, close to the depth gauge or gauge ‘cluster’ of that wetland. The accuracy of the coordinates of most (all coords **except those highlighted in gray**) has been improved from approx ±100m to approx ±5m in 2008-09 and subsequent years, principally by re-survey with hand-held GPS units (Garmin GPSmap 60Cx), using the WGS84 world datum, which for practical purposes equates to GDA94. The Big Boom, Colletts Road, Gingilup, Taarblin North, Yeagarup and Yeagarup South Bench Marks have not yet been installed.
3. CCWA (Conservation Commission of Western Australia); LGA (Local Government Authority); MWR (Minister for Water Resources); UCL (Unallocated Crown Land); WRC (Water & Rivers Commission). DPaW has management responsibility for wetlands vested in CCWA.
4. ‘Period Monitored’ is described by the first and last records, for any parameter, of discrete periods of monitoring.
5. Routine monitoring was conducted every second month (Jan, Mar, May, Jul, Sep, Nov) from May 1981 to May 1985 and twice-yearly (Sep, Nov) prior to and after that four-year period and, in the case of the 103 ‘current’ wetlands (i.e. those not shown in italics above) is ongoing.
6. A few wetlands (e.g. Forrestdale, Clifton) have been monitored more frequently (than at two-month intervals) for varying periods.
7. The 53 SWWMP wetlands shown in *italics* have been monitored under SWWMP at various times in the past, but are not currently monitored, not at least under SWWMP. They are additional to the 103 ‘current’ wetlands.
8. Wetlands not shown in italics are the 103 ‘current’ SWWMP wetlands being routinely monitored by the authors for surface water depth, salinity, pH and (until 2007) nutrients, under the State Salinity Strategy.
9. Wetlands shown in **bold** are the 25 SWWMP wetlands that have been Intensively Monitored under the State Salinity Strategy by other DPaW scientific staff for potential changes in plant and animal communities, shallow groundwater levels and detailed water chemistry.
10. Beverley Lakes is also known as Yenyenning Lakes; Boyup Brook 18239 as Kulicup Swamp; Corrigin 12900 as Paperbark Swamp, Frasers Lake as Maisey’s 1 or Maisey’s A; Kent 29020 as East Lake Bryde and Mt Marshall 26687 as Wallambin North.

Table 1 Notes continued.

11. Taarblin North and Taarblin South refer to the northern and southern basins respectively of one wetland (Taarblin).

Table 2. Monitored wetlands by DPaW Regions and Districts, with tenure, Reserve No. and Name.
See Table 1 for the coordinates (eastings and northings) of each wetland.

No.	DPaW Region	No.	DPaW District	No.	Wetland ¹	Tenure ²	Reserve No. ⁷	Reserve Name ^{3,7}
1	Midwest	1	Geraldton	1	Hebitons	Private	-	-
2	Midwest	2	Moora	1	Blue Gum ⁴	Private	-	-
3	Midwest	3	Moora	2	Capamaura ⁵	CCWA	A 24618	Capamauro NR
4	Midwest	4	Moora	3	Crackers	CCWA	28558	Namming NR
5	Midwest	5	Moora	4	Eganu	CCWA	A 25210	Pimjarrega NR
6	Midwest	6	Moora	5	Eneminga	CCWA	A 27394	Eneminga NR
7	Midwest	7	Moora	6	Guraga	LGA	31223	-
8	Midwest	8	Moora	7	Logue	CCWA	29073	Lake Logue NR
9	Midwest	9	Moora	8	Pinjarrega	CCWA	A 25210	Pinjarrega NR
10	Midwest	10	Moora	9	Streets	Private	-	-
11	Midwest	11	Moora	10	Yarra Yarra	CCWA	A 26442	Yarra Yarra Lakes NR
12	South Coast	1	Albany	1	Albany 26385	CCWA	26385	-
13	South Coast	2	Albany	2	Albany 27157	CCWA	27157	Cheyne Road NR
14	South Coast	3	Albany	3	Angove	CCWA	A 27956	Two Peoples Bay NR
15	South Coast	4	Albany	4	Camel	CCWA	A 26161	Camel Lake NR
16	South Coast	5	Albany	5	Collets Road	CCWA	-	Fitzgerald River NP
17	South Coast	6	Albany	6	Cranbrook 25812	CCWA	A 25812	-
18	South Coast	7	Albany	7	Gardner	CCWA	A 27956	Two Peoples Bay NR
19	South Coast	8	Albany	8	Gnowangerup 26264	CCWA	26264	Mailalup NR
20	South Coast	9	Albany	9	Jerdacuttup	CCWA	A 40156	Jerdacuttup Lakes NR
21	South Coast	10	Albany	10	Mettler	CCWA	26894	Mettler Lake NR
22	South Coast	11	Albany	11	Moates	CCWA	A 27956	Two Peoples Bay NR
23	South Coast	12	Albany	12	Pabelup South	CCWA	-	Fitzgerald River NP
24	South Coast	13	Albany	13	Pillenorup	CCWA	-	Stirling Range NP
25	South Coast	14	Albany	14	Plantagenet 25386	CCWA	A 25386	Chillinup NR
26	South Coast	15	Albany	15	Pleasant View	CCWA	A 15107	Lake Pleasant View NR
27	South Coast	16	Albany	16	Powell	CCWA	A 25809	Lake Powell NR
28	South Coast	17	Albany	17	White (Albany)	CCWA	A 36550	North Sister NR
29	South Coast	18	Albany	18	Yellilup	Private	-	-
30	South Coast	19	Esperance	1	Big Boom	UCL		
31	South Coast	20	Esperance	2	Coomalbidgup	LGA	24633	-
32	South Coast	21	Esperance	3	Dundas 33113	CCWA	A 33113	-
33	South Coast	22	Esperance	4	Esperance 26410	CCWA	26410	-
34	South Coast	23	Esperance	5	Esperance 27768	CCWA	27768	-
35	South Coast	24	Esperance	6	Esperance 27985	CCWA	27985	-
36	South Coast	25	Esperance	7	Esperance 32128	CCWA	A 32128	-
37	South Coast	26	Esperance	8	Esperance 32776	CCWA	A 32776	-
38	South Coast	27	Esperance	9	Gore	CCWA	A 32419	Lake Gore NR
39	South Coast	28	Esperance	10	Mortijinup	CCWA	A 35557	Lake Mortijinup NR
40	South Coast	29	Esperance	11	Mount Le Grand	CCWA	A 22795	Cape Le Grand NP
41	South Coast	30	Esperance	12	North Parriup	CCWA	A 32339	Lake Shaster NR
42	South Coast	31	Esperance	13	Shark	CCWA	A 31197	Shark Lake NR
43	South Coast	32	Esperance	14	Shaster	CCWA	A 32339	Lake Shaster NR
44	South Coast	33	Esperance	15	Station	CCWA	A 23825	Mullet Lake NR
45	South Coast	34	Esperance	16	Warden	CCWA	A 32257	Lake Warden NR
46	South Coast	35	Esperance	17	Wheatfield	CCWA	A 15231	Woody Lake NR
47	South West	1	Blackwood	1	Boyup Brook 18239 ⁶	CCWA	18239	Kulicup NR
48	South West	2	Blackwood	2	Broadwater	CCWA	27080	
49	South West	3	Blackwood	3	Davies	CCWA	30826	Leeuwin-Naturaliste NP
50	South West	4	Blackwood	4	Gingilup	CCWA	30626	Gingilup Swamps NR
51	South West	5	Wellington	1	Egret	CCWA	38393	Morangel NR
52	South West	6	Wellington	2	Harvey 12632	CCWA	12632	Riverdale NR
53	South West	7	Wellington	3	Towerrinning	CCWA	A 24917	Towerrinning NR
54	South West	8	Wellington	4	Wild Horse	CCWA	A 1740	Wild Horse Swamp NR
55	Swan	1	Perth Hills	1	Chandala	CCWA	A 37060	Chandala NR
56	Swan	2	Perth Hills	2	Chittering	CCWA	A 29538	Chittering Lakes NR

Table 2 continued.

No.	DPaW Region	No.	DPaW District	No.	Wetland	Tenure	Reserve No.	Reserve Name
57	Swan	3	Perth Hills	3	Dobaderry	CCWA	A 43281	Wandoo Cons. Park
58	Swan	4	Perth Hills	4	Goonaping	CCWA	A 43281	Wandoo Cons. Park
59	Swan	5	Swan Coastal	1	Bambun	CCWA	A 26756	Bambanup NR
60	Swan	6	Swan Coastal	2	Clifton	CCWA		Yalgorup NP
61	Swan	7	Swan Coastal	3	Ellen Brook	CCWA	A 27620	Ellen Brook NR
62	Swan	8	Swan Coastal	4	Forrestdale	CCWA	A 24781	Forrestdale Lake NR
63	Swan	9	Swan Coastal	5	Gibbs	CCWA	48797	
64	Swan	10	Swan Coastal	6	Gingin 31241	CCWA	31241	
65	Swan	11	Swan Coastal	7	Jandabup	CCWA	7349	Jandabup NR
66	Swan	12	Swan Coastal	8	Joondalup	CCWA	A 31048	Lake Joondalup NR
67	Swan	13	Swan Coastal	9	Karakin	WRC	7504	-
68	Swan	14	Swan Coastal	10	McLarty	CCWA	A 39404	Lake McLarty NR
69	Swan	15	Swan Coastal	11	Mungala	CCWA	A 26756	Bambanup NR
70	Swan	16	Swan Coastal	12	Murray 24739	CCWA	A 24739	
71	Swan	17	Swan Coastal	13	Nambung	CCWA	A 26756	Bambanup NR
72	Swan	18	Swan Coastal	14	Nine Mile	CCWA	A 16907	Nine Mile Lake NR
73	Swan	19	Swan Coastal	15	Thomsons	CCWA	A 15556	Thomsons Lake NR
74	Swan	20	Swan Coastal	16	Twin Swamps N-W	CCWA	A 27621	Twin Swamps NR
75	Swan	21	Swan Coastal	17	Wallering	CCWA	A 26756	Bambanup NR
76	Swan	22	Swan Coastal	18	Wannamal	CCWA	A 9838	Lake Wannamal NR
77	Swan	23	Swan Coastal	19	Yurine	CCWA	A 9676	Yurine Swamp NR
78	Warren	1	Donnelly	1	Byenup	CCWA	A 31880	Lake Muir NR
79	Warren	2	Donnelly	2	Jasper	CCWA	36996	D'Entrecasteaux NP
80	Warren	3	Donnelly	3	Maringup	CCWA	36996	D'Entrecasteaux NP
81	Warren	4	Donnelly	4	Muir	CCWA	A 31880	Lake Muir NR
82	Warren	5	Donnelly	5	Noobijup	CCWA	A 26680	Noobijup NR
83	Warren	6	Donnelly	6	Poorginup	CCWA	A 31880	Lake Muir NR
84	Warren	7	Donnelly	7	Red (Manjimup)	UCL		
85	Warren	8	Donnelly	8	Tordit-Gurru	CCWA	A 31880	Lake Muir NR
86	Warren	9	Donnelly	9	Unicup	CCWA	A 25798	Unicup NR
87	Warren	10	Donnelly	10	Wilson	CCWA	A 36996	D'Entrecasteaux NP
88	Warren	11	Donnelly	11	Yarnup	CCWA	29601	Yarnup NR
89	Warren	12	Donnelly	12	Yeagarup	CCWA	A 47878	Greater Hawke NP
90	Warren	13	Donnelly	13	Yeagarup South	CCWA	A 36996	D'Entrecasteaux NP
91	Warren	14	Frankland	1	Boat Harbour 1	CCWA	A 41010	Owingup NR
92	Warren	15	Frankland	2	Kwornicup	CCWA	32284	Kwornicup NR
93	Warren	16	Frankland	3	Owingup	CCWA	A 41010	Owingup NR
94	Wheatbelt	1	Central	1	Ardath	CCWA	A 25062	Seagroatt NR
95	Wheatbelt	2	Central	2	Beverley ⁶	CCWA / LGA	31837	Yenyenning Lakes NR
96	Wheatbelt	3	Central	3	Bruce Rock 30969	CCWA	A 30969	Kwohyin NR
97	Wheatbelt	4	Central	4	Campion	CCWA	24789	Lake Campion NR
98	Wheatbelt	5	Central	5	Cronin	CCWA	A 36526	Lake Cronin NR
99	Wheatbelt	6	Central	6	Dowerin	LGA	4244	
100	Wheatbelt	7	Central	7	Frasers ⁶	Private	-	-
101	Wheatbelt	8	Central	8	Goorly	UCL	-	-
102	Wheatbelt	9	Central	9	Hinds	CCWA	A 16305	Lake Hinds NR
103	Wheatbelt	10	Central	10	Mollerin	CCWA	A 14429	Mollerin NR
104	Wheatbelt	11	Central	11	Mt Marshall 26687 ⁶	CCWA	A 26687	North Wallambin NR
105	Wheatbelt	12	Central	12	Ninan	CCWA	A 27026	Lake Ninan NR
106	Wheatbelt	13	Central	13	Noonying	CCWA	A 10313	Noonying NR
107	Wheatbelt	14	Central	14	Red (Bruce Rock)	CCWA	A 16493	Red Lake NR
108	Wheatbelt	15	Central	15	Walyormouring	CCWA	A 17186	Walyormouring NR
109	Wheatbelt	16	Great Southern	1	Ace	CCWA	A 34522	Lake Ace NR
110	Wheatbelt	17	Great Southern	2	Altham	CCWA	A 28395	Chinocup NR
111	Wheatbelt	18	Great Southern	3	Anderson	CCWA	A 25914	Anderson Lake NR
112	Wheatbelt	19	Great Southern	4	Atkins Yate	Private	-	-
113	Wheatbelt	20	Great Southern	5	Bennetts	CCWA	36445	Dunn Rock NR

Table 2 continued.

No.	DPaW Region	No.	DPaW District	No.	Wetland	Tenure	Reserve No.	Reserve Name
114	Wheatbelt	21	Great Southern	6	<i>Biddy</i>	CCWA	17617	<i>Lake Biddy NR</i>
115	Wheatbelt	22	Great Southern	7	<i>Bokan</i>	CCWA	9628	<i>Bokan NR</i>
116	Wheatbelt	23	Great Southern	8	Brown	CCWA	A 24428	Nonalling NR
117	Wheatbelt	24	Great Southern	9	Bryde	MWR	28667	
118	Wheatbelt	25	Great Southern	10	<i>Cairlocup</i>	CCWA	28324	<i>Cairlocup NR</i>
119	Wheatbelt	26	Great Southern	11	Casuarina	CCWA	A 25136	Coblinine NR
120	Wheatbelt	27	Great Southern	12	<i>Coblinine</i>	CCWA	A 25133	<i>Coblinine NR</i>
121	Wheatbelt	28	Great Southern	13	Coomelberrup	CCWA	A 10472	Coomelberrup NR
122	Wheatbelt	29	Great Southern	14	Corrigin 12900⁶	CCWA	12900	Paperbark NR
123	Wheatbelt	30	Great Southern	15	Coyrecup	CCWA	A 28552	Coyrecup NR
124	Wheatbelt	31	Great Southern	16	Dulbinning	CCWA	A 9617	
125	Wheatbelt	32	Great Southern	17	Dumbleyung	CCWA / LGA	26664	Dumbleyung Lake NR
126	Wheatbelt	33	Great Southern	18	Flagstaff	CCWA	A 27609	Flagstaff Lake NR
127	Wheatbelt	34	Great Southern	19	<i>Gnowangerup 26569</i>	CCWA	A 26569	
128	Wheatbelt	35	Great Southern	20	<i>Gounter</i>	CCWA	A 21253	<i>Lake Gounter NR</i>
129	Wheatbelt	36	Great Southern	21	<i>Gundaring</i>	CCWA	A 24373	<i>Gundaring Lake NR</i>
130	Wheatbelt	37	Great Southern	22	Kent 29020 ⁶	CCWA	A 29020	Lake Bryde NR
131	Wheatbelt	38	Great Southern	23	<i>Kondinin</i>	CCWA	A 22519	<i>Kondinin Lake NR</i>
132	Wheatbelt	39	Great Southern	24	<i>Kwobrup</i>	Private	-	-
133	Wheatbelt	40	Great Southern	25	Little White	CCWA	A 26786	Carmody NR
134	Wheatbelt	41	Great Southern	26	Martinup	CCWA	A 17055	Martinup NR
135	Wheatbelt	42	Great Southern	27	Mears	CCWA	A 12398	Lake Mears NR
136	Wheatbelt	43	Great Southern	28	<i>Miripin</i>	CCWA	A 24912	<i>Miripin NR</i>
137	Wheatbelt	44	Great Southern	29	<i>Murapin</i>	CCWA	A 17257	<i>Murapin NR</i>
138	Wheatbelt	45	Great Southern	30	Ngopitchup	WRC	2184	
139	Wheatbelt	46	Great Southern	31	<i>Nonalling</i>	CCWA	A 24428	<i>Nonalling NR</i>
140	Wheatbelt	47	Great Southern	32	<i>Pallarup</i>	CCWA	A 29860	<i>Pallarup NR</i>
141	Wheatbelt	48	Great Southern	33	Parkeyerring	CCWA	A 10733	Parkeyerring NR
142	Wheatbelt	49	Great Southern	34	<i>Queerearrup</i>	LGA	17255	
143	Wheatbelt	50	Great Southern	35	Range Road Yate	MWR	29124	
144	Wheatbelt	51	Great Southern	36	Ronnerup	CCWA	A 39422	Lake King NR
145a	Wheatbelt	52a	Great Southern	37a	Taarblin North	CCWA	A 9550	Taarblin Lake NR
145b	Wheatbelt	52b	Great Southern	38b	Taarblin South	CCWA	A 9550	Taarblin Lake NR
146	Wheatbelt	53	Great Southern	38	Toolibin	CCWA	A 24556	Toolibin NR
147	Wheatbelt	54	Great Southern	39	Varley	CCWA	A 27928	Lake Varley NR
148	Wheatbelt	55	Great Southern	40	<i>Wagin 2088</i>	CCWA	A 2088	<i>Casuarina NR</i>
149	Wheatbelt	56	Great Southern	41	Walbyring	CCWA	A 14398	Walbyring NR
150	Wheatbelt	57	Great Southern	42	<i>Wardering</i>	CCWA	A 17258	<i>Wardering Lake NR</i>
151	Wheatbelt	58	Great Southern	43	Warrinup	CCWA	A 1931	Warrenup NR
152	Wheatbelt	59	Great Southern	44	West Arthur 5456	CCWA	A 5456	Dead Mans Swamp NR
153	Wheatbelt	60	Great Southern	45	White (Narrogin)	CCWA	A 21284	Quongunnerunding NR
154	Wheatbelt	61	Great Southern	46	White Water	CCWA	A 24428	Nonalling NR
155	Wheatbelt	62	Great Southern	47	Yaalup	CCWA	A 36967	
156	Wheatbelt	63	Great Southern	48	Yealering	LGA	9610	

Notes:

1. Wetlands without official names at the commencement of monitoring are identified by Local Government Authority and Reserve Number, e.g. Albany 26385.
2. CCWA (Conservation Commission of Western Australia); LGA (Local Government Authority); MWR (Minister for Water Resources); UCL (Unallocated Crown Land); WRC (Water & Rivers Commission). DPaW has management responsibility for wetlands vested in CCWA.
3. Entries in the 'Reserve No.' and 'Reserve Name' columns are incomplete and unchecked.
4. Wetlands shown in **bold** are in the group of 25 Intensively Monitored wetlands (see Note 9 of Table 1).
5. In addition to the 103 SWWMP wetlands currently being monitored under the State Salinity Strategy there are 53 SWWMP wetlands that have been monitored at some time in the past, but are not currently being monitored under SWWMP. These 53 are shown above in *italics*.

Table 2 Notes continued.

6. Beverley Lakes is also known as Yenyenning Lakes, Boyup Brook 18239 as Kulicup Swamp; Corrigin 12900 as Paperbark Swamp, Frasers Lake as Maisey's 1 or Maisey's A; Kent 29020 as East Lake Bryde and Mt Marshall 26687 as Wallambin North.
7. Reserves in some instances do not include all of the relevant SWWMP wetland.

Table 3. Number of current and historically-monitored wetlands in each DPaW Region and District.

DPaW Region (Current, historical)	DPaW District	Current	Historical
Midwest (6, 5)	Geraldton	0	1
	Moora	6	4
South Coast (22, 13)	Albany	11	7
	Esperance	11	6
South West (7, 1)	Blackwood	4	0
	Wellington	3	1
Swan (14, 9)	Perth Hills	3	1
	Swan Coastal	11	8
Warren (15, 1)	Donnelly	12	1
	Frankland	3	0
Wheatbelt (39, 24)	Central	8	7
	Great Southern	31	17
Totals (103, 53)		103	53

The locations of DPaW Regional and District Headquarters are, in most instances, not obvious from Region or District names and are therefore listed below, for the convenience of readers.

DPaW Region / District	HQ Location
Midwest /	Geraldton
Geraldton	Geraldton
Moora	Jurien Bay
South Coast /	Albany
Albany	Albany
Esperance	Esperance
South West /	Bunbury
Blackwood	Busselton
Wellington	Collie
Swan /	Bentley
Perth Hills	Mundaring
Swan Coastal	Wanneroo
Warren /	Manjimup
Donnelly	Pemberton
Frankland	Walpole
Wheatbelt /	Narrogin
Central	Merredin
Great Southern	Narrogin

Table 4. Ramsar and Directory Sites of south-western Australia, and their SWWMP wetlands.

A. Ramsar Sites (each contains one or more Directory Site).

Ramsar Site	Directory Site	SWWMP wetland
Becher Point Wetlands	Becher Point Wetlands	-
Forrestdale & Thomsons Lakes	Forrestdale Lake	Forrestdale
	Thomsons Lake	Thomsons
Lake Gore	Lake Gore System	Gore
Muir-Byenup System	(southern part of) Byenup Lagoon System	Byenup, Poorginup, Tordit-Gurup
	Lake Muir	Muir
Peel-Yalgorup System	Yalgorup Lakes System	Clifton
	Lake McLarty System	McLarty, <i>Murray 24739</i>
Toolibin Lake	Toolibin Lake	Toolibin
Vasse-Wonnerup System	Vasse-Wonnerup Wetland System	-
Lake Warden System	Lake Warden System	Station, Warden, Wheatfield
		13 Current 1 Historical

B. Other Directory Sites (not within Ramsar Sites).

Directory Site	SWWMP wetland
Balicup Lake System	<i>Camel</i>
Barraghup Swamp	-
Benger Swamp	-
Bennetts Lake	Bennetts
Booragoon Lake	-
Brixton Street Swamps	-
Lake Bryde – East Lake Bryde	Bryde , Kent 29020
(northern part of) Byenup Lagoon System	Noobijup , Unicup, Yarnup
Cape Leeuwin System	-
Chandala Swamp	Chandala
Chittering-Needonga Lakes	<i>Chittering</i>
Coyrecup Lake	Coyrecup
Lake Cronin	<i>Cronin</i>
Doggerup Creek System	-
Dumbleyung Lake	Dumbleyung
Dunn Rock Gnamma Holes	-
Ellen Brook Swamps System	<i>Ellen Brook, Twin Swamps NW</i>
Gibbs Road Swamp System	Gibbs
Gingilup-Jasper Wetland System	Gingilup, Jasper, Wilson
Lake Grace System	Altham
Guraga Lake	Guraga
Herdsmen Lake	-
Hutt Lagoon System	-
Joondalup Lake	Joondalup
Karakin Lakes	<i>Karakin</i>
Kondinin Samphire Marsh	-
Lancelin Defence Training Area (Cwlth)	-
Lake Logue-Indoon System	Logue
Maringup Lake	Maringup

Directory Site	SWWMP wetland
McCarley's Swamp (Ludlow Swamp)	-
Loch McNess System	-
Moates Lake System	Moates, <i>Angove, Gardner</i>
Mortijinup Lake System	Mortijinup
Mount Soho Swamps	-
Owingup Swamp System	Boat Harbour 1, Owingup
Palmer Barracks, Guildford (Cwlth)	-
Paperbark Swamp	Corrigin 12900
Perth Airport Woodland Swamps (Cwlth)	-
Pink Lake	-
Lake Pleasant View System	Albany 26385, Pleasant View
RAAF Caversham (Cwlth)	-
Rottnest Island Lakes	-
Spectacles Swamp	-
Lake Thetis	-
Wannamal Lakes System	Wannamal
Yealering Lakes System	Brown, White Water, Yealering, <i>Nonalling</i>
Yellilup Yate Swamp System	Yellilup
Yorkrakine Rock Pools	-
30 Current 9 Historical	

The 'Directory' is 'A Directory of Important Wetlands in Australia', a cooperative project of the State, Territory and Commonwealth Governments. Three editions have been published, in 1993, 1996 and 2001. The Directory continues to be added to and updated from time to time (e.g. by Elscot *et al.* 2009). It is accessible online at <http://www.environment.gov.au>.

Nine south-west Western Australian Directory Sites are not listed in Tables 4A or 4B, because they are essentially riverine or estuarine and do not contain SWWMP-monitored wetlands. They are Peel-Harvey Estuary (part of Peel-Yalgorup Ramsar Site), Avon River Valley, Blackwood River (Lower Reaches) and Tributaries, Broke Inlet System, Culham Lake System, Fitzgerald Inlet System, Murchison River (Lower Reaches), Oyster Harbour and Swan-Canning Estuary.

Wetlands shown in *italics* have been monitored in the past under SWWMP, but not currently.

Wetlands shown in **bold** are in the group of 25 Intensively Monitored wetlands (see Note 9 of Table 1).

Table 5. Natural Diversity Recovery Catchments and their SWWMP wetlands.

Natural Diversity Recovery Catchment	DPaW Region	DPaW District	SWWMP-monitored wetlands
Lake Bryde	Wheatbelt	Great Southern	Bryde , Kent 29020
Buntine-Marchagee	Wheatbelt	Central	-
Drummond	Swan	Perth Hills	-
Esperance Lakes	South Coast	Esperance	Shark, Station, Warden, Wheatfield
Muir-Unicup	Warren	Donnelly	Byenup, Muir, Noobijup , Pooginup, Tordit-Gurup, Unicup, Yarnup, <i>Red (Manjimup)</i>
Toolibin Lake	Wheatbelt	Great Southern	Dulbinning, Taarblin, Toolibin , Walbyring
			17 Current 1 Historical

Notes:

1. Kent 29020 is also known as East Lake Bryde
2. Taarblin has two basins, north and south. Both are monitored.
3. *Red (Manjimup)* has been monitored in the past under SWWMP, but is not currently.
4. Most of the wetlands listed above, and some others (non-SWWMP wetlands) not listed, are also monitored under Recovery Catchment programs. Nonetheless it is considered important to continue the twice-yearly routine monitoring under SWWMP, which in all cases pre-dates the establishment of the Natural Diversity Recovery Catchments and their programs.
5. Wetlands shown in **bold** are in the group of 25 Intensively Monitored wetlands (see Note 9 of Table 1).

Table 6. Bathymetrically-mapped SWWMP wetlands.

All SWWMP wetlands known by the authors to have been bathymetrically-mapped are listed in the Table below, together with the years of mapping, methods employed, products and custodians / sources.

No.	Wetland	Custodian / Source	Year of Mapping	Products	Methods / Comment
1	Ardath ¹	DPaW	2004	Paper map. Digital data. D-V calc. ⁴	RTK ⁵
2	Beverley ²	DPaW	2002/3	Paper map. Digital data. D-V calc.	RTK
3	Bryde	DPaW	2002	Paper map. Digital data. D-V calc.	RTK
4	Byenup	DPaW	2009	Digital data. Maps in preparation.	RTK by boat, amphibious vehicle (Argo) & walking.
4	Byenup	DPaW	2013	Digital data. D-V calc. D-SA calc.	LIDAR & RTK
5	Clifton	DoW		Not seen.	Mapping referred to by Knott <i>et al.</i> (2003).
6	Campion	DPaW	2004/6/7	Paper map. Digital data. D-V calc.	RTK
7	Coyrecup	DPaW	2001	Paper map. Digital data. D-V calc. D-SA calc. ⁴	RTK at 100m intervals on 9 E-W transects 300m apart.
	Dulbinning	-	-	-	See Water Authority file 00617SW for inflow & outflow channel and some lakebed elevns.
8	Dumbleyung	DPaW	1998/01	Paper map. Digital data. D-V calc. D-SA calc.	RTK of bed at 100m intervals on 8 E-W transects 1km apart; Photogrammetry of shore. Correction of outflow elevation in 2002.
9	Forrestdale	DoW		Paper map.	Metropolitan Water Board Special Plan 81C, FB 11318, Stadia Book 11319. Arnold (1990d) pp 356, 357, 359, 360.
10	Gore	DPaW	2003	Paper map. Digital data. D-V calc.	Boat-based RTK and echo-sounding.
11	Hinds	DPaW	2000/1	Paper & PDF maps. Digital data. D-V calc.	
12	Jandabup	DoW		Paper map. 1:5,000.	MWB Special Plan 115, File 763107/74, Stadia L.B. 11650. Arnold (1990a) pp 60, 61, 66.
13	Jasper				Depth transects are shown in Dortch (1996).
14	Joondalup	DoW		Paper map. 1:5,000.	MWB Special Plan 117B, File 763107/74, Stadia L.B. 11651. Arnold (1990b) pp 104, 110-112.
15	Kent 29020 ²	DPaW	2002	Paper map. Digital data. D-V calc.	RTK
16	Mears	DPaW	2003	Paper map. Digital data. D-V calc.	RTK
17	<i>Mollerin</i> ³	DPaW	2004	<i>Paper map. Digital data</i>	<i>Photogrammetry and RTK ground truthing.</i>
18	<i>Mt Marshall 26687</i> ²	DPaW	2004	<i>Paper map. Digital data. D-V calc.</i>	<i>RTK</i>
19	Muir	DPaW	2013	Digital data. D-V calc. D-SA calc.	LIDAR
20	Ninan	DPaW	2000	Paper & PDF maps. Digital data. D-V calc.	Boat-based RTK and echo-sounding.
21	Noobijup	DPaW	2013	Digital data. D-V calc.	LIDAR
22	Poorginup	DPaW	2013	Digital data. D-V calc.	LIDAR
23	Powell	DoW	2003?		
24	<i>Red (Manjimup)</i>	PPaW	2013	<i>Digital data. D-V calc. D-SA calc.</i>	<i>LIDAR</i>
25	Shark	DPaW	2003	Paper map. Digital data. D-V calc.	Boat-based RTK.
26	Station	DPaW	2002	Paper map. Digital data. D-V calc.	RTK
27a	Taarblin North	DPaW	2004	Paper & PDF maps. Digital data. D-V calc.	RTK
28	Thomsons			Paper maps.	See Arnold (1990c) pp 266, 267, 269, 270. Davis <i>et al.</i> (2001).
29	Toolibin	DoW		Scanned copy of paper map, '609 009 PWD WA 54732', with spot heights and 0.5m AHD contours	Also see Water Authority file 00617SW for inflow & outflow channel and W bank elevns.
30	Tordit-Gurrup	DPaW	2011	Paper map. Digital data.	RTK by amphibious vehicle (Argo) & walking.
30	Tordit-Gurrup	DPaW	2013	Digital data. D-V calc. D-SA calc.	LIDAR & RTK
31	Towerrinning	Froend & McComb (1991)	1986	≈1:25,000 paper map (<A4); 0.5m contours to -2.5m, shoreline = 0.0m	Weighted graduated rope; ≈50m intervals on 7 transects (4 E-W, 3 N-S) ≈500m apart.
31	Towerrinning	JDA (2012)	2012	Digital & paper maps in JDA (2012).	Spot heights, cross sections & invert levels surveyed by JBA Surveys in Feb 2012.

Table 6 continued.

32	Unicup	DPaW	2013	Digital data. D-V calc. D-SA calc.	LIDAR & RTK
33	Walbyring	-	-	-	See DoW (Water Authority) file 00617SW for inflow channel elevations.
34	Warden	DPaW	2002	Paper map. Digital data. D-V calc.	Boat-based RTK and echo-sounding.
35	Wheatfield	DPaW	2002	Paper map. Digital data. D-V calc.	Boat-based RTK.
36	Yarnup	DPaW	2013	Digital data. D-V calc.	LIDAR
37	Yealering	JDA (2012)	2012	Digital & paper maps in JDA (2012).	Spot heights, cross sections & invert levels surveyed by JBA Surveys in Feb 2012.

Notes:

1. Wetlands shown in **bold** are in the group of 25 Intensively Monitored wetlands (see Note 9 of Table 1).
2. Beverley Lakes is also known as Yenyenning Lakes, Kent 29020 as East Lake Bryde and Mt Marshall 26687 as Wallambin North.
3. Wetlands shown in *italics* have been monitored in the past under SWWMP, but not currently.
4. 'D-V calc.' and 'D-SA calc.' are Depth to Volume and Depth to Surface Area calculators, derived from the bathymetry.
5. 'RTK' refers to collecting 3-dimensional position (point) data using the Real-Time Kinematic Differential Global Positioning System (RTK DGPS).
6. SWWMP personnel have participated in mapping several non-SWWMP wetlands, these being Bokarup, Brown (connected to Champion), Cowcowing, Quallilup, and other wetlands (in addition to Station, Warden and Wheatfield) in the Lake Warden System, namely Ewans, Mullet, Windabout and Woody.

Source references

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Table 7. SWWMP wetlands for which aerial oblique photography is available. High-resolution, low altitude, aerial oblique photographs of the following SWWMP wetlands were captured by DEC during 2008-2012. Requests for these photographs should be directed to jim.lane@dpaw.wa.gov.au. A small charge for supply may be required.

No.	Wetland Name ¹	Code	Tenure ²	Local Government Authority	Date of Photography
1	<i>Ace</i> ³	ACE	CCWA	Lake Grace	17 May 2009
2	Albany 26385 ⁴	ALB1	CCWA	Albany	21 May 2008
3	Albany 27157	ALB2	CCWA	Albany	21 May 2008, 28 May 2011
4	Altham ⁵	ALTH	CCWA	Kent	17 May 2009
5	Anderson	ANDE	CCWA	Tambellup	21 May 2008
6	<i>Angove</i>	ANGO	CCWA	Albany	21 May 2008
7	Ardath	ARDA	CCWA	Bruce Rock	07 June 2010
8	Atkins Yate	ATKI	Private	Lake Grace	17 May 2009
9	Bambun	BAMB	CCWA	Gingin	06 June 2010
10	Bennetts	BENN	CCWA	Lake Grace	17 May 2009
11	Beverley ⁶	BEVE	CCWA / LGA	Beverley / Brookton / Quairading	07 June 2010
12	<i>Biddy</i>	BIDD	CCWA	Lake Grace	26 May 2010
13	Blue Gum	BLUE	Private	Moora	07 June 2010
14	Boat Harbour 1	BOA1	CCWA	Denmark	26 May 2008, 27 May 2011
15	<i>Bokan</i>	BOKA	CCWA	Narrogin	26 May 2010
16	Boyup Brook 18239 ⁶	BOYU	CCWA	Boyup Brook	19 May 2008
17	Broadwater	BROA	CCWA	Busselton	6, 11 & 12 May 2011
18	Brown	BROW	CCWA	Corrigin	07 June 2010
19	Bruce Rock 30969	BRUC	CCWA	Bruce Rock	26 May 2012
20	Bryde	BRYD	CCWA	Kent	17 May 2009
21	Byenup	BYEN	CCWA	Manjimup	24 May 2008, 11 May 2011
22	<i>Cairlocup</i>	CAIR	CCWA	Kent	17 May 2009
23	<i>Camel</i>	CAME	CCWA	Cranbrook	21 May 2008
24	Campion	CAMP	CCWA	Nungarin / Merredin	26 May 2012
25	<i>Capamaura</i>	CAPA	CCWA	Carnamah	07 June 2010
26	Casuarina	CASU	CCWA	Katanning	17 May 2009
27	Chandala	CHAN	CCWA	Chittering	06 June 2010
28	<i>Chittering</i>	CHIT	CCWA	<i>Chittering</i>	06 June 2010
29	Clifton	CLIF	CCWA	Mandurah / Waroona	29 May 2011
30	<i>Cobline</i>	COBL	CCWA	<i>Dumbleyung</i>	17 May 2009
31	Collets Road	COLL	CCWA	Jerramungup	16 May 2009
32	Coomalbidgup	CMBG	LGA	Esperance	16 May 2009
33	Coomelberrup	COOM	CCWA	Dumbleyung	17 May 2009
34	Corrigin 12900 ⁶	CORR	CCWA	Corrigin	07 June 2010
35	Coyrecup	COYR	CCWA	Katanning	17 May 2009
36	Crackers	CRAC	CCWA	Dandaragan	07 June 2010
37	<i>Cranbrook 25812</i>	CRAN	CCWA	<i>Cranbrook</i>	21 May 2008
38	<i>Cronin</i>	CRON	CCWA	<i>Kondinin</i>	26 May 2010
39	Davies	DAVI	CCWA	Augusta-Margaret River	19 May 2008, 11 May 2011
40	Dobaderry	DOBA	CCWA	Beverley	07 June 2010
41	<i>Dowerin</i>	DOWE	LGA	<i>Dowerin</i>	27 May 2012
42	Dulbinning	DULB	CCWA	Wickepin	26 May 2010
43	Dumbleyung	DUMB	CCWA / LGA	Dumbleyung / Wagin	17May2009, 26May2010
44	<i>Dundas 33113</i>	DUND	CCWA	<i>Dundas</i>	16 May 2009

Table 7 continued.

No.	Wetland Name ¹	Code	Tenure ²	Local Government Authority	Date of Photography
45	Eganu	EGAN	CCWA	Coorow	07 June 2010
46	Egret	EGRE	CCWA	Harvey	19 May 2008
47	<i>Ellen Brook</i>	<i>ELLE</i>	CCWA	<i>Swan</i>	<i>06 June 2010</i>
48	Eneminga	ENEM	CCWA	Dandaragan	07 June 2010
49	Esperance 26410	ESP1	CCWA	Esperance	16 May 2009
50	<i>Esperance 27768</i>	<i>ESP2</i>	CCWA	<i>Esperance</i>	<i>16 May 2009</i>
51	<i>Esperance 27985</i>	<i>ESP3</i>	CCWA	<i>Esperance</i>	<i>16 May 2009</i>
52	<i>Esperance 32128</i>	<i>ESP4</i>	CCWA	<i>Esperance</i>	<i>16 May 2009</i>
53	<i>Esperance 32776</i>	<i>ESP5</i>	CCWA	<i>Esperance</i>	<i>16 May 2009</i>
54	Flagstaff	FLAG	CCWA	Woodanilling	17 May 2009
55	Forrestdale	FORR	CCWA	Armadale	06 June 2010
56	<i>Frasers</i>	<i>FRAS</i>	<i>Private</i>	<i>Dowerin</i>	<i>27 May 2012</i>
57	<i>Gardner</i>	<i>GARD</i>	CCWA	<i>Albany</i>	<i>21 May 2008</i>
58	Gibbs	GIBB	CCWA	Armadale	06 June 2010
59	<i>Gingin 31241</i>	<i>GING</i>	CCWA	<i>Gingin</i>	<i>06 June 2010</i>
60	<i>Gnowangerup 26264</i>	<i>GNO1</i>	CCWA	<i>Gnowangerup</i>	<i>21 May 2008</i>
61	<i>Gnowangerup 26569</i>	<i>GNO2</i>	CCWA	<i>Gnowangerup</i>	<i>17 May 2009</i>
62	Goonaping	GOON	CCWA	Beverley	07 June 2010
63	<i>Goorly</i>	<i>GOOR</i>	<i>UCL</i>	<i>Dalwallinu</i>	<i>27 May 2012</i>
64	Gore	GORE	CCWA	Esperance	16 May 2009
65	<i>Gounter</i>	<i>GOUN</i>	CCWA	<i>Kondinin</i>	<i>26 May 2010</i>
66	<i>Gundaring</i>	<i>GUND</i>	CCWA	<i>Wagin</i>	<i>17 May 2009</i>
67	Guraga	GURA	LGA	Dandaragan	07 June 2010
68	Harvey 12632	HARV	CCWA	Harvey	19 May 2008
69	<i>Hebitons</i>	<i>HEBI</i>	<i>Private</i>	<i>Mullewa</i>	<i>27 May 2012</i>
70	Hinds	HIND	CCWA	Wongan-Ballidu	27 May 2012
71	Jandabup	JAND	CCWA	Wanneroo	06 June 2010
72	Jasper	JASP	CCWA	Nannup	20 May 2008
73	Jerdacuttup	JERD	CCWA	Ravensthorpe	16 May 2009
74	Joondalup	JOON	CCWA	Joondalup	06 June 2010
75	<i>Karakin</i>	<i>KARA</i>	<i>WRC</i>	<i>Gingin</i>	<i>06 June 2010</i>
76	Kent 29020 ⁶	KENT	CCWA	Kent	17 May 2009
77	<i>Kondinin</i>	<i>KOND</i>	CCWA	<i>Kondinin</i>	<i>07 June 2010</i>
78	<i>Kwobrup</i>	<i>KWOB</i>	<i>Private</i>	<i>Kent</i>	<i>17 May 2009</i>
79	Kwornicup	KWOR	CCWA	Plantagenet	21 May 2008
80	Little White	LITT	CCWA	Narrogin	26 May 2010
81	Logue	LOGU	CCWA	Carnamah	<i>27 May 2012</i>
82	Maringup	MARI	CCWA	Manjimup	20 May 2008, 11 & 28 May 2011
83	Martinup	MART	CCWA	Woodanilling	11 May 2011
84	McLarty	MCLA	CCWA	Murray	21 May 2008
85	Mears	MEAR	CCWA	Brookton	07 June 2010, 26 May 2012
86	Mettler	METT	CCWA	Albany	21 May 2008
87	<i>Miripin</i>	<i>MIRI</i>	CCWA	<i>Woodanilling</i>	<i>17 May 2009</i>
88	Moates	MOAT	CCWA	Albany	21 May 2008
89	<i>Mollerin</i>	<i>MOLL</i>	CCWA	<i>Koorda</i>	<i>26 May 2012</i>
90	Mortijinup	MORT	CCWA	Esperance	16 May 2009

Table 7 continued.

No.	Wetland Name ¹	Code	Tenure ²	Local Government Authority	Date of Photography
91	Mount Le Grand	MLGR	CCWA	Esperance	16 May 2009
92	<i>Mt Marshall 26687</i>	MTMA	CCWA	<i>Mt Marshall</i>	<i>26 May 2012</i>
93	Muir	MUIR	CCWA	Manjimup	20 & 24 May 2008
94	<i>Mungala</i>	MUNG	CCWA	<i>Gingin</i>	<i>06 June 2010</i>
95	<i>Murapin</i>	MURA	CCWA	<i>Woodanilling</i>	<i>17 May 2009</i>
96	<i>Murray 24739</i>	MURR	CCWA	<i>Murray</i>	<i>21 May 2008</i>
97	<i>Nambung</i>	NAMB	CCWA	<i>Gingin</i>	<i>06 June 2010</i>
98	Ngopitchup	NGOP	WRC	Broomehill	24 May 2008
99	Ninan	NINA	CCWA	Wongan-Ballidu	27 May 2012
100	Nine Mile	NINE	CCWA	Murray	19 May 2008
101	<i>Nonalling</i>	NONA	CCWA	<i>Corrigin</i>	<i>07 June 2010</i>
102	Noobijup	NOOB	CCWA	Cranbrook	24 May 2008
103	Noonying	NOON	CCWA	Tammin	27 May 2012
104	North Parriup	NPAR	CCWA	Ravensthorpe	16 May 2009
105	Owingup	OWIN	CCWA	Denmark	20 May 2008
106	Pabelup South	PABE	CCWA	Jerramungup	16 May 2009
107	<i>Pallarup</i>	PALL	CCWA	<i>Lake Grace</i>	<i>17 May 2009</i>
108	Parkeyerring	PARK	CCWA	Wagin	11 May 2011
109	Pillenorup	PILL	CCWA	Plantagenet	21 May 2008, 28 May 2011
110	<i>Pinjarrega</i>	PINJ	CCWA	<i>Coorow</i>	<i>07 June 2010</i>
111	<i>Plantagenet 25386</i>	PLAN	CCWA	<i>Plantagenet</i>	<i>21 May 2008</i>
112	Pleasant View	PLEA	CCWA	Albany	21 May 2008, 28 May 2011
113	Poorginup	POOR	CCWA	Manjimup	20 May 2008
114	Powell	POWE	CCWA	Albany	21 May 2008, 28 May 2011
115	<i>Queerearrup</i>	QUEE	LGA	<i>Woodanilling</i>	<i>17 May 2009</i>
116	Range Road Yate	RANG	MWR	Kent	17 May 2009
117	Red (Bruce Rock)	REDB	CCWA	Bruce Rock	07 June 2010
118	<i>Red (Manjimup)</i>	REDM	UCL	<i>Manjimup</i>	<i>24 May 2008</i>
119	Ronnerup	RONN	CCWA	Lake Grace	17 May 2009
120	Shark	SHAR	CCWA	Esperance	16 May 2009
121	<i>Shaster</i>	SHAS	CCWA	<i>Ravensthorpe</i>	<i>16 May 2009</i>
122	Station	STAT	CCWA	Esperance	16 May 2009
123	<i>Streets</i>	STRE	Private	<i>Moora</i>	<i>07 June 2010</i>
124a	Taarblin North ⁷	TAAN	CCWA	Narrogin	26 May 2010
124b	Taarblin South ⁷	TAAR	CCWA	Narrogin	26 May 2010
125	Thomsons	THOM	CCWA	Cockburn	06 June 2010
126	Toolibin	TOOL	CCWA	Wickepin	26May2010, 07Jun2010
127	Tordit-Gurru	TORD	CCWA	Manjimup	20 May 2008 (limited), 11 (E) & 28 (W) May 2011
128	Towerrinning	TOWE	CCWA	West Arthur	24 May 2008
129	<i>Twin Swamps N-W</i>	TWIN	CCWA	<i>Swan</i>	<i>06 June 2010</i>
130	Unicup	UNIC	CCWA	Cranbrook	11, 27 & 28 May 2011
131	Varley	VARL	CCWA	Kulin	26 May 2010
132	<i>Wagin 2088</i>	WAGI	CCWA	<i>Wagin</i>	<i>17 May 2009</i>
133	Walbyring	WALB	CCWA	Wickepin	26May2010, 07Jun2010
134	<i>Walling</i>	WALL	CCWA	<i>Gingin</i>	<i>06 June 2010</i>
135	Walyormouring	WALY	CCWA	Goomalling	27 May 2012

Table 7 continued.

No.	Wetland Name ¹	Code	Tenure ²	Local Government Authority	Date of Photography
136	Wannamal	WANN	CCWA	Gingin	06 June 2010
137	Warden	WARD	CCWA	Esperance	16 May 2009
138	<i>Wardering</i>	WARG	CCWA	<i>Woodanilling</i>	<i>11 May 2011</i>
139	Warrinup	WARR	CCWA	Cranbrook	24 May 2008
140	West Arthur 5456	WEST	CCWA	West Arthur	11 & 27 May 2011
141	Wheatfield	WHEA	CCWA	Esperance	16 May 2009
142	<i>White (Albany)</i>	WHIA	CCWA	<i>Albany</i>	<i>21 May 2008</i>
143	White (Narrogin)	WHIN	CCWA	Narrogin	26May2010, 07Jun2010
144	White Water	WHIW	CCWA	Corrigin	07 June 2010
145	<i>Wild Horse</i>	WILD	CCWA	<i>West Arthur</i>	<i>19 May 2008</i>
146	Wilson	WILS	CCWA	Manjimup	20 May 2008
147	Yaalup	YAAL	CCWA	Kent	17 May 2009
148	Yarnup	YARN	CCWA	Cranbrook	24 May 2008, 27 May 2011
149	Yarra Yarra	YARR	CCWA	Carnamah	26 May 2012
150	Yealering	YEAL	LGA	Wickepin	07 June 2010
151	Yellilup	YELL	Private	Jerramungup	21 May 2008, 28 May 2011
152	Yurine	YURI	CCWA	Gingin	06 June 2010

Notes:

1. Wetlands without official names at the commencement of monitoring are identified by Local Government Authority and Reserve Number (e.g. Albany 26385).
2. CCWA (Conservation Commission of Western Australia); LGA (Local Government Authority); MWR (Minister for Water Resources); UCL (Unallocated Crown Land), WRC (Water & Rivers Commission). DPaW has management responsibility for wetlands vested in CCWA.
3. The SWWMP wetlands shown in *italics* have been monitored under SWWMP at various times in the past, but are not currently monitored, not at least under SWWMP.
4. Wetlands not shown in italics are 'current' SWWMP wetlands being routinely monitored by the authors for surface water depth, salinity, pH and (until 2007) nutrients, under the State Salinity Strategy. These include the Intensively Monitored wetlands shown in bold.
5. Wetlands shown in **bold** are SWWMP wetlands being Intensively Monitored by other DPaW scientific staff for potential changes in plant and animal communities, shallow groundwater levels and detailed water chemistry under the State Salinity Strategy. They are a subset of the 'current' wetlands.
6. Beverley Lakes is also known as Yenyenning Lakes; Boyup Brook 18239 as Kulicup Swamp; Corrigin 12900 as Paperbark Swamp and Kent 29020 as East Lake Bryde.
7. Taarblin North and Taarblin South refer to the northern and southern basins respectively of one wetland (Taarblin).
8. The only SWWMP wetlands not yet photographed are Big Boom (Esperance), Gingilup (Nannup), Yeagarup (Manjimup) and Yeagarup South (Manjimup). These wetlands have only recently been added to SWWMP (Yeagarup and Yeagarup South in 2011, Big Boom and Gingilup in 2012).

Table 8. Number of SWWMP wetlands with 1, 2, 3, etc. years of September and/or¹ November depth, pH and salinity data as at November 2012.

Number of years of Sep and/or ¹ Nov data at Nov 2012	No. of currently monitored wetlands			No. of historically monitored wetlands		
	With Depth data	With pH data	With Salinity data	With Depth data	With pH data	With Salinity data
0	2				2	2
1	2	3	3		4	2
2		2	2	1	4	4
3				5	10	7
4				4	12	5
5				9	4	9
6		1	1	10		5
7		2	1	4	2	3
8		1	2		3	1
9		3			5	4
10	1	1	2	2	4	
11	1	3	1	4	2	6
12	4	2	2	2		1
13	7	7	7	11		3
14	4	2	4			
15		1	1			
16						
17	3	1	1			
18	1	4	1			
19	2	6	6			
20	4	1	2		1	
21	4	7	4			1
22	1	5	3	1		
23		2	5			
24	2	4	4			
25	1	2	3			
26	1	2	2			
27	3	7	3			
28	5	6	5			
29	9	4	5			
30		10	1			
31	5	11				
32	5	3	12			
33	12		7			
34	23		11			
35	1		2			
Total Wetlands	103	103	103	53	53	53

SUMMARY

Number of years of Sep and/or ¹ Nov data at Nov 2012	No. of currently monitored wetlands			No. of historically monitored wetlands		
	With Depth data	With pH data	With Salinity data	With Depth data	With pH data	With Salinity data
≥ 10	99	91	94	20	7	11
≥ 20	76	64	69	1	1	1
≥ 30	46	24	33	0	0	0

Notes:

1. The objective is to monitor all SWWMP wetlands in both September *and* November each year. However, on occasions, circumstances may prevent data collection at one or a few wetlands in either Sep or Nov (rarely at same wetland in both months) of a particular year.
2. More wetlands have 10+, 20+, 30+ years of depth data than salinity (or pH) data because in most years some wetlands are dry in September and/or November.
3. Fewer wetlands have 10+, 20+, 30+ years of pH data than salinity data because routine pH monitoring began several years after depth and salinity monitoring.
4. Taarblin North is not included in this Table. It has been monitored for a shorter period than Taarblin South, which is included. They are two connected basins of the same wetland (Lake Taarblin).

APPENDICES

APPENDIX 1. Reports, publications and databases (to 2010)¹ in which use is made of SWWMP data.

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¹ Except JDA (2012). This Appendix is not updated annually.

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APPENDIX 2. Recreation and SWWMP wetlands.

Wetlands in south-western Australia are used for many forms of recreation including water-based sports such as waterskiing, sailing, sailboarding, canoeing and kayaking and other 'in the water' experiences such as tadpole and macroinvertebrate collecting and waterbird surveys. Many urban wetlands have trails or footpaths on or near their shores and these are enjoyed by walkers, joggers and cyclists. Others have parks, picnic areas and family playgrounds. In both situations, the lake-side vistas and ambience add enjoyment to the recreational experience. Some wetlands have hides, platforms and walkways for viewing birds and their environments. People enjoy the aesthetics of healthy wetlands and the opportunity to closely observe, and perhaps photograph, the local wildlife.

SWWMP wetlands and recreational access

SWWMP wetlands provide many opportunities for recreational enjoyment of wildlife. Some have easy access and others do not. Below is a list (a-f) of all SWWMP wetlands categorised according to their proximity to Perth, to other major urban centres and to smaller towns and settlements, and according to their ease of access at present.

While reading the list, the following should be noted:

There are hazards (e.g. water, mud, venomous snakes, toxic algae, overpowering odours, possibility of becoming lost) associated with all wetlands and 'easy access' should not be interpreted as low risk. Assignment to access categories (a-f) is based on ease of access to each wetland and not necessarily to each wetland's depth gauge(s). The use of watercraft is generally not permitted on SWWMP wetlands (or other wetlands reserved for conservation or in National Parks) except in a few instances where and when indicated by on-site signage. No privately-owned SWWMP wetlands (*Hebitons*, *Blue Gum*, *Streets*, *Frasers*, *Ardath*, *Kwobrup*, *Atkins Yate* and *Yellilup*) are listed below. Landowners' permission is required to access privately-owned wetlands. SWWMP wetlands on public land but only accessible via private property are included in the 'difficult access' category (f). The wetlands within each category are listed approximately N-S and W-E. Wetlands in italics are 'historical' and not currently monitored under SWWMP. The approximate location, coordinates and tenure of each wetland can be ascertained from Figure 1 and Table 1 of this report. Tables 2 and 3 may also be helpful.

a) SWWMP wetlands in the Perth metropolitan area are: Joondalup, Thomsons, Forrestdale, Gibb and Jandabup. The first three are easy to access and have some interpretive and other recreational facilities.

b) SWWMP wetlands in or close to other major urban centres¹ are: Egret (Australind), Broadwater (Busselton), Moates, *Angove*, *Gardner*, Powell (Albany) and Warden, Shark, Wheatfield, Station (Esperance). Access is easy to all except Moates, *Angove* and Station.

c) SWWMP wetlands close to smaller rural towns¹ and settlements¹ and easy to access are: Yarra Yarra (Three Springs), Wannamal (Wannamal), *Nambung* and *Wallerling* (Bambun), McLarty (Birchmont), 'Boyup Brook 18239' (Kulicup), Towerrinning (Moodiarrup), Pleasant View, 'Albany 26385' (ALB1), 'Albany 27157' (ALB2) and *White Albany* (Manypeaks), Yealering (Yealering), '*Wagin 2088*' and Parkeyerring (Wagin), *Kondinin* (Kondinin), *Gounter* (Hyden), Jerdacuttup (Hopetoun), Coomalbidgup (Coomalbidgup). **Not readily accessible** are Bambun and *Mungala* (Bambun), Noonying (Tammin) and Mettler (Wellstead).

d) SWWMP wetlands in National Parks and easy to access are: Clifton (Yalgorup NP), Davies (Leeuwin-Naturaliste NP), Yeagarup (D'Entrecasteaux NP). **Not readily accessible** are Jasper, Wilson, Yeagarup South and Maringup (D'Entrecasteaux NP), Pillenorup (Stirling Range NP), Colletts and Pabelup South (Fitzgerald River RNP) and Mount Le Grand (Cape Le Grand NP),

e) Other SWWMP wetlands readily accessible by road (though may involve a short easy walk): *Goorly*, Yurine, *Chittering*, Hinds, Ninan, Walyormouring, *Dowerin*, *Mollerin*, *Campion*, '*Bruce Rock 30969*', Red Bruce Rock, Beverley, Mears, Brown, White Water, Dulbinning, Toolibin, Walbyring, Taarblin, Flagstaff, *Queerearrup*, *Murapin*, Martinup, Dumbleyung, *Coblinine*, Casuarina, Coyrecup, Muir, *Red Manjimup*, Unicup, Yarnup, Noobijup, Warrinup, Kwonnicup, Anderson, Altham, Bryde, Range Road, *Biddy*, *Pallarup*, *Cronin*, '*Plantagenet 25386*', Gore, '*Esperance 27985*' (ESP3) and '*Dundas 33113*'. Several of these wetlands, e.g. Ninan, Walyormouring, Beverley, Mears, Toolibin, Dumbleyung and Muir, have some limited facilities for recreation.

f) Other SWWMP wetlands NOT readily accessible by road (long or difficult walk required): Logue, *Capamaura*, Eganu, *Pinjarrega*, Eneminga, Guraga, Crackers, *Karakin*, '*Gingin 31241*', Chandala, *Twin Swamps*, *Ellen Brook*, Dobaderry, Goonaping, '*Murray 24739*', Nine Mile, 'Harvey 12632', Gingilup, Byenup, Tordit-Gurup, Poorginup, Owingup, 'Boat Harbour 1', '*Mount Marshall 26687*', 'Corrigin 12900', *Nonalling*, *Bokan*, Little White, White Narrogin, *Gundaring*, Coomelberrup, *Wardering*, *Miripin*, 'West Arthur 5456', *Wild Horse*, Ngopitchup, '*Cranbrook 25812*', *Camel*, '*Gnowangerup 26264*' (GNO1), '*Gnowangerup 26569*' (GNO2), Yaalup, *Cairlocup*, 'Kent 29020', Bennetts, Ronnerup,

¹ Town / settlement name in brackets.

Ace, Varley, Mettler, North Parriup, *Shaster*, 'Esperance 26410' (ESP1), Mortijinup, 'Esperance 27768' (ESP2), 'Esperance 32128' (ESP4), 'Esperance 32776' (ESP5) and Big Boom. None of these wetlands have facilities for recreation.

SWWMP wetlands, recreational boating and some other activities

SWWMP wetlands currently approved (Department of Transport website¹, 30/8/2013) for water skiing are Bennetts, Dumbleyung, Jasper, *Queerearrup* and Towerrinning. Other SWWMP wetlands (not including privately-owned wetlands) known or understood to have been used for waterskiing in the past are Anderson, Beverley, Bryde, Champion, *Cobline*, Coyrecup, Forrestdale, Guraga, Hinds, *Kondinin*, Mears, Ninan, *Queerearrup*, Unicup, and Yealering. Waterskiing might also have occurred at 'Mt Marshall 26697'. On Dec 31st 1964, Donald Campbell set a new world water speed record when he piloted his boat, 'Bluebird K7' across the recently full-to-overflowing Lake Dumbleyung at 445 km/hr.

Canoes, kayaks or small dinghies are known or are thought to have been used in recent times at some of the above lakes and on *Angove*, Bambun, Clifton, Gore, *Gundaring*, Joondalup, *Miripin*, Powell, Shark, Toolibin, Walyormouring and Warden. Sailboards and small yachts are thought to have been used on Dumbleyung and Towerrinning. During the 1980s, a small number of permits were issued to allow RAOU²-affiliated bird observers to use small craft to survey certain large or deep SWWMP wetlands during an assessment of waterbird use of wetland nature reserves (Jaensch *et al.* 1988).

Swimming may occur at Dumbleyung and *Cronin* and at *Cobline* where the remains of a wooden diving tower and board were evident a decade or so ago. Horses have been exercised in Parkeyerring. Horse races were apparently conducted on the bed of Red (Bruce Rock) decades ago and some bush-pole structures remain. Fishing for bream has occurred at Clifton and possibly at Wheatfield and marroning at Jasper and Moates. Recreational egg-collecting (now banned) no doubt occurred on some SWWMP wetlands in the past.

Note that some of the above activities are now prohibited and mention here should not be taken to indicate otherwise.

SWWMP wetlands, bird watching and bird studies by volunteers

Except perhaps for duck-shooting (see below), the most geographically extensive recreational use of SWWMP and other wetlands in south-western Australia has been the 1977-81 Atlas of Australian Birds (Blakers *et al.* 1984), the 1981-85 survey of waterbird use of wetland nature reserves (Jaensch *et al.* 1988), the Great Duck Counts of 1986-88 (Jaensch & Vervest 1988), the 1998-2002 New Atlas of Australian Birds (Barrett *et al.* 2003), the Hooded Plover surveys of the 1990s, the Australasian and Little Bittern surveys of 2007-13 (Pickering 2013) and the waterbird survey efforts of B. & A. Buchanan and possibly others unknown to or not recalled by the authors. The waterbird surveys of R. Garstone (197?) in the Great Southern and by the WA Field & Game Association prior to 1992 have also been noteworthy. Most notable overall is the fact that a comprehensive assessment by volunteers of the numbers and breeding activity of all waterbird species across the south-west has not been made for three decades, that is, since the 1981-85 survey by members of the former RAOU, now Birdlife Australia.

SWWMP wetlands and recreational duck shooting

Prior to being banned in Western Australia in 1992, recreational duck shooting was undertaken by thousands of licensed shooters. During the last declared season in the south-west (Jan 14th to Feb 11th 1990), the following 40 SWWMP wetlands (and some other wetland reserves) in the conservation estate were declared 'Game Reserves' open for licensed recreational duck shooting: Beverley, Brown, *Bokan*, *Camel*, Champion, *Cobline*, Coomelberrup, Coyrecup, Dulbinning, Eganu, Eneminga, Flagstaff, Gore, *Gundaring*, Hinds, Jerdacuttup, Martinup, Mears, Muir (part), *Murapin*, Ninan, *Nonalling*, Noobijup, Noonying, Parkeyerring, *Pinjarrega*, *Shaster*, Station, Taarblin, Unicup, 'Wagin 2088', Walbyring, Walyormouring, Wannamal (part), Wheatfield, *White (Albany)*, White (Narrogin), White Water, *Wild Horse* and Yurine. Recreational duck shooting may also have been permitted on one or more of several privately-owned SWWMP wetlands.

Throughout the year, all nature reserves not declared to be game reserves and all national parks were closed to shooting. These included a number of SWWMP wetlands. In addition, a number of 'waterfowl refuge areas' were declared closed to shooting at all times. These included the following SWWMP wetlands: 'Albany 27157' (ALB2), Anderson, Bambun, Broadwater, *Chittering*, Clifton, 'Corrigin 12900', Crackers, *Cobline*, Dumbleyung, Egret, Forrestdale, Jandabup, Joondalup, McLarty, Muir (part), *Mungala*, *Murapin*, 'Murray 24739', *Nambung*, Powell, Toolibin, Towerrinning, *Walling*, Wannamal (part), *Wardering* and Yealering.

¹ http://www.transport.wa.gov.au/mediaFiles/marine/MAC-M-WaterSki_InlandWaterDamsLakes3.pdf

² Now 'Birdlife Australia'.

APPENDIX 3. 'Waterbird Spectaculars'

The most recent broad-scale survey of all waterbird species, numbers and breeding activity on hundreds of wetlands across the south-west is the 1981-85 survey of waterbird usage of wetland nature reserves (and many other wetlands) in south-western Australia (Jaensch *et al.* 1988). This survey was a cooperative effort by the WA Department of Fisheries & Wildlife (a predecessor of DPaW) and the Royal Australasian Ornithologists Union (now Birdlife Australia) and was funded by recreational duck-shooting licence fees. The Tables below show where the highest counts were made, which wetlands had the highest numbers of birds per unit area, the water depth and salinity at the time of each highest count, and the most abundant species.

The main purpose of preparing these Tables is to show that, when conditions are suitable, large numbers and densities of waterbirds gather, providing periodic opportunities to witness 'waterbird spectaculars'. They also demonstrate how count, depth and salinity data could be used to predict future events of this nature.

In the first Table, wetlands are listed (ranked) in order of highest count. In the second, the same wetlands are listed in order of count per unit area, i.e. waterbird density.

(A) Ranked by Highest Count

SWWMP Wetland	Highest Count (month & year)	Count Rank	Area (ha)	Count / Area Ratio	Count / Area Rank	Local Authority	Depth (m)	Sal. (ppt)	Single most abundant species in highest count
Dumbleyung	24,839 (Mar85)	1	3,968	6.3	28	Dumbl./Wagin	2.75	40	Coot (10,500)
Forrestdale	17,484 (Jan83)	2	198	88.3	5	Armadale	0.17	11	Uid Ducks (4,500)
Warden	16,919 (Nov82)	3	600	28.2	14	Esperance	0.40	166	Banded Stilt (7,000)
Thomsons	14,675 (Mar85)	4	239	61.4	7	Cockburn	0.33	8	Coot (5,200)
Gore	13,505 (Nov84)	5	738	18.3	21	Esperance	1.67	49	Shelduck (7,000)
Mears	10,958 (May82)	6	279	39.3	12	Brookton	0.20	95	Banded Stilt (5,200)
Eganu	10,940 (Jan82)	7	84	130.2	3	Coorow	1.82	18	Grey Teal (4,000)
Pinjarrega	10,311 (Dec81)	8	570	18.1	22	Coorow	1.94	27	Shelduck (3,000)
Hinds	9,614 (Oct83)	9	1,197	8.0	27	Wong.-Ballidu	1.44	61	Banded Stilt (8,000)
White Narrogin	8,399 (Mar84)	10	200	42.0	11	Narrogin	1.22	7	Grey Teal (6,000)
Kwornicup	7,361 (Sep82)	11	219	33.6	13	Plantagenet	0.14	46	Banded Stilt (7,000)
Guraga	7,217 (Mar84)	12	350	20.6	19	Dandaragan	1.52	10	Uid Grebe, Coot (2,000 ea)
Joondalup	6,573 (Mar84)	13	469	14.0	24	Joondalup	2.40	2	Coot (4,436)
Wardering	6,304 (Mar84)	14	43	146.6	2	Woodanilling	0.37	29	Grey Teal (4,000)
Broadwater	6,125 (Jan83)	15	63	97.2	4	Busselton	-	-	Grey Teal (2,000)
Coyrecup	6,070 (May83)	16	417	14.6	23	Katanning	0.92	13	Grey Teal (2,680)
Chandala	5,202 (Oct83)	17	120	43.4	9	Chittering	0.90	1	Straw-n. Ibis (5,000)
McLarty	4,639 (Feb85)	18	200	23.2	15	Murray	-	-	Grey Teal (1,500)
Walyormouring	4,473 (Nov81)	19	≈500	≈8.9	26	Goomalling	0.51	20	Grey Teal, Hardhead (2,000 ea)
Jandabup	4,438 (Mar83)	20	232	19.1	20	Wanneroo	0.34	3	Red-c. Plover (3,000)
Flagstaff	4,336 (Jan85)	21	≈200	≈21.7	16	Woodanilling	0.52	96	Shelduck (2,500)
Taarblin	4,241 (Feb84)	22	985	4.3	29	Narrogin	1.52	3	Grey Teal (3,000)
Ninan	4,178 (Oct82)	23	199	21.0	18	Wong.-Ballidu	0.88	110	Banded Stilt (3,000)
Wannamal	4,158 (Nov84)	24	64	65.0	6	Gingin	1.28	8	Coot (3,600)
Beverley (cntrl)	3,423 (Apr84)	25	≈75	≈45.6	8	Beverley	0.88	110	Banded Stilt (2,500)
Coomelberrup	3,459 (Jan83)	26	82	42.2	10	Dumbleyung	0.61	39	Grey Teal (1,300)
Parkeyerring	3,317 (Jul84)	27	≈300	≈11.1	25	Wagin	1.13	23	Coot (1,800)
White Water	3,204 (Sep82)	28	≈150	≈21.4	17	Corrigin	0.14	56	Banded Stilt (2,880)
Muir	3,012 (Jan85)	29	4600	0.7	30	Manjimup	0.70	58	Shelduck (3,000)
* Shark	2,642 (Mar85)	30	4.5	587.1	1	Esperance	1.83	2	Grey Teal (2,000)

- The cutoff for this Table is 3,000 birds. Shark Lake has been added because of its exceptionally high count / area ratio.
- Twenty of the wetlands in this Table are in the inland agricultural area where rainfall is declining and wetlands are filling less frequently than during 1981-85. Waterbird numbers are probably also in decline and 'waterbird spectaculars' less frequent.
- This Table could be usefully updated by addition of, for example, unpublished 1986-1992 RAOU data, the 1986-1988 *Great Duck Counts* (Jaensch & Vervest 1988); 1987-1992 *Annual Waterfowl Counts* (e.g. Halse *et al.* 1995); Esperance District counts (Clarke & Lane 2003); count data from DPaW Recovery Catchments and from intensive monitoring of SWWMP wetlands by Halse, Pinder & Cale, and data from articles appearing in post-1990 issues of *WA Bird Notes*. Lake Muir, for example, supported 51,613 ducks, swans and coots in March 1989 (Halse *et al.* 1990), greatly exceeding the highest count for any wetland in the above Table.

APPENDIX 3 continued.

(B) Ranked by Waterbird Density (Count/Area Ratio)

SWWMP Wetland	Highest Count (month & year)	Count Rank	Area (ha)	Count / Area Ratio	Count / Area Rank	Local Authority	Depth (m)	Sal. (ppt)	Single most abundant species in highest count
* Shark	2,642 (Mar85)	30	4.5	587.1	1	Esperance	1.83	2	Grey Teal (2,000)
Wardering	6,304 (Mar84)	14	43	146.6	2	Woodanilling	0.37	29	Grey Teal (4,000)
Eganu	10,940 (Jan82)	7	84	130.2	3	Coorow	1.82	18	Grey Teal (4,000)
Broadwater	6,125 (Jan83)	15	63	97.2	4	Busselton	-	-	Grey Teal (2,000)
Forrestdale	17,484 (Jan83)	2	198	88.3	5	Armadale	0.17	11	Uid Ducks (4,500)
Wannamal	4,158 (Nov84)	24	64	65.0	6	Gingin	1.28	8	Coot (3,600)
Thomsons	14,675 (Mar85)	4	239	61.4	7	Cockburn	0.33	8	Coot (5,200)
Beverley (cntrl)	3,423 (Apr84)	25	≈75	≈45.6	8	Beverley	0.88	110	Banded Stilt (2,500)
Chandala	5,202 (Oct83)	17	120	43.4	9	Chittering	0.90	1	Straw-n. Ibis (5,000)
Coomelberrup	3,459 (Jan83)	26	82	42.2	10	Dumbleyung	0.61	39	Grey Teal (1,300)
White Narrogin	8,399 (Mar84)	10	200	42.0	11	Narrogin	1.22	7	Grey Teal (6,000)
Mears	10,958 (May82)	6	279	39.3	12	Brookton	0.20	95	Banded Stilt (5,200)
Kwornicup	7,361 (Sep82)	11	219	33.6	13	Plantagenet	0.14	46	Banded Stilt (7,000)
Warden	16,919 (Nov82)	3	600	28.2	14	Esperance	0.40	166	Banded Stilt (7,000)
McLarty	4,639 (Feb85)	18	200	23.2	15	Murray	-	-	Grey Teal (1,500)
Flagstaff	4,336 (Jan85)	21	≈200	≈21.7	16	Woodanilling	0.52	96	Shelduck (2,500)
White Water	3,204 (Sep82)	28	≈150	≈21.4	17	Corrigin	0.14	56	Banded Stilt (2,880)
Ninan	4,178 (Oct82)	23	199	21.0	18	Wong.-Ballidu	0.88	110	Banded Stilt (3,000)
Guraga	7,217 (Mar84)	12	350	20.6	19	Dandaragan	1.52	10	Uid Grebe, Coot (2,000 ea)
Jandabup	4,438 (Mar83)	20	232	19.1	20	Wanneroo	0.34	3	Red-c. Plover (3,000)
Gore	13,505 (Nov84)	5	738	18.3	21	Esperance	1.67	49	Shelduck (7,000)
Pinjarrega	10,311 (Dec81)	8	570	18.1	22	Coorow	1.94	27	Shelduck (3,000)
Coyrecup	6,070 (May83)	16	417	14.6	23	Katanning	0.92	13	Grey Teal (2,680)
Joondalup	6,573 (Mar84)	13	469	14.0	24	Joondalup	2.40	2	Coot (4,436)
Parkeyerring	3,317 (Jul84)	27	≈300	≈11.1	25	Wagin	1.13	23	Coot (1,800)
Walyormouring	4,473 (Nov81)	19	≈500	≈8.9	26	Goomalling	0.51	20	Grey Teal, Hardhead (2,000 ea)
Hinds	9,614 (Oct83)	9	1,197	8.0	27	Wong.-Ballidu	1.44	61	Banded Stilt (8,000)
Dumbleyung	24,839 (Mar85)	1	3,968	6.3	28	Dumbl./Wagin	2.75	40	Coot (10,500)
Taarblin	4,241 (Feb84)	22	985	4.3	29	Narrogin	1.52	3	Grey Teal (3,000)
Muir	3,012 (Jan85)	29	4600	0.7	30	Manjimup	0.70	58	Shelduck (3,000)

Depths at the time of highest counts being recorded ranged from 2.75m (Dumbleyung) to 0.14m (Kwornicup, White Water) and salinities from 166ppt (Warden) to 1ppt (Chandala). Timing was as follows: Jun-Jul (1 wetland), Aug-Sep (2), Oct-Nov (7), Dec-Jan (7), Feb-Mar (10), Apr-May (3). These data are consistent with the senior authors' experience that highest numbers are most likely to occur between late spring and early autumn and that the timing at particular wetlands is depth-specific, with salinity primarily affecting species composition rather than the occurrence or otherwise of high numbers.

'Waterbird spectacles' may also be observed at other, non-SWWMP wetlands in the south-west, such as Peel Inlet at Mandurah and Vasse-Wonnerup at Busselton, where large flocks of migratory and resident species gather each summer. Feeding frenzies involving hundreds of pelicans, egrets, herons, ibis, cormorants and spoonbills may be seen in the lowest reaches of Vasse-Wonnerup in December-January each year. The nesting colony of Black Swans at the northern end of Wonnerup estuary and the ibis and cormorant colonies on the Vasse estuary floodplain are also sights to be seen.

APPENDIX 4. Threatened species in SWWMP wetlands.

'Wildlife Conservation (Specially Protected Fauna) Notice 2012(2)', issued under Section 14(4) of the 'Wildlife Conservation Act 1950' and gazetted on November 6th, 2012, declared a number of species of Western Australian fauna 'that is rare or likely to become extinct ... to be fauna that is in need of special protection'. Listed below are the species that occur on south-west wetlands.

Mammals

Setonix brachyurus Quokka

Quokkas make extensive use of thick vegetation associated with wetlands. In the northern part of its mainland range the habitat critical to its survival comprises Swamp Peppermint *Taxandria linearifolia* swamps. Further south it occupies a range of forest, woodland and wetland ecotypes (DEC 2013). Habitat critical to survival on the south coast includes swamps, riparian areas, incised gullies and dense coastal heath (de Tores *et al.* 2007).

SWWMP wetlands that lie within the putative boundaries of the various sub-populations (DEC 2013) are as follows: Dobaderry, Goonaping (Northern Jarrah), 'Boat Harbour 1', Davies, Gingilup, Jasper, Maringup, Owingup, Wilson, Yeagarup, Yeagarup South, (Southern Forest), Moates, Gardner, Angove, 'Albany 27175' (South Coast) and Pillenorup (Stirling Range). There are no SWWMP wetlands within the boundaries of the Central Jarrah sub-population.

Birds

Botaurus poiciloptilus Australasian Bittern ('The Bunyip Bird')

Currently, the threatened waterbird species of primary interest on south-west wetlands is the Australasian Bittern, which is considered threatened throughout its range. A substantial effort has been made in recent years by Alan Clarke (co-author of this report), Robyn Pickering and other members of Birdlife Australia to ascertain, through field survey, which wetlands it is now restricted to and its abundance (Pickering 2012, 2013). Since this effort began in 2007, Australasian Bitterns have been recorded at 29 sites, including the following 15 SWWMP wetlands: 'Albany 26385' (ALB1), 'Albany 27157' (ALB2), Big Boom, 'Boat Harbour 1', Byenup, Forrestdale, Gingilup, Maringup, Moates, Owingup, Pleasant View (highest count of survey was 8 birds in April 2012), Pooriginup, Thomsons and Tordit-Gurru. Historically, this bittern has also been recorded on several other SWWMP wetlands, namely Angove, Gardner, Gundaring, Jandabup, McLarty, Muir, Powell, Shark, Toolibin, Towerinning, Unicup, White (Albany?) and Yarnup (Pickering 2013).

Calidris ferruginea Curlew Sandpiper

Curlew Sandpipers are primarily coastal and estuarine birds, but do make significant use of lake environments in the south-west. The three lakes in the south-west with highest numbers include two SWWMP wetlands: Thomsons (2,500 in Jan 1993) and Forrestdale (2,000 in Jan 1993). These numbers are considered internationally significant (Bamford *et al.* 2008).

Rallus pectoralis clelandi Lewin's Rail

The Lewin's Rail subspecies *clelandi*, which is now 'presumed to be extinct' is 'Known from four specimens: two from Margaret River, 1907; one from King George's Sound, date unknown; one from Bridgetown, Dec 1931' (Marchant & Higgins 1993) and was last recorded in 1932, near Bridgetown. There are no records of this species on SWWMP wetlands, although there are a number of SWWMP wetlands within its former range.

Rostratula benghalensis australis Australian Painted Snipe

The Australian Painted Snipe is found mainly in eastern Australia and is rare in Western Australia. There is a record of three birds on SWWMP wetland Bambun in Nov 1986 (Jaensch & Vervest 1987) and the species was 'evidently common in swamps of Swan Coastal Plain last century' with the 'last breeding record in 1923 (near Moora)' (Johnstone & Storr 1998).

Six additional shorebird species are listed as 'specially protected', however these make very limited use of wetlands other than estuaries. They are as follows. *Calidris canutus* Red Knot, *Calidris tenuirostris* Great Knot, *Charadrius leschenaultii leschenaultii* Greater Sand Plover (Mongolian), *Charadrius mongolus* Lesser Sand Plover, *Limosa lapponica* Bar-tailed Godwit and *Numenius madagascariensis* Eastern Curlew.

Reptiles

Pseudemydura umbrina Western Swamp Tortoise

Globally, the Western Swamp Tortoise is restricted to three or four small locations north of Perth, two of which, *Twin Swamps* and *Ellen Brook*, are historical SWWMP wetlands that were monitored under SWWMP between 1979 and 1984.

Water level and water quality monitoring of these wetlands is now undertaken under programs relating specifically to the conservation of the species, rather than under SWWMP.

Frogs

Three frog species of the south-west have been listed as 'specially protected'. These are *Geocrinia alba* White-bellied Frog, *Geocrinia vitellina* Orange-bellied Frog and *Spicospina flammocaerulea* Sunset Frog. Given their non-lentic habitat preferences, none is considered likely to occur in SWWMP wetlands.

Fish

Galaxias truttaceus hesperius Western Trout Minnow

In WA, the Western Trout Minnow 'is found only in the landlocked Goodga and Angove catchments in the vicinity of Two Peoples Bay ... and in one tributary of the Kent River' (Morgan *et al.* 2011). It might therefore occur in the following SWWMP wetlands: Angove, Gardner, Moates and perhaps Owingup or 'Boat Harbour 1'.

Nannatherina balstoni Balston's Pygmy Perch

Balston's Pygmy Perch is 'restricted to near-coastal streams, lakes and wetlands between the upper Margaret River and the Goodga Rive (near Albany)' (Morgan *et al.* 2011). SWWMP wetlands in this geographic area are (from west to east) Davies, Jasper, Wilson, Yeagarup, Yeagarup South, Maringup, Owingup, 'Boat Harbour 1', Powell and Moates.

Jaensch (1992) recorded Balston's Pygmy Perch in Maringup, Owingup and 'Boat Harbour 1' in autumn 1992.

The Mud Minnow *Galaxiella munda* has 'a preference for permanent stream habitats rather than ephemeral wetlands' (Morgan *et al.* 2011) and therefore seems unlikely to occupy any SWWMP wetlands.

Threatened Invertebrates, Threatened Flora and Threatened Ecological Communities

Readers are directed to the Department of Parks & Wildlife's website <http://www.dec.wa.gov.au/management-and-protection/threatened-species/listing-of-species-and-ecological-communities.html> for the official lists of threatened invertebrate fauna, threatened flora and threatened ecological communities. Their occurrence on SWWMP wetlands will perhaps be addressed in future annual SWWMP reports.

GRAPHS

The following graphs of wetland water depth, pH and salinity are arranged in the same order (alphabetical by wetland name) as in Table 1 where coordinates, tenure and location (by Local Government Authority) are provided.

Only routinely-collected September and November data from 99 of the 103 SWWMP wetlands currently monitored under the State Salinity Strategy are displayed. Yeagarup and Yeagarup South have not been graphed as depth gauges have yet to be installed (though water level measurements area being made). Big Boom and Gingilup have not been graphed due to the limited amount of data collected to date.

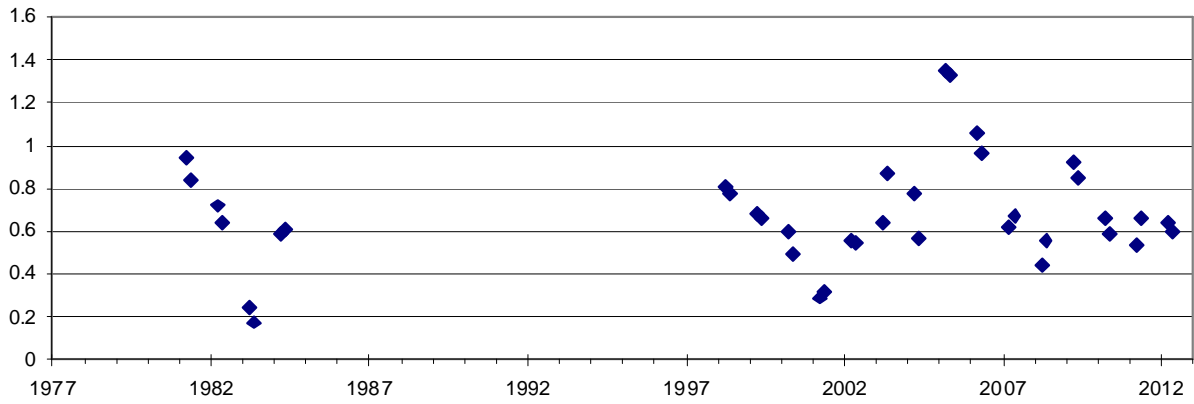
The 25 wetlands Intensively Monitored by DPaw scientific staff for additional biological and physico-chemical attributes (see second-last paragraph of Section 3 and Note 9 of Table 1) are indicated.

Listing as a Wetland of International Importance under the 'Ramsar' *Convention on Wetlands* (Government of Western Australia 1990, 2000; Ramsar Secretariat 2013) and listing in '*A Directory of Important Wetlands in Australia*' (Environment Australia 2001) is indicated where this is the case.

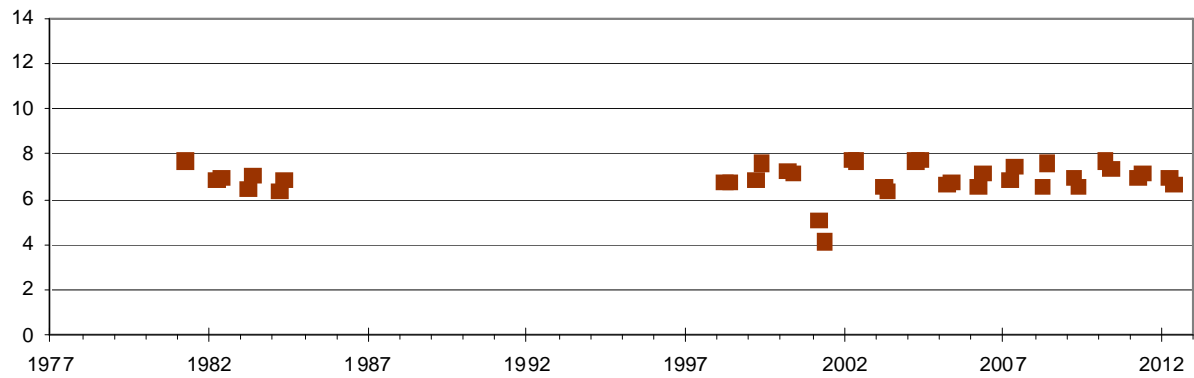
Inclusion in a Natural Diversity Recovery Catchment (Government of Western Australia 1996a; Wallace & Lloyd 2008) is also indicated where applicable.

ALBANY 26385

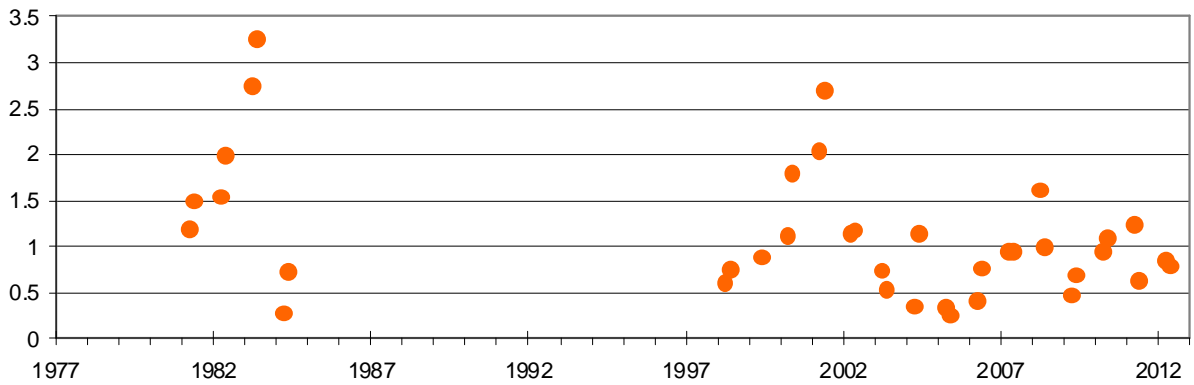
Depth mLD



pH



Salinity (ppt)



Notes:

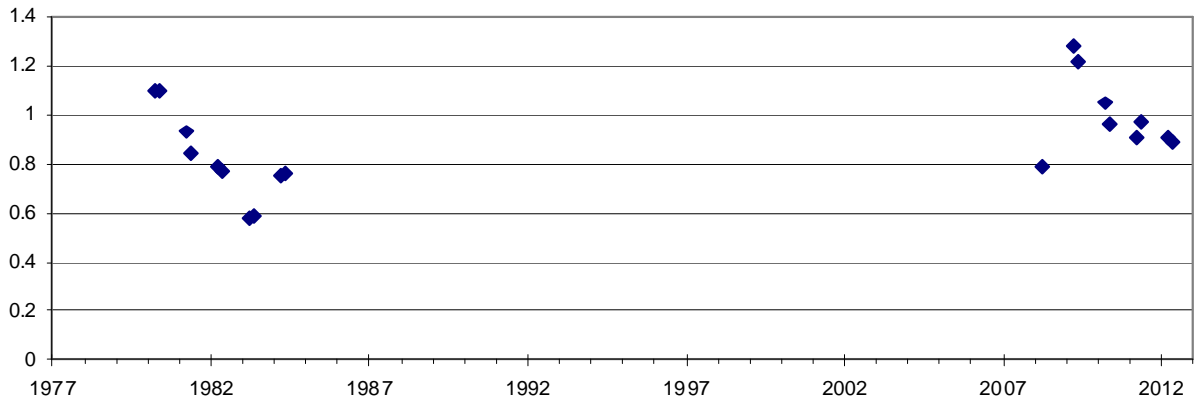
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Albany 26385 is a component of the 'Lake Pleasant View System', which is listed in the 'Directory of Important Wetlands in Australia'.

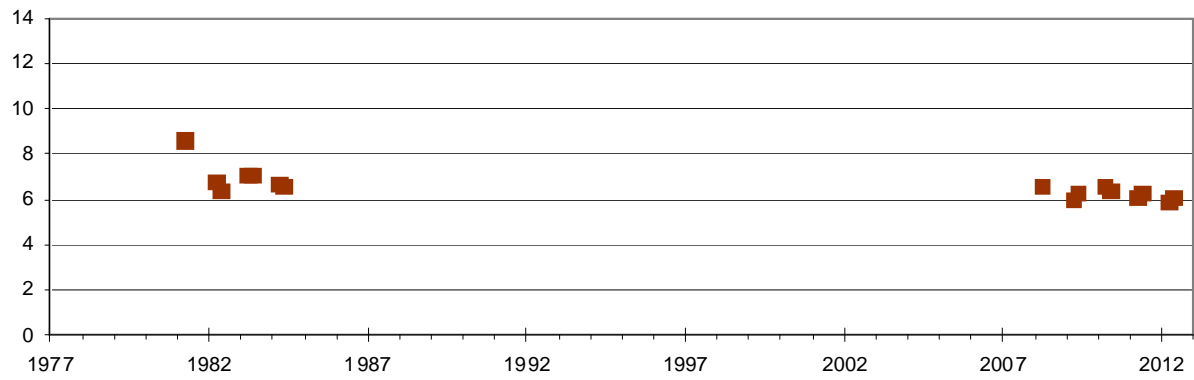
Albany 26385 is in the Albany District of the South Coast DPaW Region.

ALBANY 27157

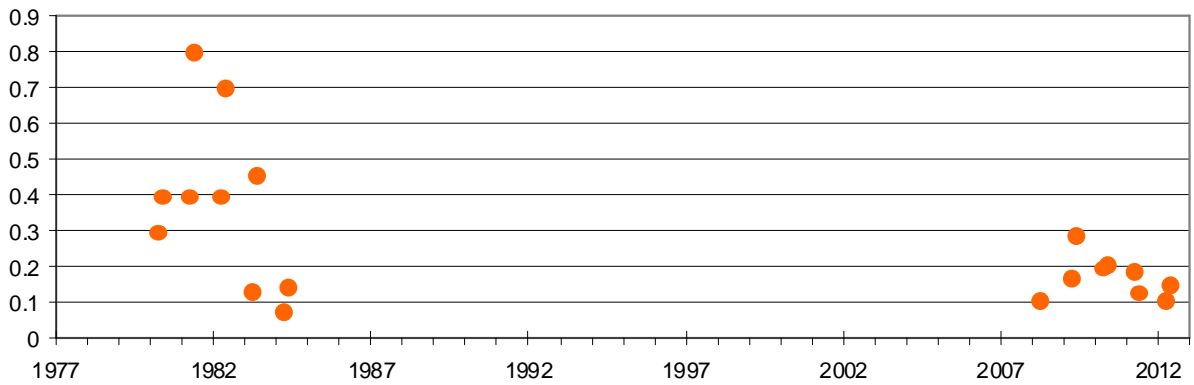
Depth mLD



pH



Salinity (ppt)



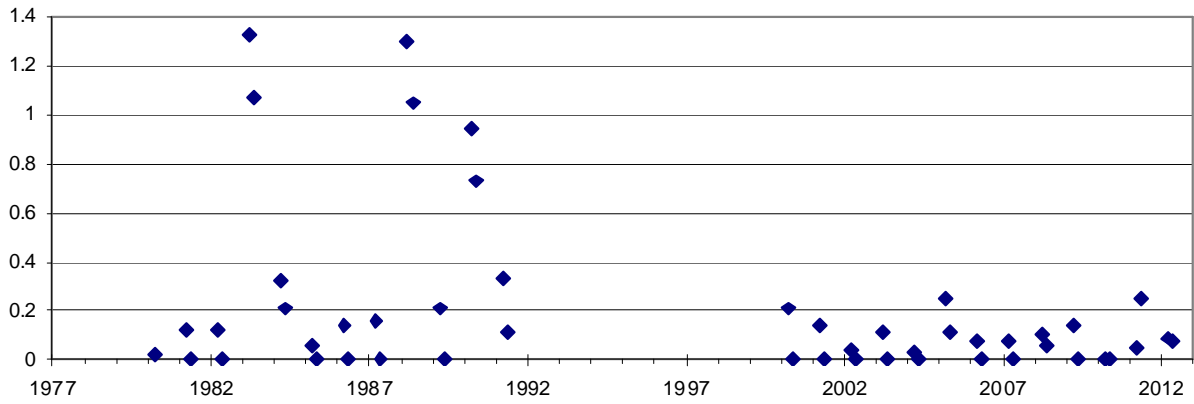
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

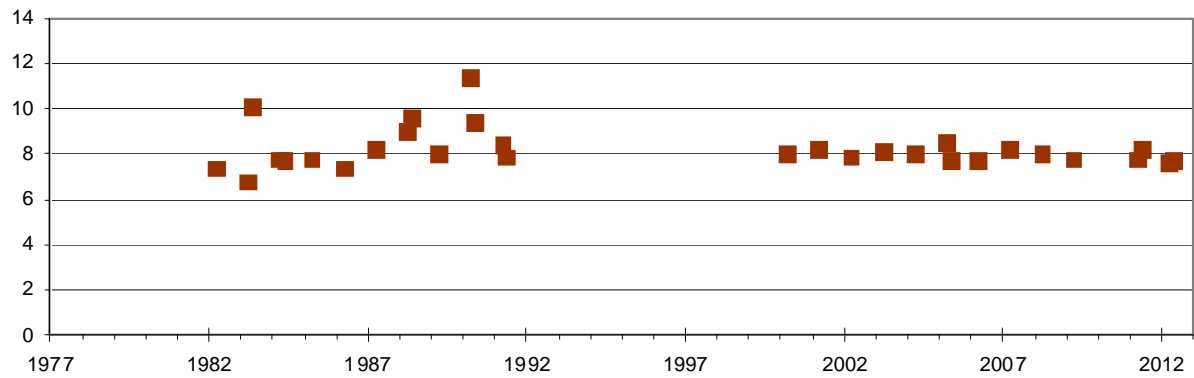
Albany 27157 is in the Albany District of the South Coast DPaW Region.

ALTHAM^{IM}

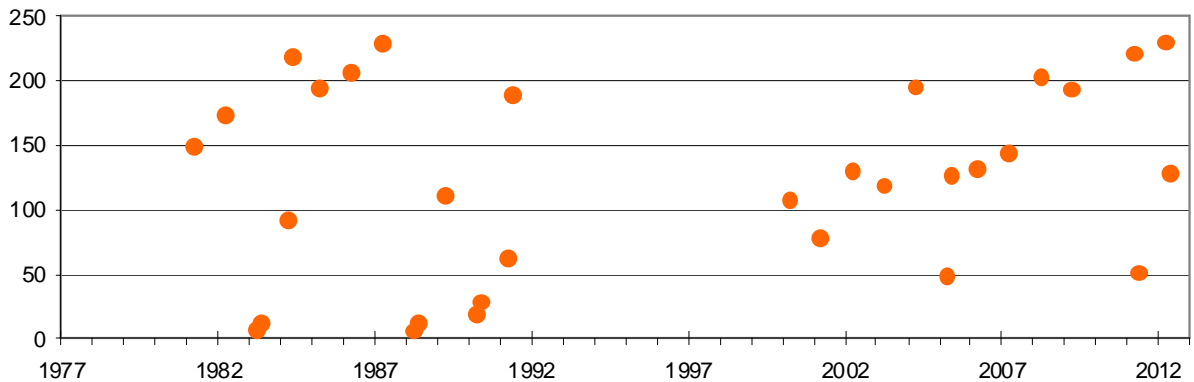
Depth mLD



pH



Salinity (ppt)



Notes:

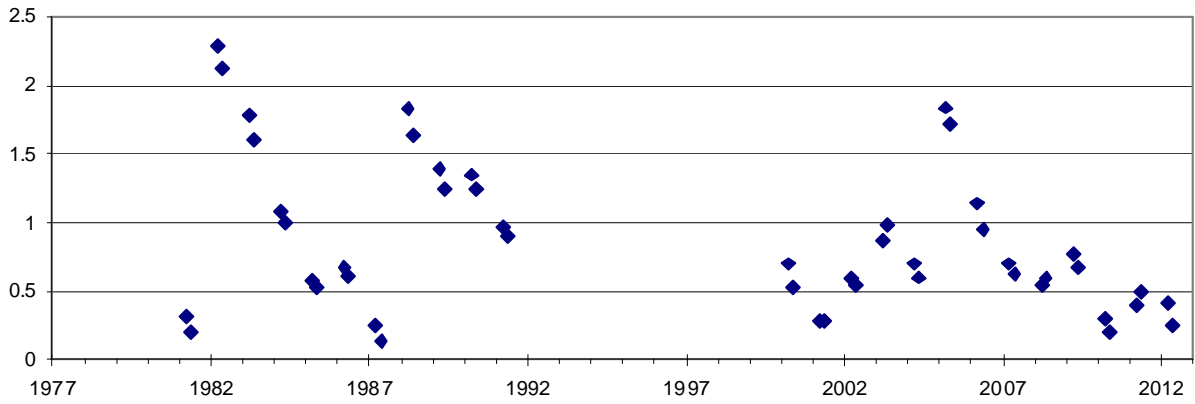
1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Altham is a component of the 'Lake Grace System', which is listed in the 'Directory of Important Wetlands in Australia'.

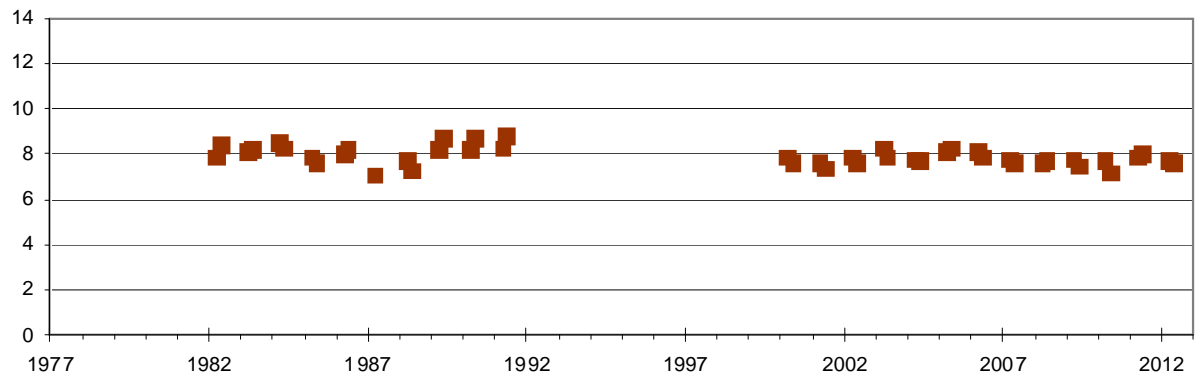
Altham is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

ANDERSON

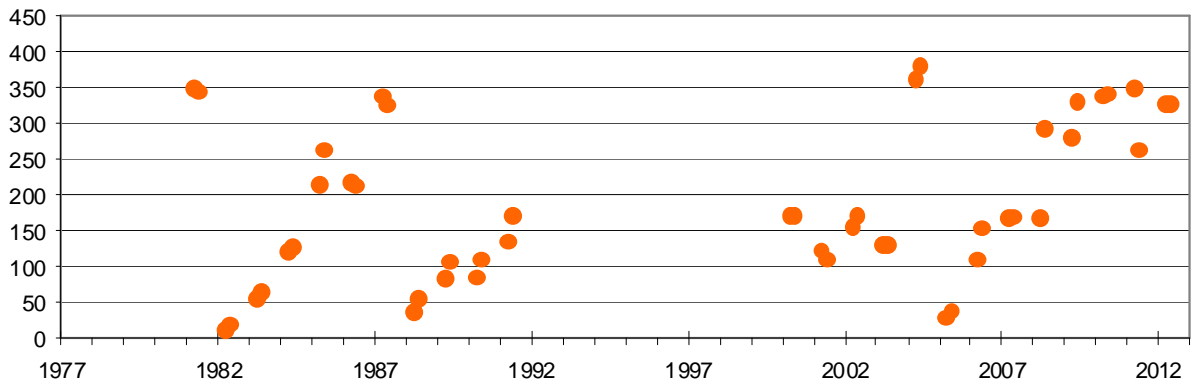
Depth mLD



pH



Salinity (ppt)



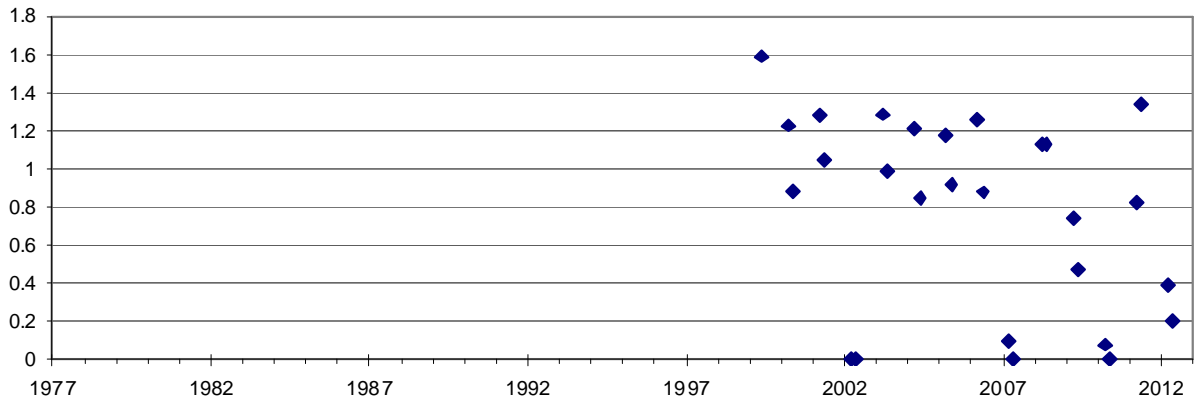
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

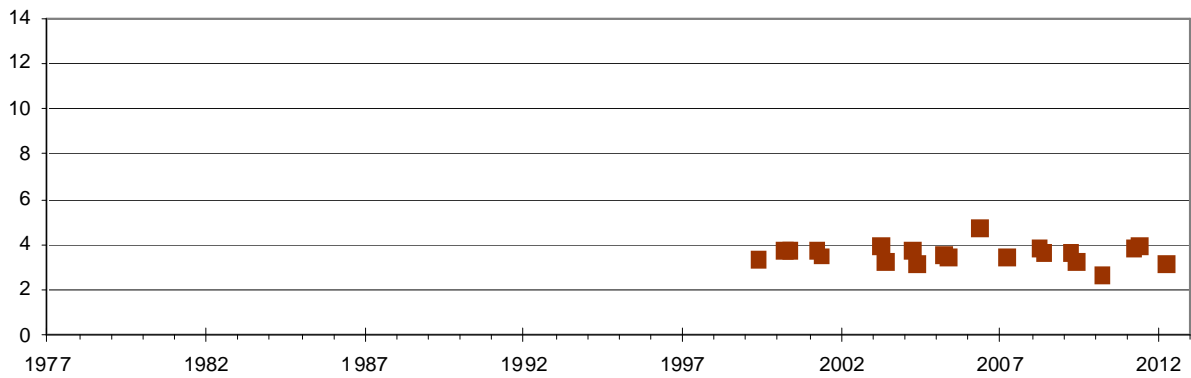
Anderson is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

ARDATH^{IM}

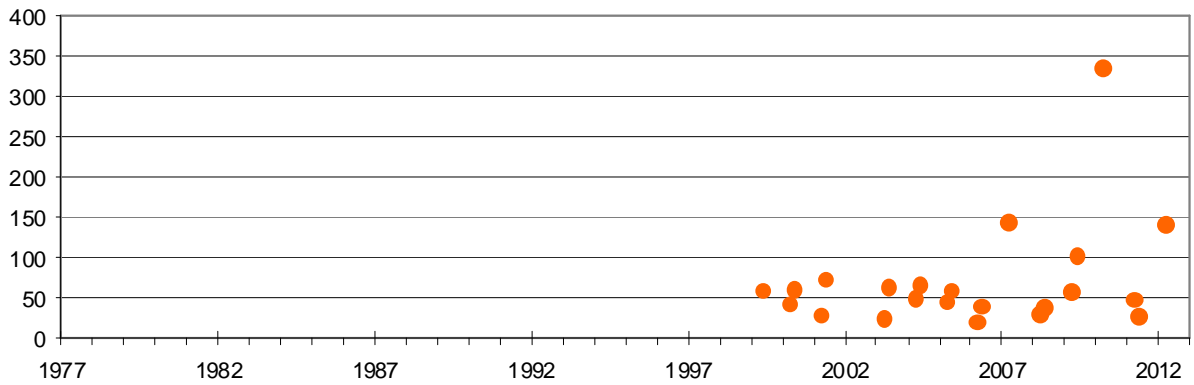
Depth mLD



pH



Salinity (ppt)



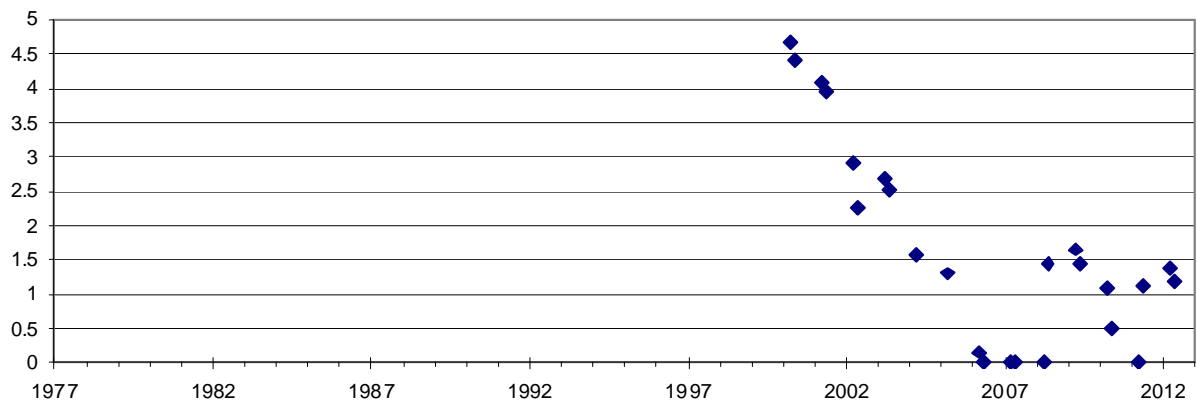
Notes:

1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

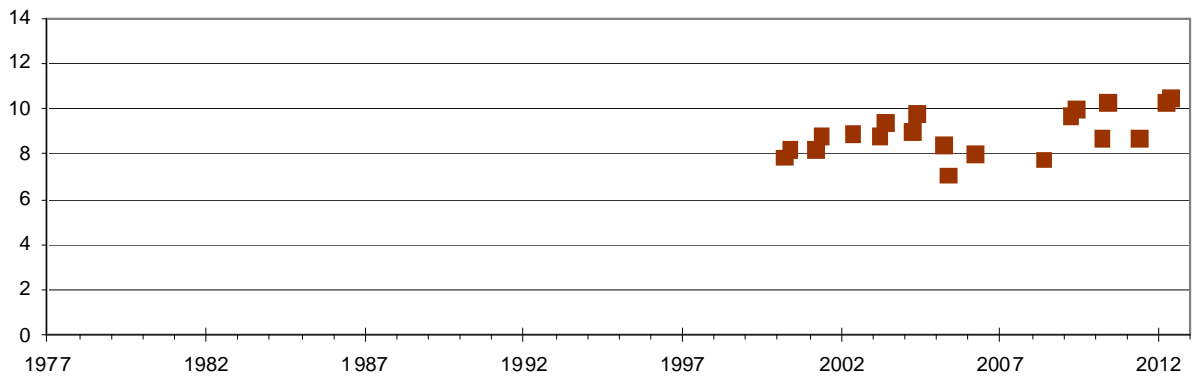
Ardath is in the Central District (headquartered in Merredin) of the Wheatbelt DPaW Region.

ATKINS YATE

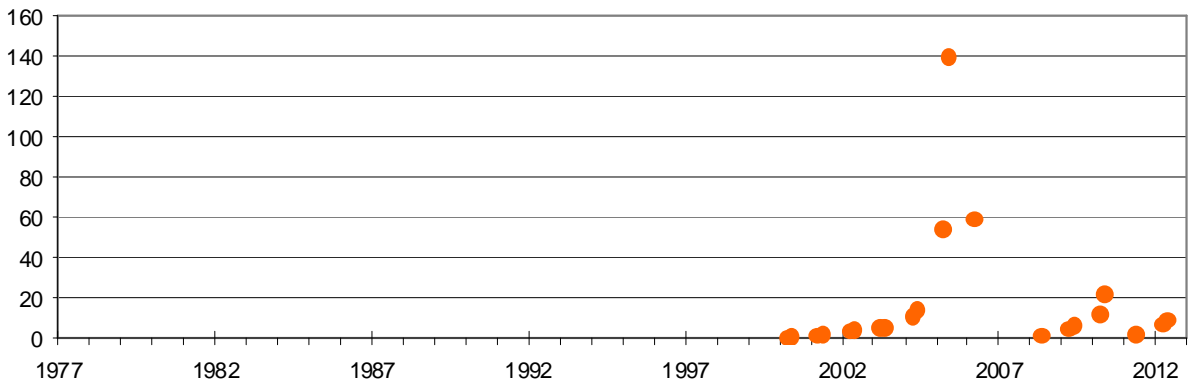
Depth mLD



pH



Salinity (ppt)



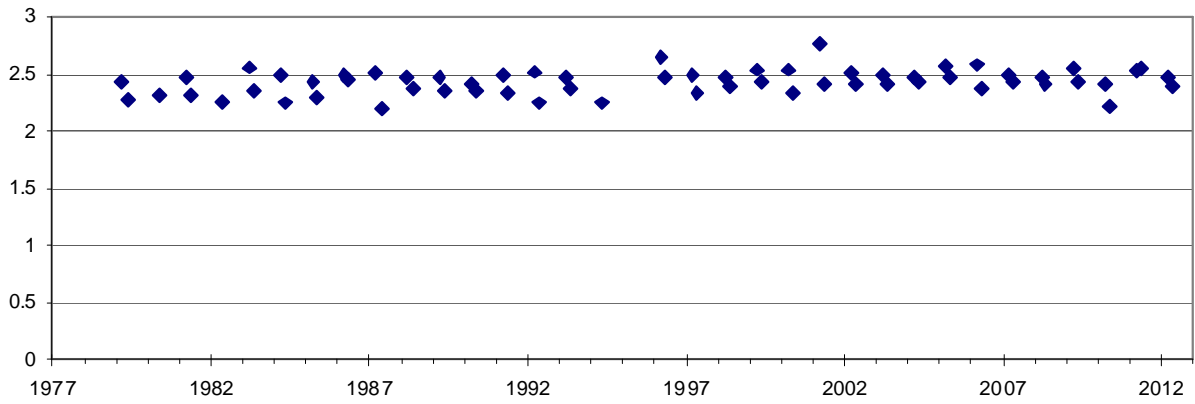
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

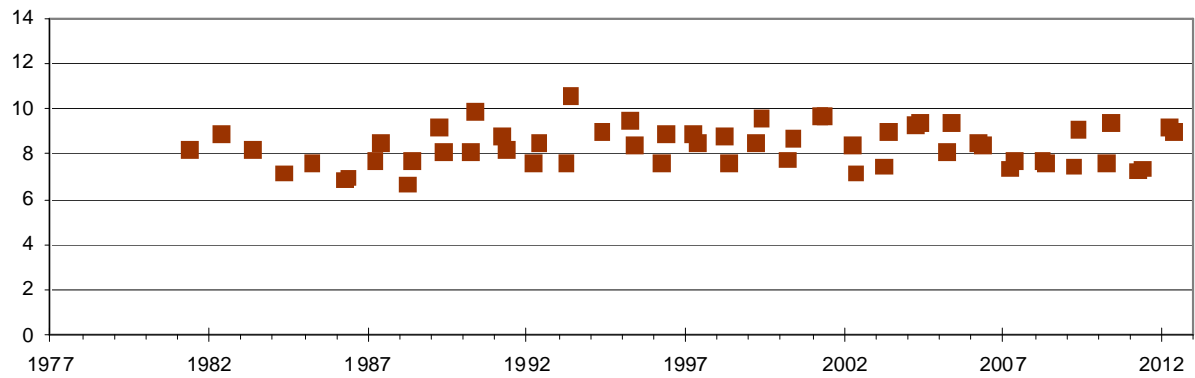
Atkins Yate is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

BAMBUN

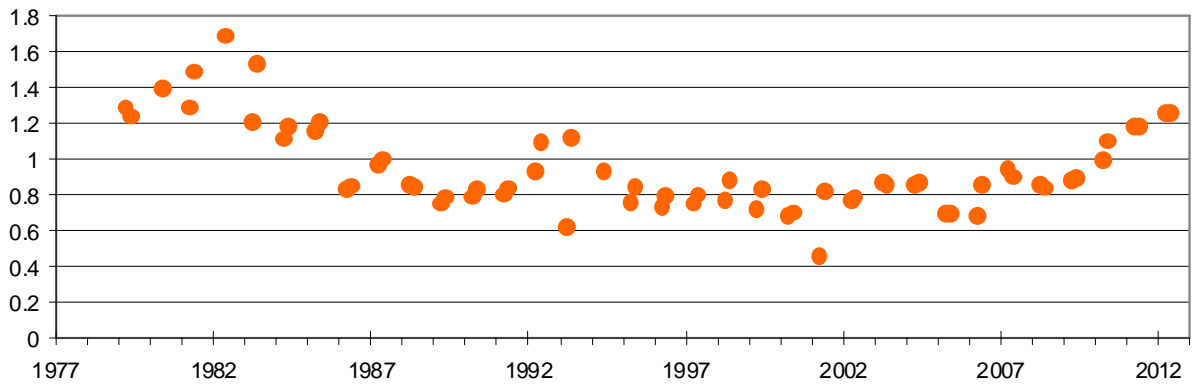
Depth mLD



pH



Salinity (ppt)



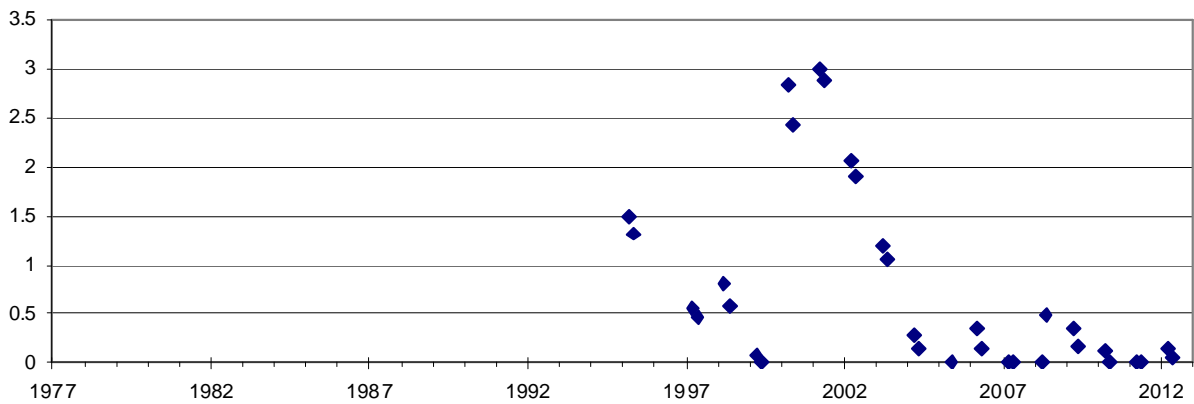
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

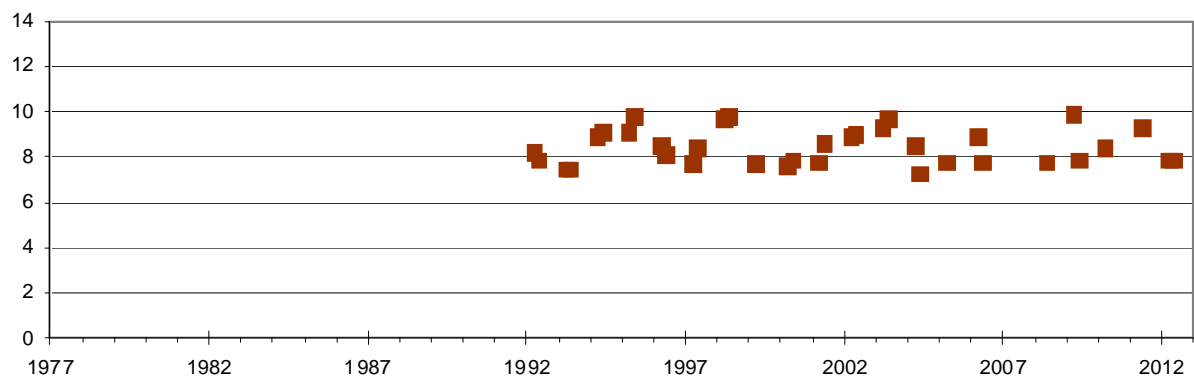
Bambun is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DPaW Region.

BENNETTS^{IM}

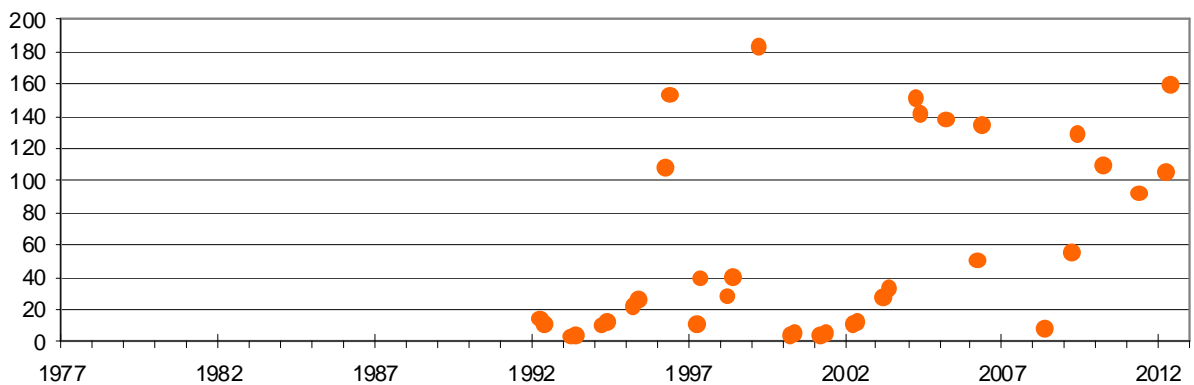
Depth mLD



pH



Salinity (ppt)



Notes:

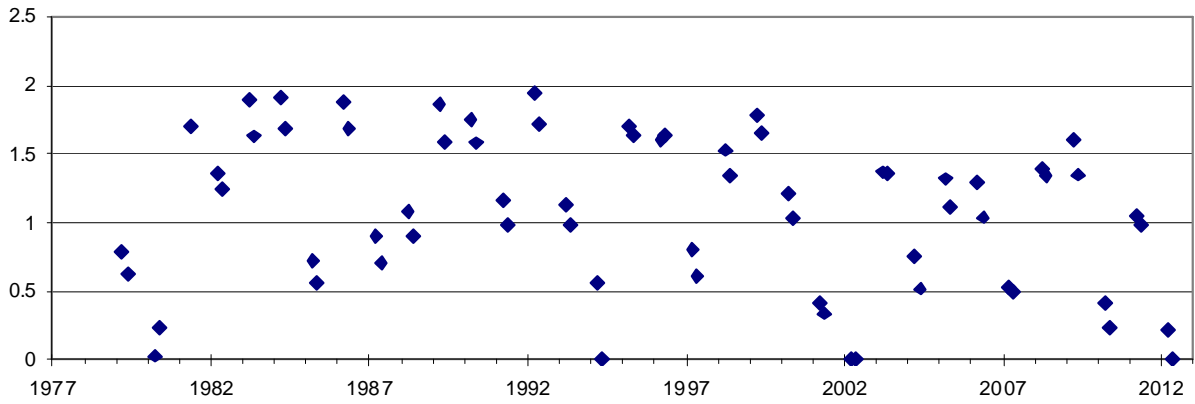
1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Bennetts Lake has been nominated for listing in the 'Directory of Important Wetlands in Australia' (Elsicot *et al.* 2009).

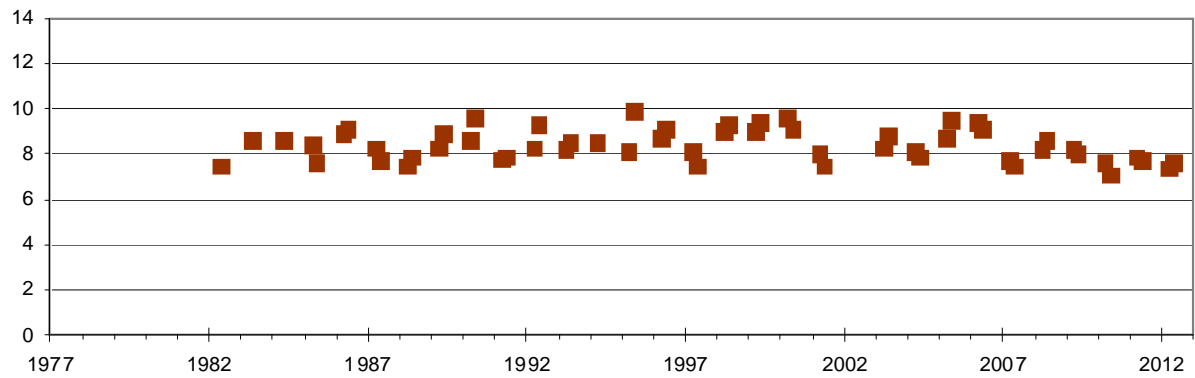
Bennetts is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

BEVERLEY

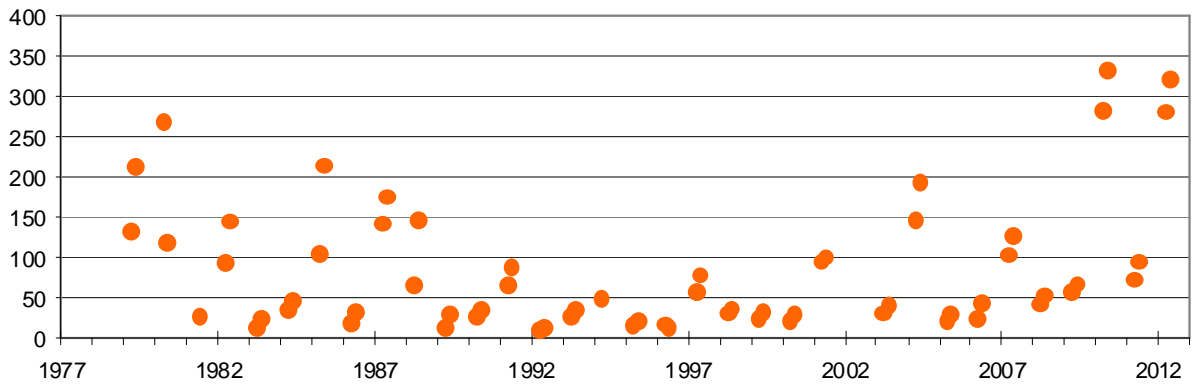
Depth mLD



pH



Salinity (ppt)



Notes:

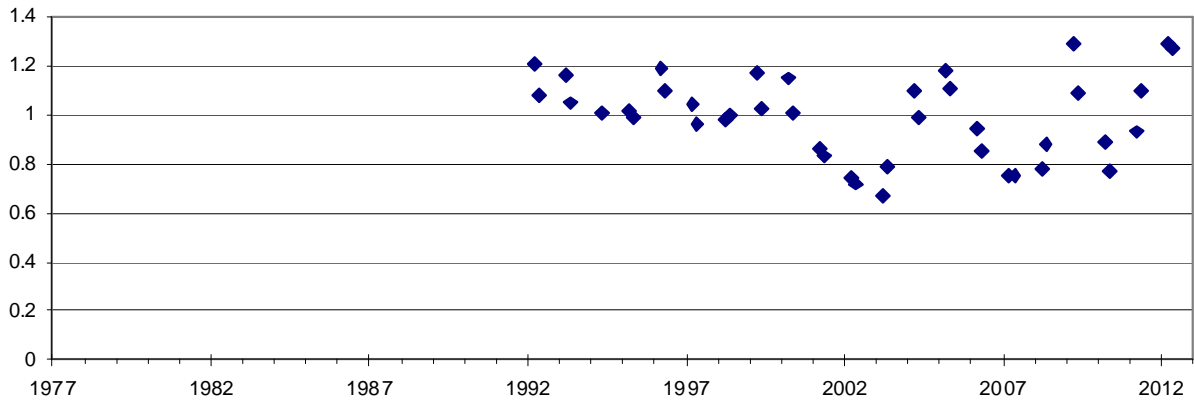
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Beverley Lakes is also known as Yenyenning Lakes.

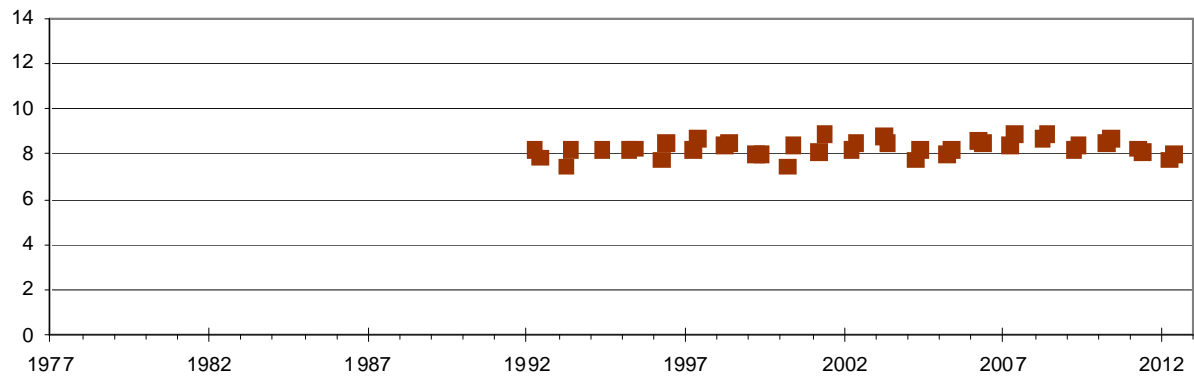
Beverley is in the Central District (headquartered in Merredin) of the Wheatbelt DPaW Region.

BOAT HARBOUR 1

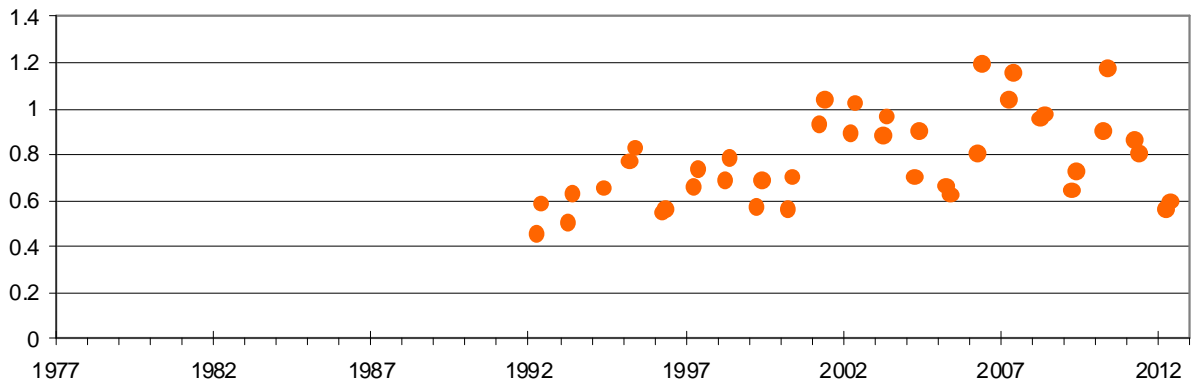
Depth mLD



pH



Salinity (ppt)



Notes:

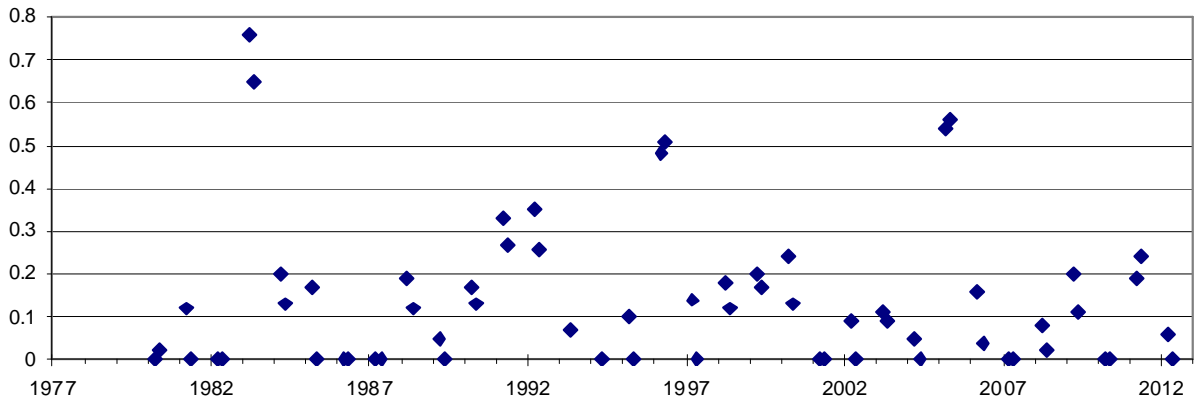
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Boat Harbour 1 is a component of the 'Owingup Swamp System', which is listed in the 'Directory of Important Wetlands in Australia'.

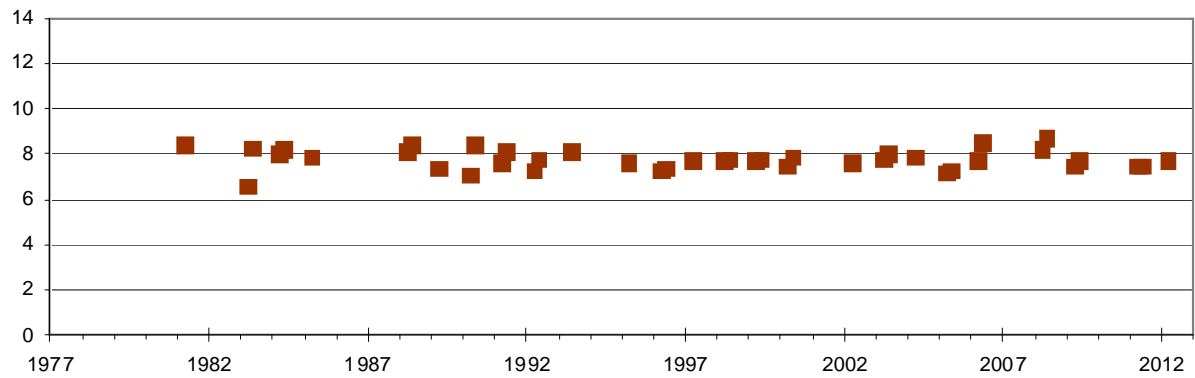
Boat Harbour 1 is in the Frankland District (headquartered in Walpole) of the Warren DPaW Region.

BOYUP BROOK 18239^{IM}

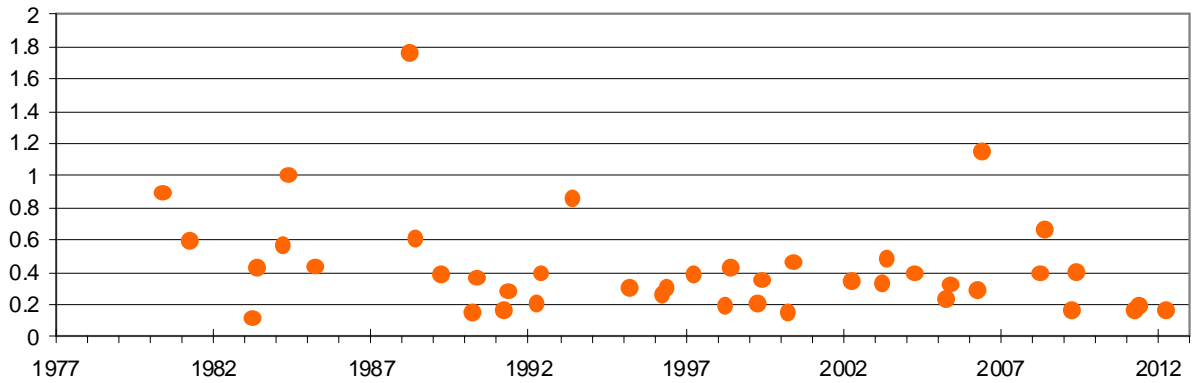
Depth mLD



pH



Salinity (ppt)



Notes:

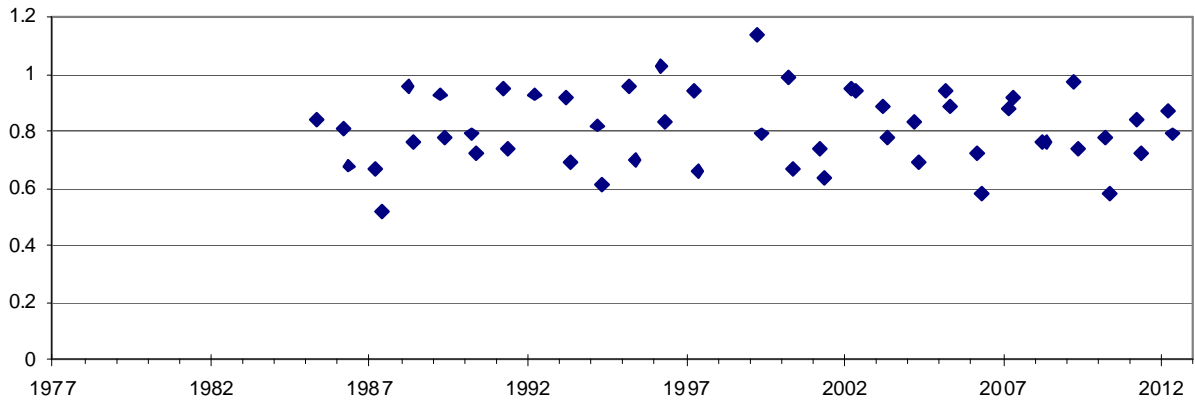
1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Boyup Brook 18239 is also known as Kulicup Swamp.

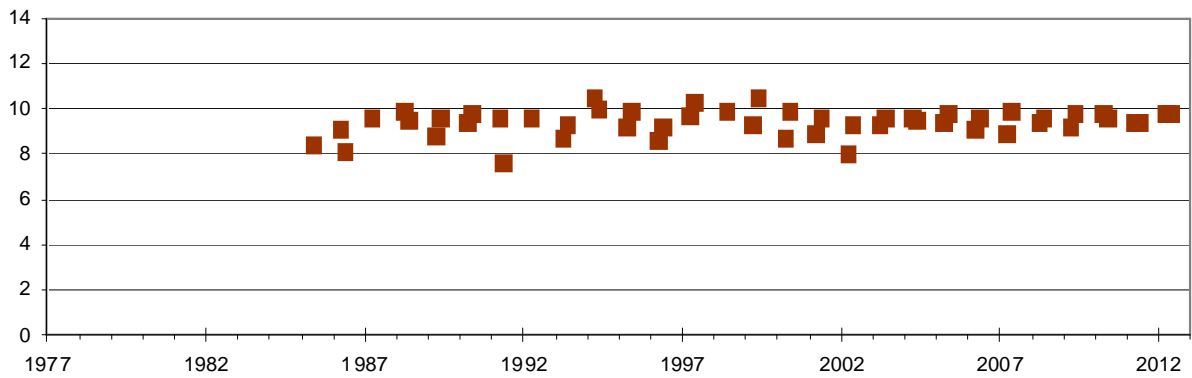
Boyup Brook 18239 is in the Blackwood District (headquartered in Busselton) of the South West DPaW Region.

BROADWATER

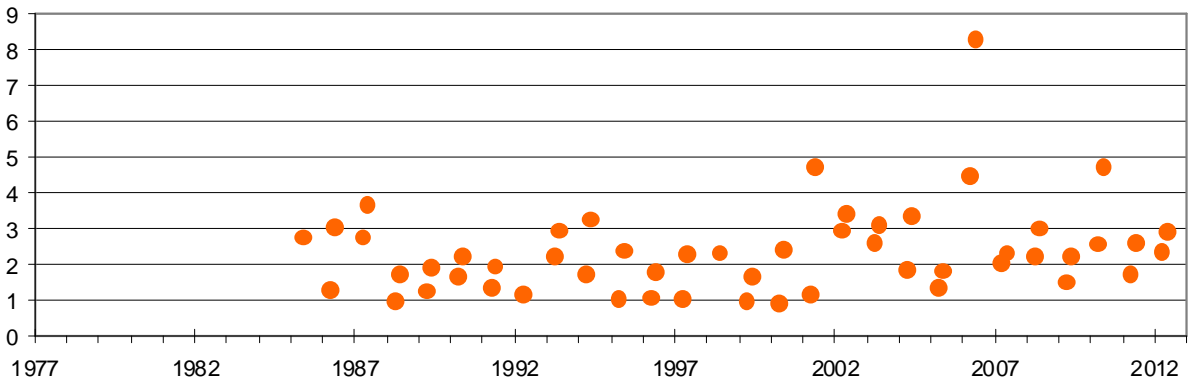
Depth mLD



pH



Salinity (ppt)



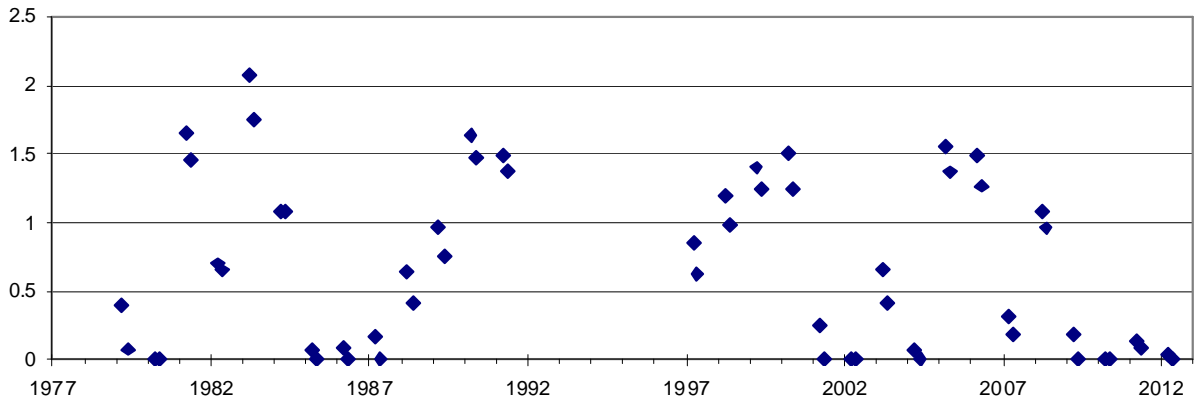
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

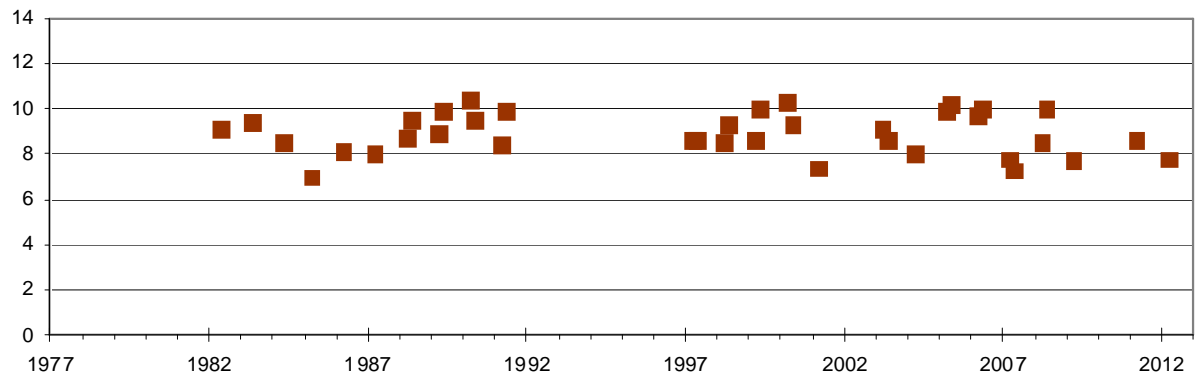
Broadwater is in the Blackwood District (headquartered in Busselton) of the South West DPaW Region.

BROWN

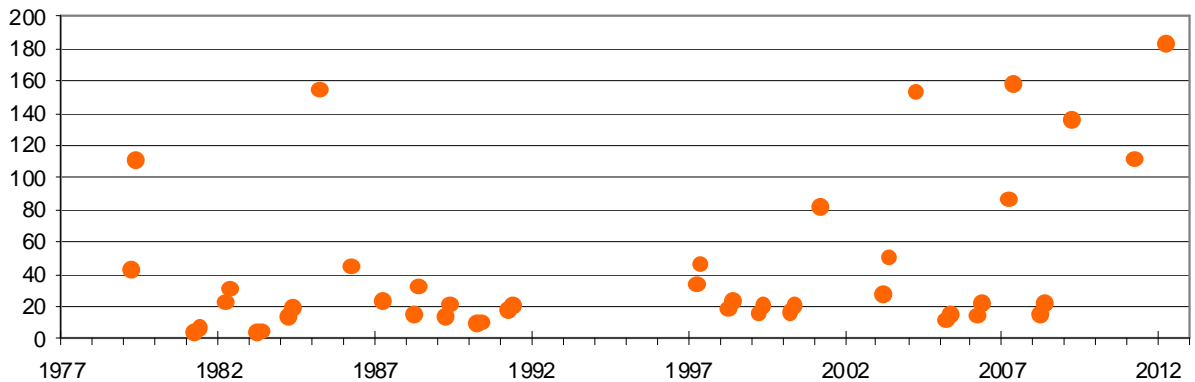
Depth mLD



pH



Salinity (ppt)



Notes:

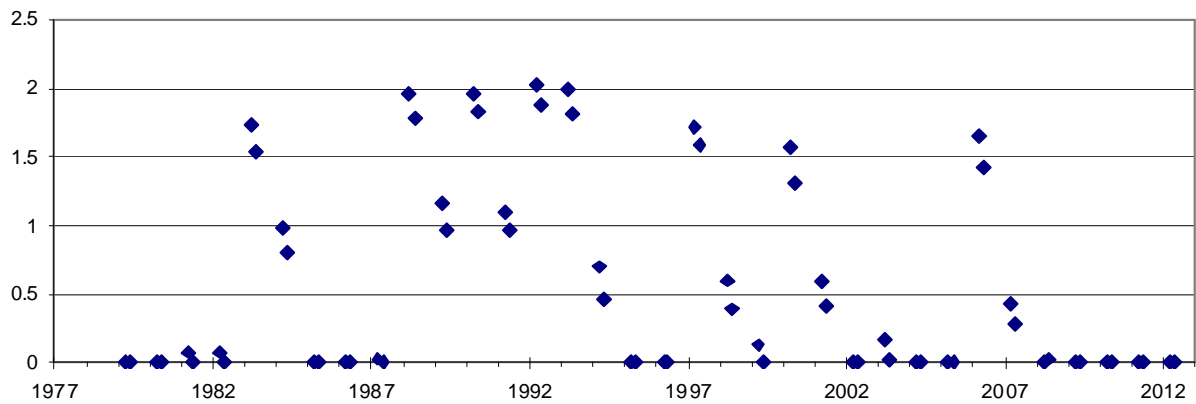
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Brown is a component of the 'Yealering Lakes System', which is listed in the 'Directory of Important Wetlands in Australia'.

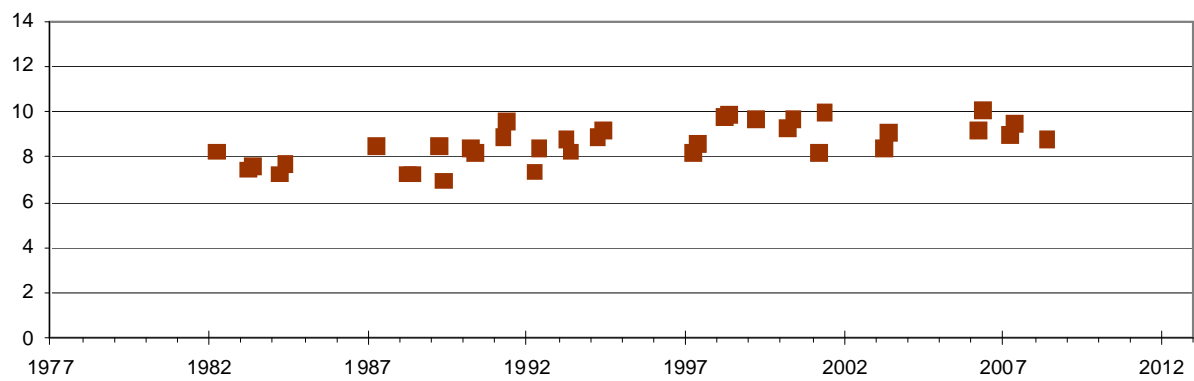
Brown is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

BRYDE ^{IM}

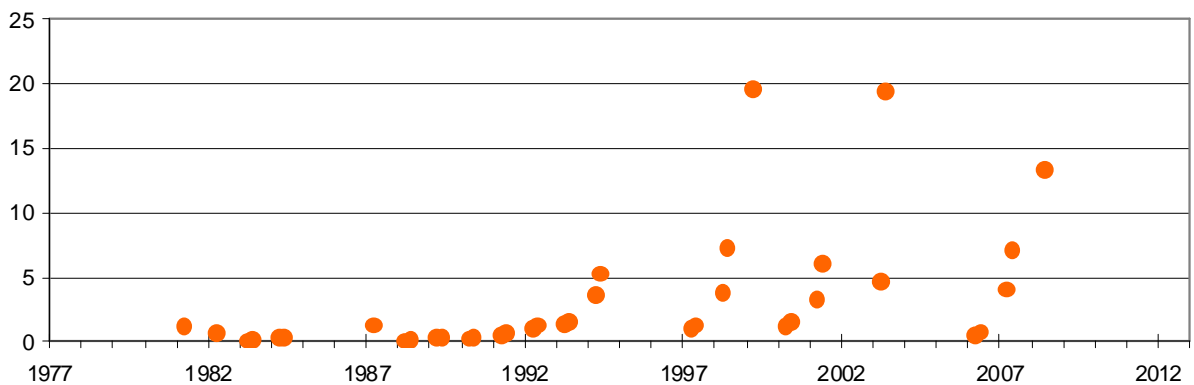
Depth mLD



pH



Salinity (ppt)



Notes:

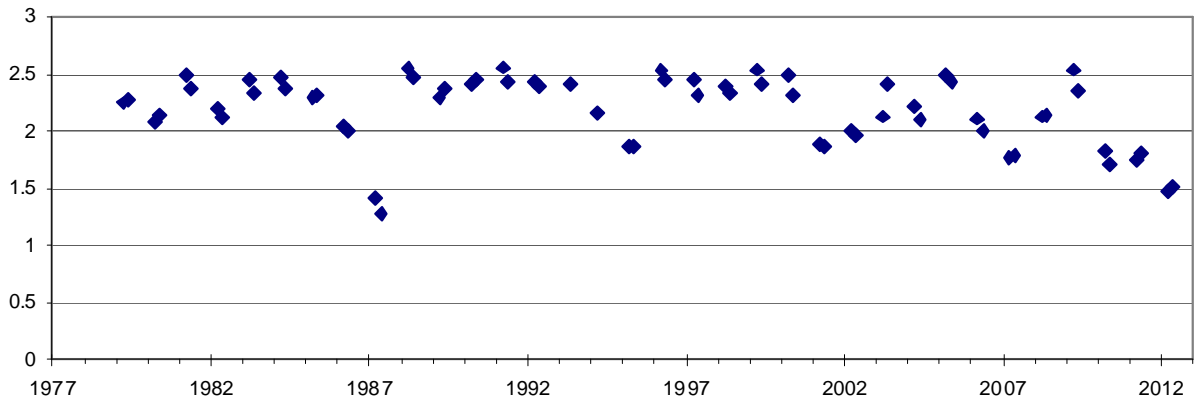
1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Bryde is part of the 'Lake Bryde – East Lake Bryde System' listed in the 'Directory of Important Wetlands in Australia'.

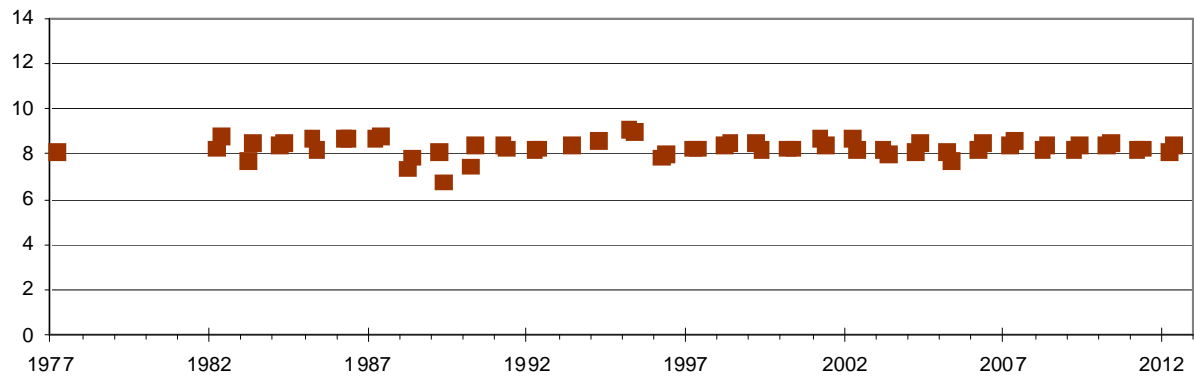
Bryde is within the Lake Bryde Natural Diversity Recovery Catchment and is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaw Region.

BYENUP

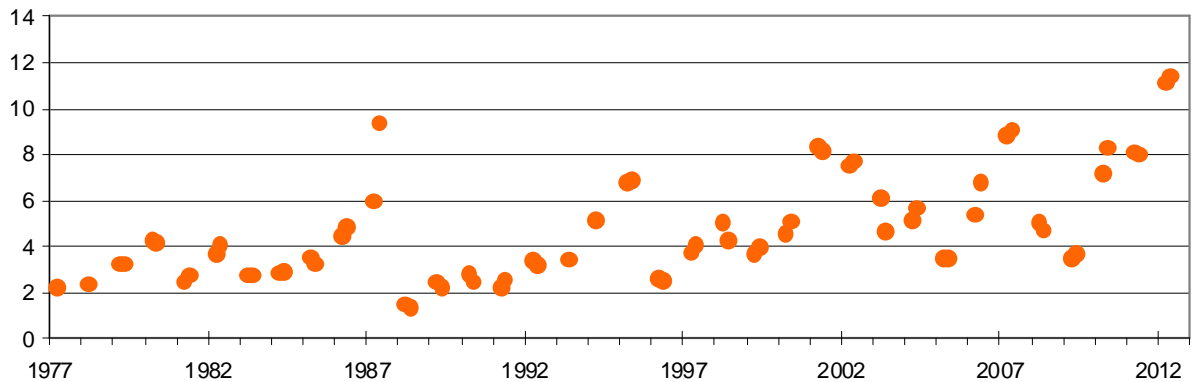
Depth mLD



pH



Salinity (ppt)



Notes:

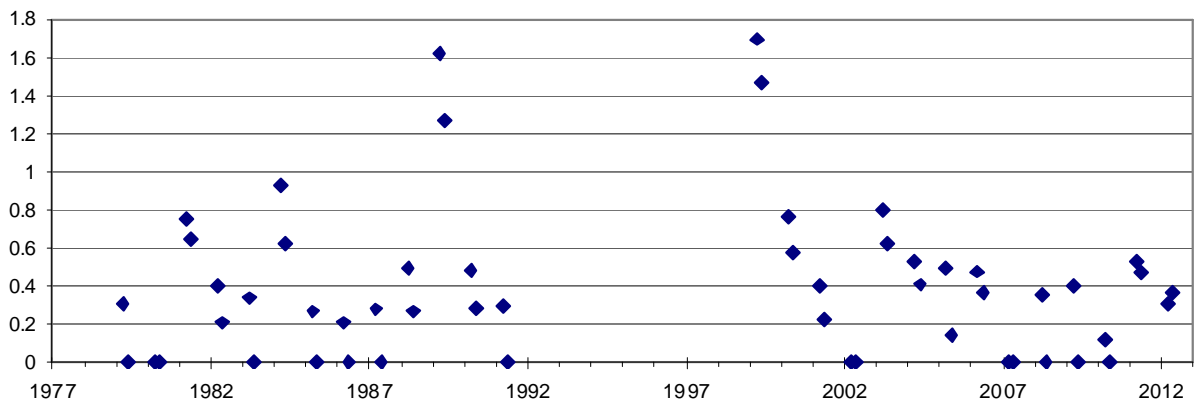
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Byenup is a component of the 'Muir-Byenup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands, and is also part of the 'Byenup Lagoon System' listed in the 'Directory of Important Wetlands in Australia'.

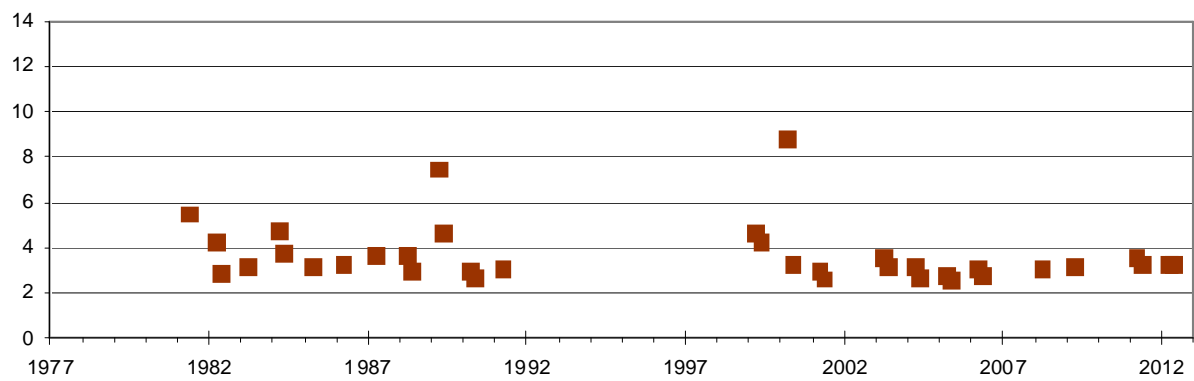
Byenup is within the Muir-Unicup Natural Diversity Recovery Catchment and is in the Donnelly District (headquartered in Pemberton) of the Warren DPaW Region.

CAMPION^{IM}

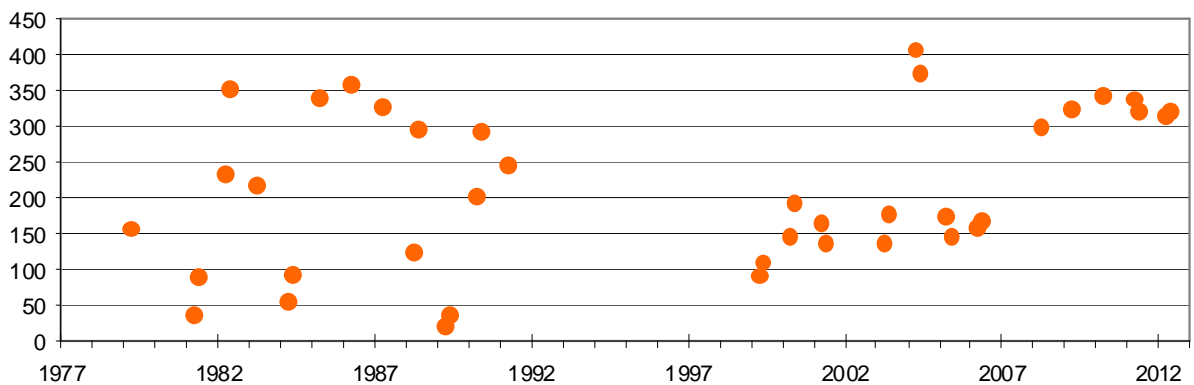
Depth mLD



pH



Salinity (ppt)



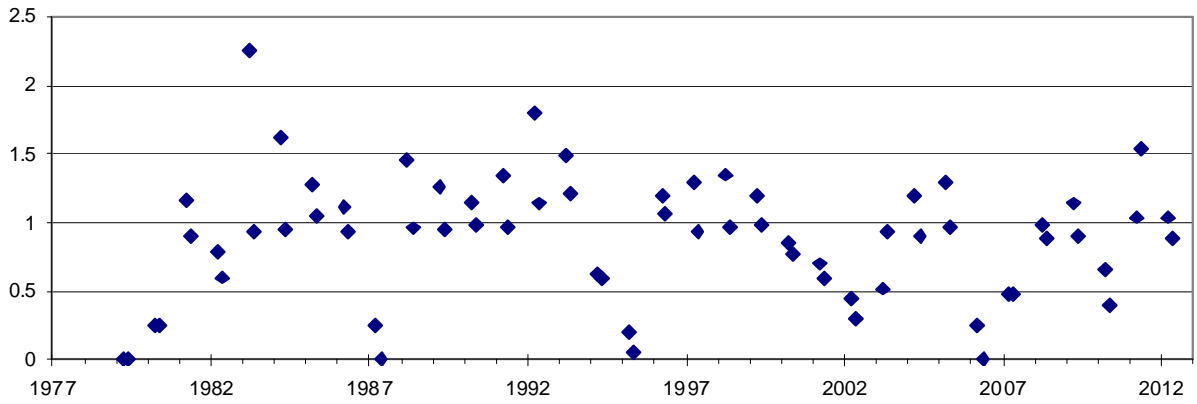
Notes:

1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

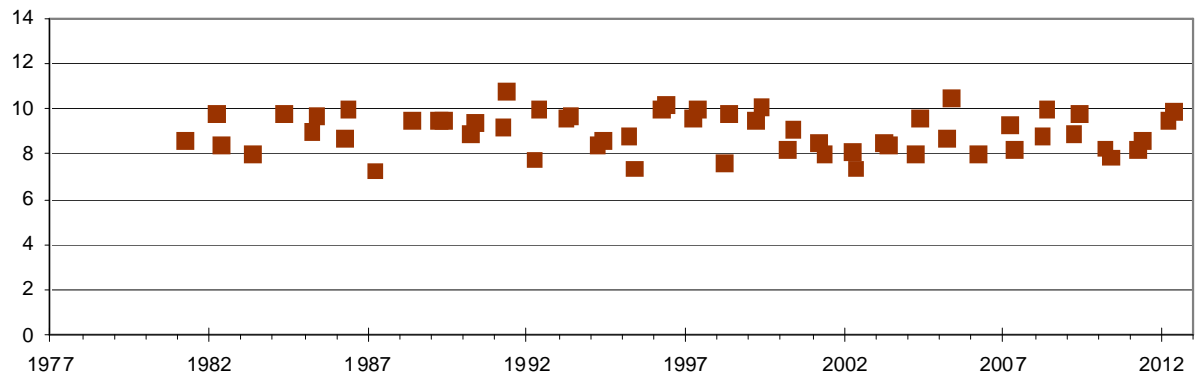
Campion is in the Central District (headquartered in Merredin) of the Wheatbelt DPaW Region.

CASUARINA

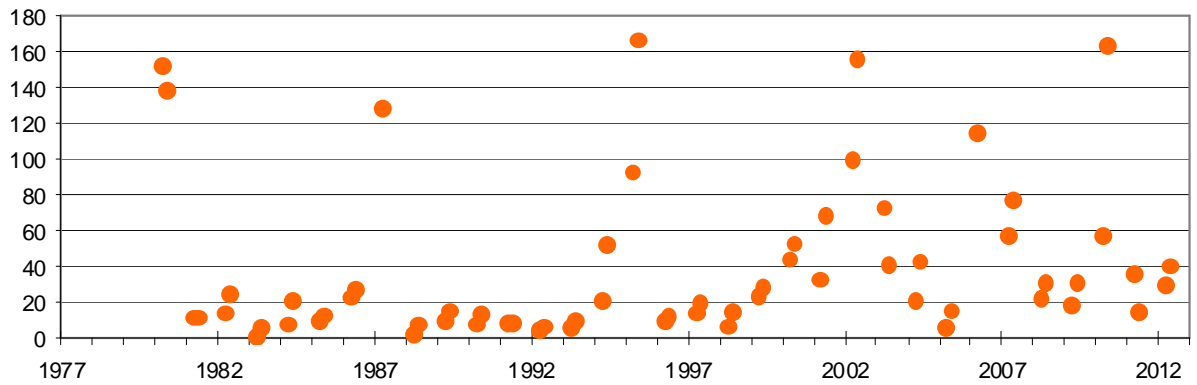
Depth mLD



pH



Salinity (ppt)



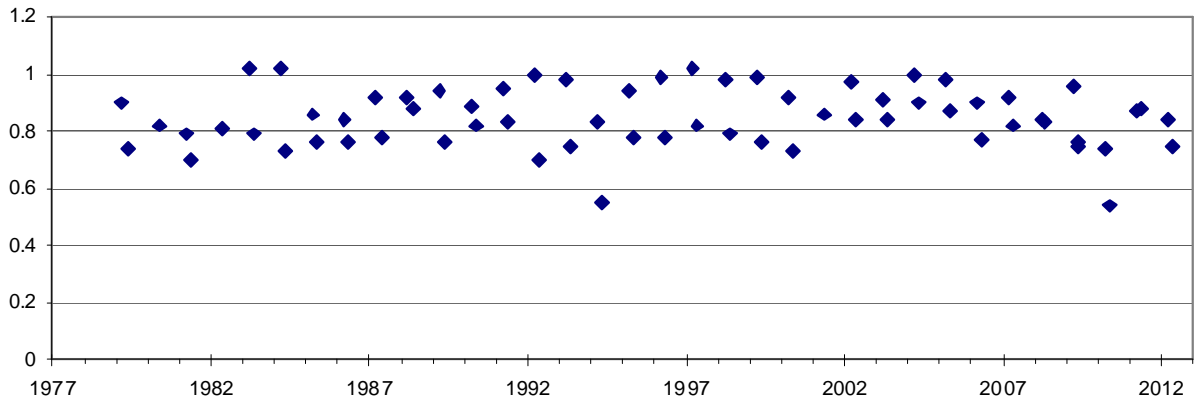
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

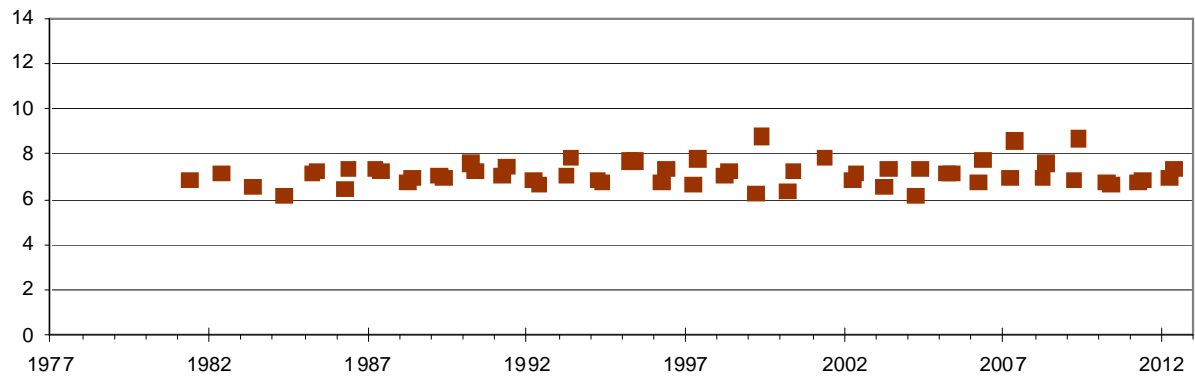
Casuarina is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

CHANDALA

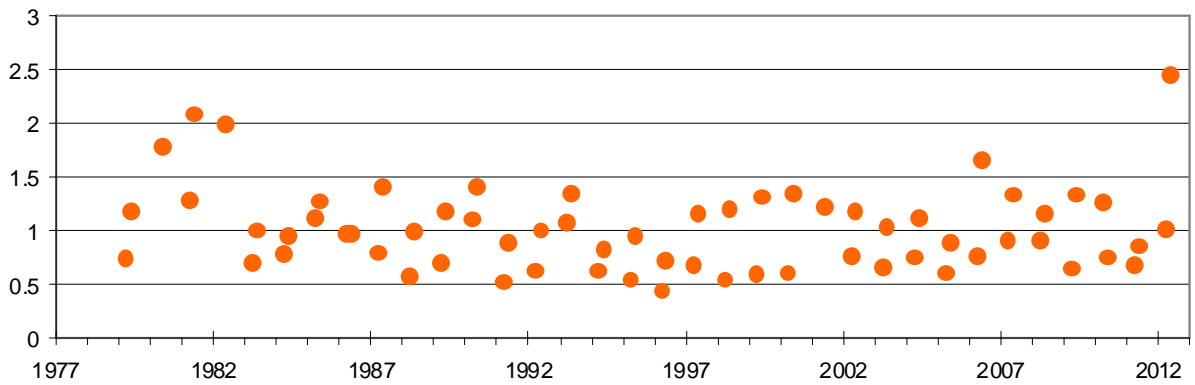
Depth mLD



pH



Salinity (ppt)



Notes:

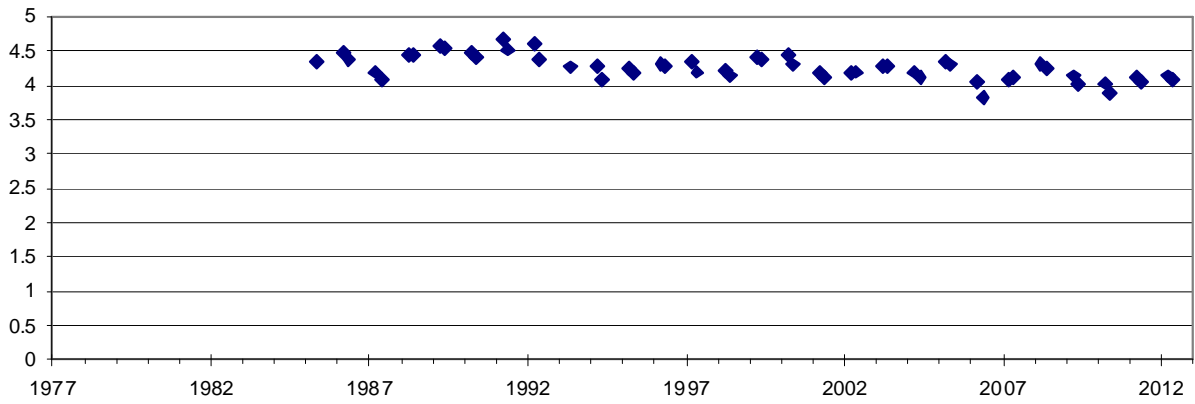
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Chandala Swamp is listed in the 'Directory of Important Wetlands in Australia'.

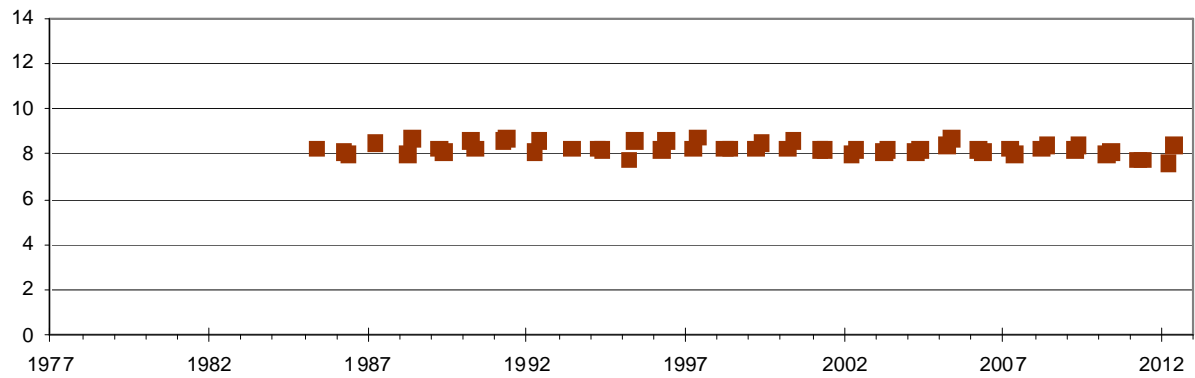
Chandala is in the Perth Hills District (headquartered in Mundaring) of the Swan DPaW Region.

CLIFTON (with Depth axis 0-5m)

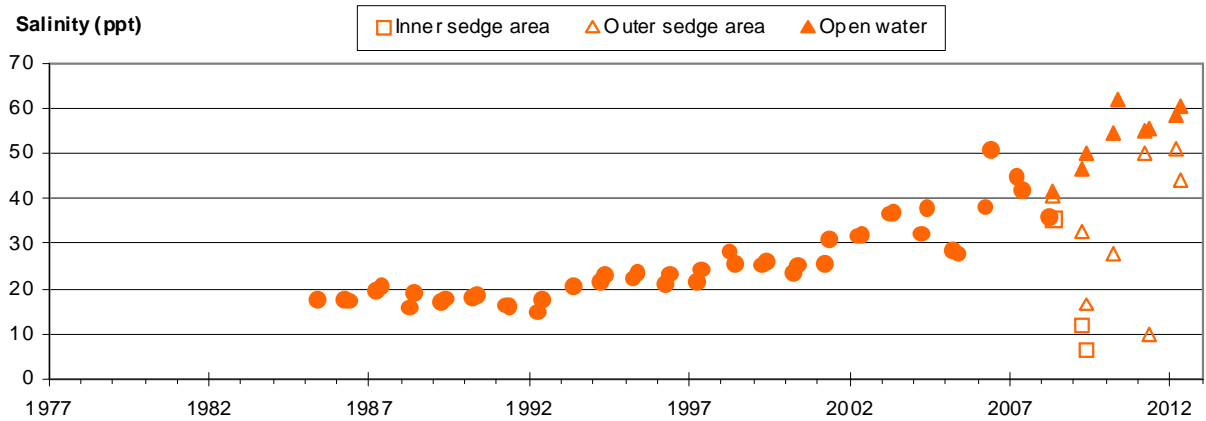
Depth mLD



pH



Salinity (ppt)



Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

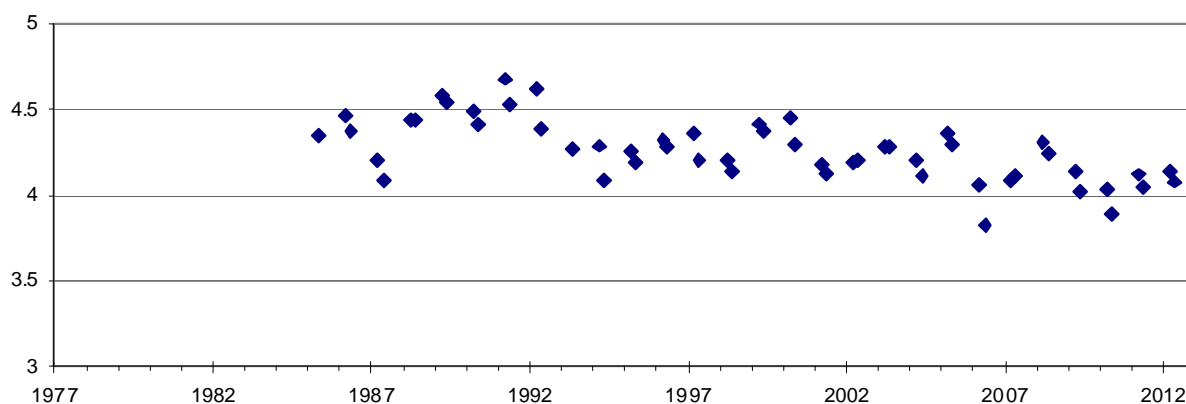
Clifton is a component of the 'Peel-Yalgorup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

Clifton is also a component of the 'Yalgorup Lakes System', which is listed in the 'Directory of Important Wetlands in Australia'.

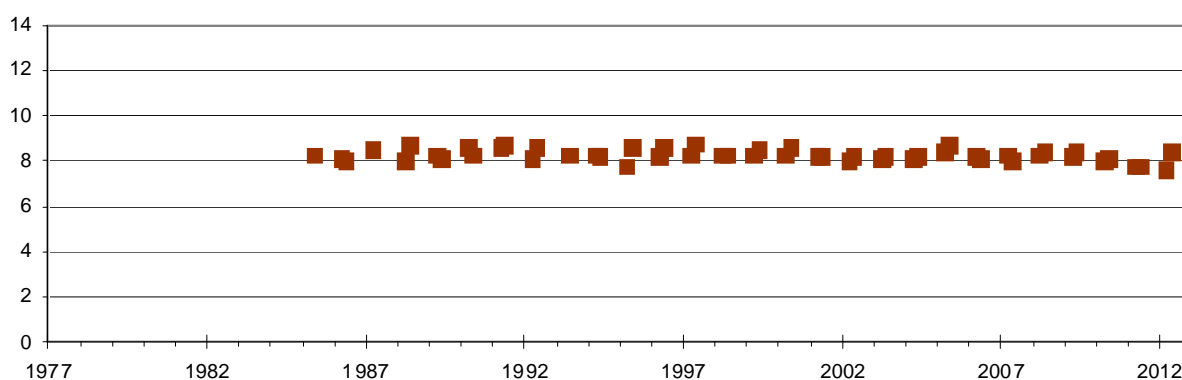
Clifton is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DPaW Region.

CLIFTON (with Depth axis 3-5m)

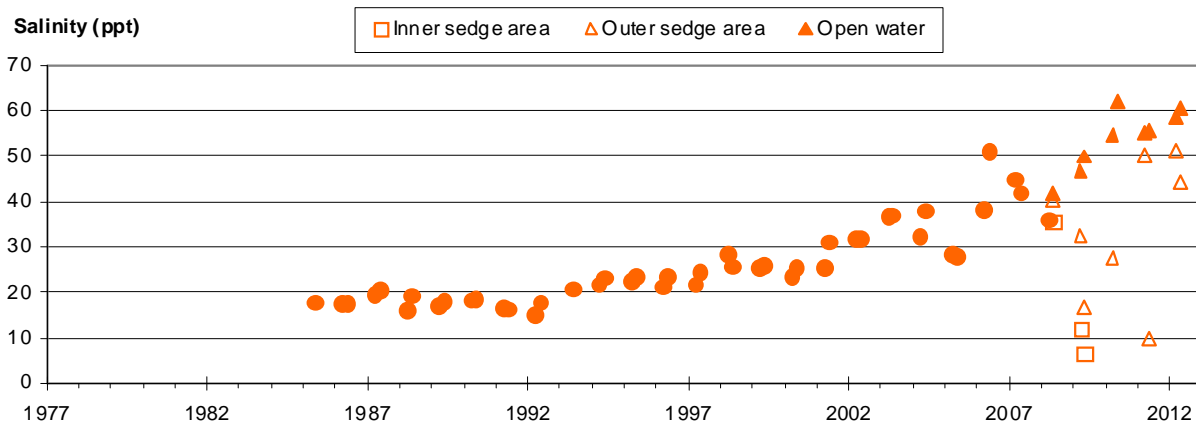
Depth mLD



pH



Salinity (ppt)



Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

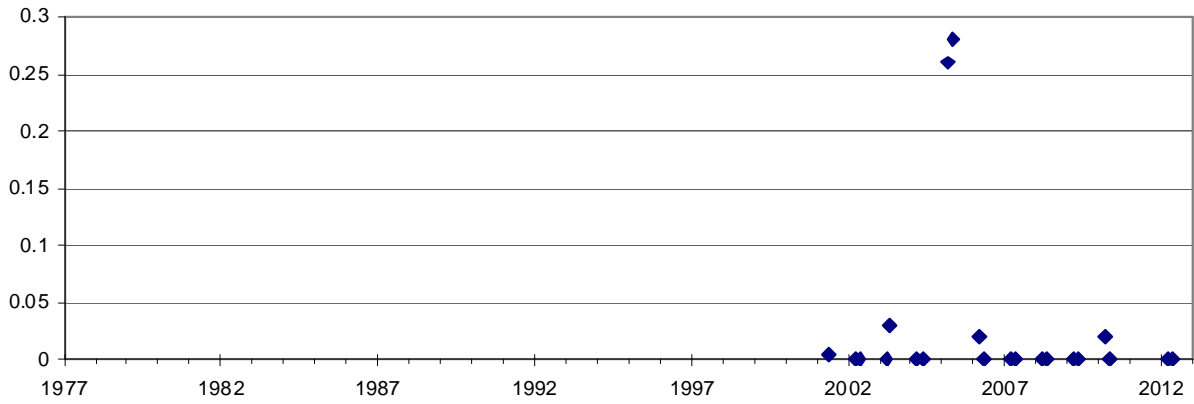
Clifton is a component of the 'Peel-Yalgorup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

Clifton is also a component of the 'Yalgorup Lakes System', which is listed in the 'Directory of Important Wetlands in Australia'.

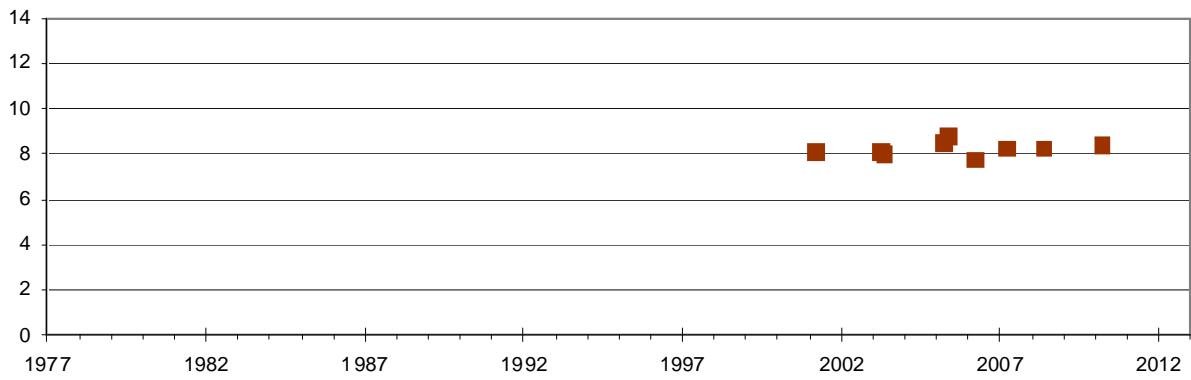
Clifton is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DPaW Region.

COLLETS ROAD

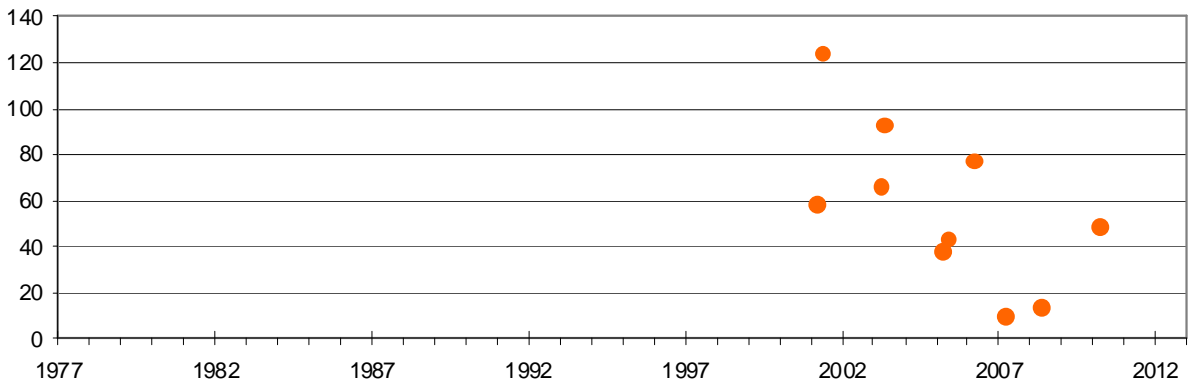
Depth mLD



pH



Salinity (ppt)



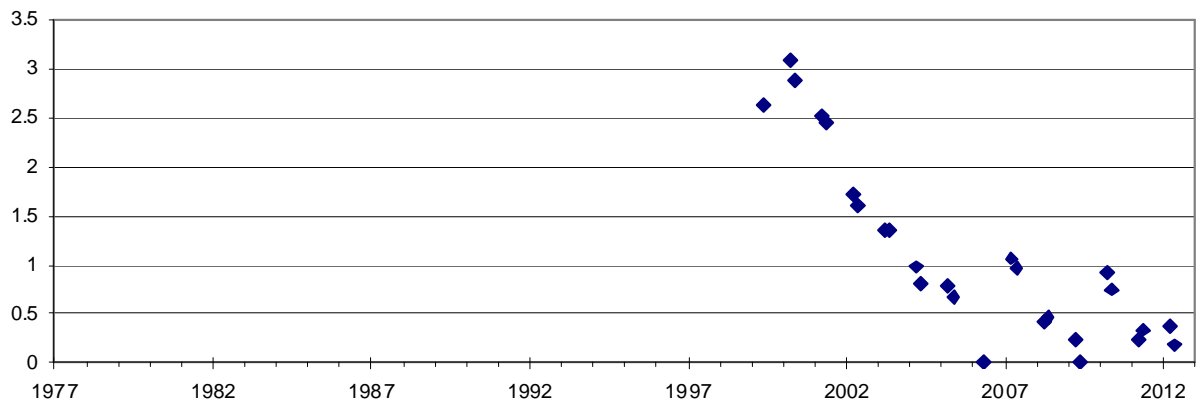
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

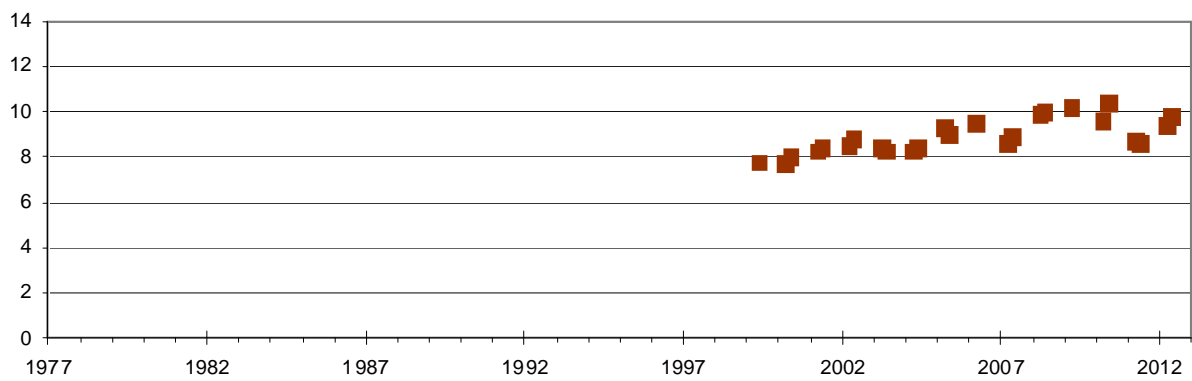
Colletts Road Swamp is in the Albany District of the South Coast DPaW Region

COOMALBIDGUP^{IM}

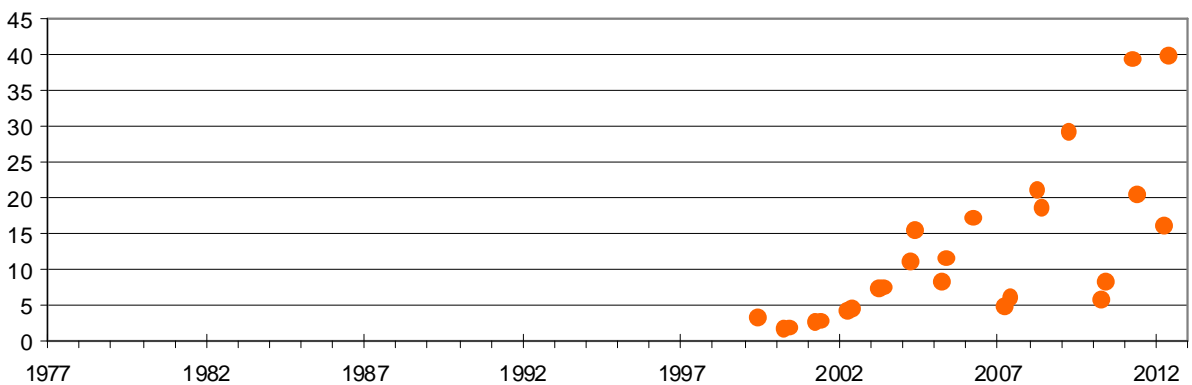
Depth mLD



pH



Salinity (ppt)



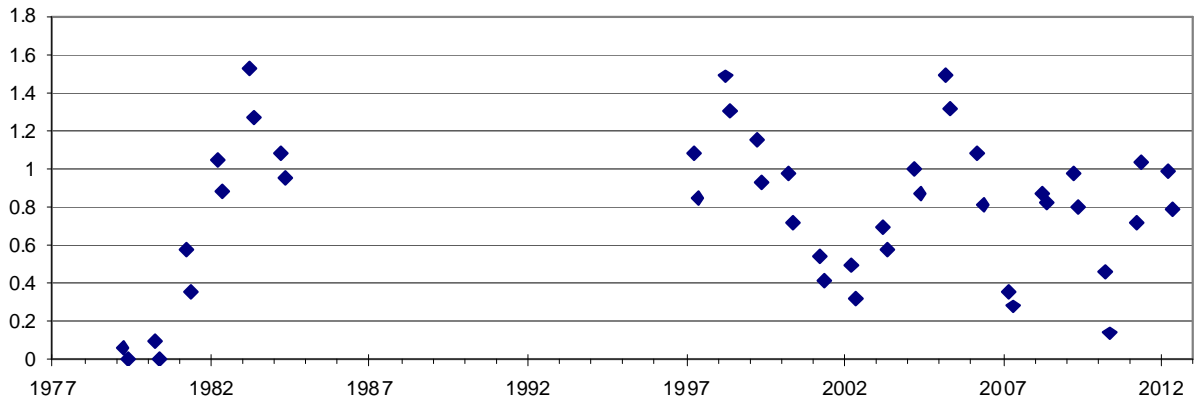
Notes:

1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

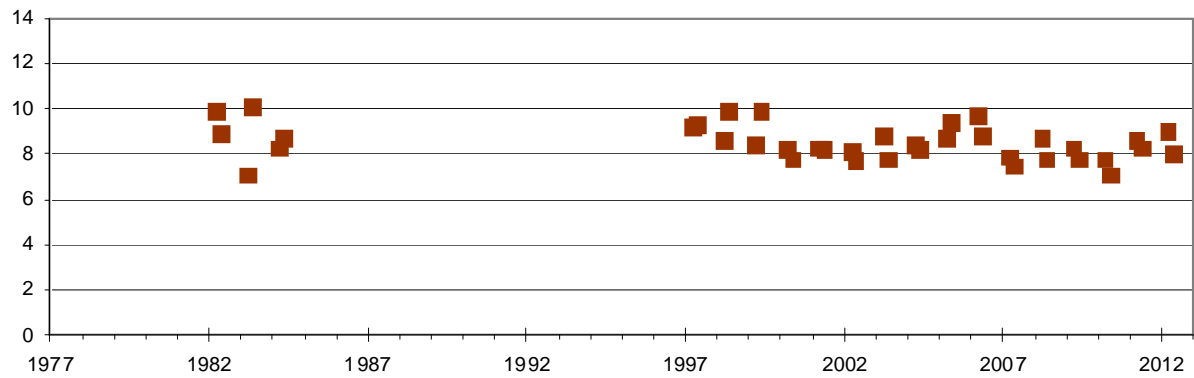
Coomalbidgup is in the Esperance District of the South Coast DPaW Region.

COOMELBERRUP^{IM}

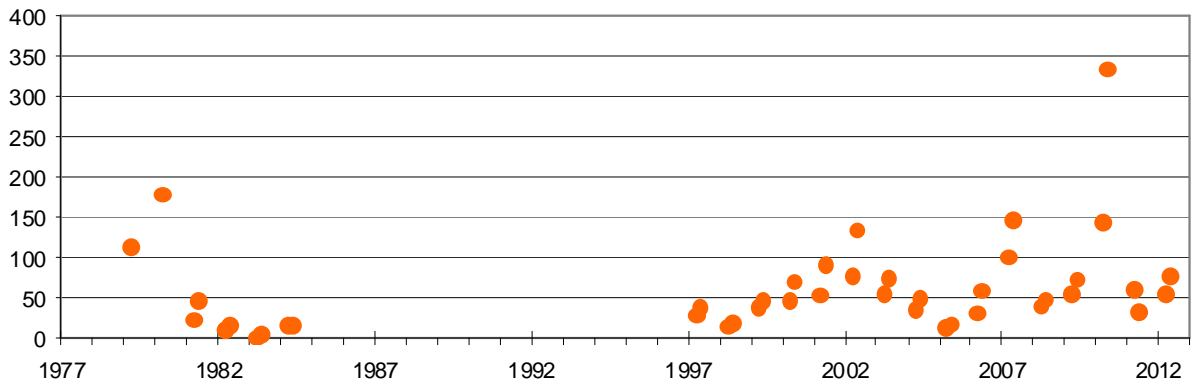
Depth mLD



pH



Salinity (ppt)



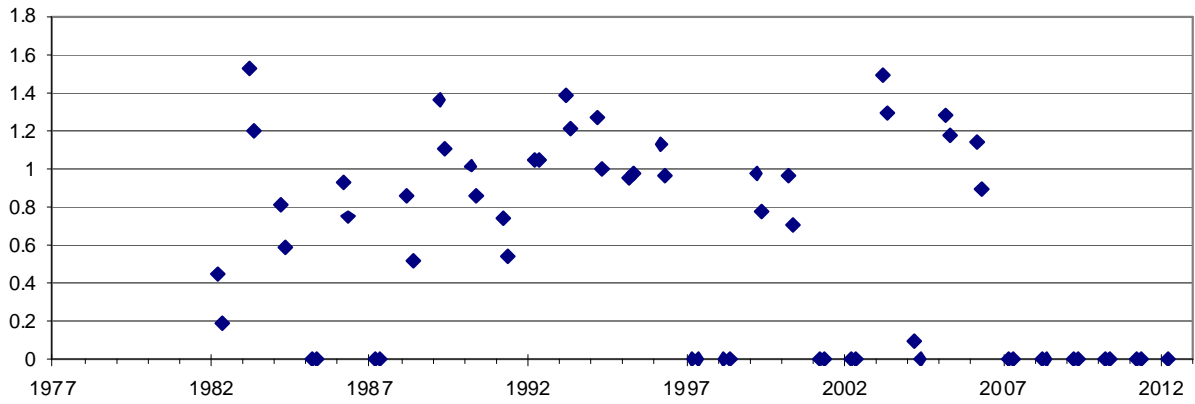
Notes:

1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

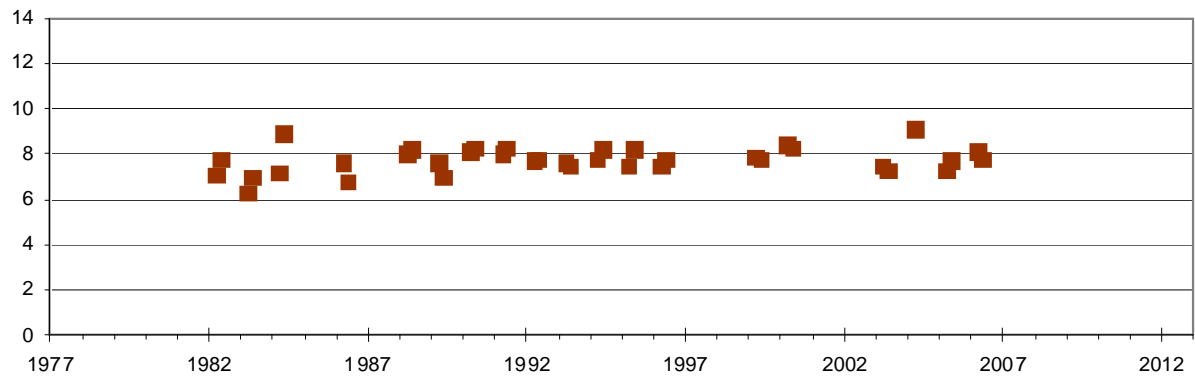
Coomelberrup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaw Region.

CORRIGIN 12900^{IM}

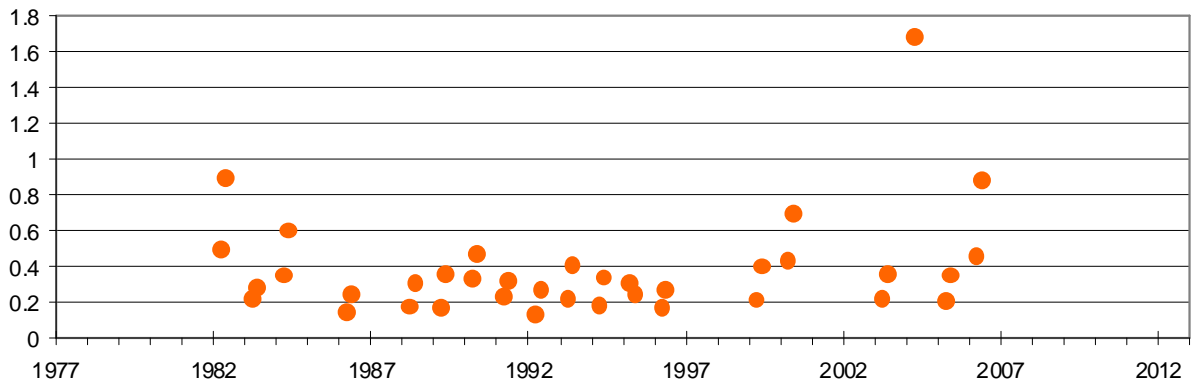
Depth mLD



pH



Salinity (ppt)



Notes:

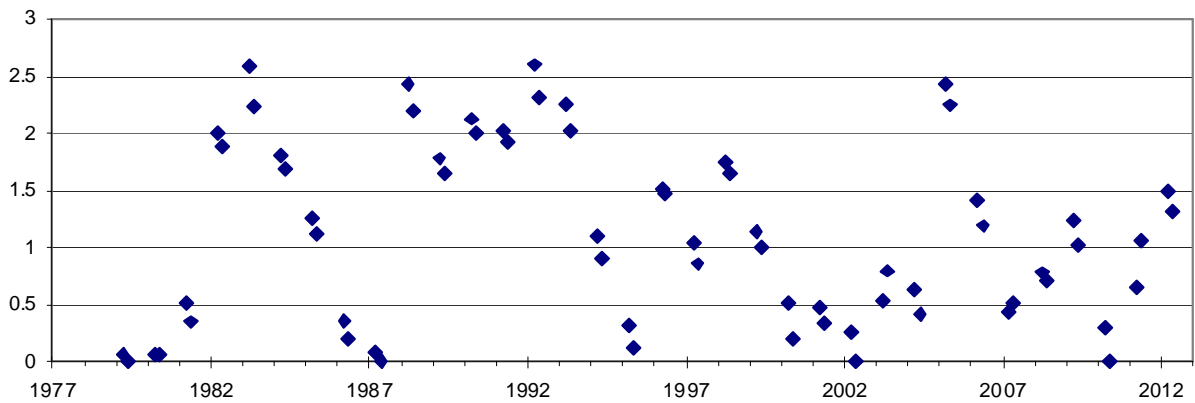
1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Corrigin 12900 (also known as Paperbark Swamp) has been nominated for listing in the 'Directory of Important Wetlands in Australia' (Elsco et al. 2009).

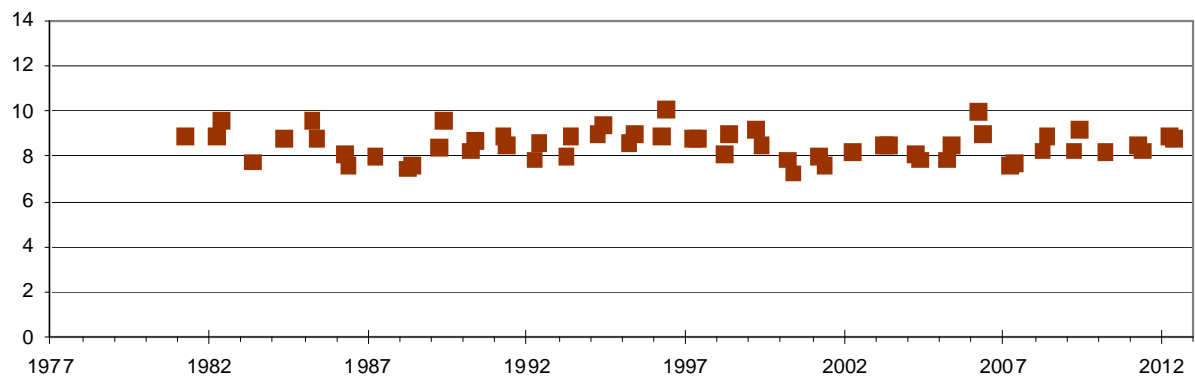
Corrigin 12900 is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

COYRECUP^{IM}

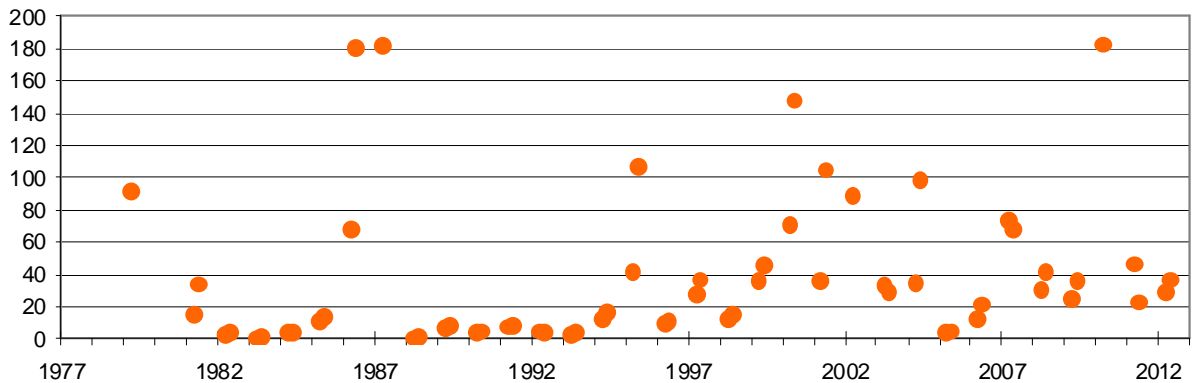
Depth mLD



pH



Salinity (ppt)



Notes:

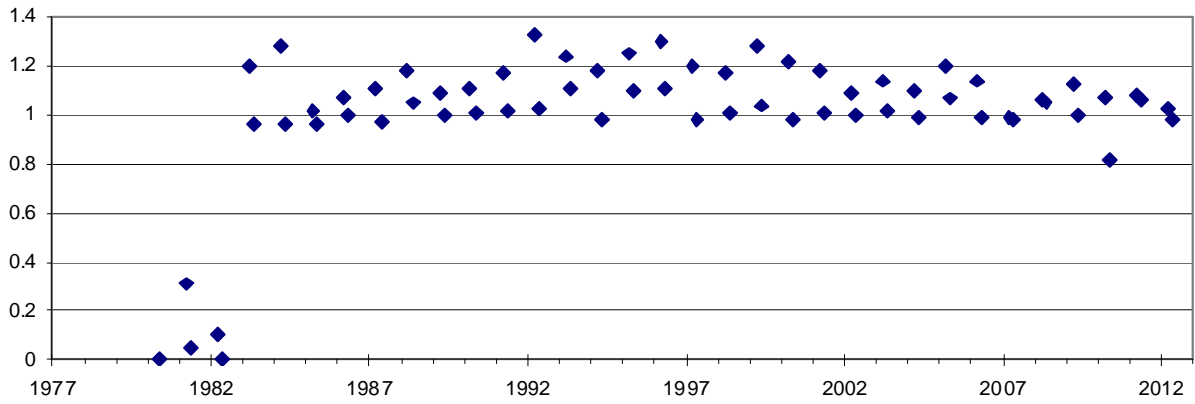
1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Coyrecup Lake is listed in the 'Directory of Important Wetlands in Australia'.

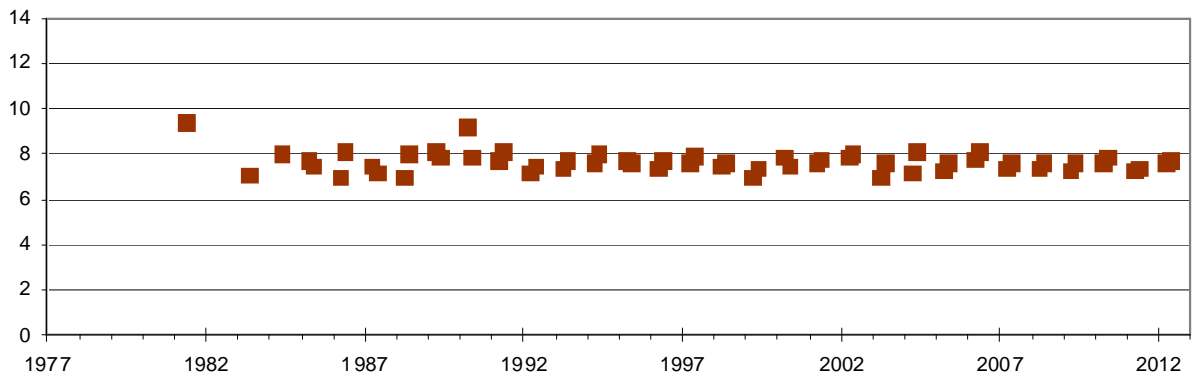
Coyrecup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

CRACKERS

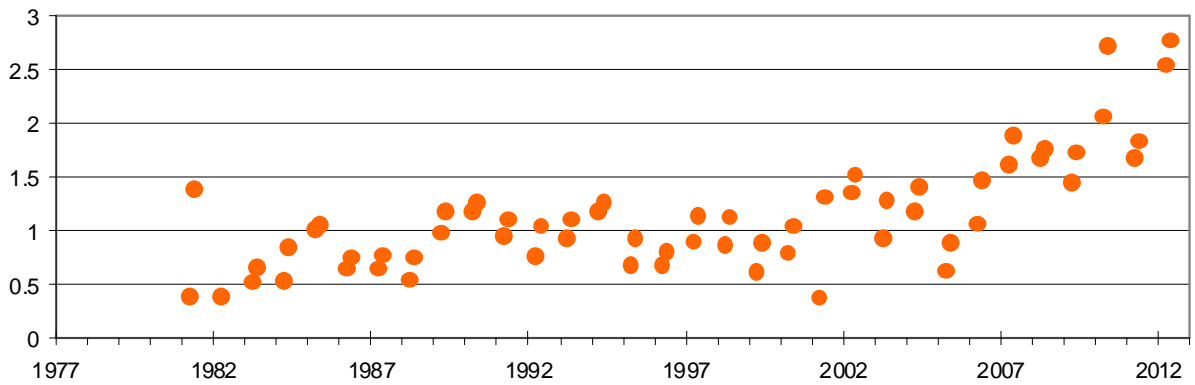
Depth mLD



pH



Salinity (ppt)

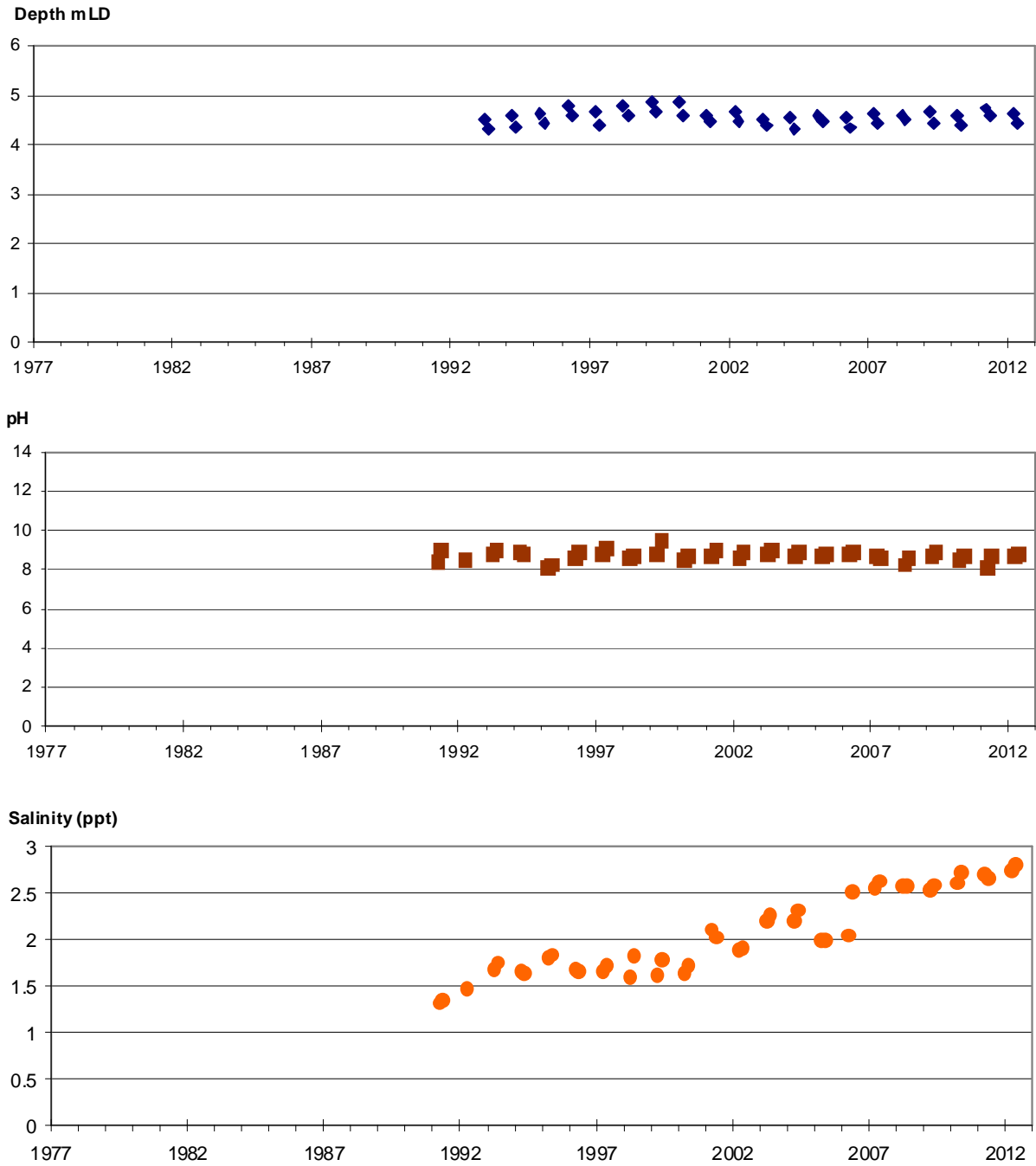


Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Crackers is in the Moora District (headquartered in Jurien Bay) of the Midwest DPaW Region.

DAVIES (with Depth axis 0-6m)



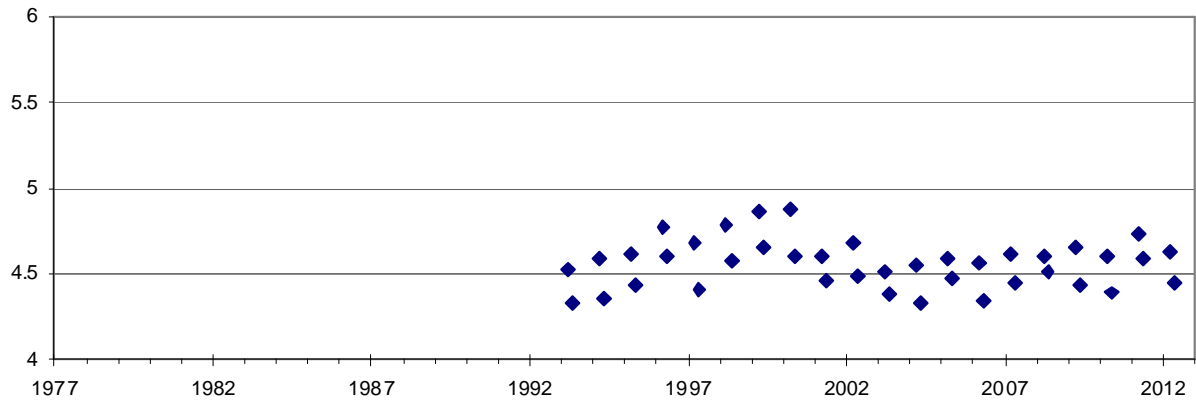
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

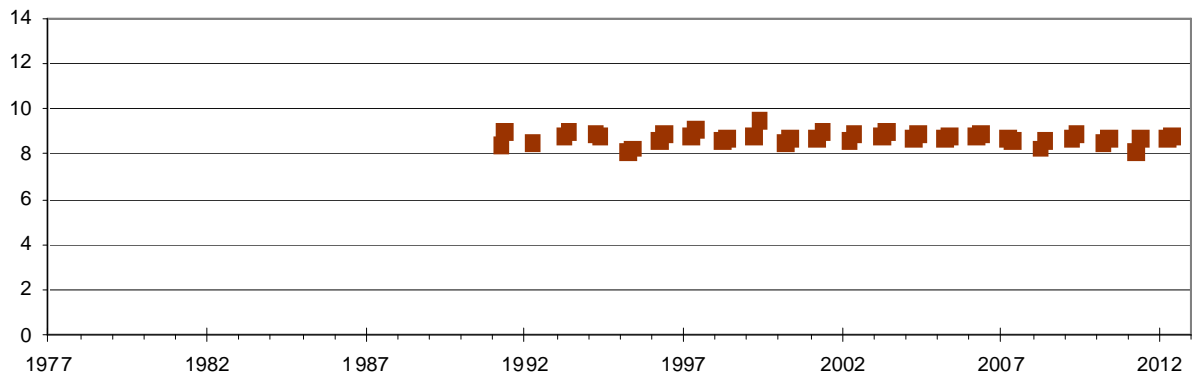
Davies is in the Blackwood District (headquartered in Busselton) of the South West DPaW Region.

DAVIES (with Depth axis 4-6m)

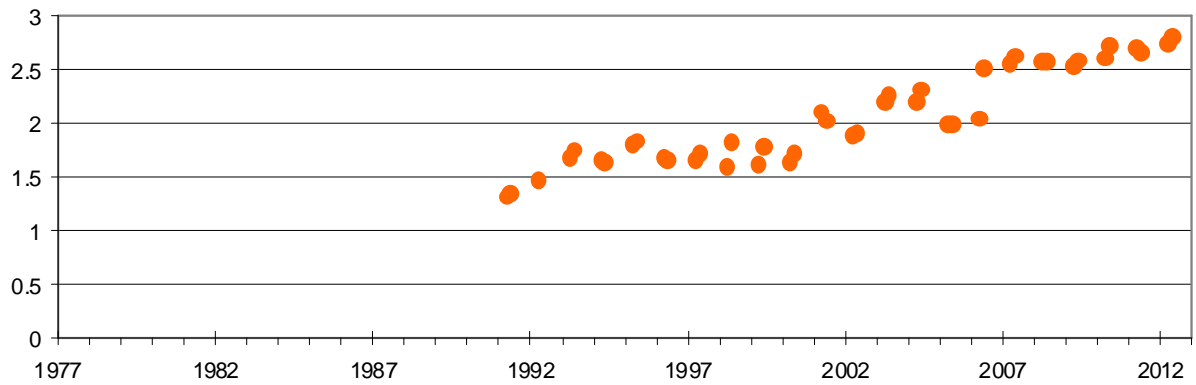
Depth mLD



pH



Salinity (ppt)



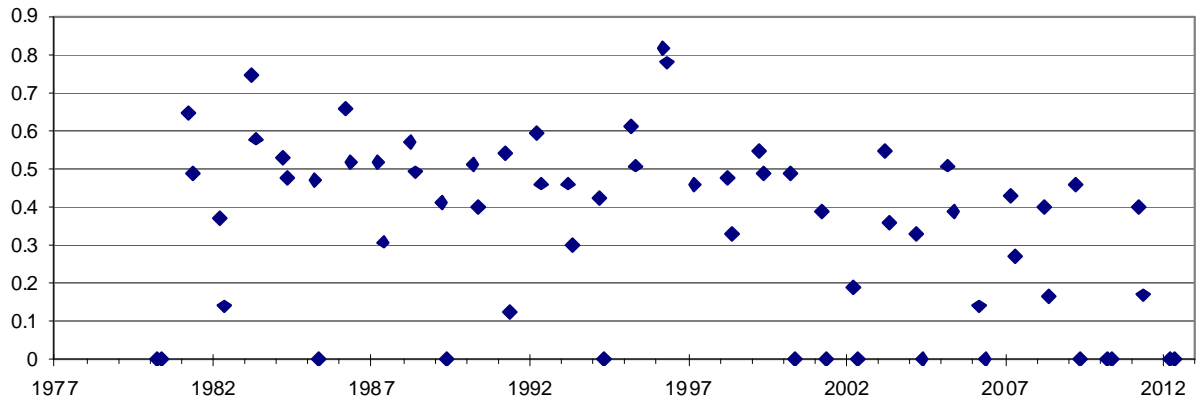
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

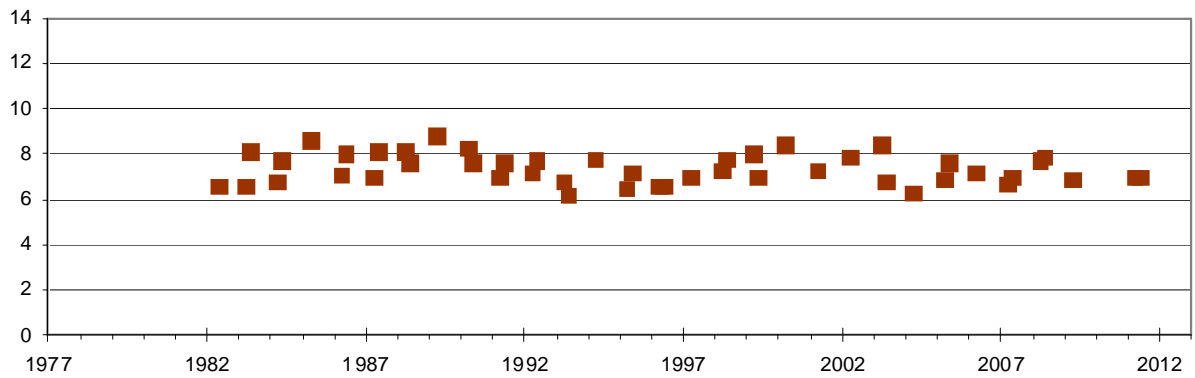
Davies is in the Blackwood District (headquartered in Busselton) of the South West DPaW Region.

DOBADERRY

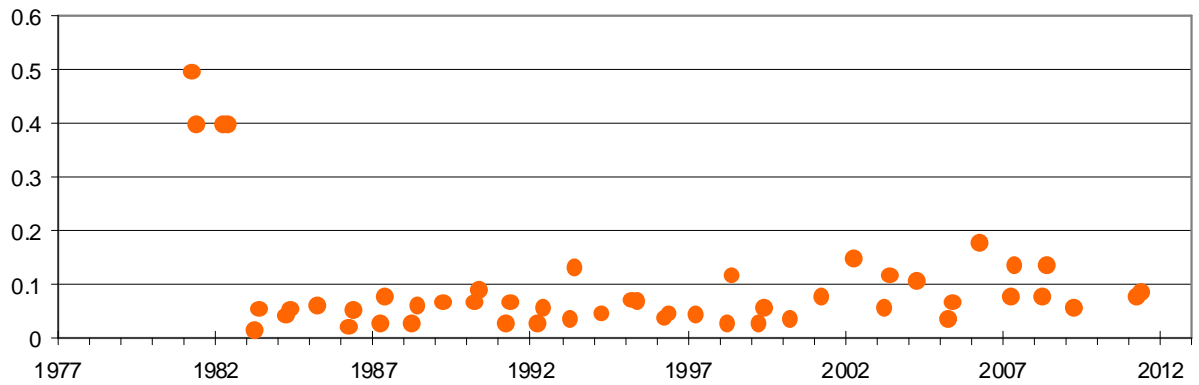
Depth mLD



pH



Salinity (ppt)



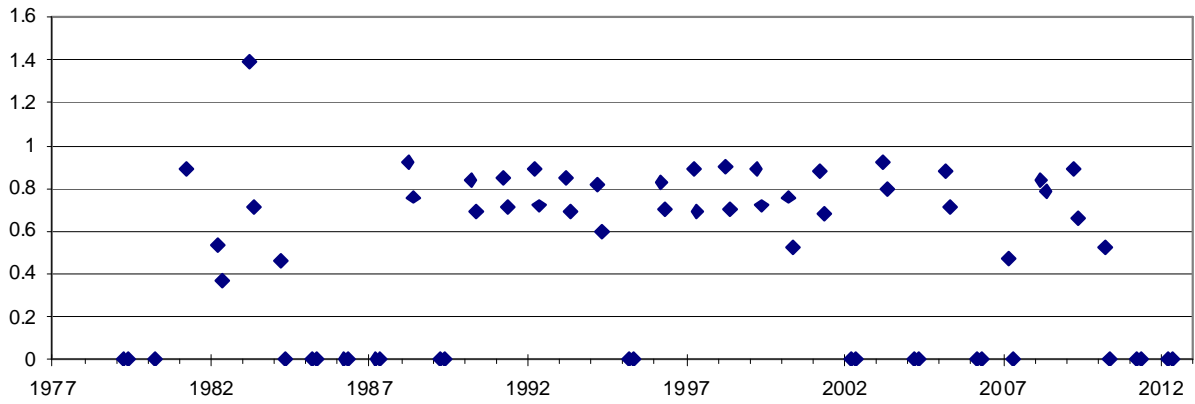
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

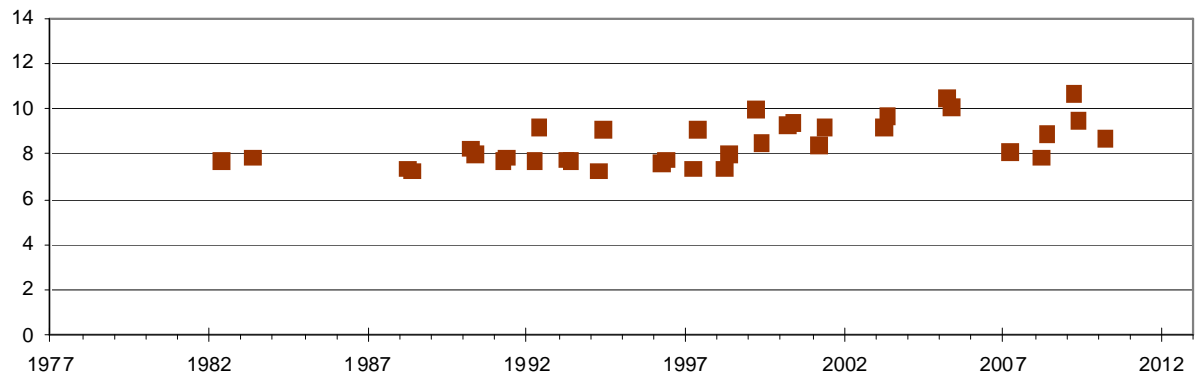
Dobaderry is in the Perth Hills District (headquartered in Mundaring) of the Swan DPaW Region.

DULBINNING

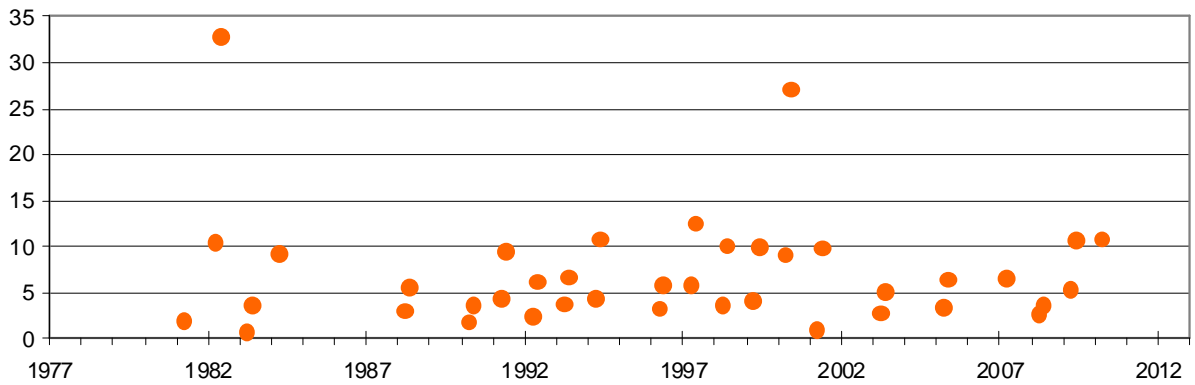
Depth mLD



pH



Salinity (ppt)



Notes:

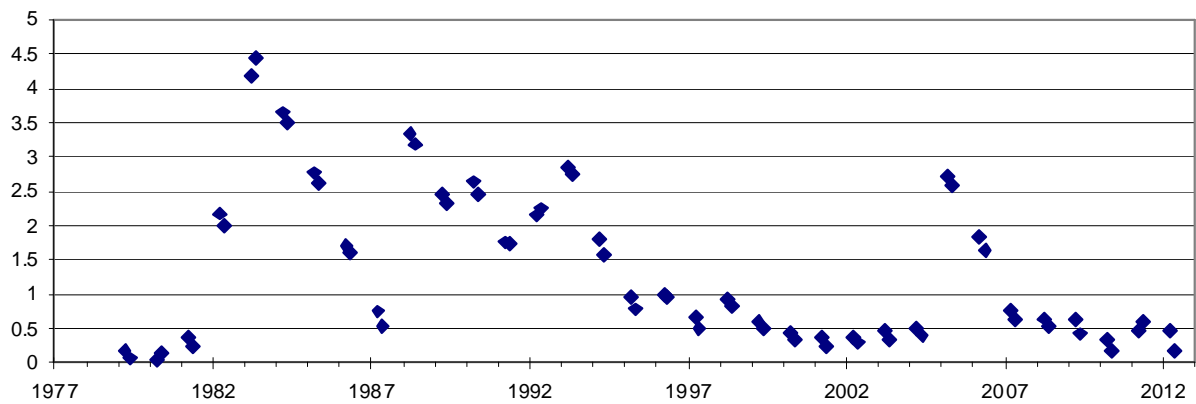
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Dulbinning is within the Toolibin Lake Natural Diversity Recovery Catchment.

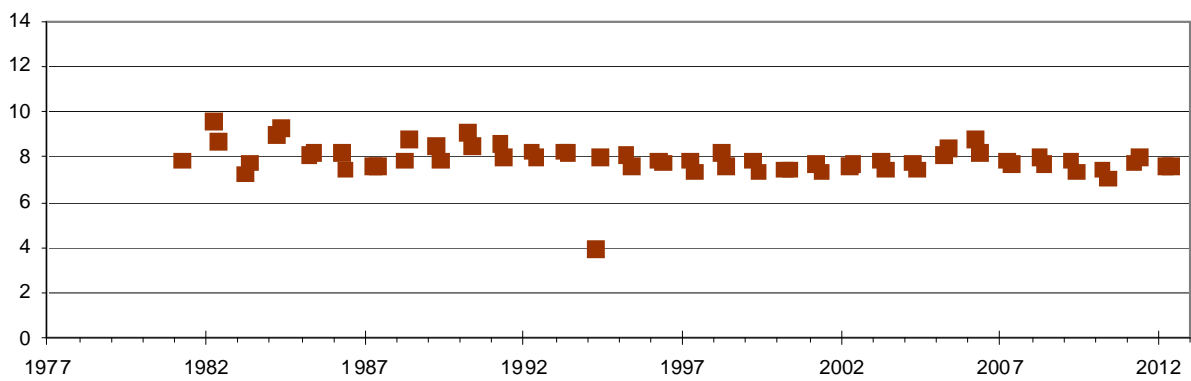
Dulbinning is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

DUMBLEYUNG^{IM}

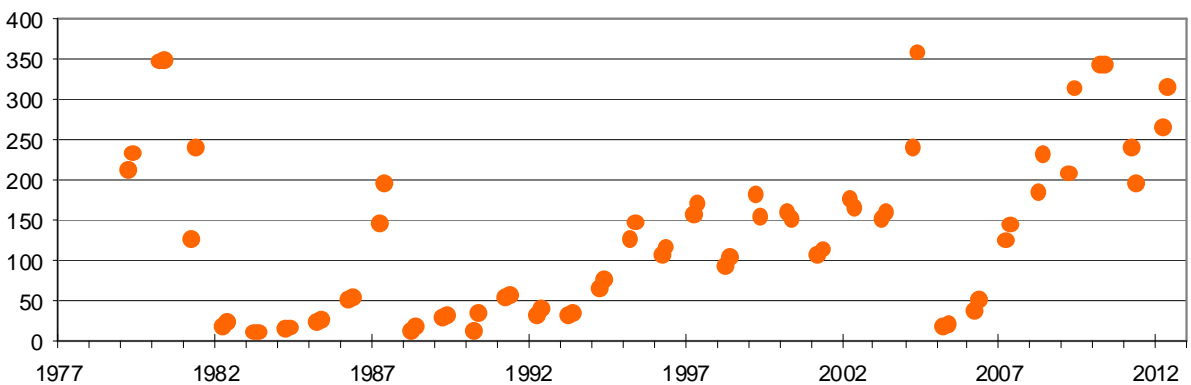
Depth mLD



pH



Salinity (ppt)



Notes:

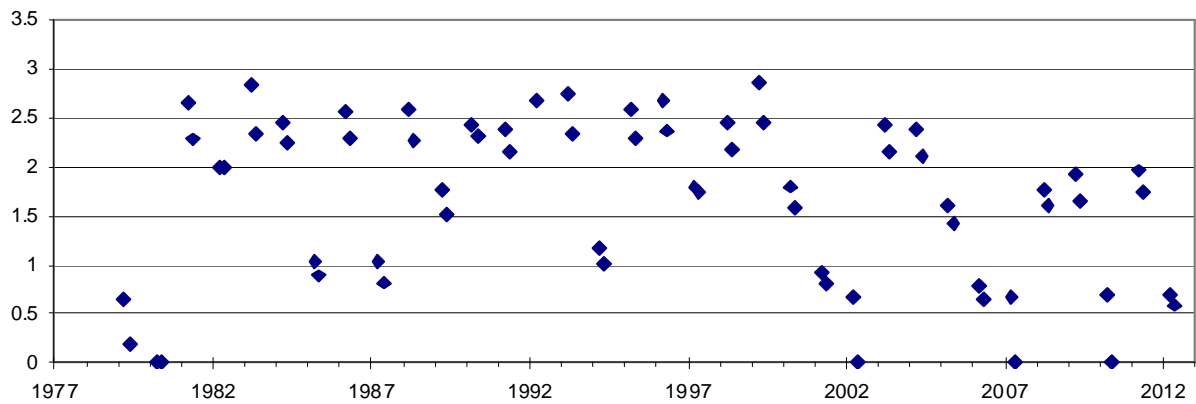
1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Dumbleyung Lake is listed in the 'Directory of Important Wetlands in Australia'.

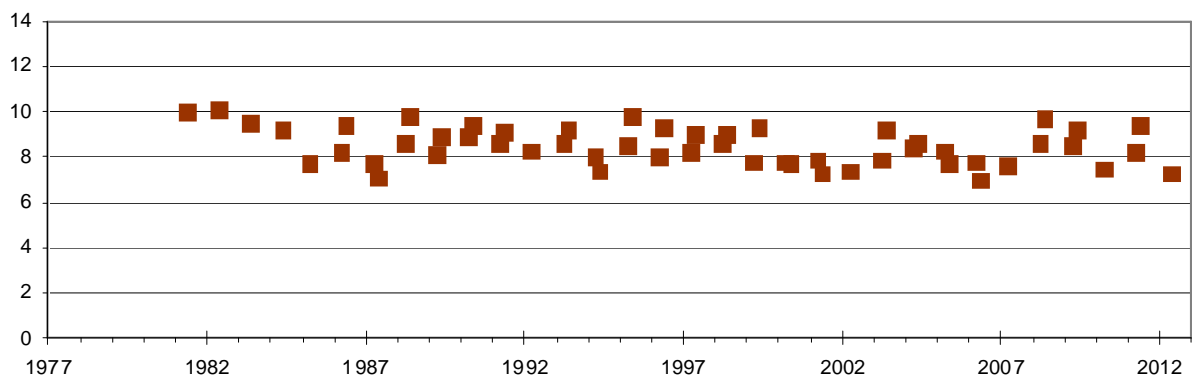
Dumbleyung is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

EGANU^{IM}

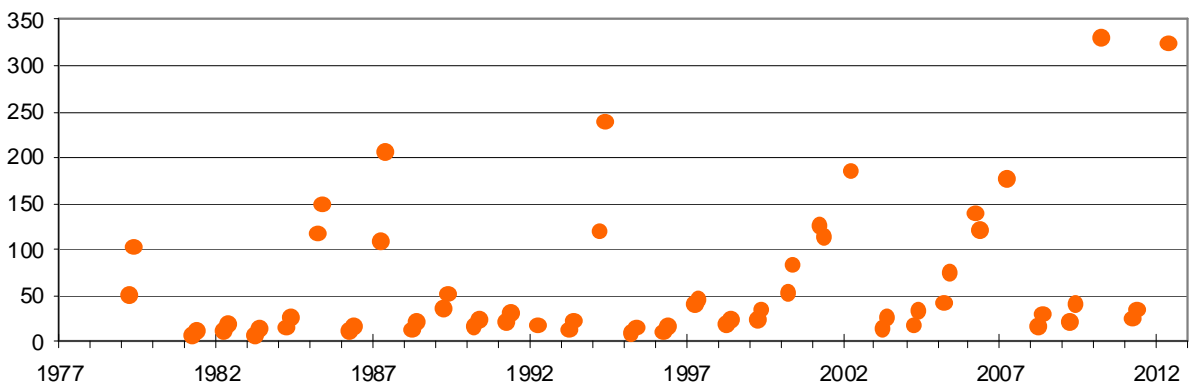
Depth mLD



pH



Salinity (ppt)



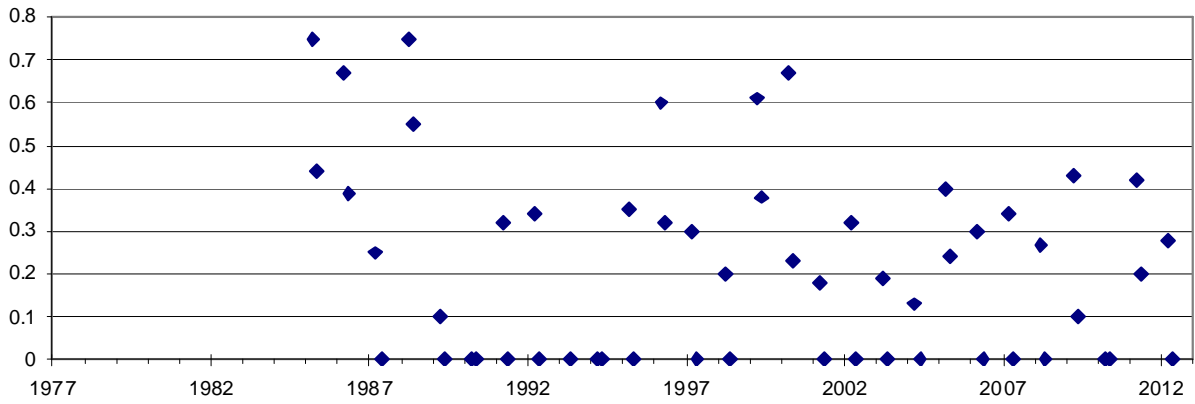
Notes:

1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

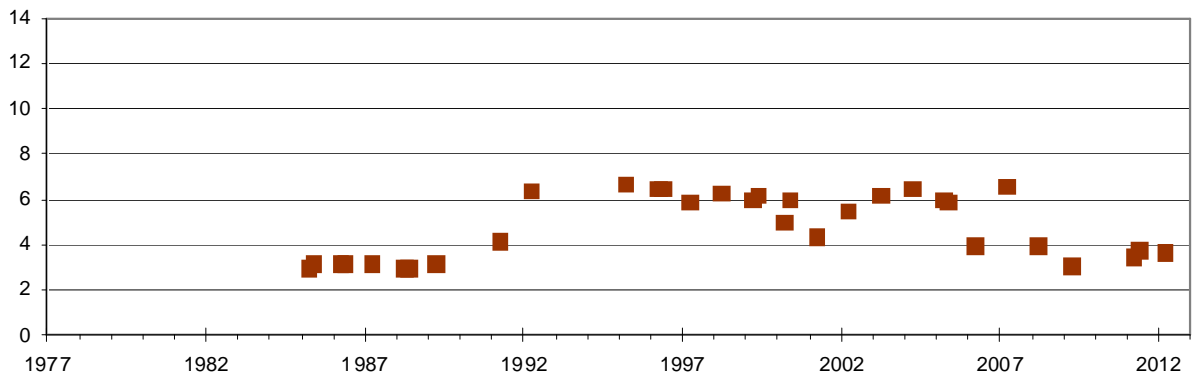
Eganu is in the Moora District (headquartered in Jurien Bay) of the Midwest DPaW Region.

EGRET

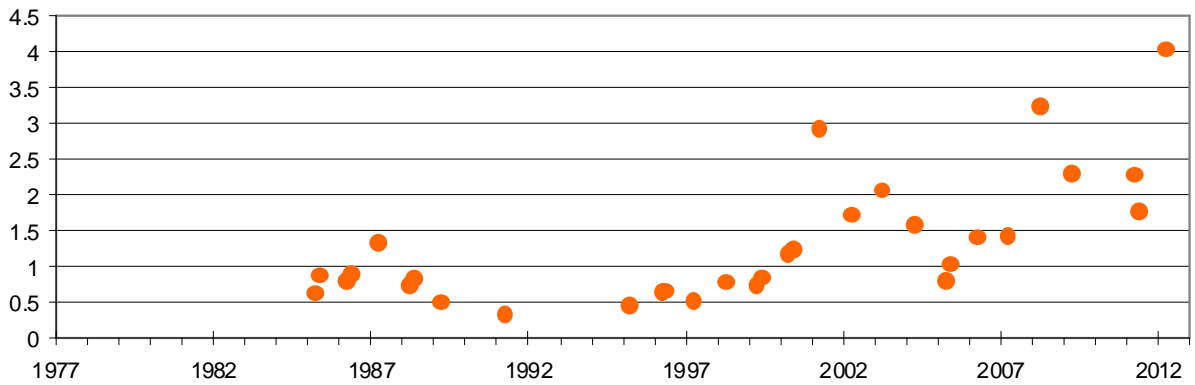
Depth mLD



pH



Salinity (ppt)



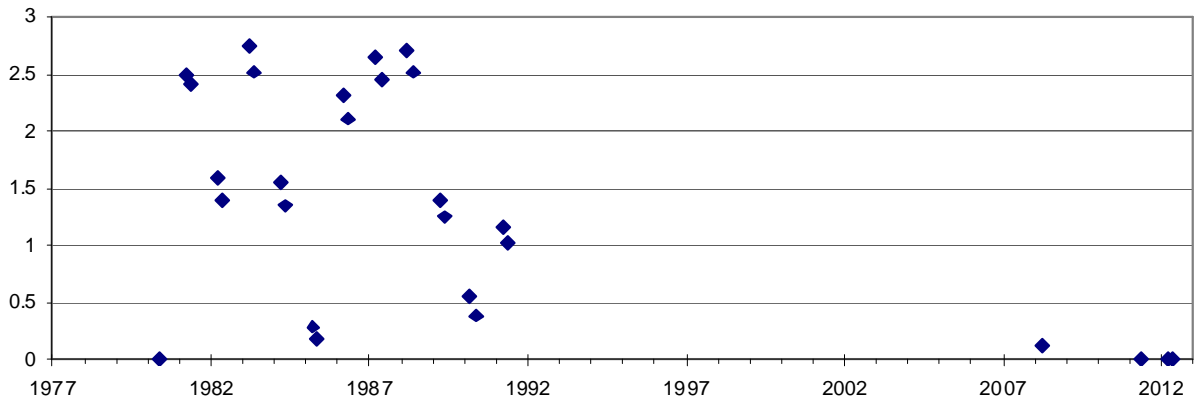
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

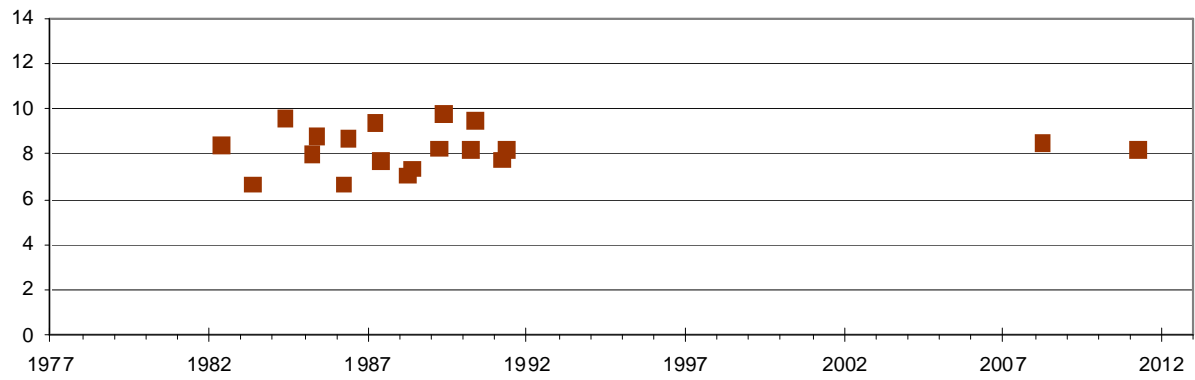
Egret is in the Wellington District (headquartered in Collie) of the South West DPaW Region.

ENEMINGA

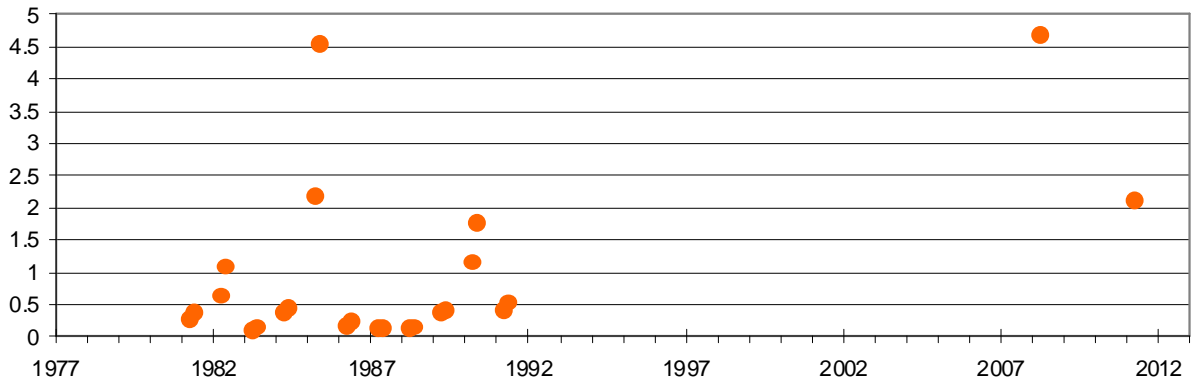
Depth mLD



pH



Salinity (ppt)



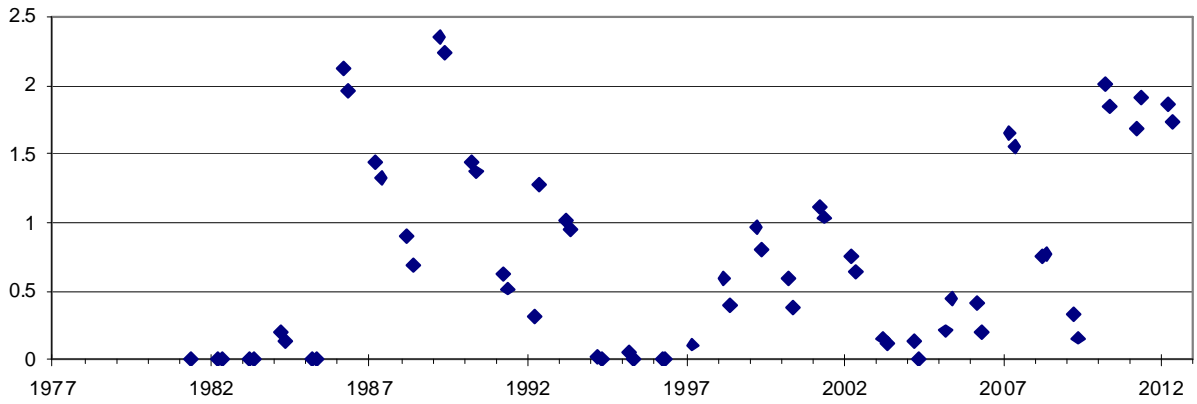
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

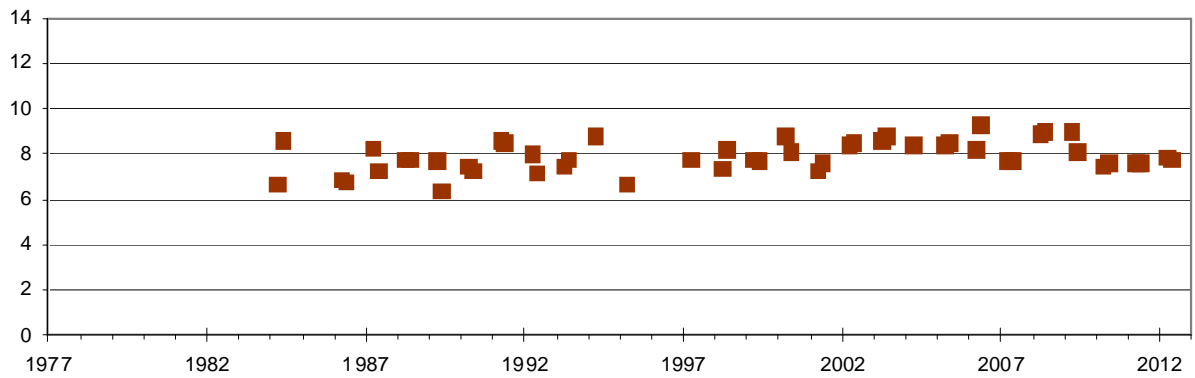
Eneminga is in the Moora District (headquartered in Jurien Bay) of the Midwest DPaW Region.

ESPERANCE 26410

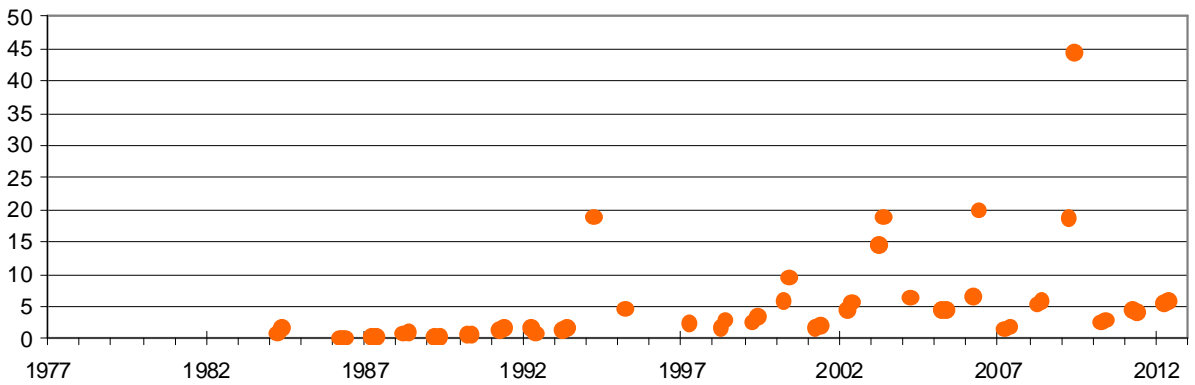
Depth mLD



pH



Salinity (ppt)



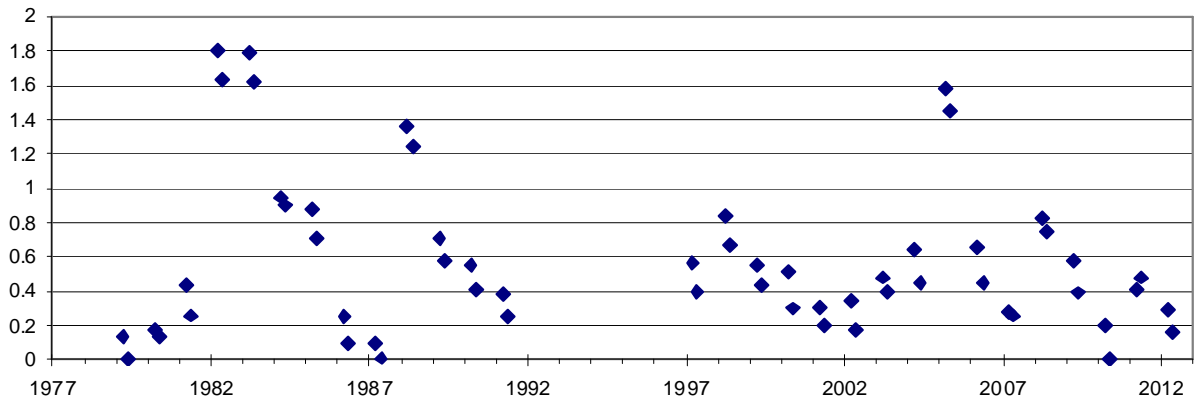
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

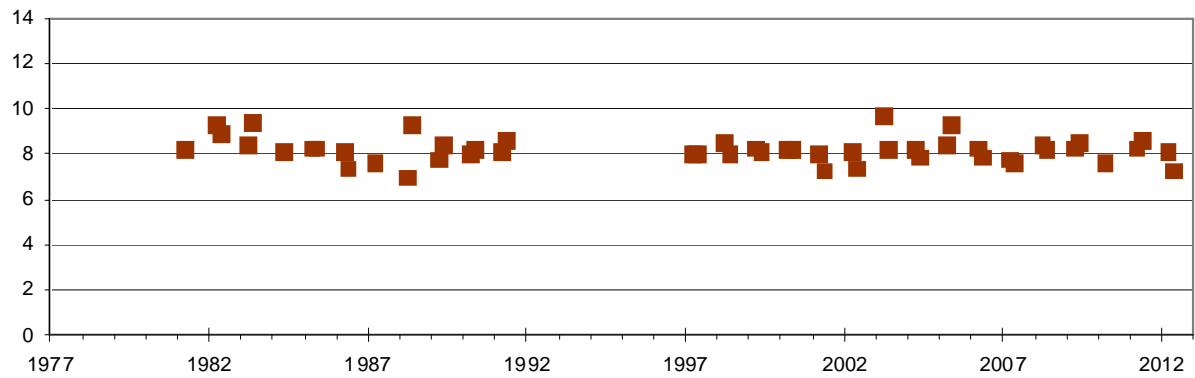
Esperance 26410 is in the Esperance District of the South Coast DPaw Region.

FLAGSTAFF

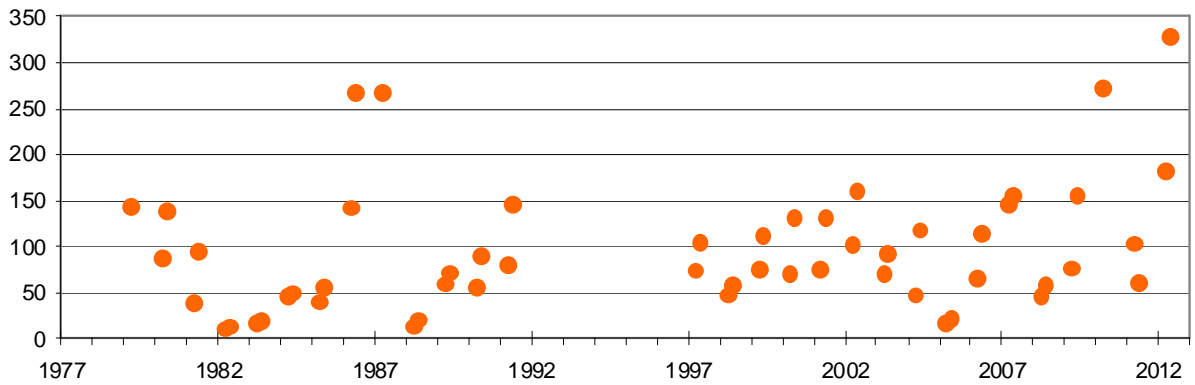
Depth mLD



pH



Salinity (ppt)



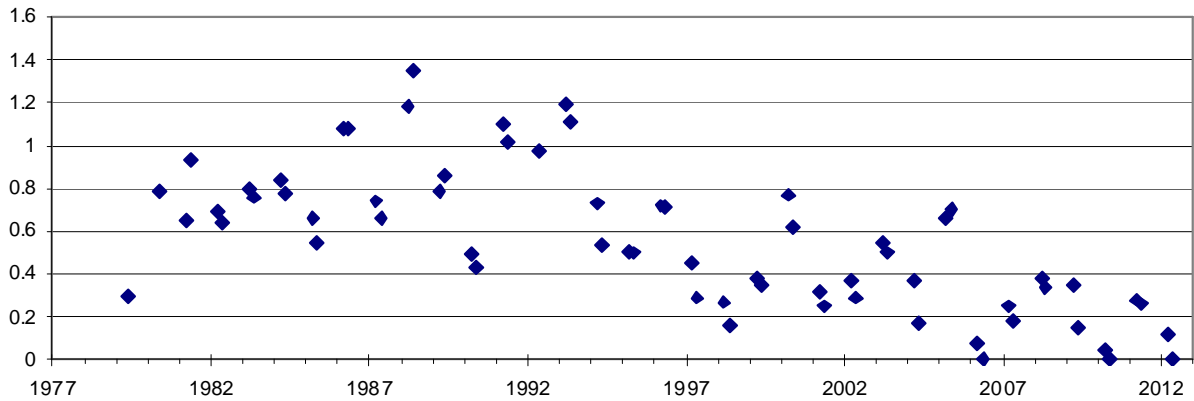
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

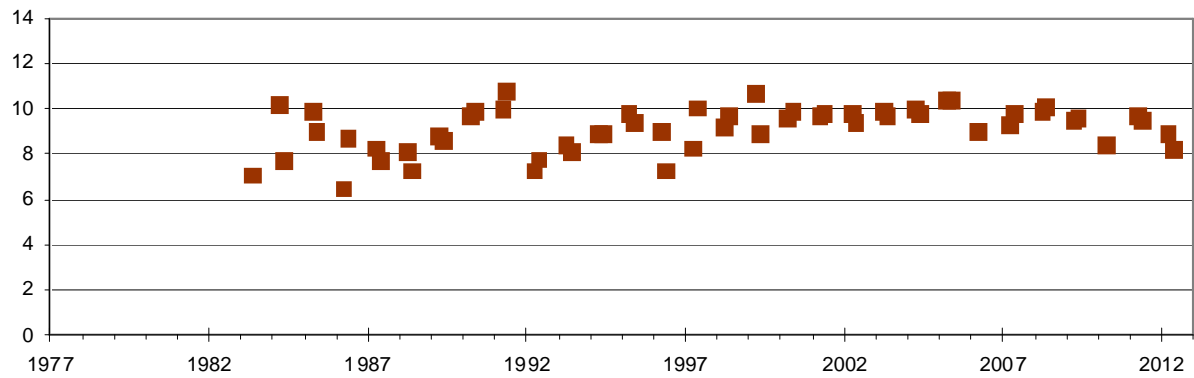
Flagstaff is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

FORRESTDALE

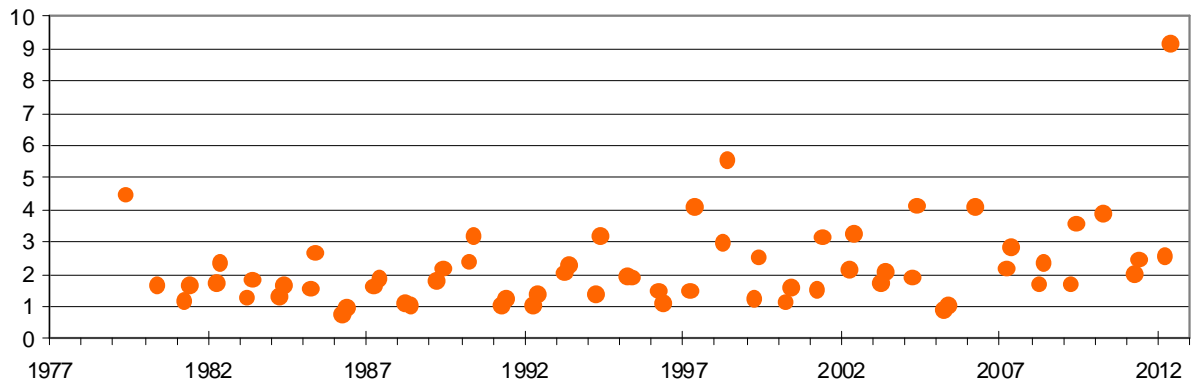
Depth mLD



pH



Salinity (ppt)



Notes:

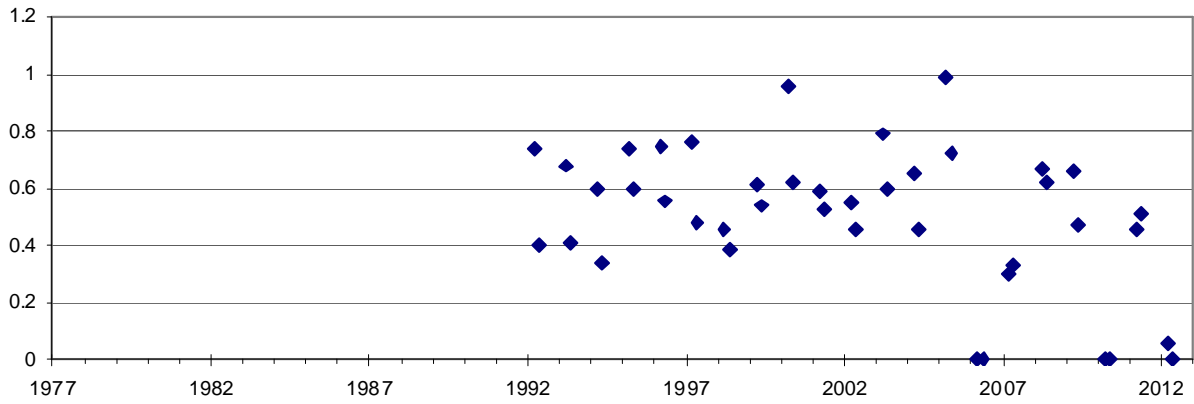
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Forrestdale Lake is a component of the 'Forrestdale and Thomsons Lakes' system, which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands, and is also listed in the 'Directory of Important Wetlands in Australia'.

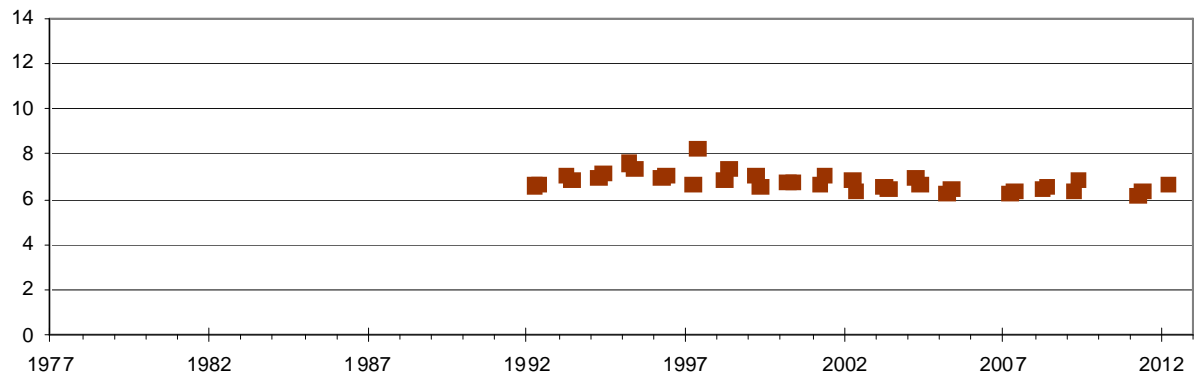
Forrestdale is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DPaW Region.

GIBBS

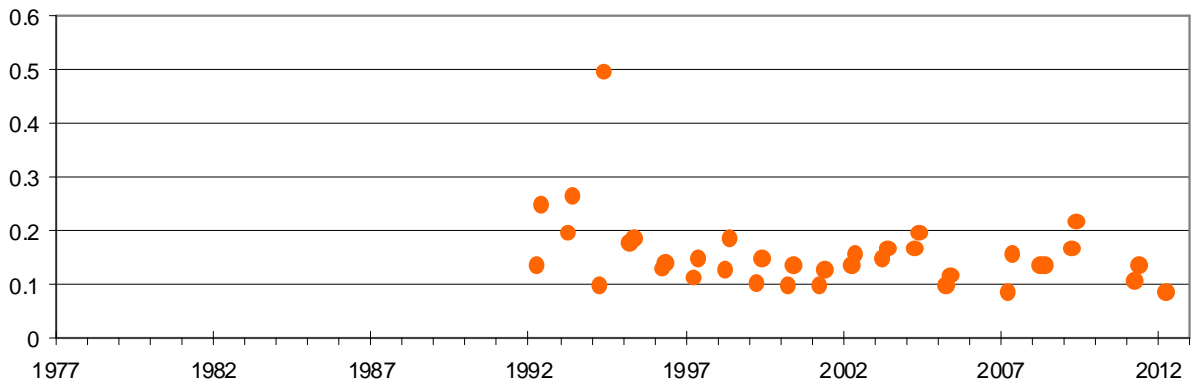
Depth mLD



pH



Salinity (ppt)



Notes:

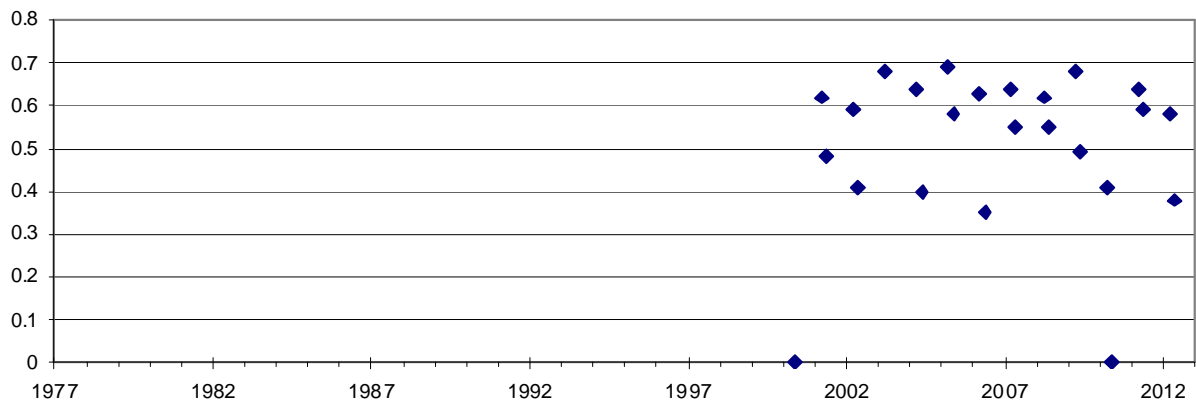
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Gibbs is a component of the 'Gibbs Road Swamp System', which is listed in the 'Directory of Important Wetlands in Australia'.

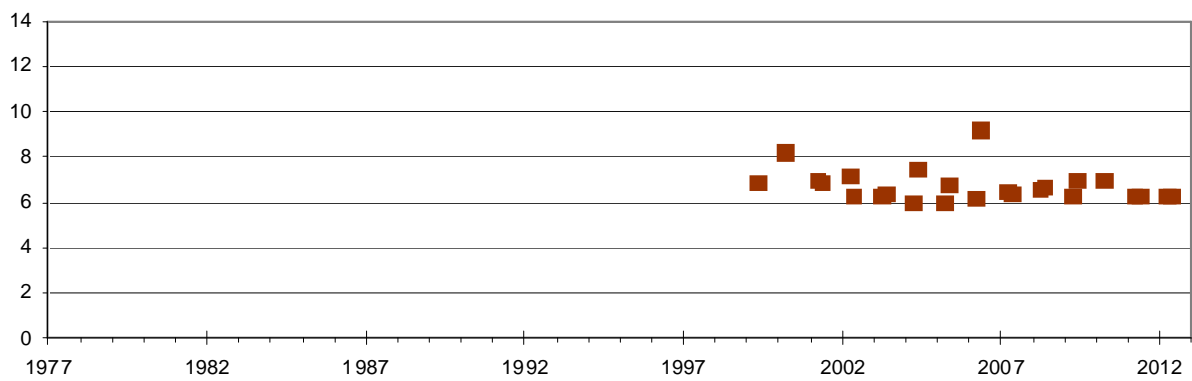
Gibbs is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DPaW Region.

GOONAPING^{IM}

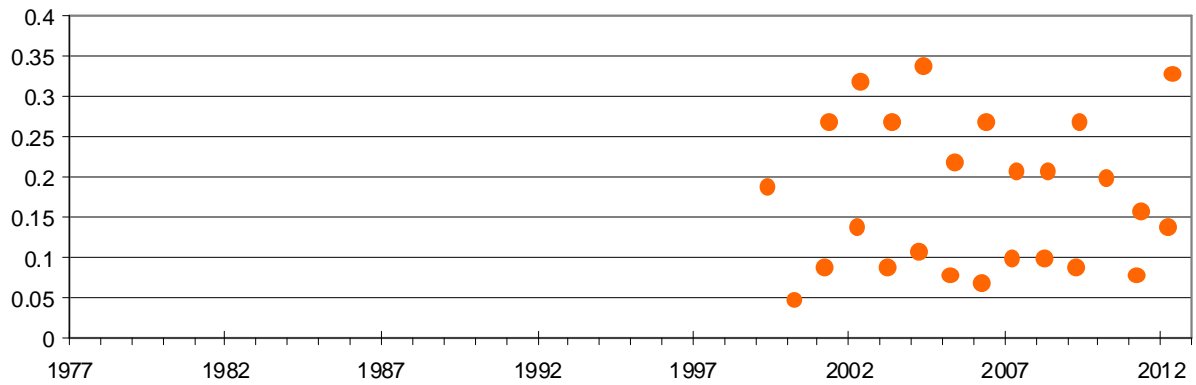
Depth mLD



pH



Salinity (ppt)



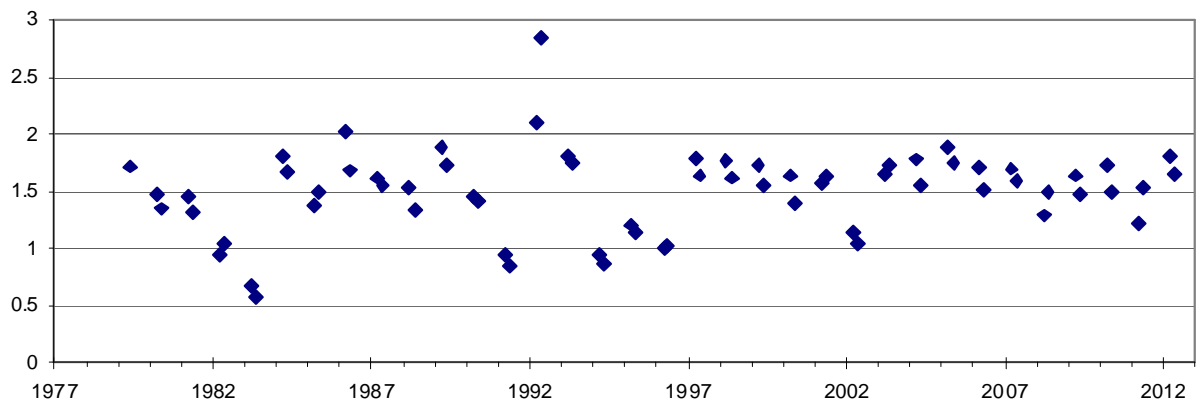
Notes:

1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

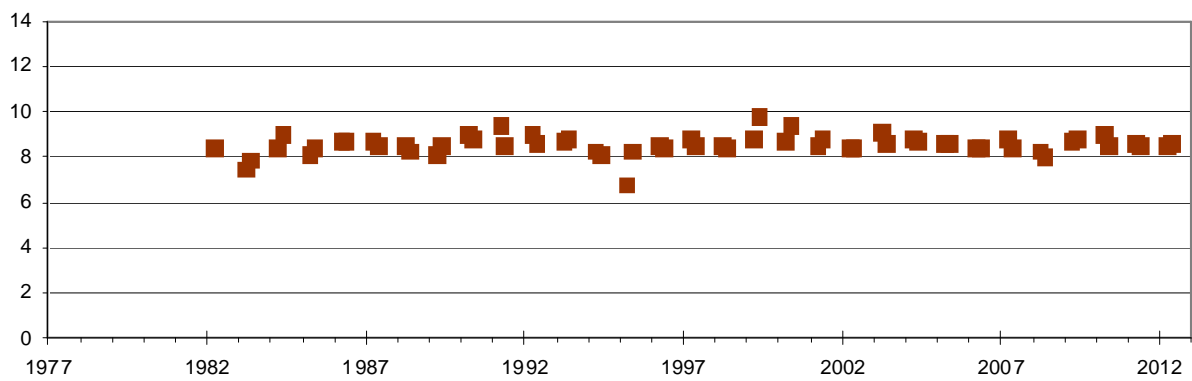
Goonaping is in the Perth Hills District (headquartered in Mundaring) of the Swan DPaW Region.

GORE

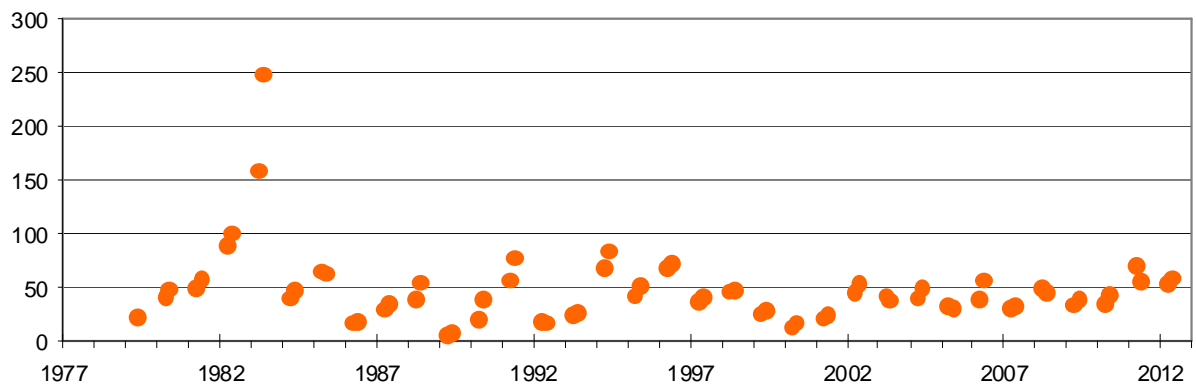
Depth mLD



pH



Salinity (ppt)



Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

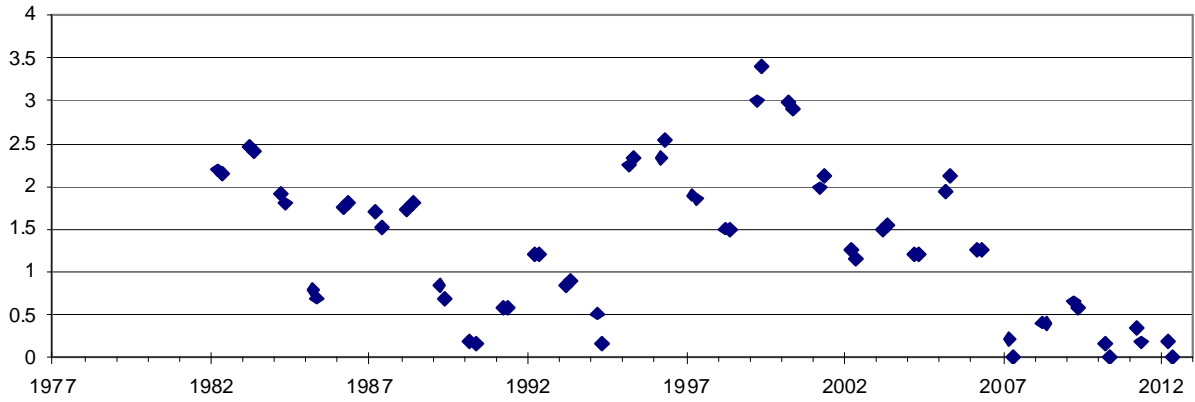
Lake Gore is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

Lake Gore is also a component of the 'Lake Gore System', which is listed in the 'Directory of Important Wetlands in Australia'.

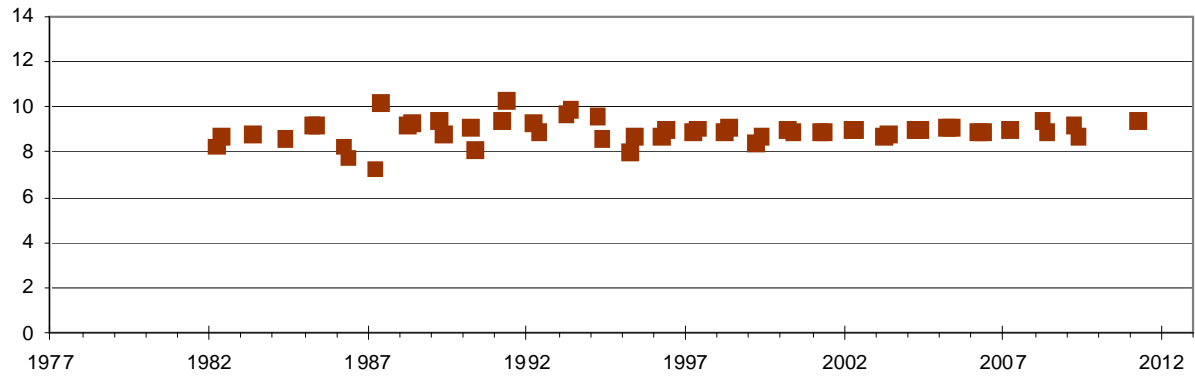
Gore is in the Esperance District of the South Coast DPaW Region.

GURAGA (with Salinity axis 0-250ppt)

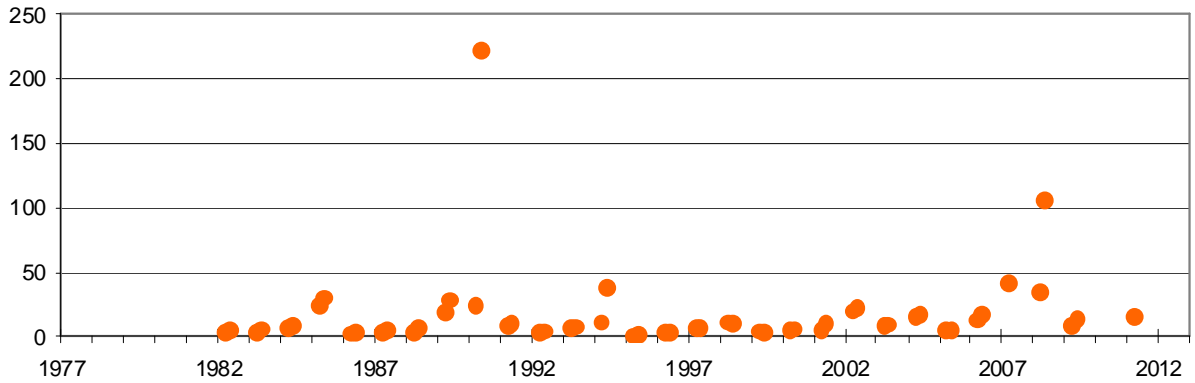
Depth mLD



pH



Salinity (ppt)



Notes:

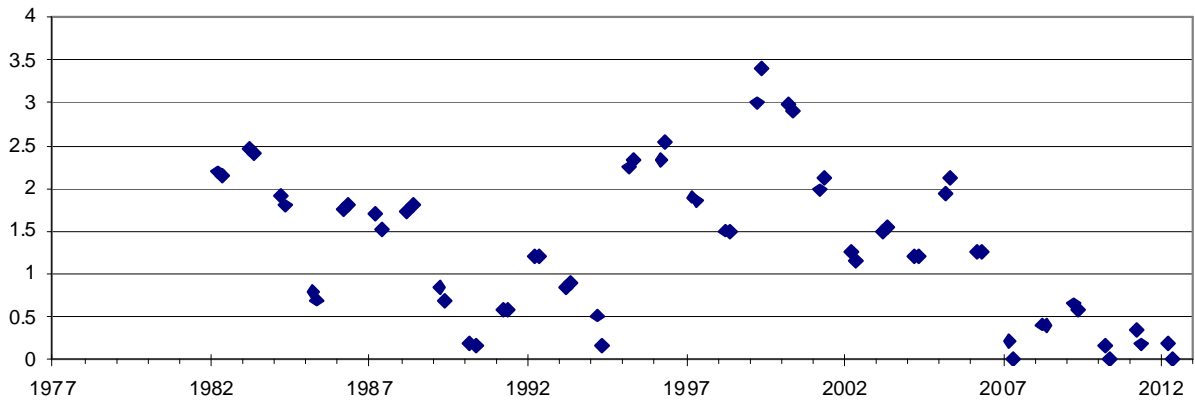
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Guraga Lake is listed in the 'Directory of Important Wetlands in Australia'.

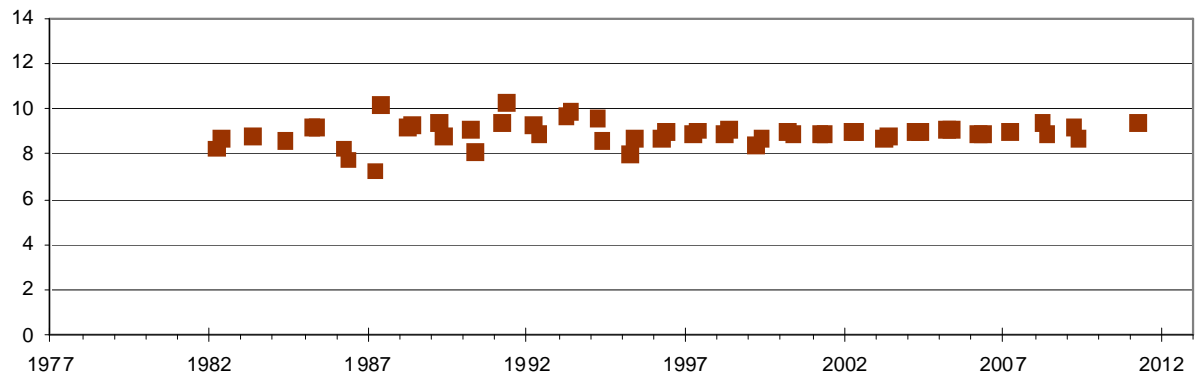
Guraga is in the Moora District (headquartered in Jurien Bay) of the Midwest DPaW Region.

GURAGA (with Salinity axis 0-125ppt)

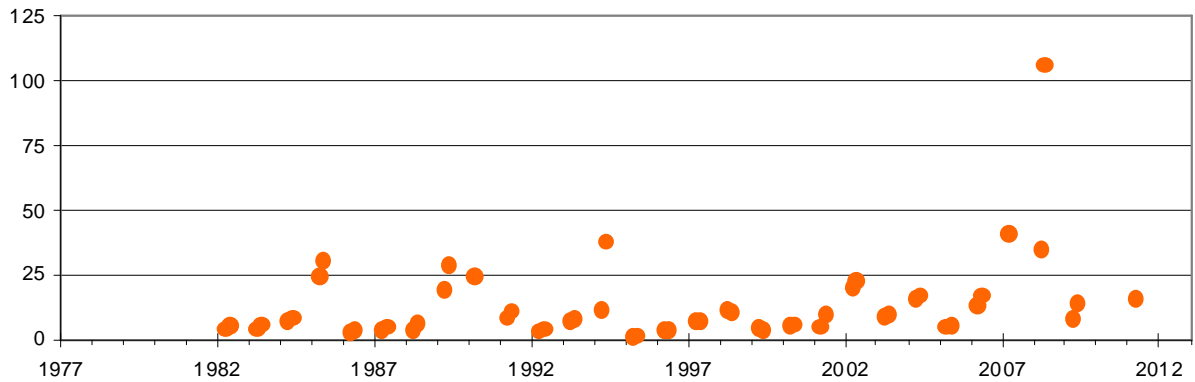
Depth mLD



pH



Salinity (ppt)



Notes:

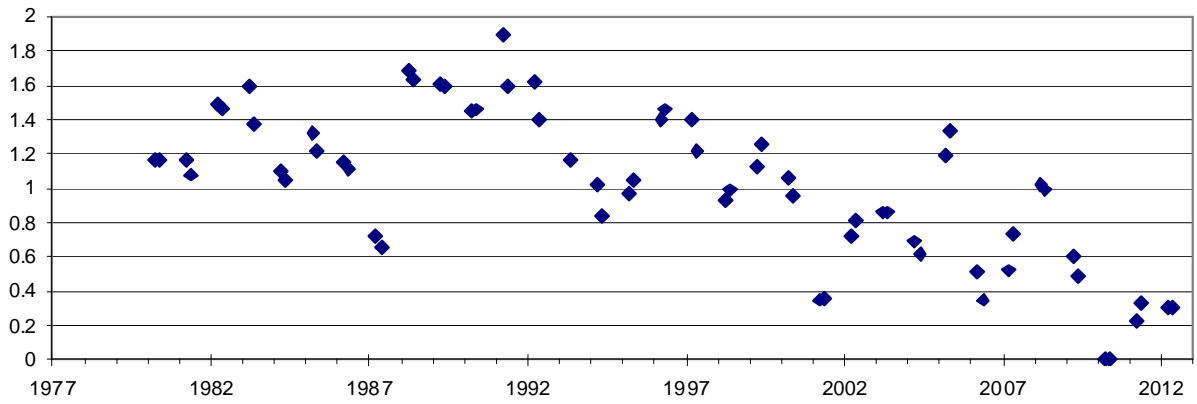
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Guraga Lake is listed in the 'Directory of Important Wetlands in Australia'.

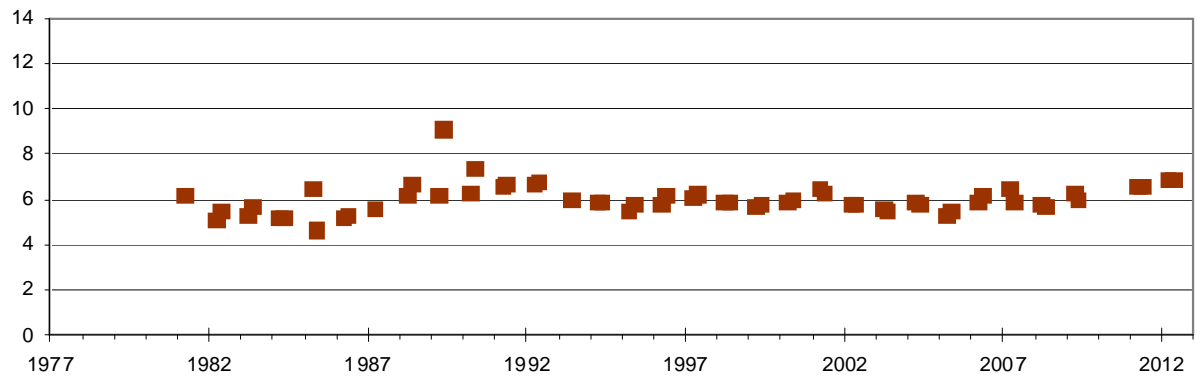
Guraga is in the Moora District (headquartered in Jurien Bay) of the Midwest DPaW Region.

HARVEY 12632

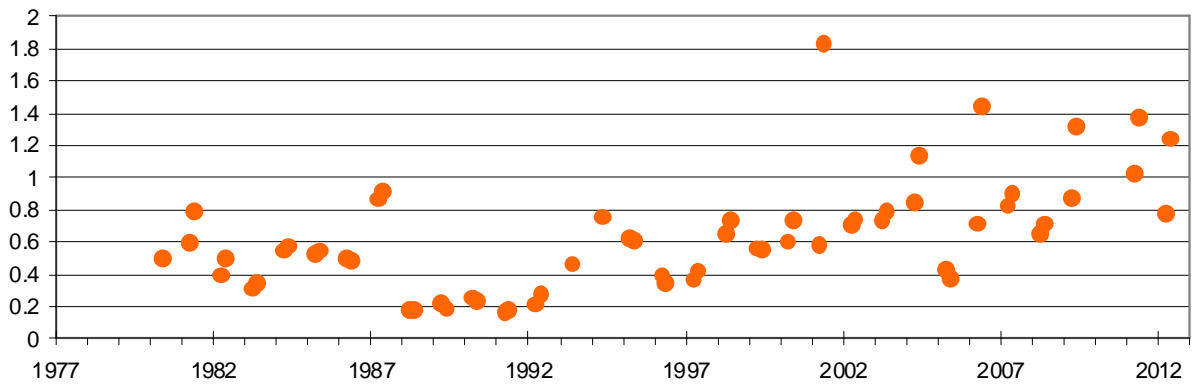
Depth mLD



pH



Salinity (ppt)



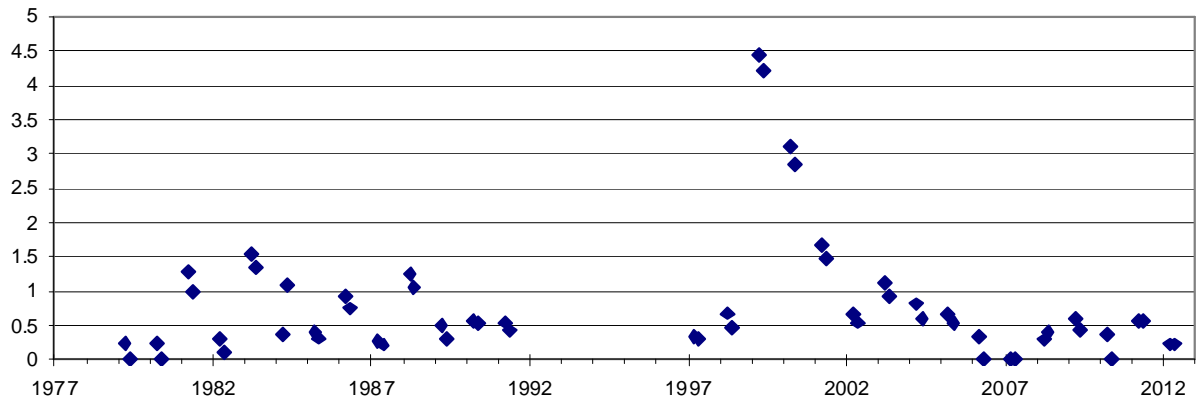
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

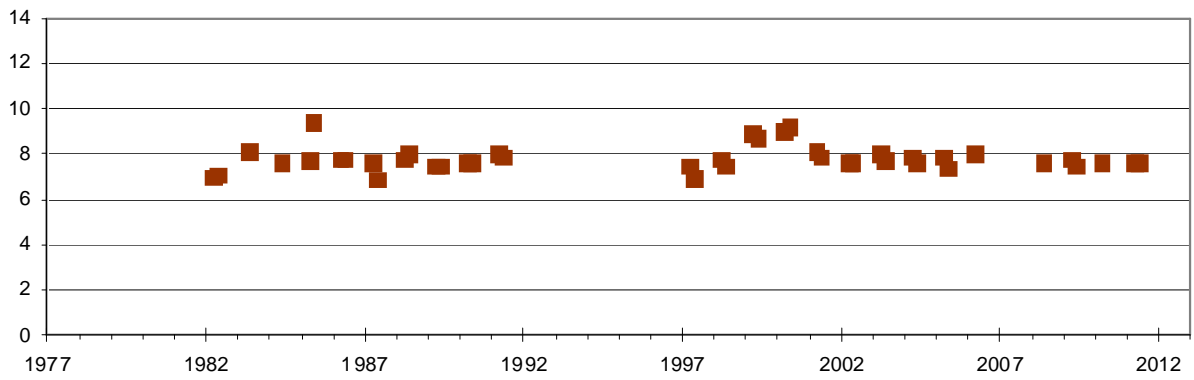
Harvey 12632 is in the Wellington District (headquartered in Collie) of the South West DPaW Region.

HINDS

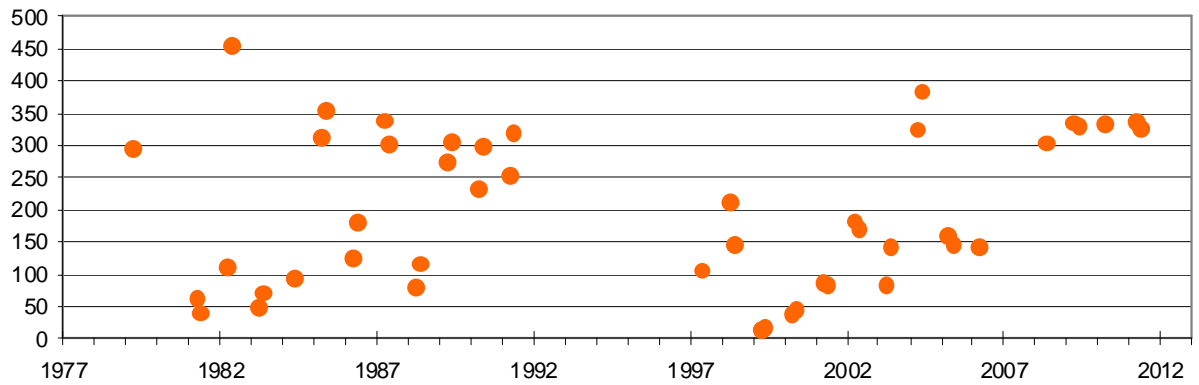
Depth mLD



pH



Salinity (ppt)



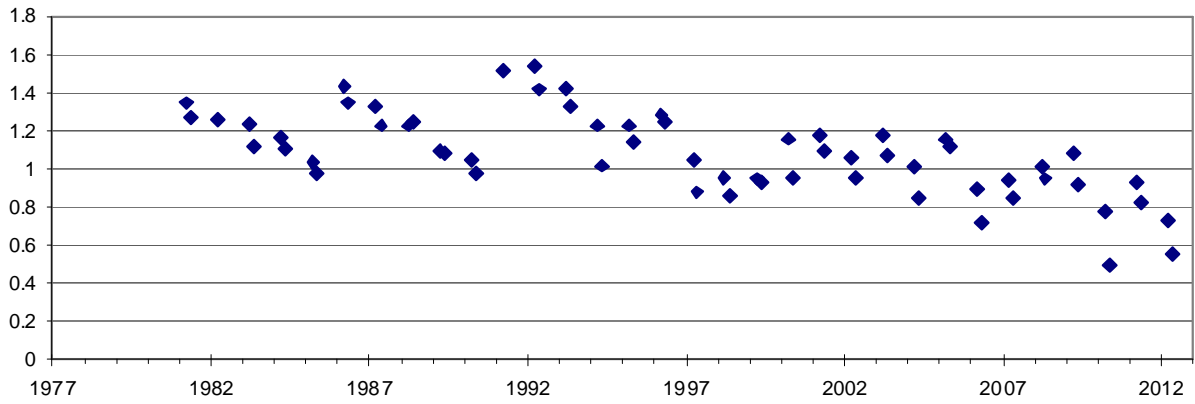
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

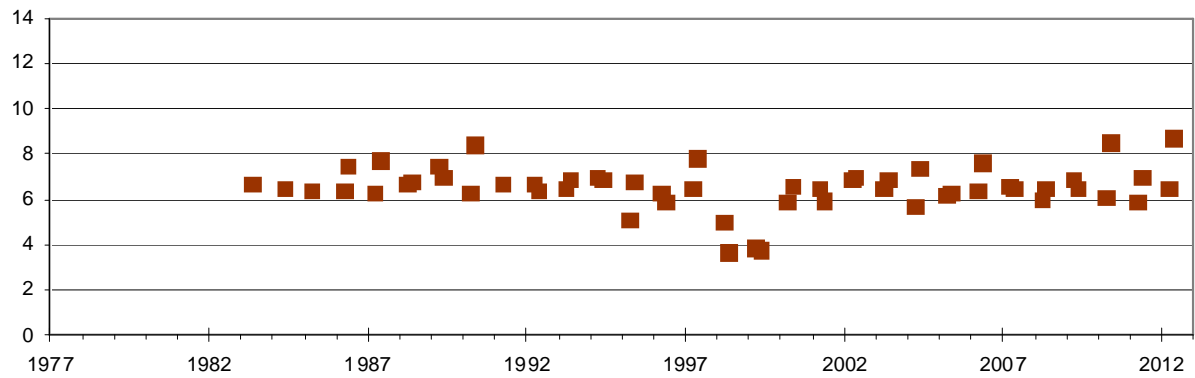
Hinds is in the Central District (headquartered in Merredin) of the Wheatbelt DPaW Region.

JANDABUP

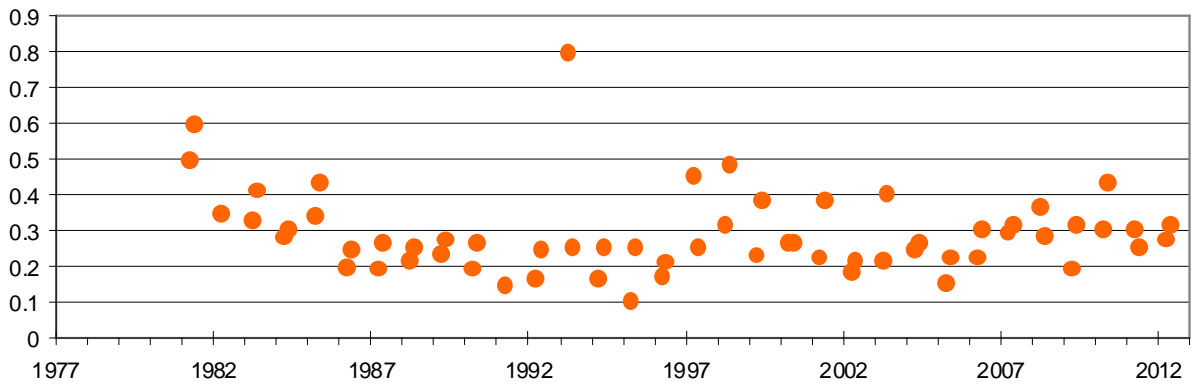
Depth mLD



pH



Salinity (ppt)



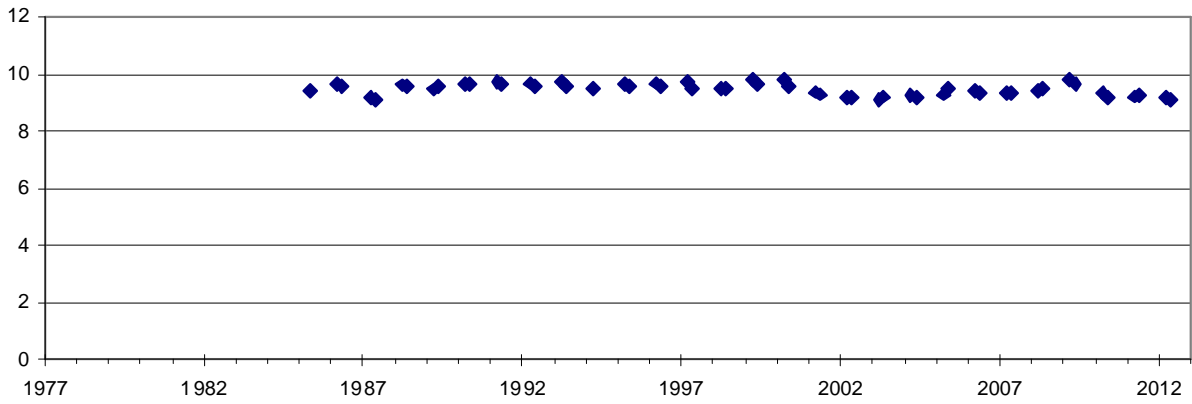
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

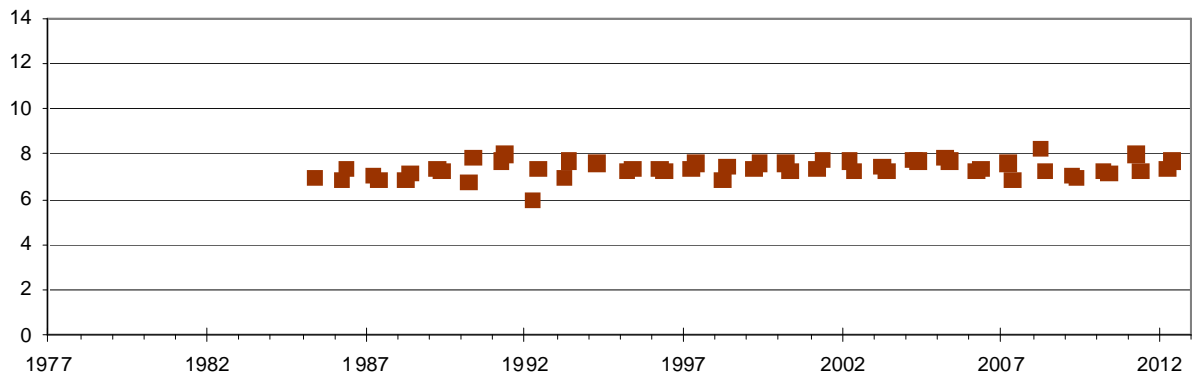
Jandabup is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DPaW Region.

JASPER (with Depth axis 0-12m)

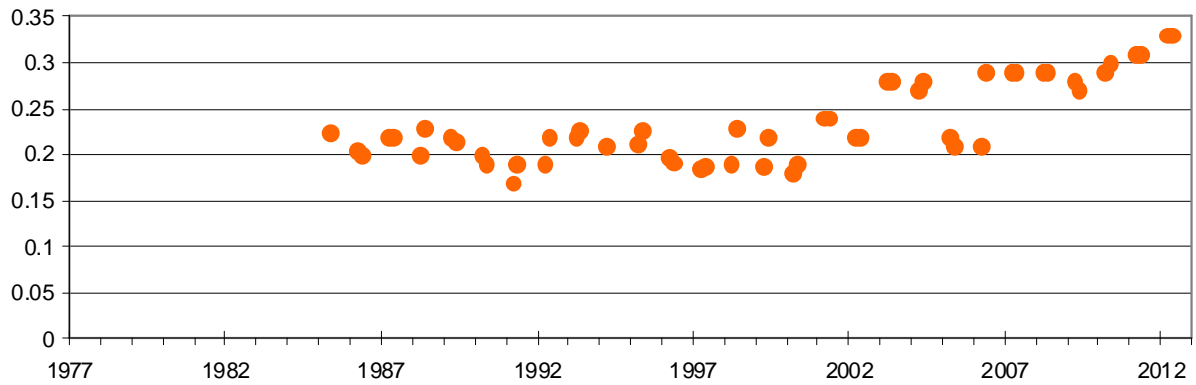
Depth mLD



pH



Salinity (ppt)



Notes:

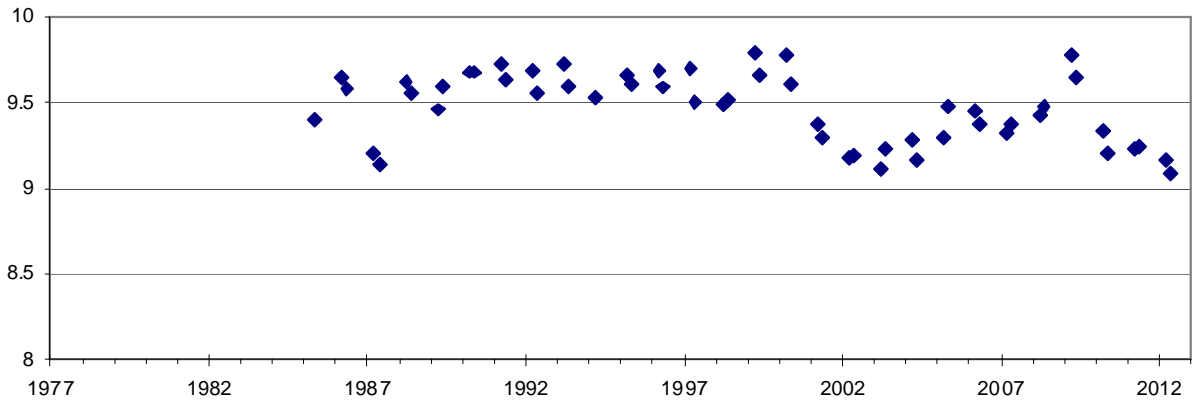
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Jasper is a component of the 'Gingilup-Jasper Wetland System', which is listed in the 'Directory of Important Wetlands in Australia'.

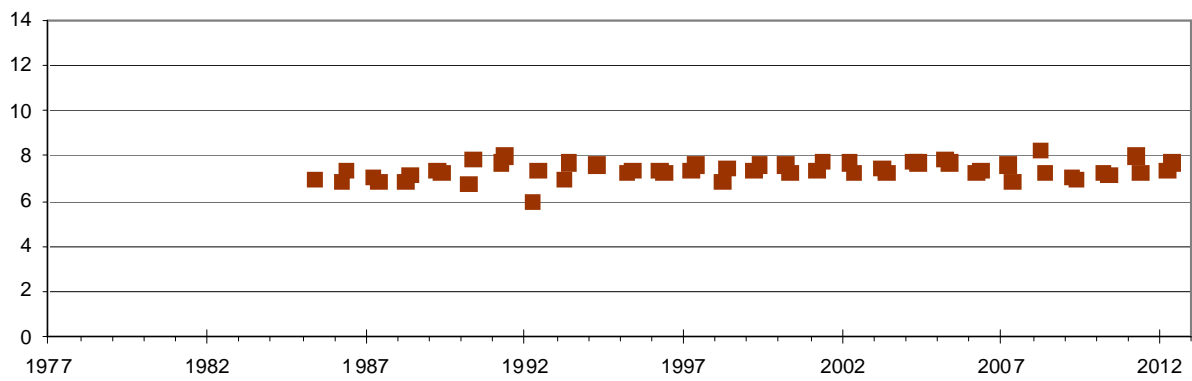
Jasper is in the Donnelly District (headquartered in Pemberton) of the Warren DPaW Region.

JASPER (with Depth axis 8-10m)

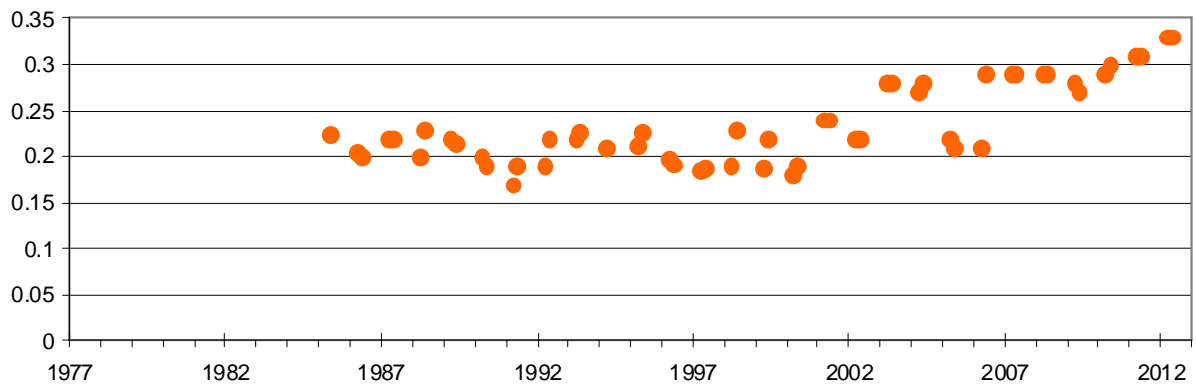
Depth mLD



pH



Salinity (ppt)



Notes:

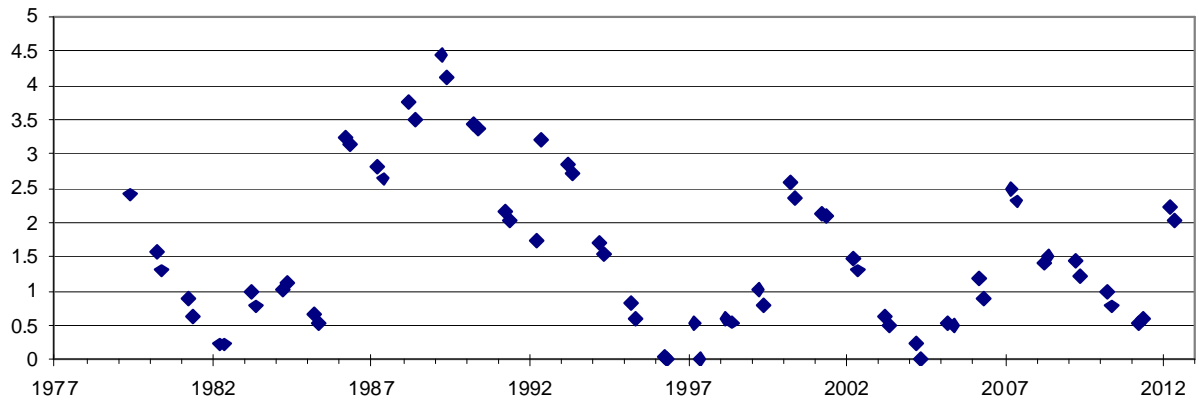
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Jasper is a component of the 'Gingilup-Jasper Wetland System', which is listed in the 'Directory of Important Wetlands in Australia'.

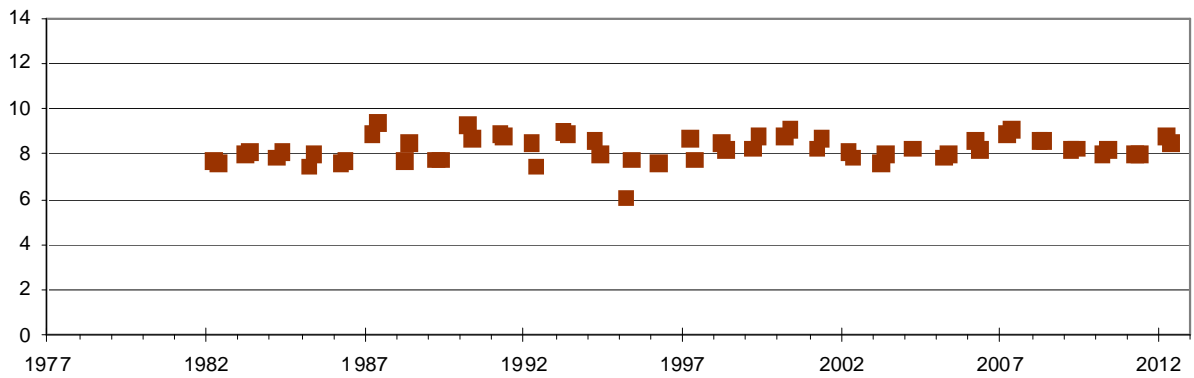
Jasper is in the Donnelly District (headquartered in Pemberton) of the Warren DPaW Region.

JERDACUTTUP

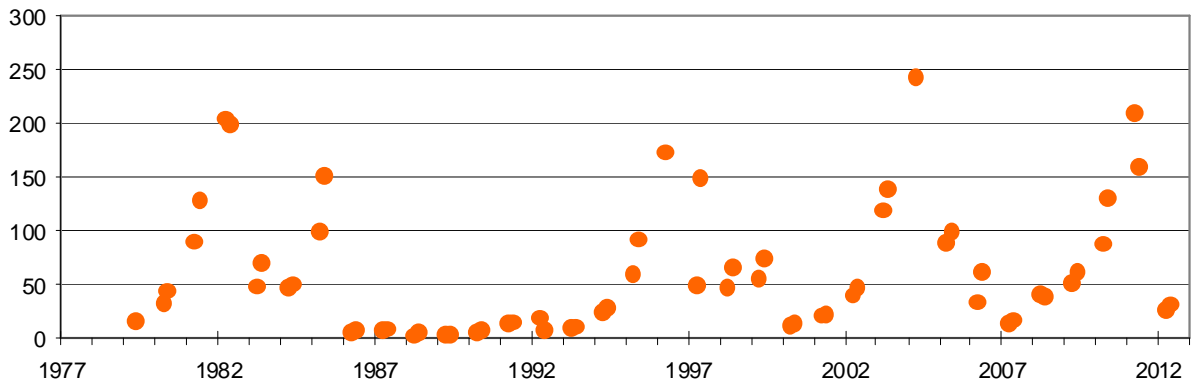
Depth mLD



pH



Salinity (ppt)



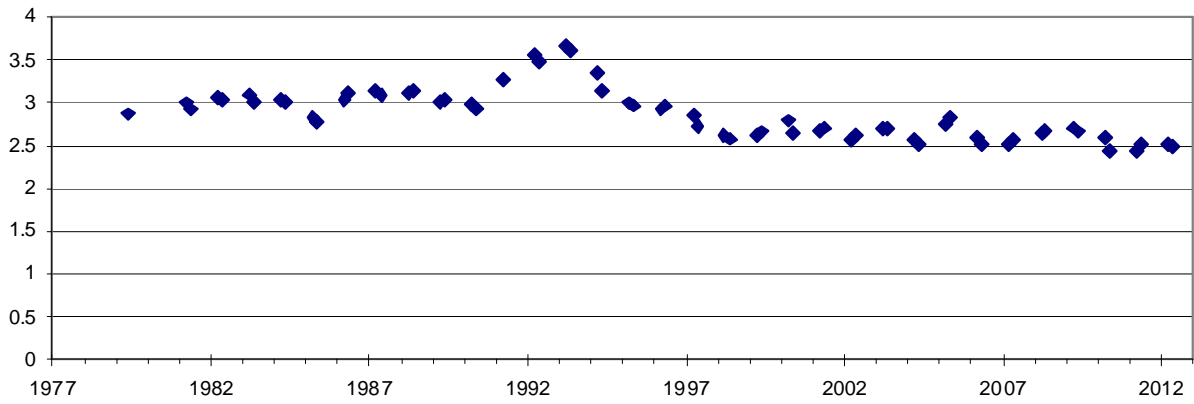
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

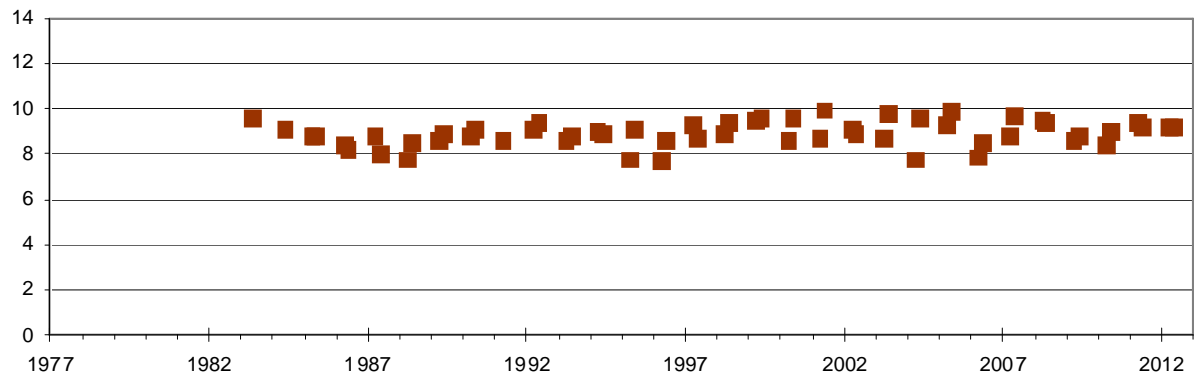
Jerdacuttup is in the Albany District of the South Coast DPW Region

JOONDALUP

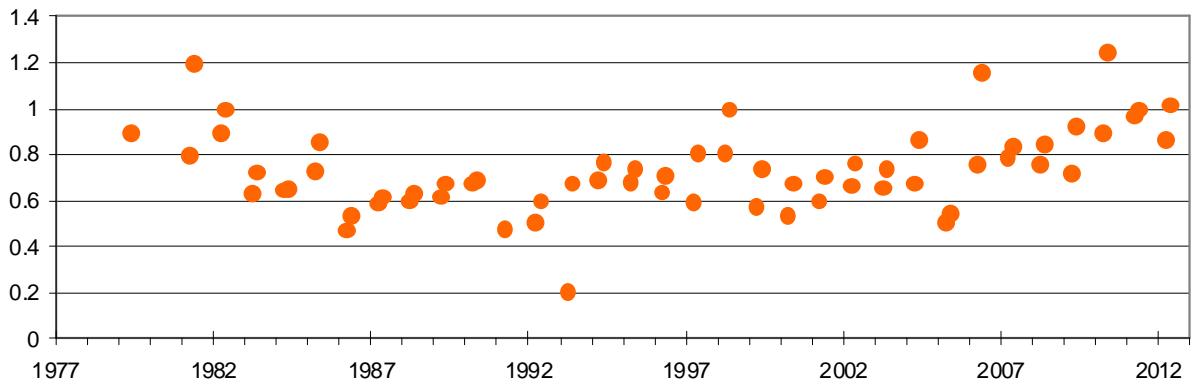
Depth mLD



pH



Salinity (ppt)



Notes:

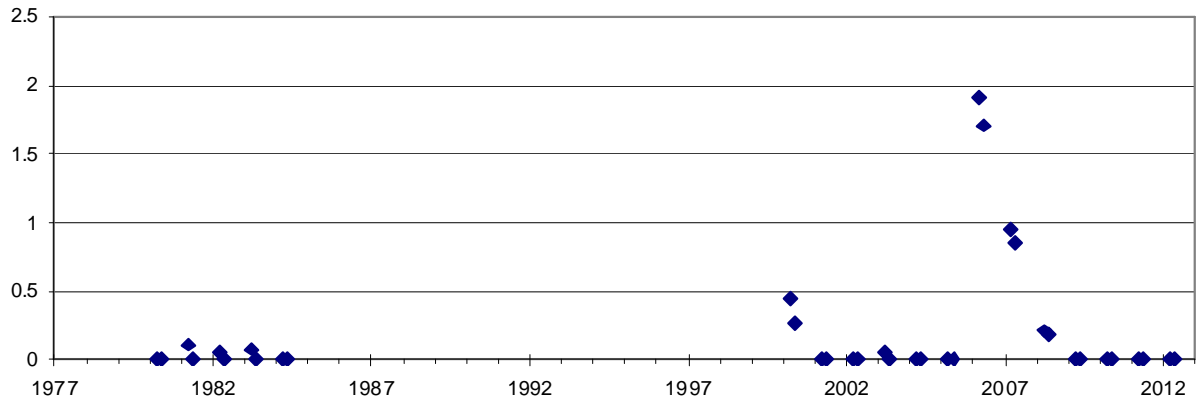
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Joondalup Lake is listed in the 'Directory of Important Wetlands in Australia'.

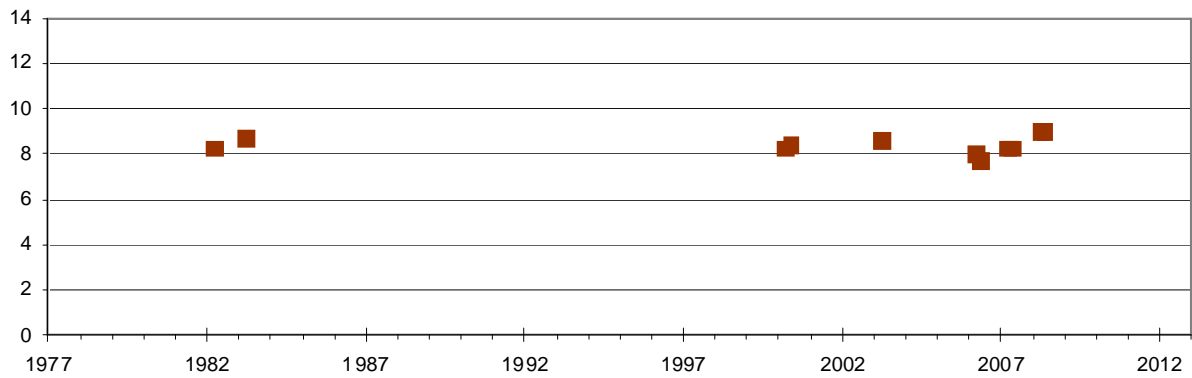
Joondalup is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DPaW Region.

KENT 29020

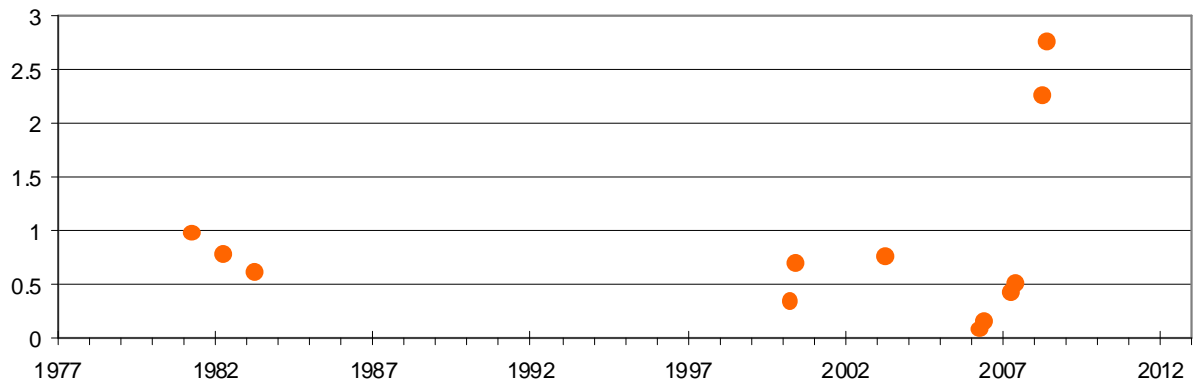
Depth mLD



pH



Salinity (ppt)



Notes:

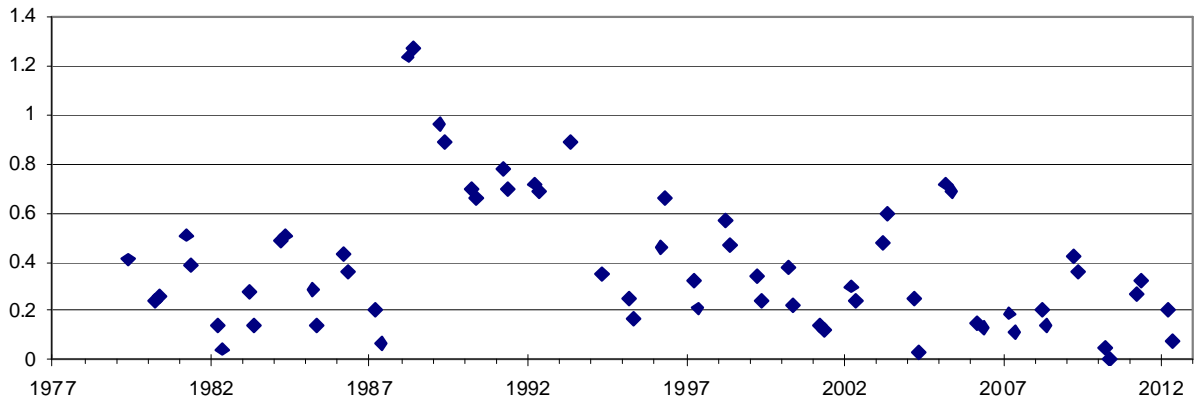
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Kent 29020 (also known as East Lake Bryde) is a component of the 'Lake Bryde – East Lake Bryde System', which is listed in the 'Directory of Important Wetlands in Australia'.

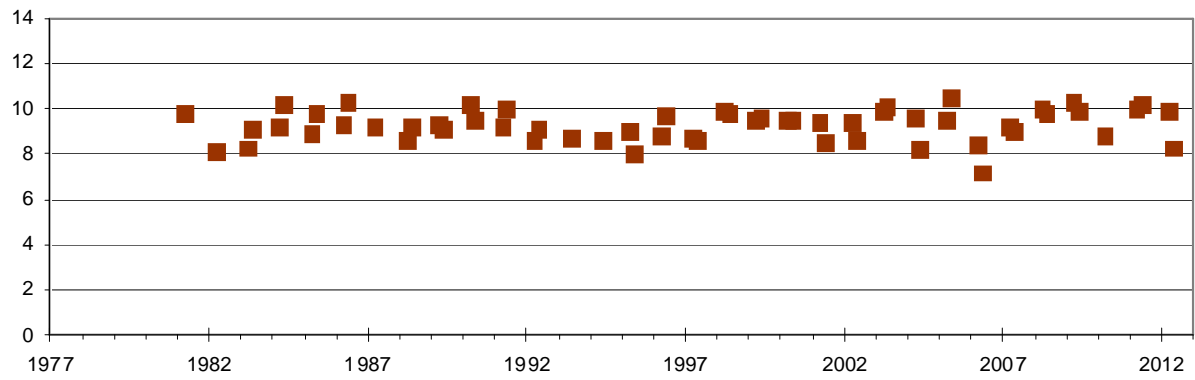
Kent 29020 is within the Lake Bryde Natural Diversity Recovery Catchment and is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

KWORNICUP

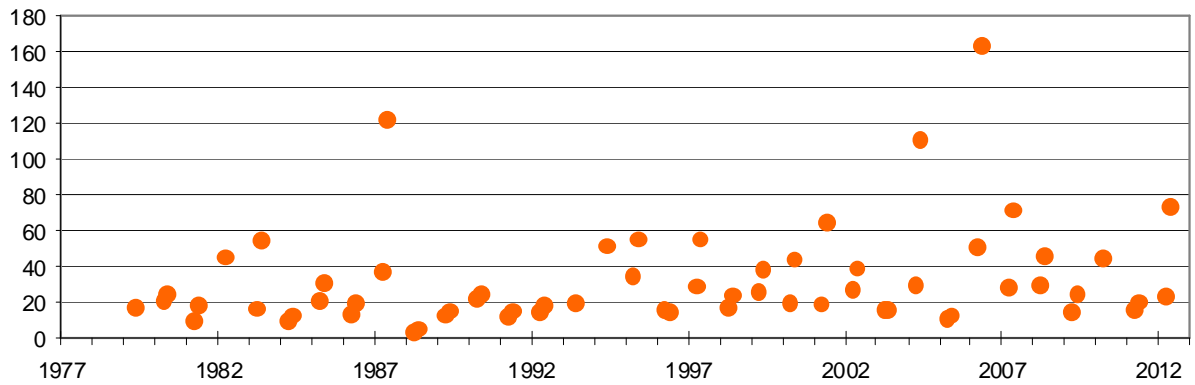
Depth mLD



pH



Salinity (ppt)



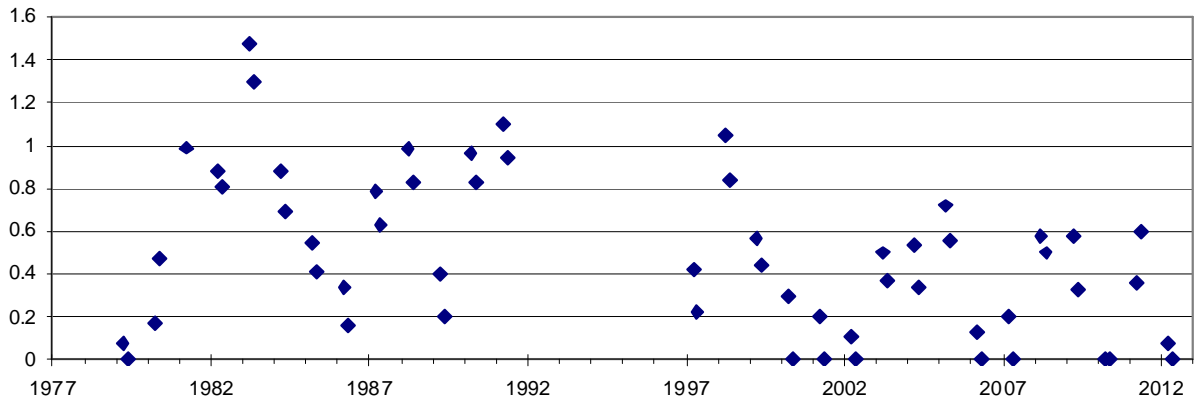
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

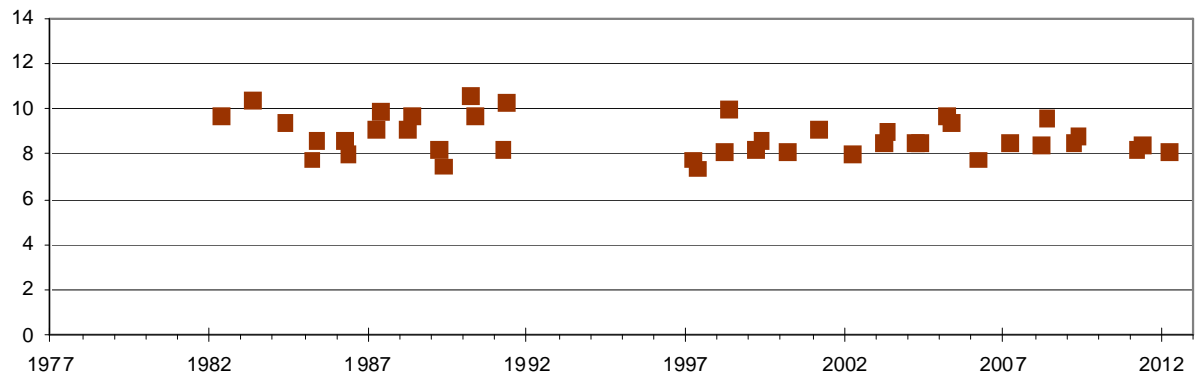
Kwornicup is in the Frankland District (headquartered in Walpole) of the Warren DPaw Region.

LITTLE WHITE

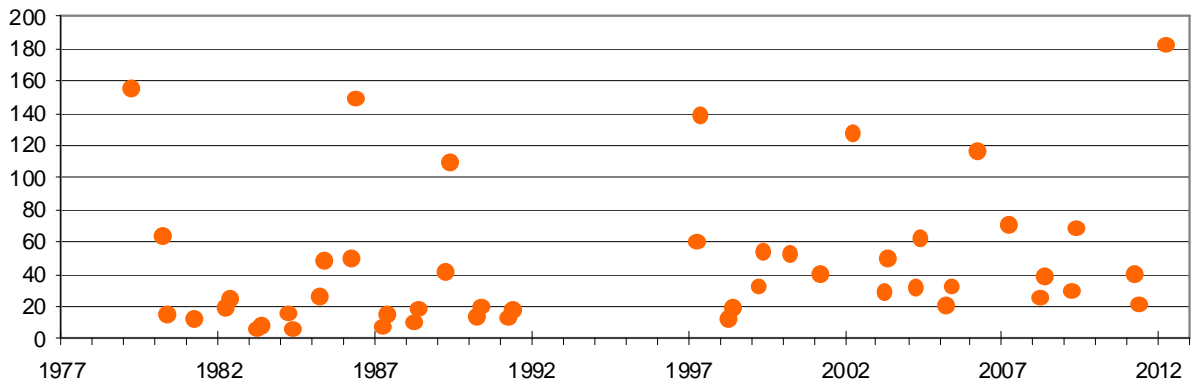
Depth mLD



pH



Salinity (ppt)



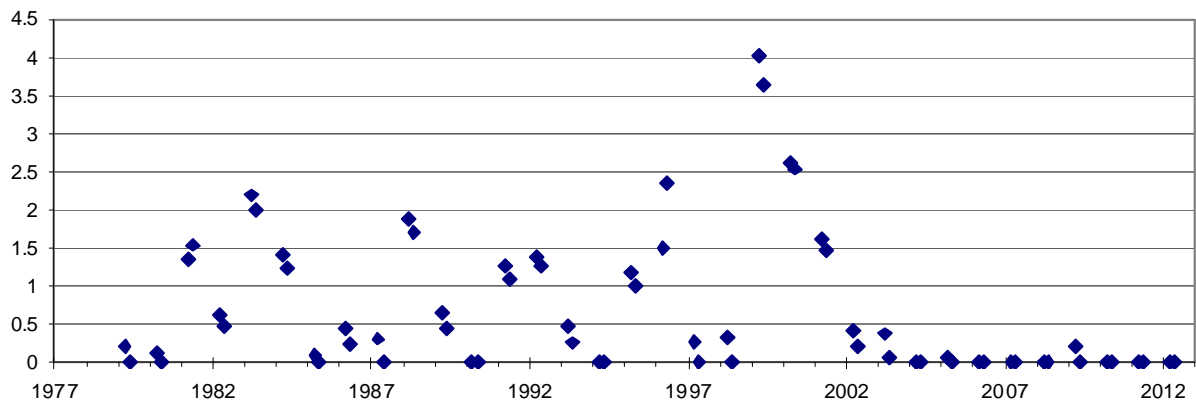
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

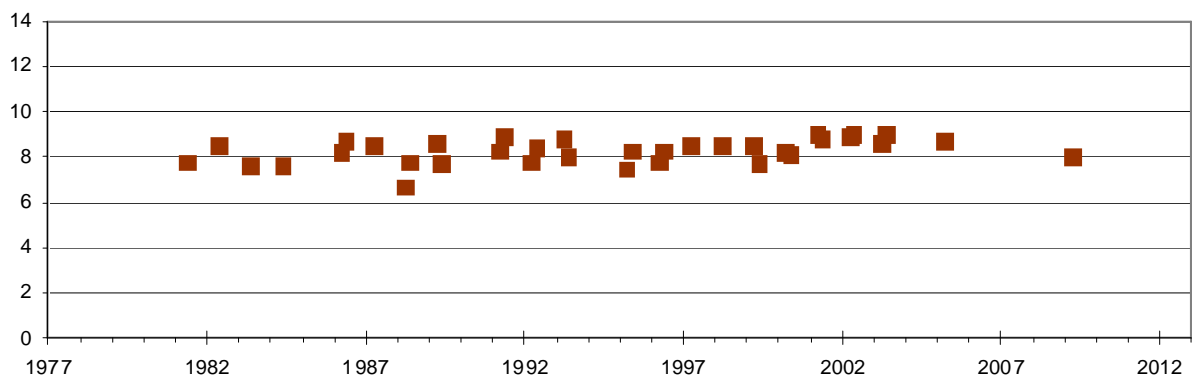
Little White is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

LOGUE^{IM}

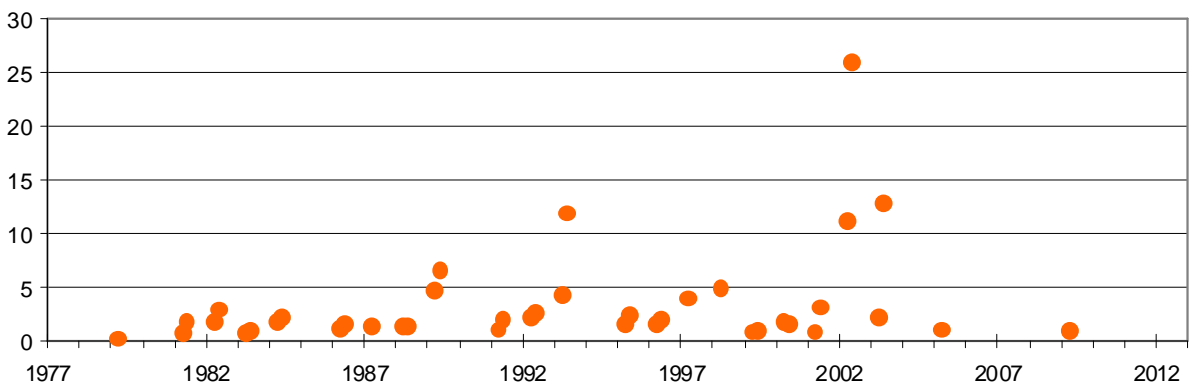
Depth mLD



pH



Salinity (ppt)



Notes:

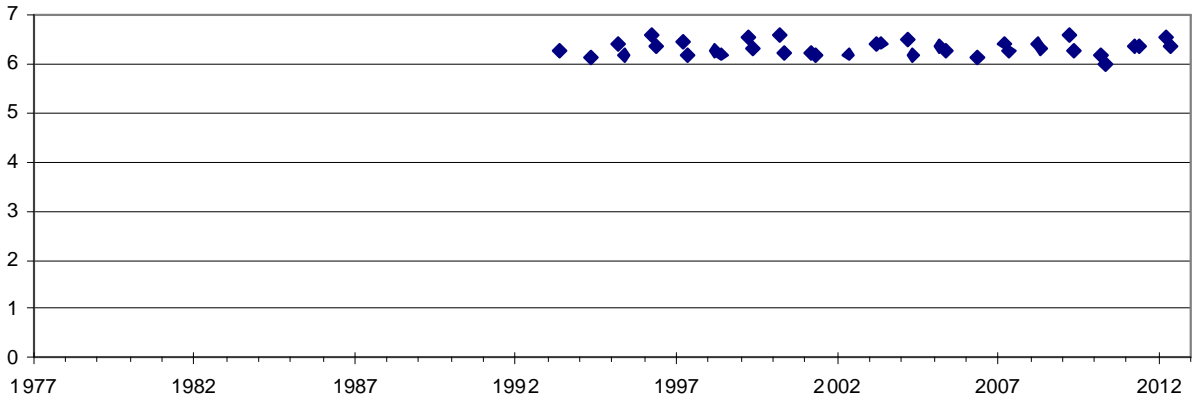
1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Logue is a component of the 'Lake Logue-Indoon System', which is listed in the 'Directory of Important Wetlands in Australia'.

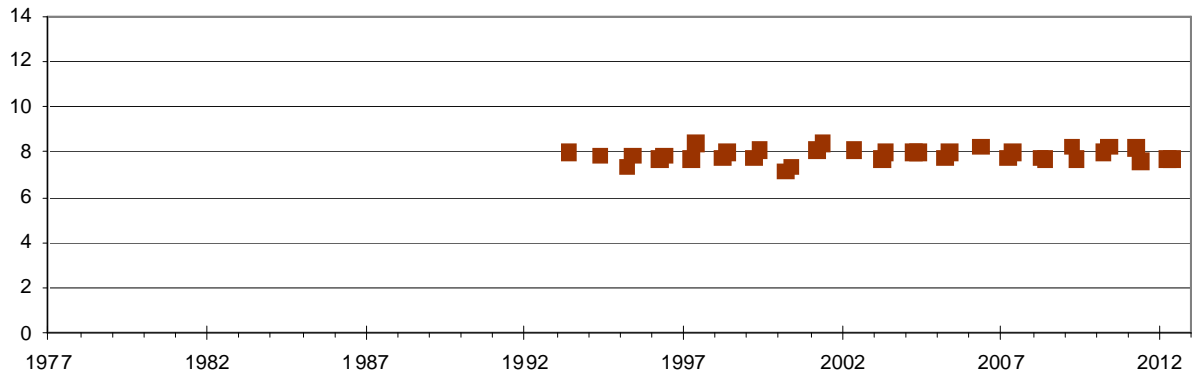
Logue is in the Moora District (headquartered in Jurien Bay) of the Midwest DPaw Region.

MARINGUP (with Depth axis 0-7m)

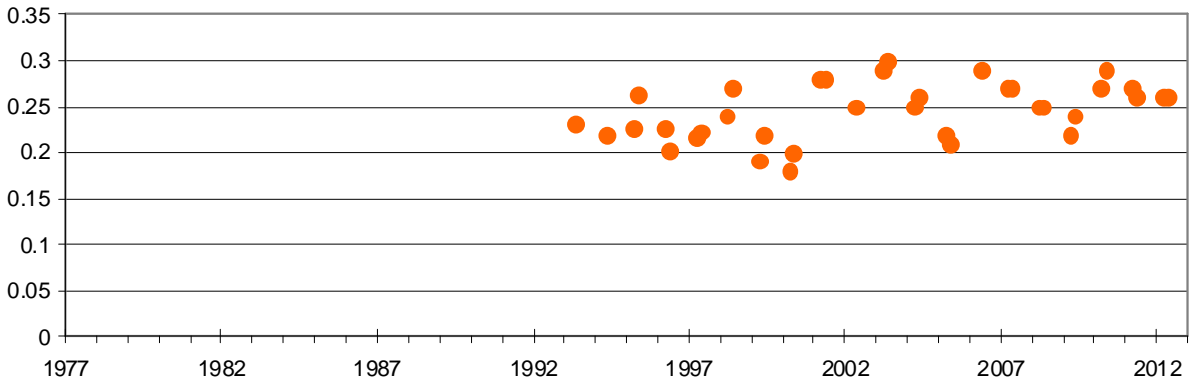
Depth mLD



pH



Salinity (ppt)



Notes:

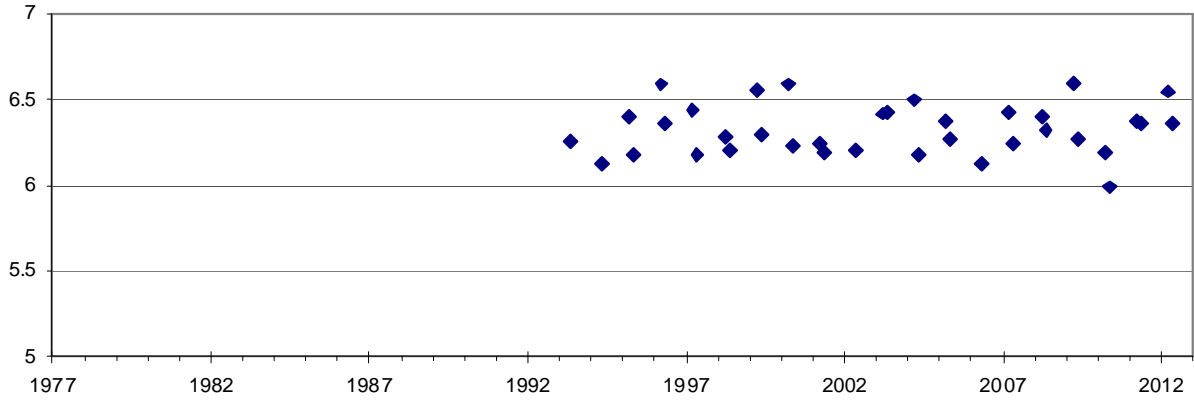
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Maringup Lake is listed in the 'Directory of Important Wetlands in Australia'.

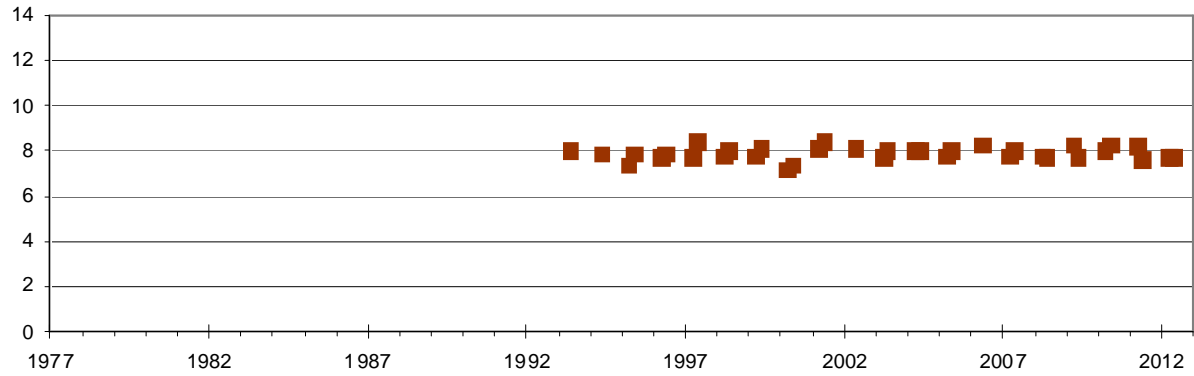
Maringup is in the Donnelly District (headquartered in Pemberton) of the Warren DPaW Region.

MARINGUP (with Depth axis 5-7m)

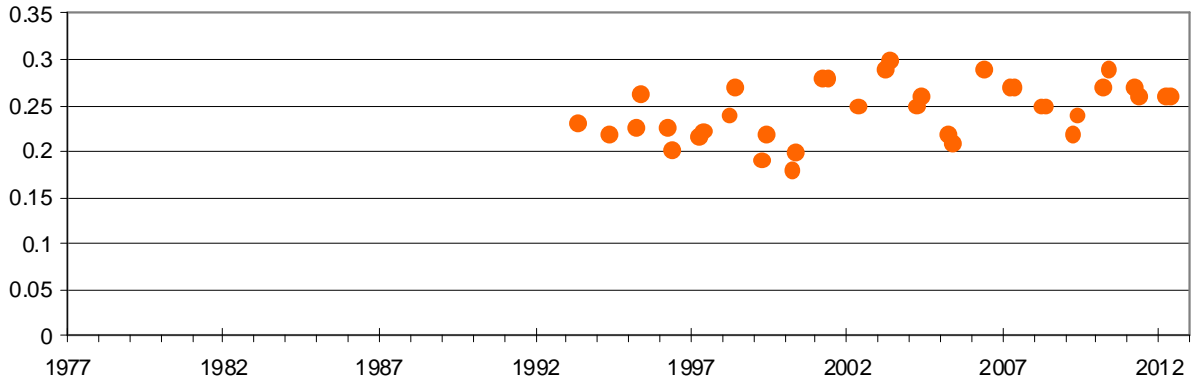
Depth mLD



pH



Salinity (ppt)



Notes:

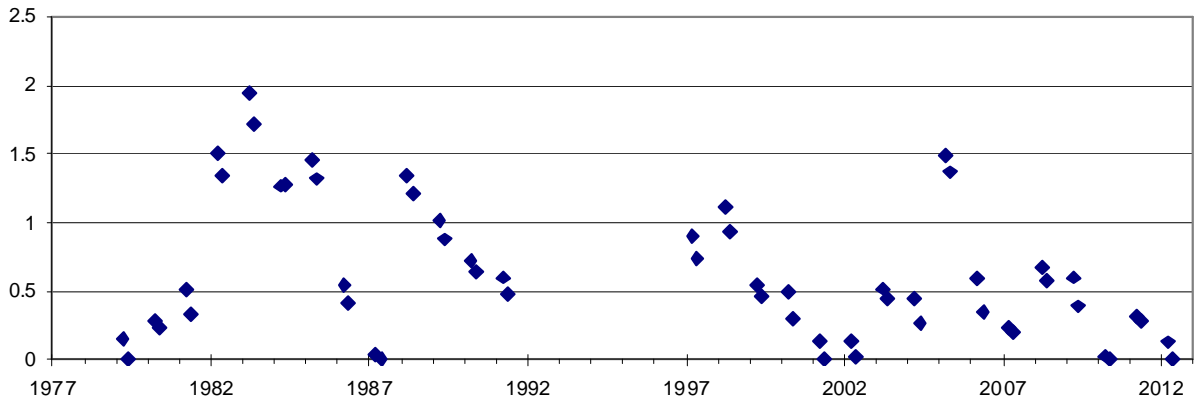
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Maringup Lake is listed in the 'Directory of Important Wetlands in Australia'.

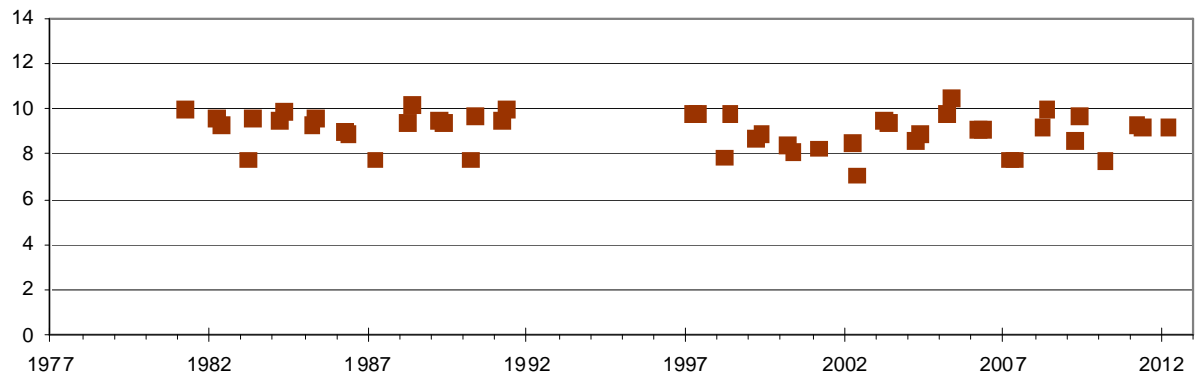
Maringup is in the Donnelly District (headquartered in Pemberton) of the Warren DPaw Region.

MARTINUP

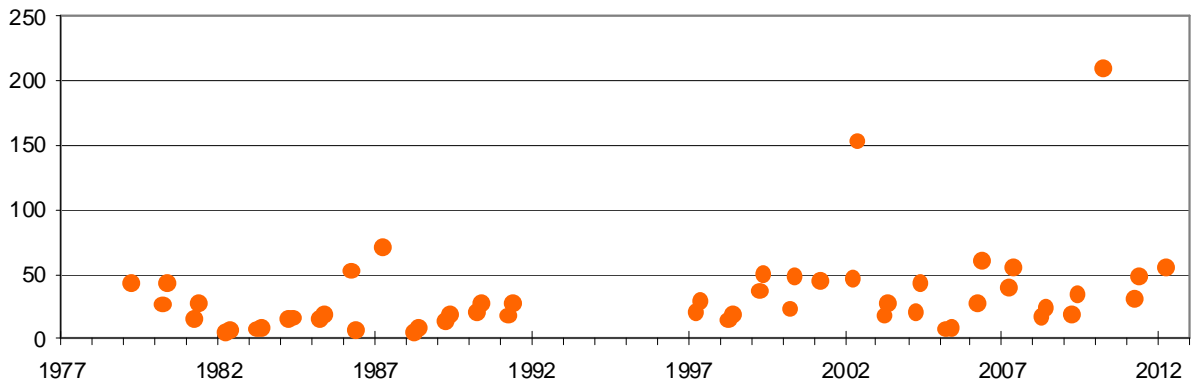
Depth mLD



pH



Salinity (ppt)



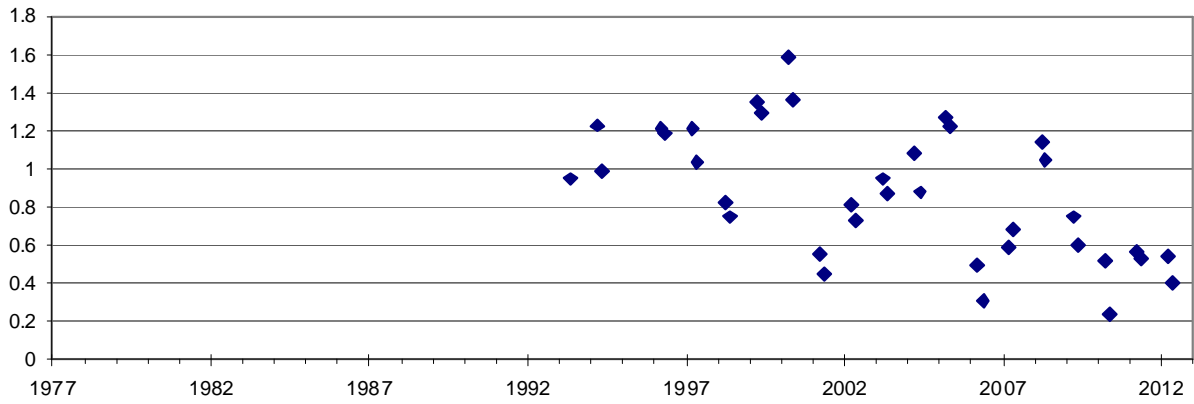
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

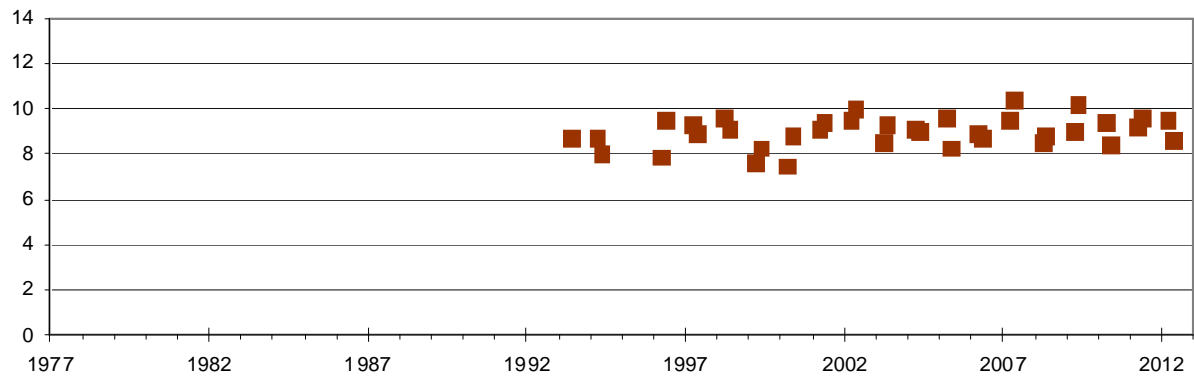
Martinup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

McLARTY

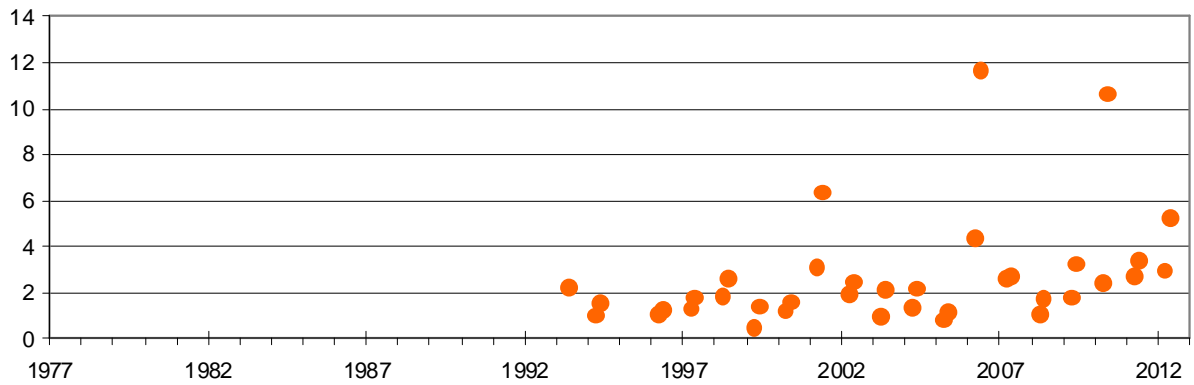
Depth mLD



pH



Salinity (ppt)



Notes:

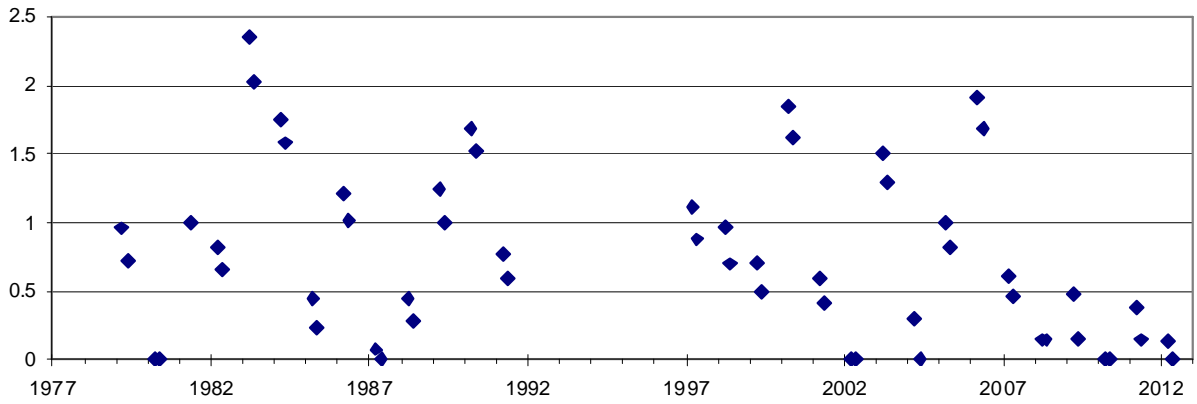
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

McLarty is a component of the 'Peel-Yalgorup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands, and is also a component of the 'Lake McLarty System' listed in the 'Directory of Important Wetlands in Australia'.

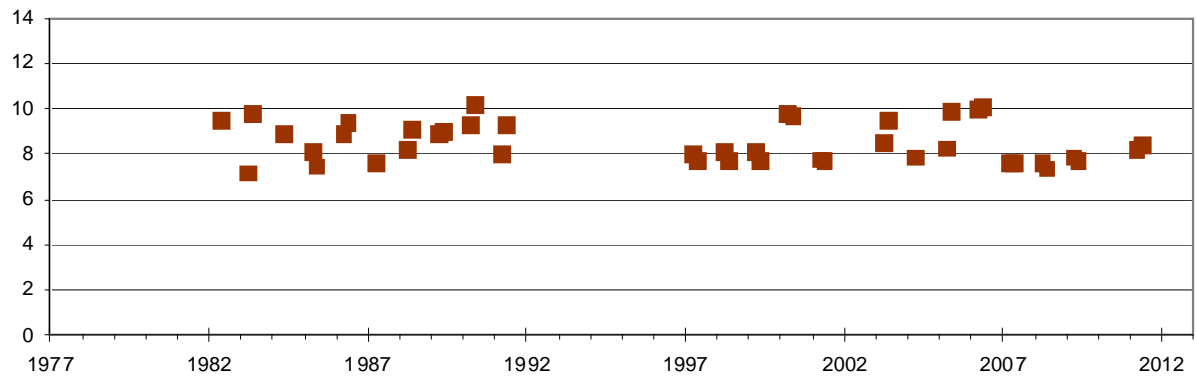
McLarty is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DPaW Region.

MEARS

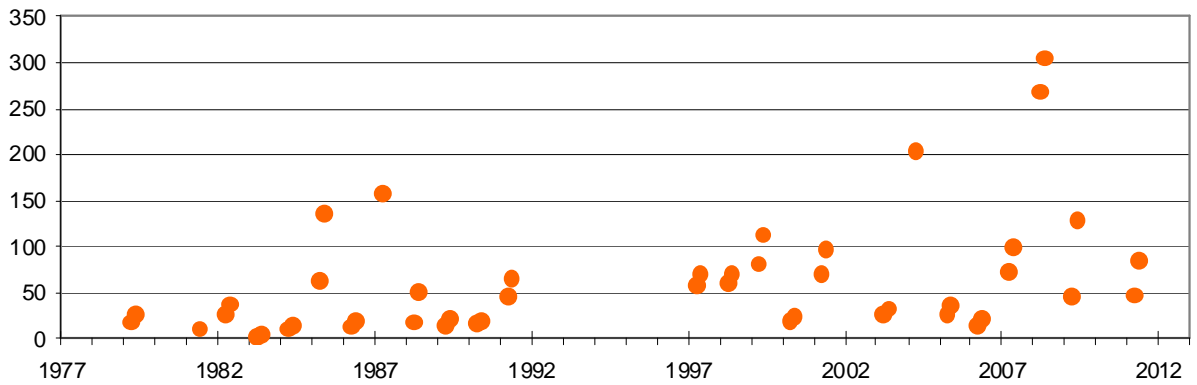
Depth mLD



pH



Salinity (ppt)



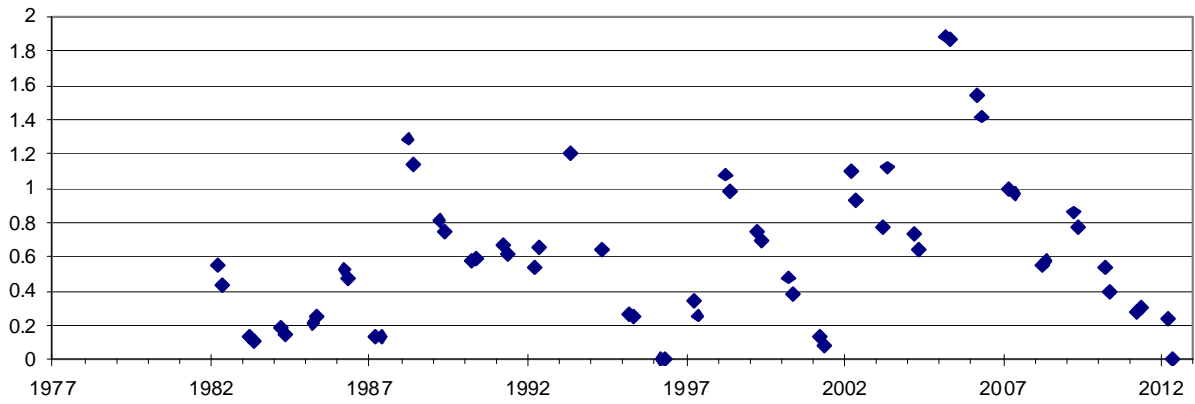
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

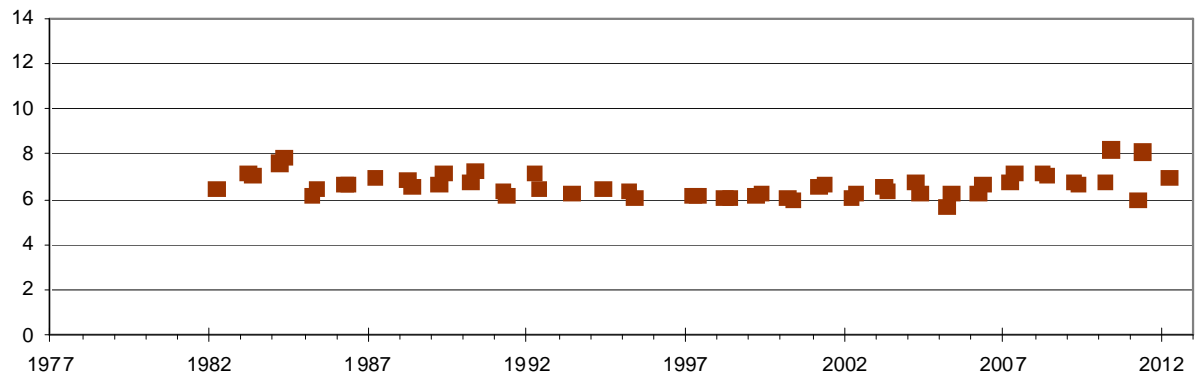
Mears is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

METTLER

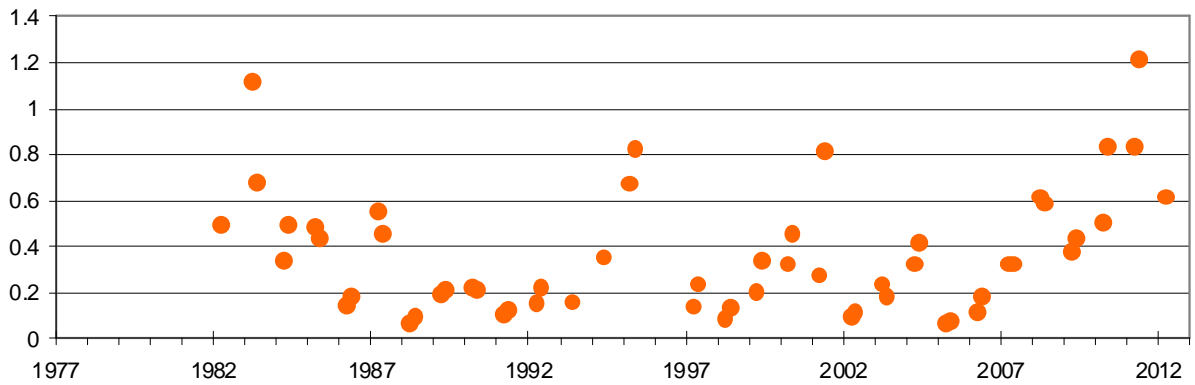
Depth mLD



pH



Salinity (ppt)

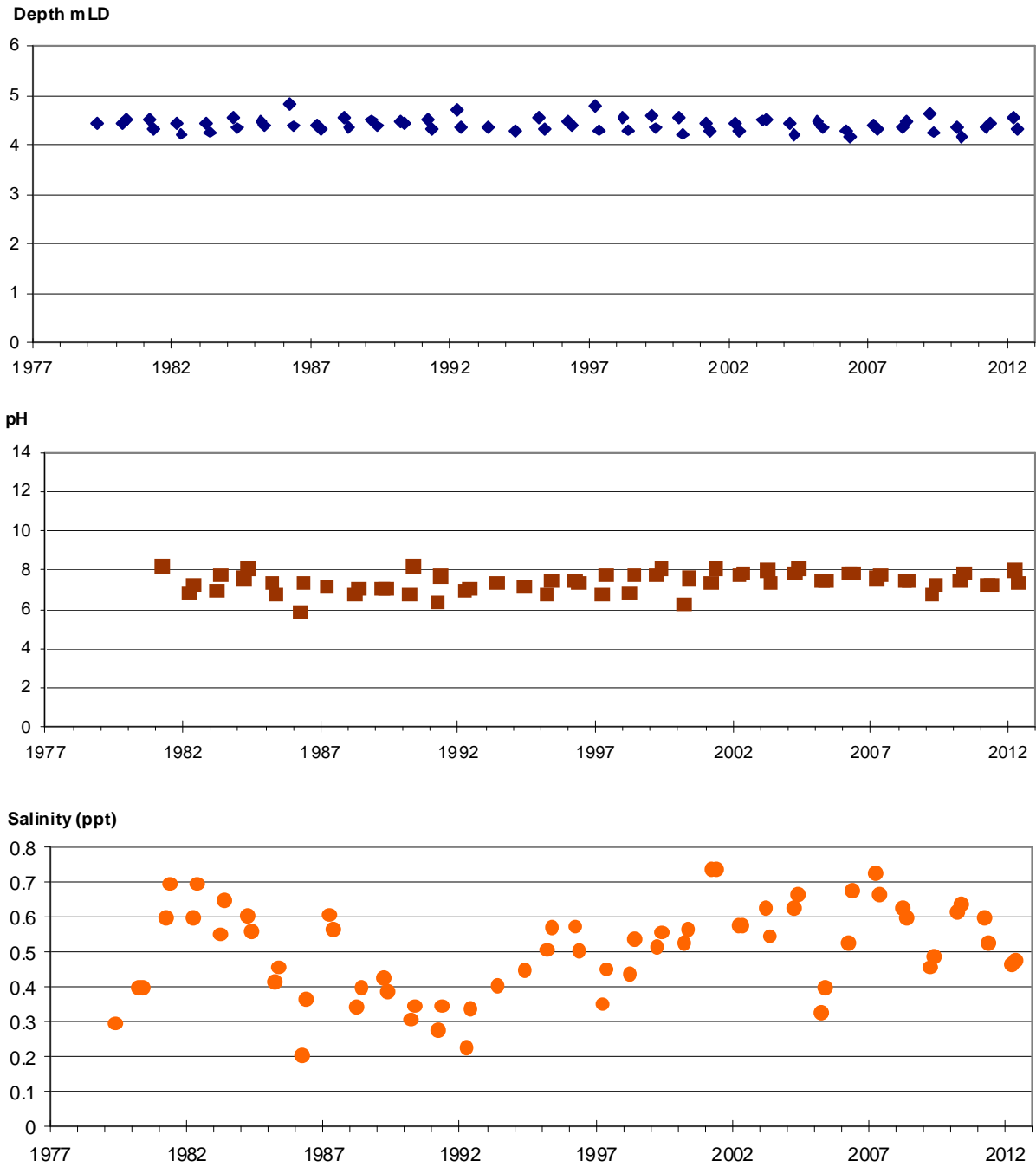


Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Mettler is in the Albany District of the South Coast DPaW Region

MOATES (with Depth axis 0-6m)



Notes:

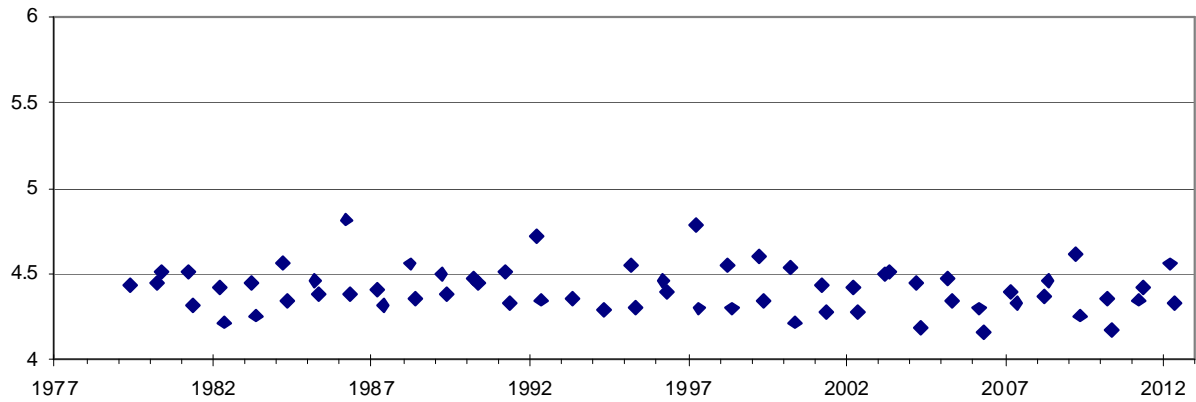
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Moates is a component of the 'Moates Lake System', which is listed in the 'Directory of Important Wetlands in Australia'.

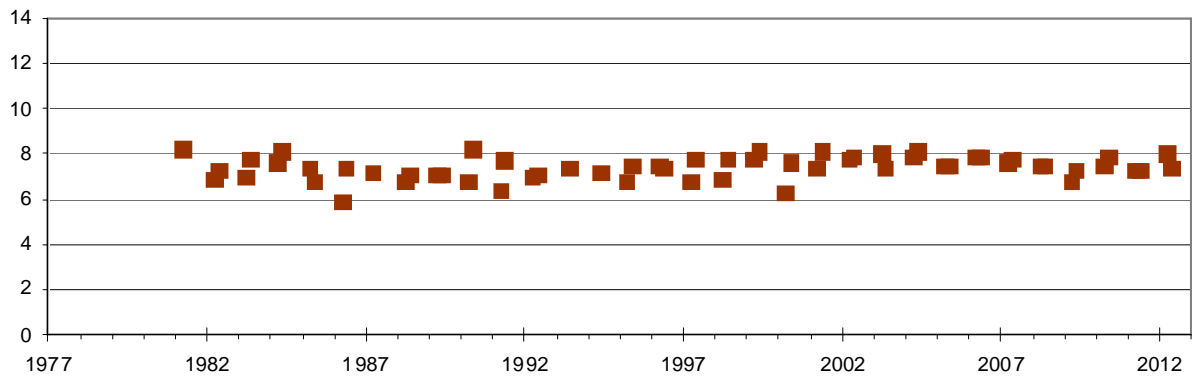
Moates is in the Albany District of the South Coast DPaW Region

MOATES (with Depth axis 4-6m)

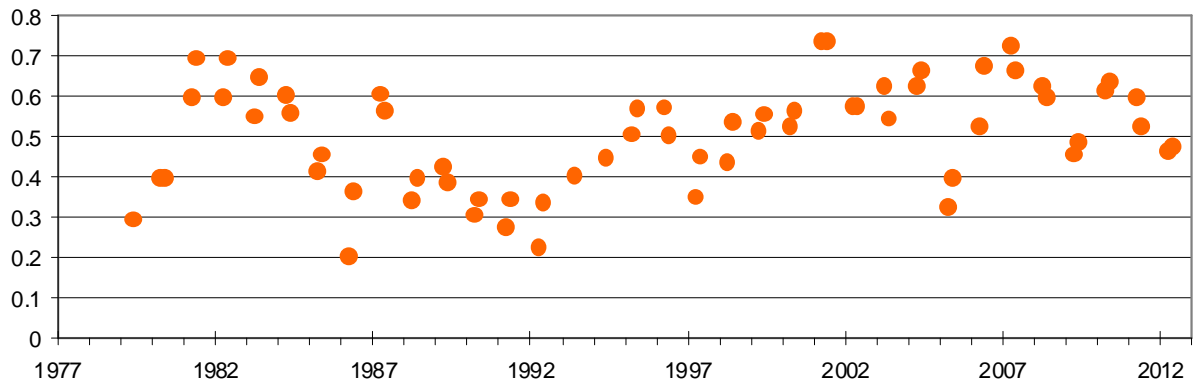
Depth mLD



pH



Salinity (ppt)



Notes:

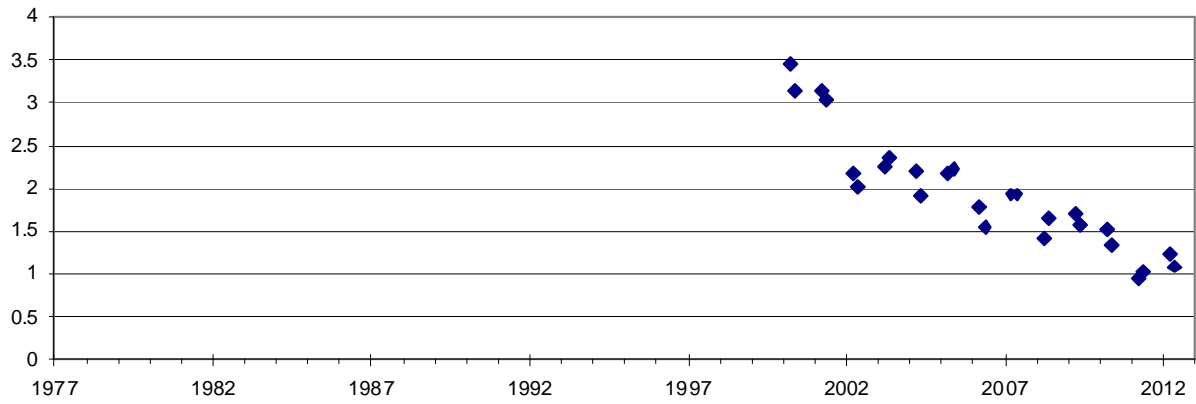
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Moates is a component of the 'Moates Lake System', which is listed in the 'Directory of Important Wetlands in Australia'.

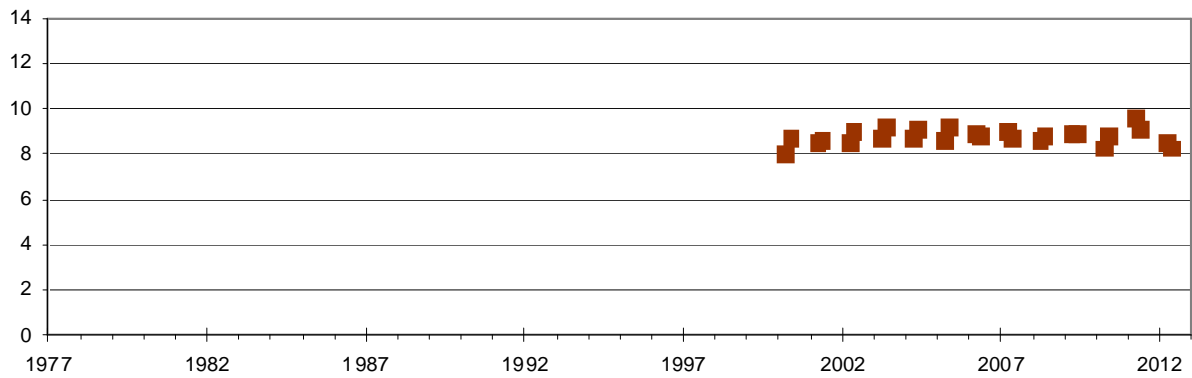
Moates is in the Albany District of the South Coast DPaW Region

MORTIJINUP

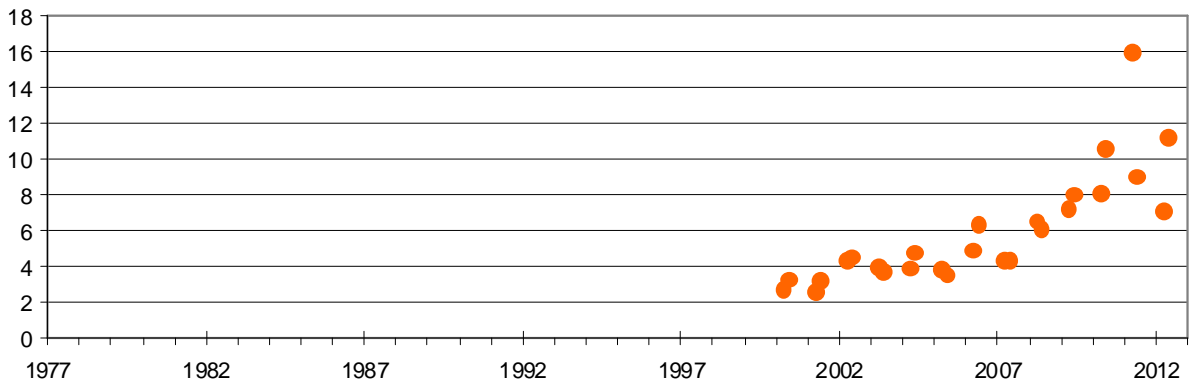
Depth mLD



pH



Salinity (ppt)



Notes:

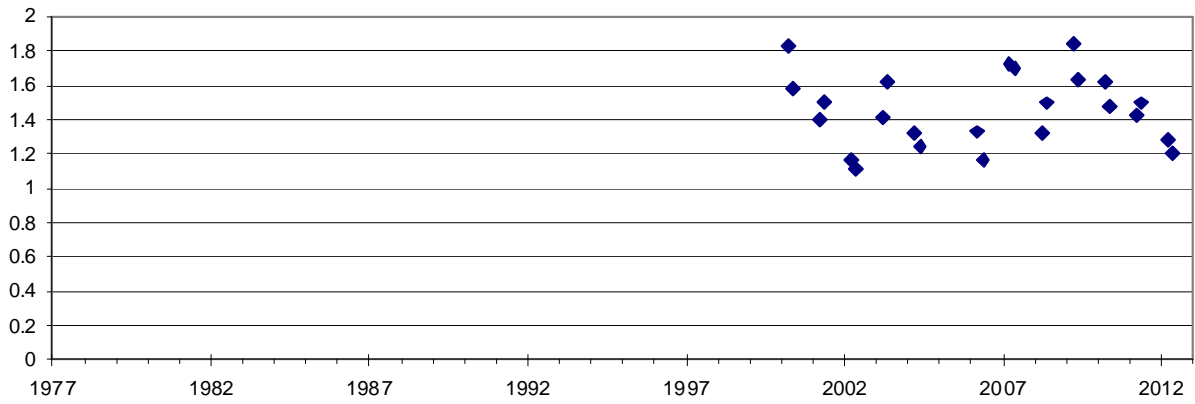
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Mortijinup is a component of the 'Mortijinup Lake System', which is listed in the 'Directory of Important Wetlands in Australia'.

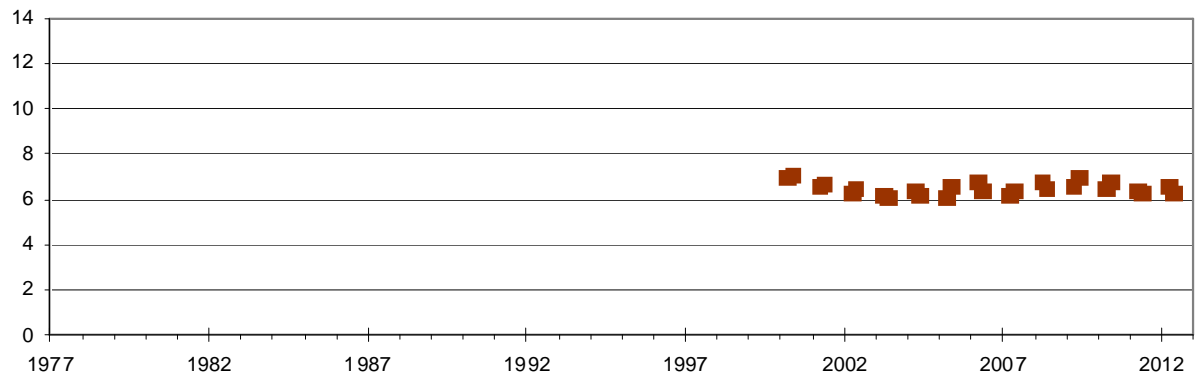
Mortijinup is in the Esperance District of the South Coast DPaw Region.

MOUNT LE GRAND

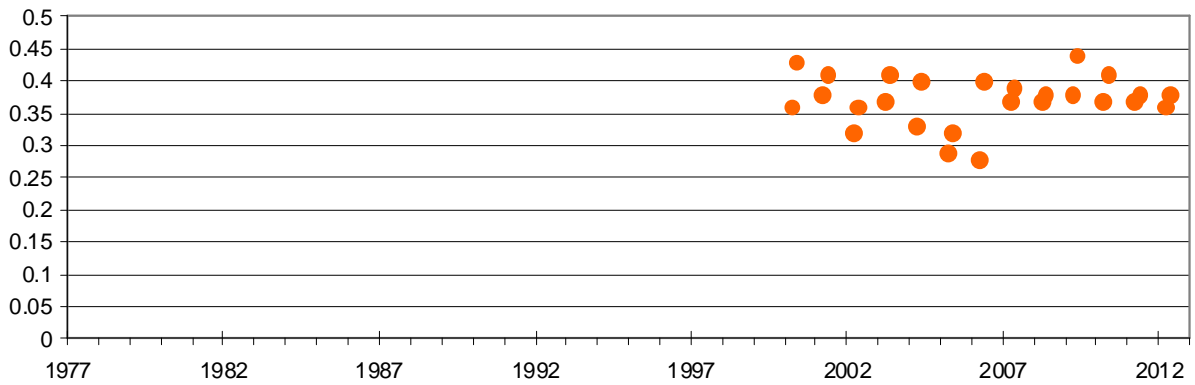
Depth mLD



pH



Salinity (ppt)



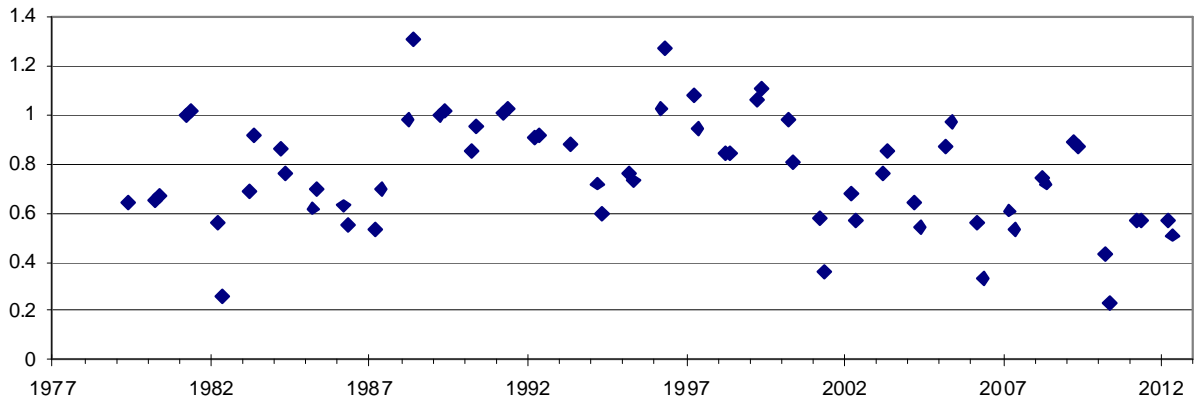
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

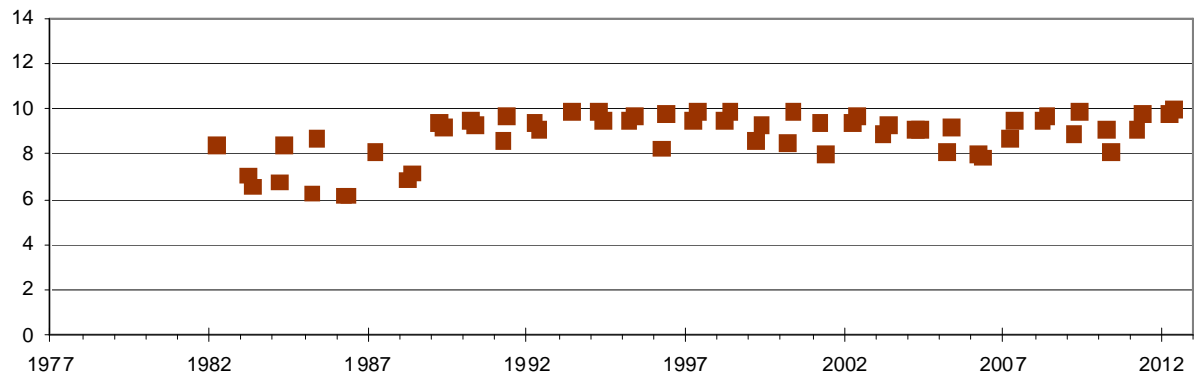
Mount Le Grand is in the Esperance District of the South Coast DPaW Region.

MUIR

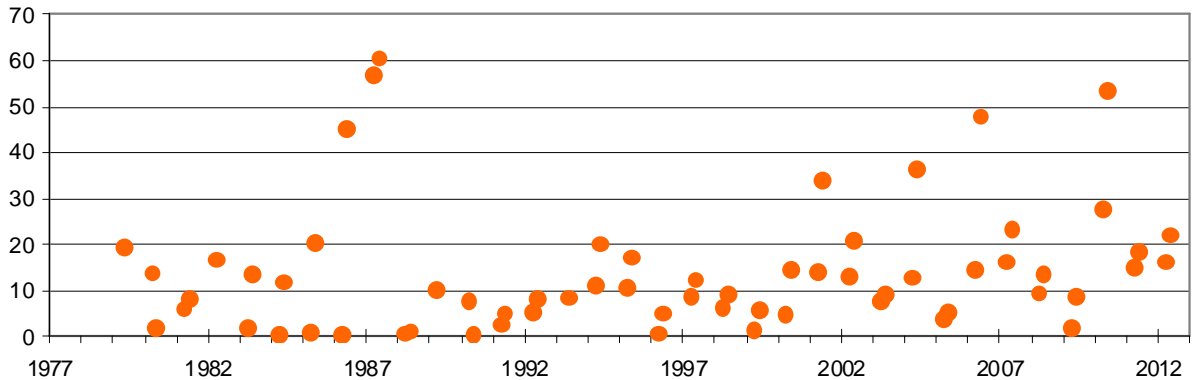
Depth mLD



pH



Salinity (ppt)



Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

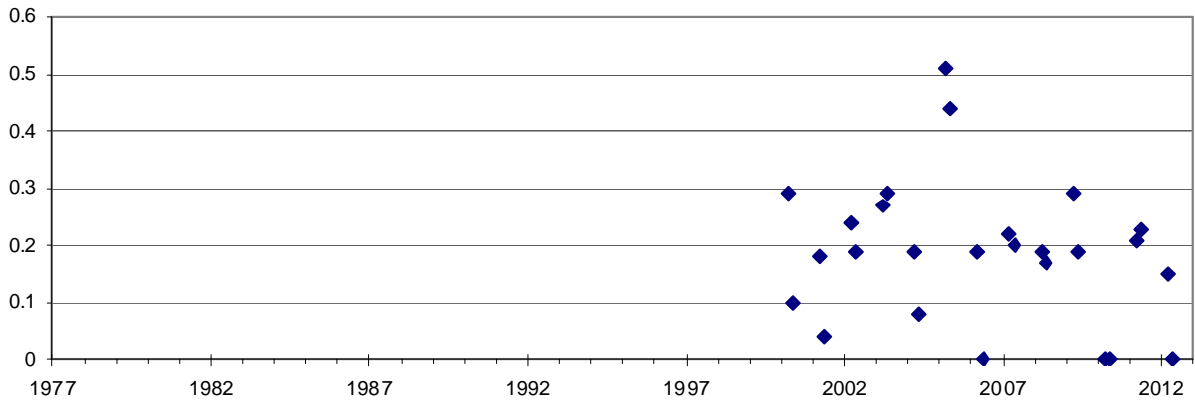
Lake Muir is a component of the 'Muir-Byenup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

Lake Muir is also listed in the 'Directory of Important Wetlands in Australia'.

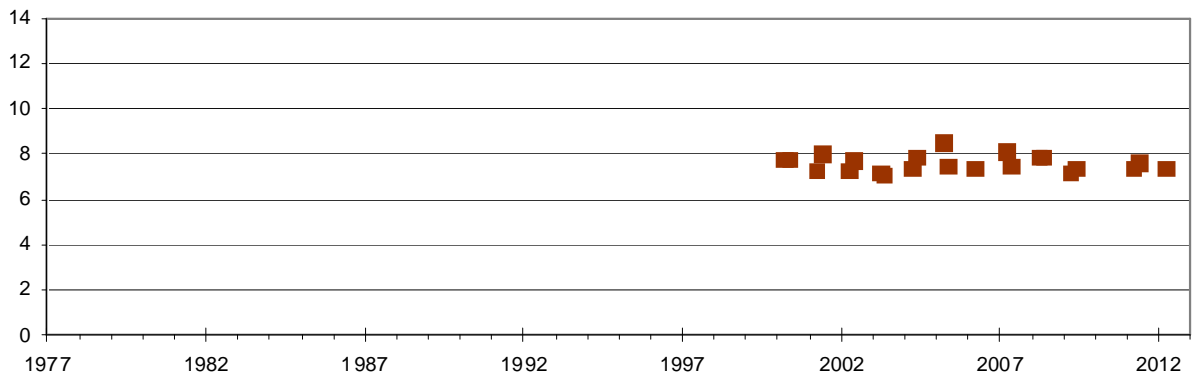
Muir is within the Muir-Uncup Natural Diversity Recovery Catchment and is in the Donnelly District (headquartered in Pemberton) of the Warren DPaW Region.

NGOPITCHUP

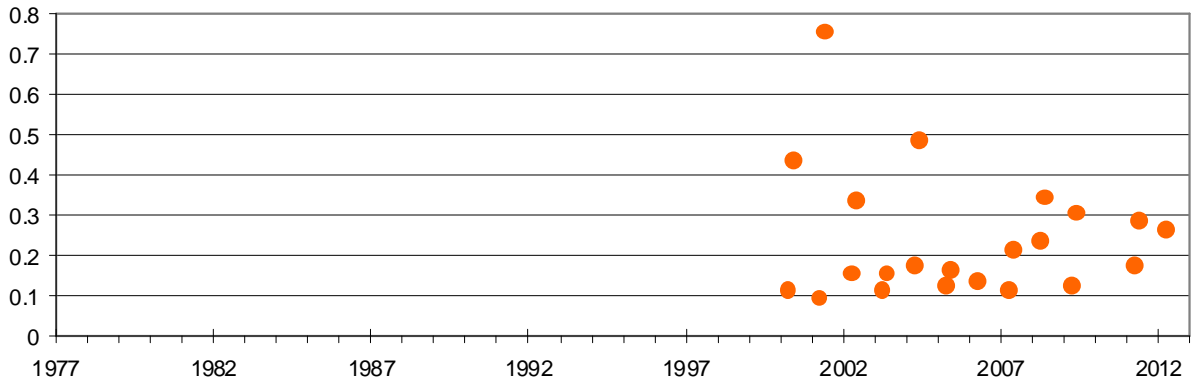
Depth mLD



pH



Salinity (ppt)



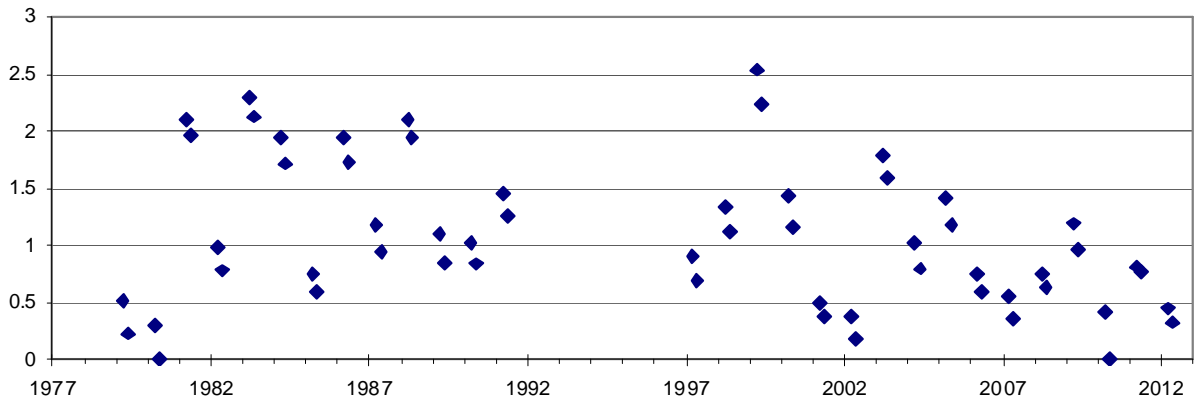
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

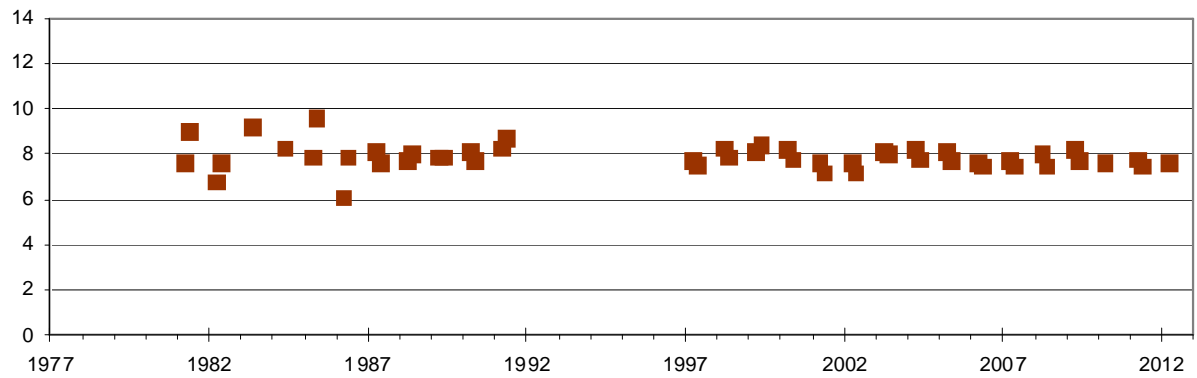
Ngopitchup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

NINAN

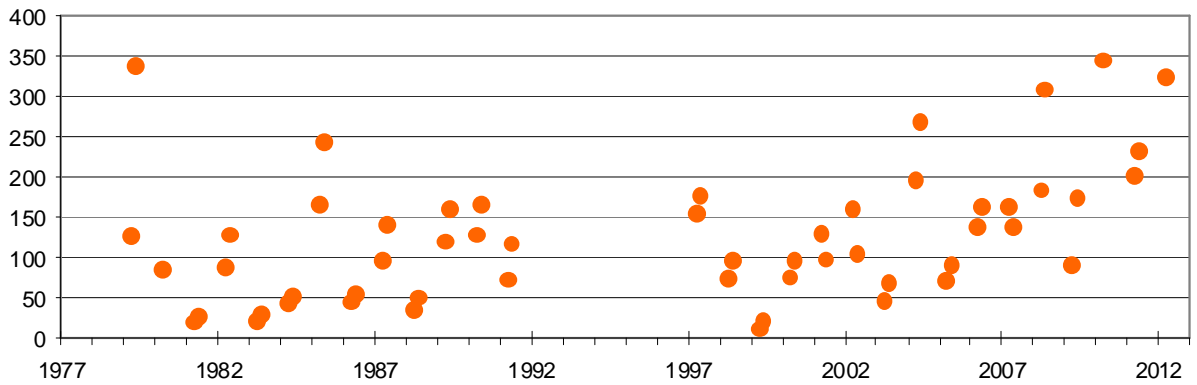
Depth mLD



pH



Salinity (ppt)



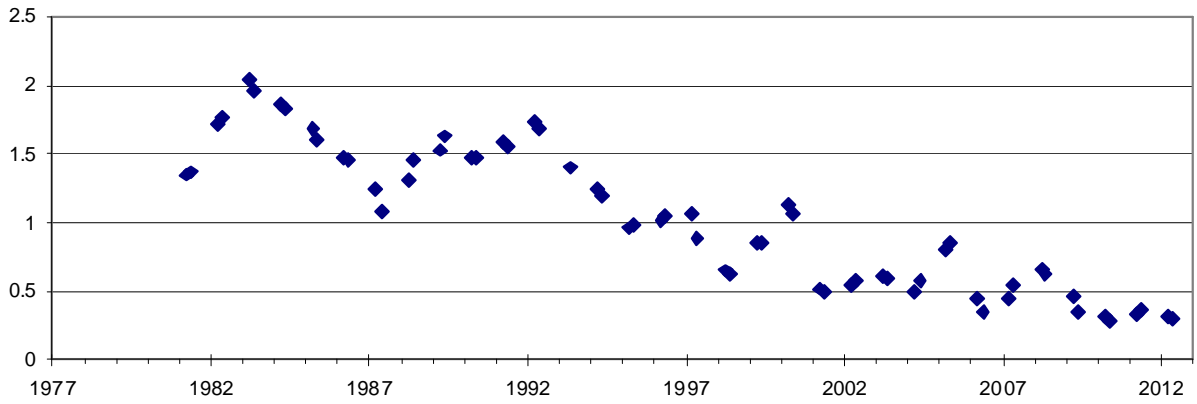
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

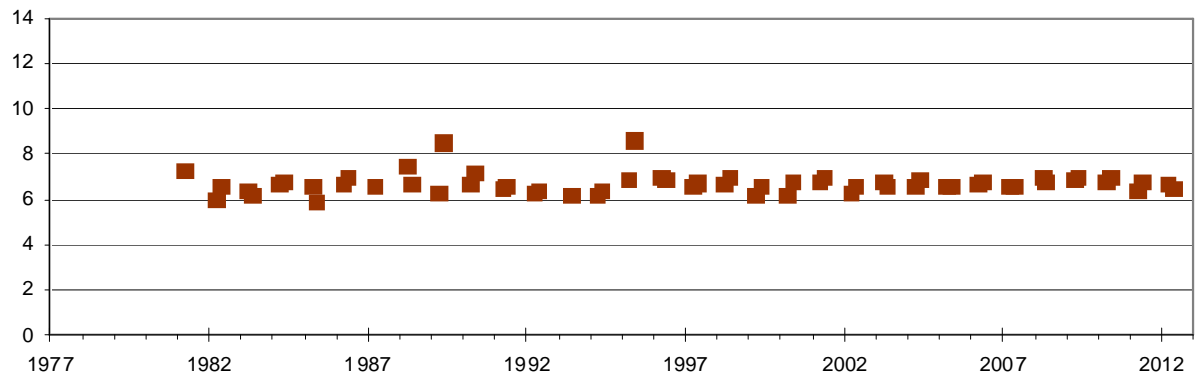
Ninan is in the Central District (headquartered in Merredin) of the Wheatbelt DPaW Region.

NINE MILE

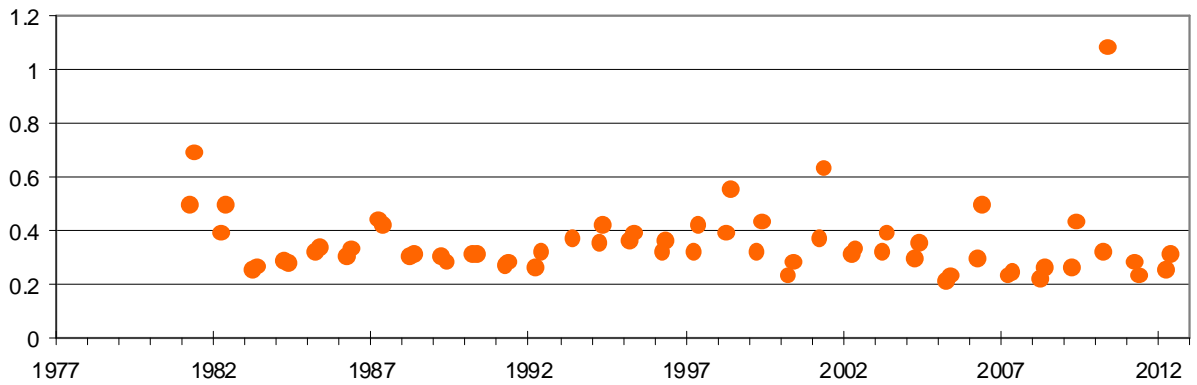
Depth mLD



pH



Salinity (ppt)



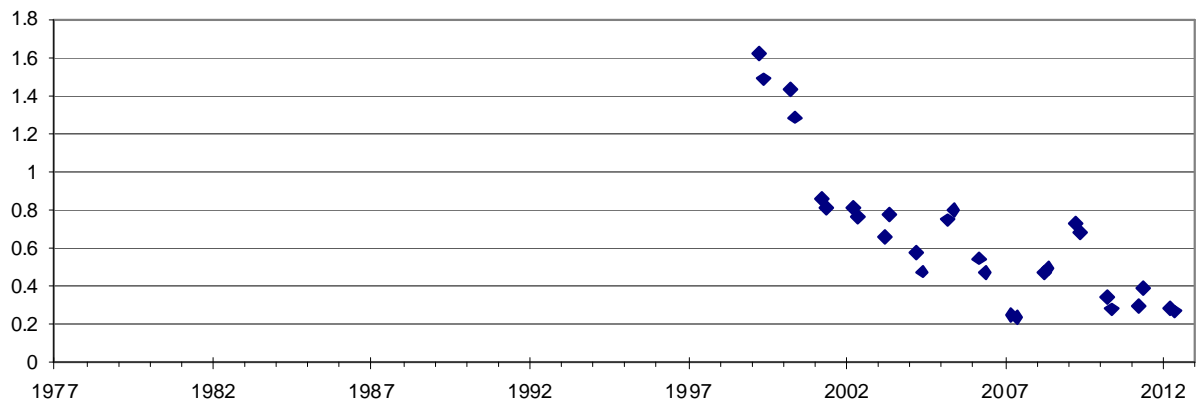
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

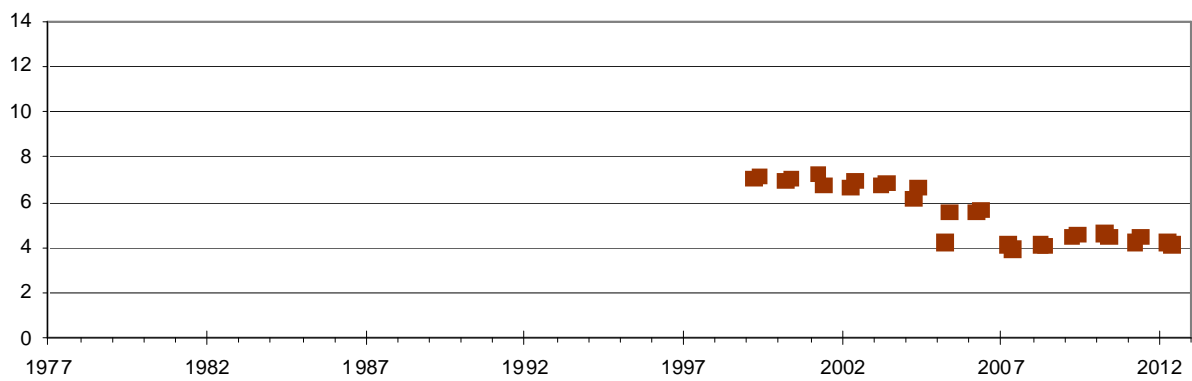
Nine Mile is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DPaW Region.

NOOBIJUP^{IM}

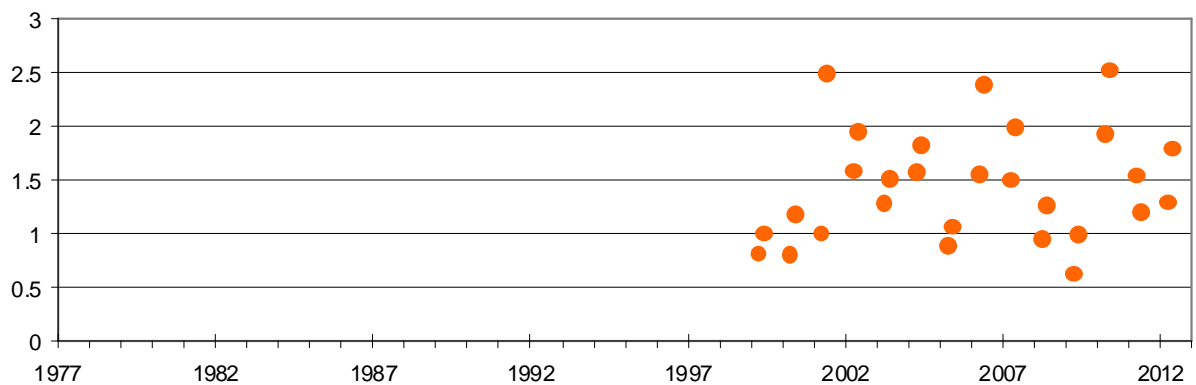
Depth mLD



pH



Salinity (ppt)



Notes:

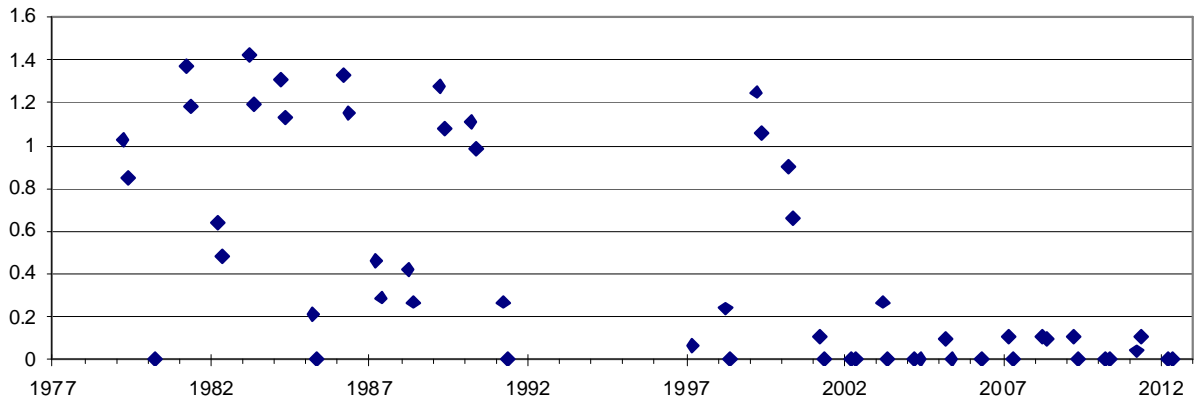
1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Noobijup is a component of the 'Byenup Lagoon System', which is listed in the 'Directory of Important Wetlands in Australia'.

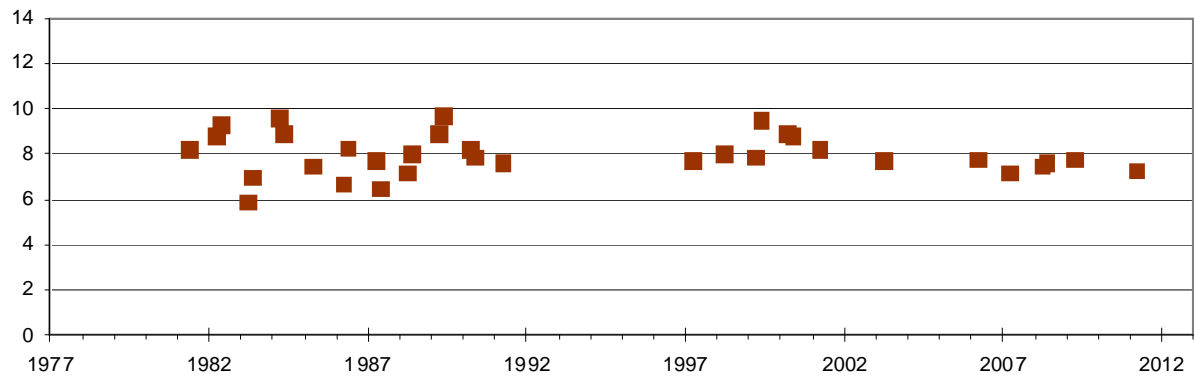
Noobijup is within the Muir-Unicup Natural Diversity Recovery Catchment and is in the Donnelly District (headquartered in Pemberton) of the Warren DPaW Region.

NOONYING

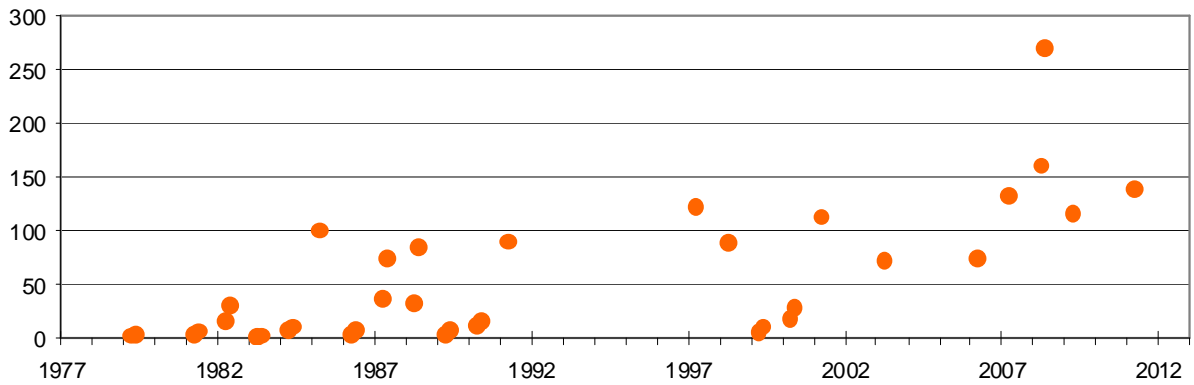
Depth mLD



pH



Salinity (ppt)



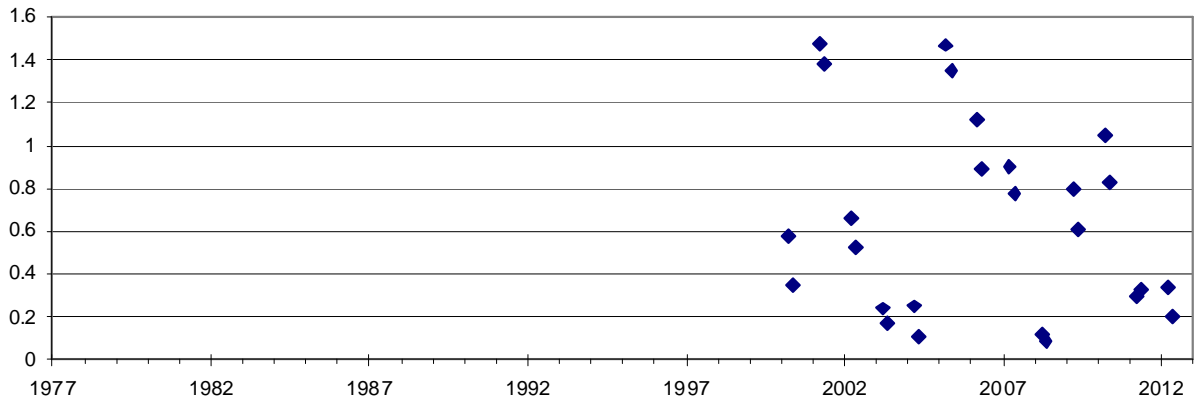
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

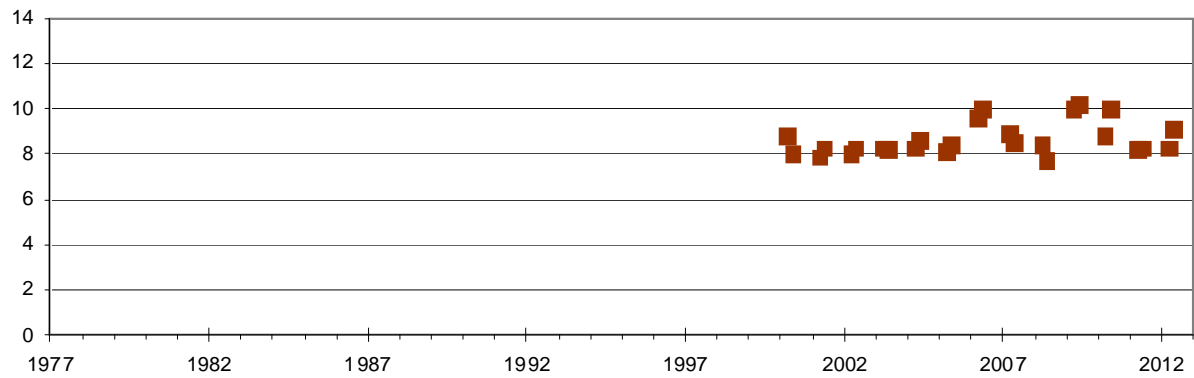
Noonying is in the Central District (headquartered in Merredin) of the Wheatbelt DPaW Region.

NORTH PARRIUP

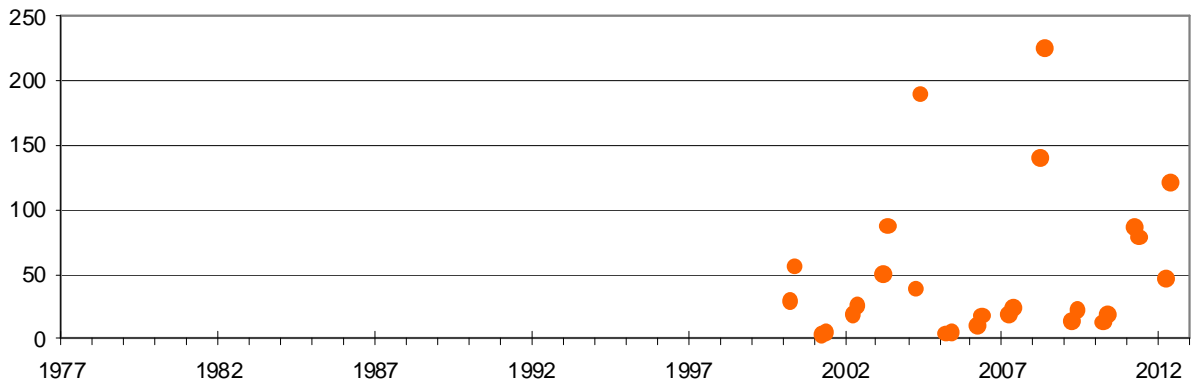
Depth mLD



pH



Salinity (ppt)



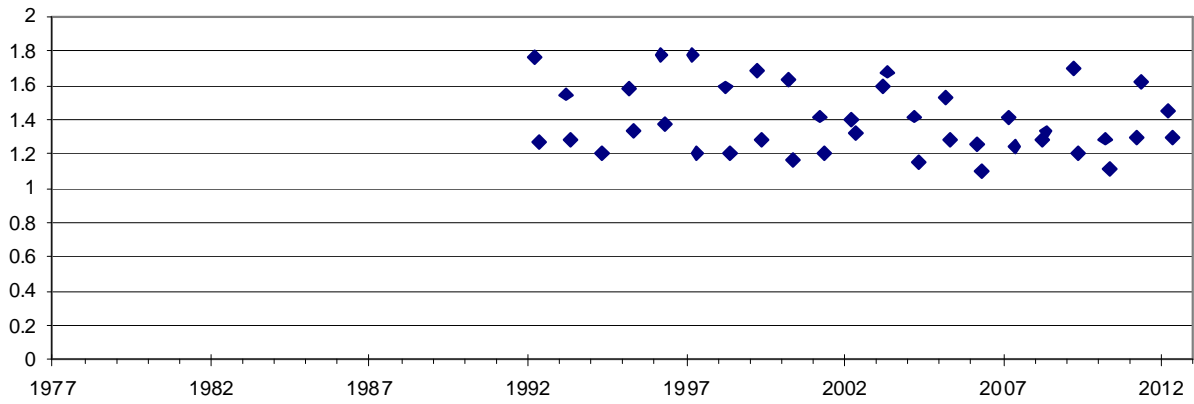
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

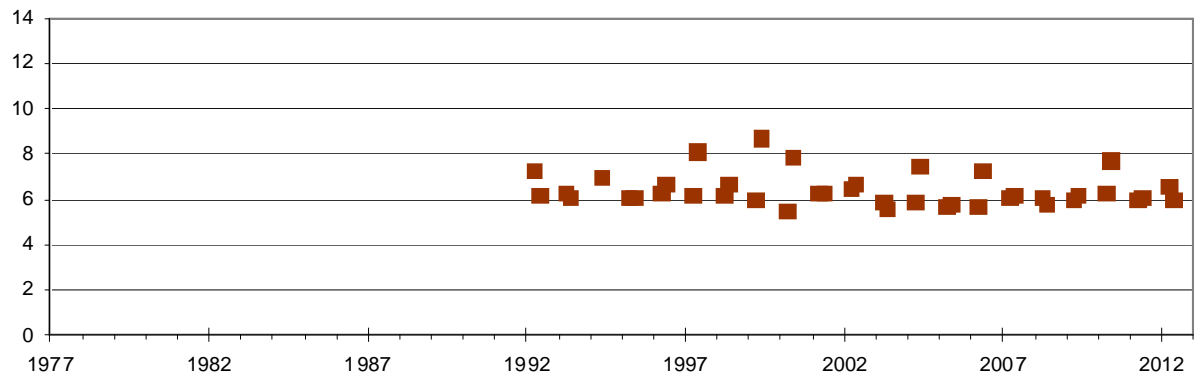
North Parriup is in the Esperance District of the South Coast DPaw Region.

OWINGUP

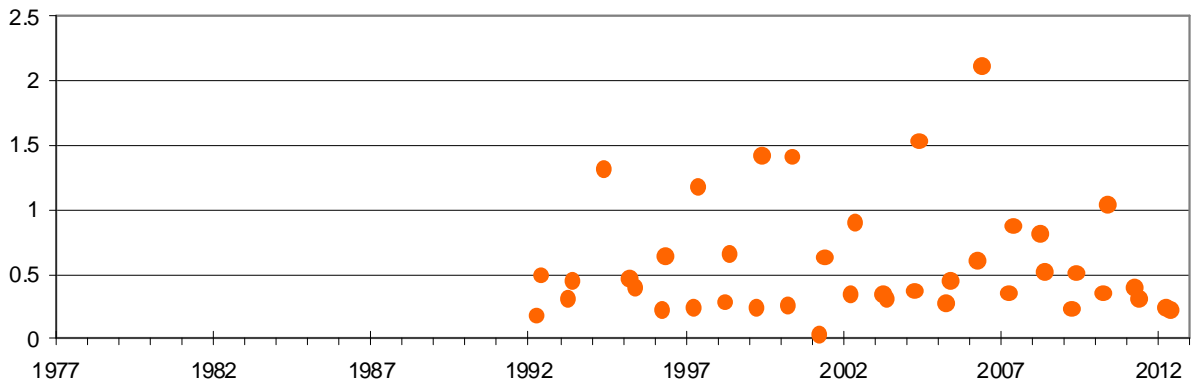
Depth mLD



pH



Salinity (ppt)



Notes:

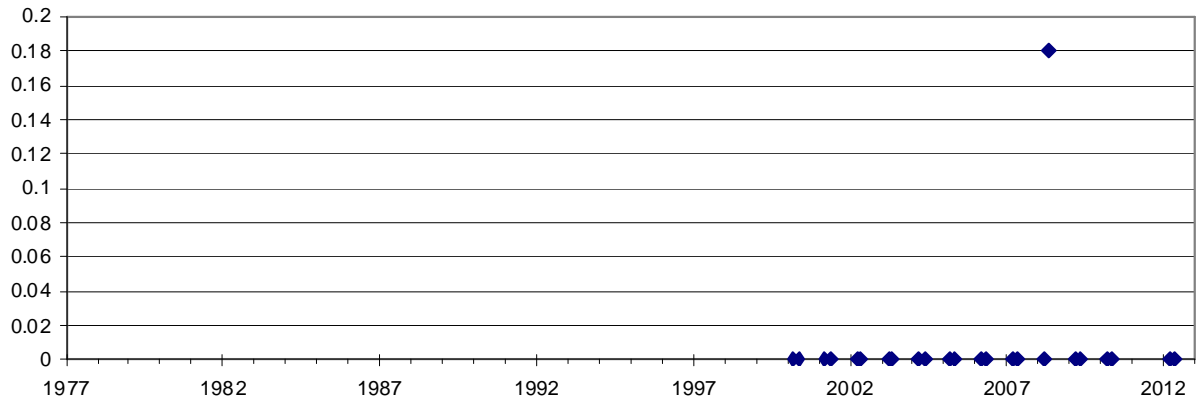
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Owingup is a component of the 'Owingup Swamp System', which is listed in the 'Directory of Important Wetlands in Australia'.

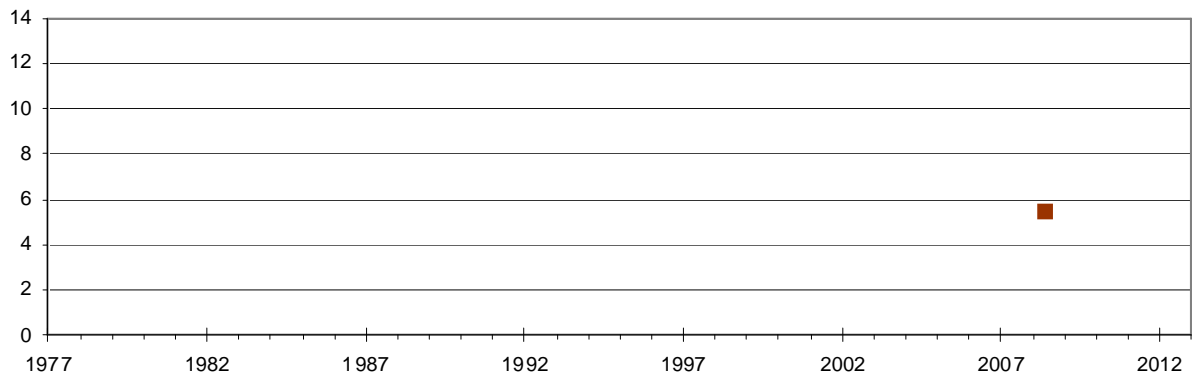
Owingup is in the Frankland District (headquartered in Walpole) of the Warren DPaW Region.

PABELUP SOUTH

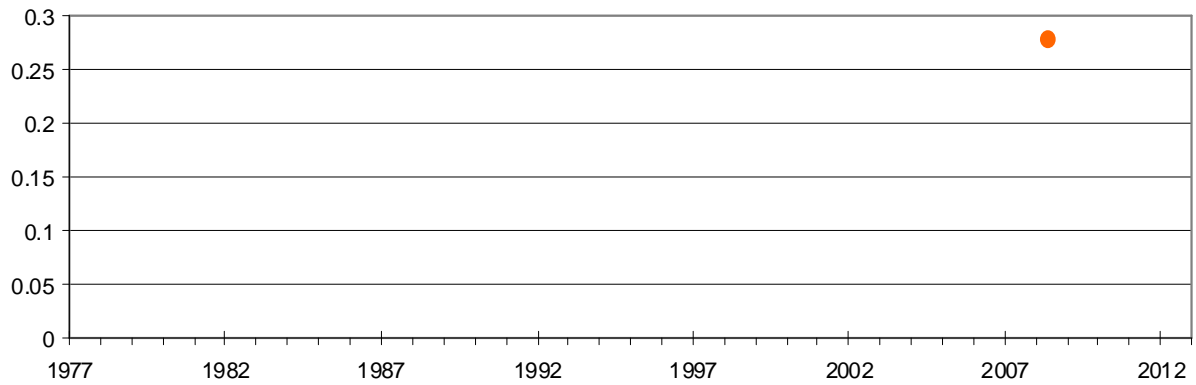
Depth mLD



pH



Salinity (ppt)



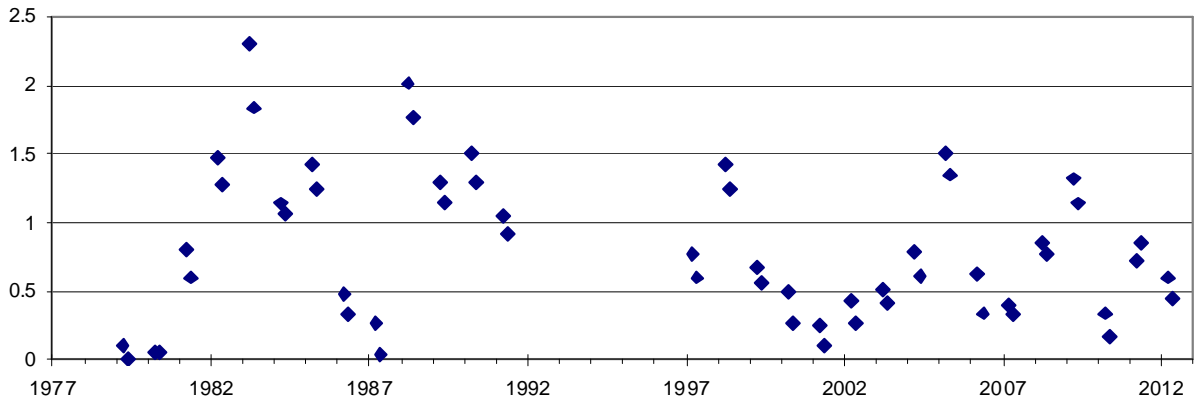
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

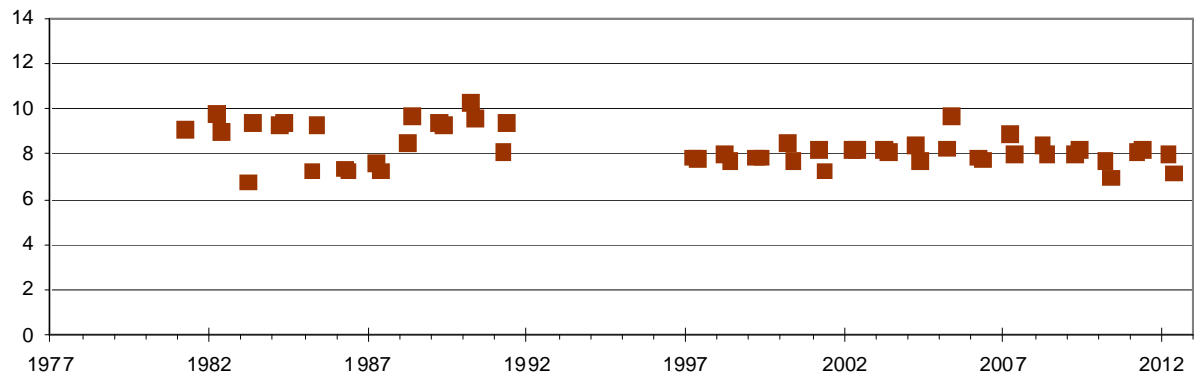
Pabelup South is in the Albany District of the South Coast DPaW Region

PARKEYERRING^{IM}

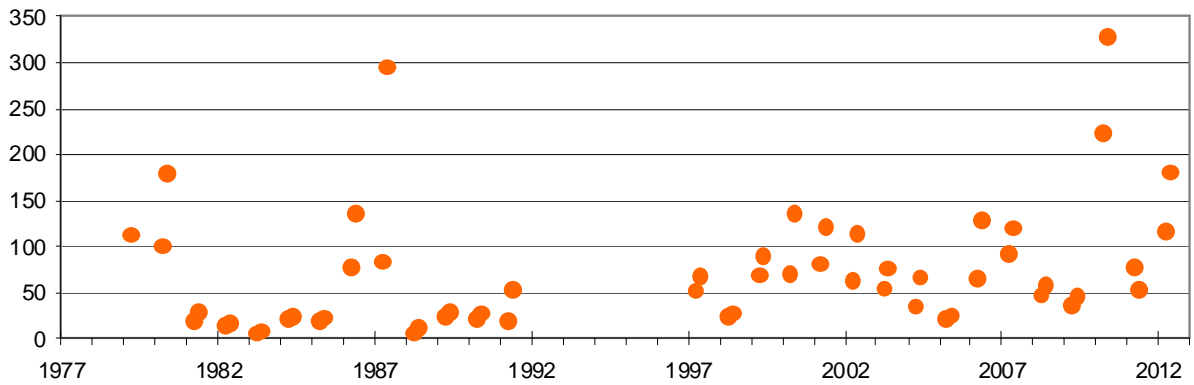
Depth mLD



pH



Salinity (ppt)



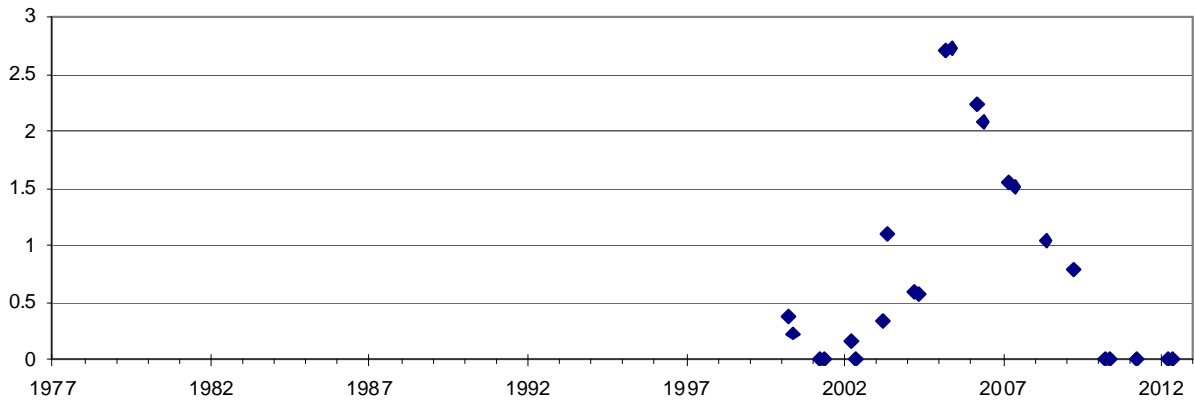
Notes:

1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

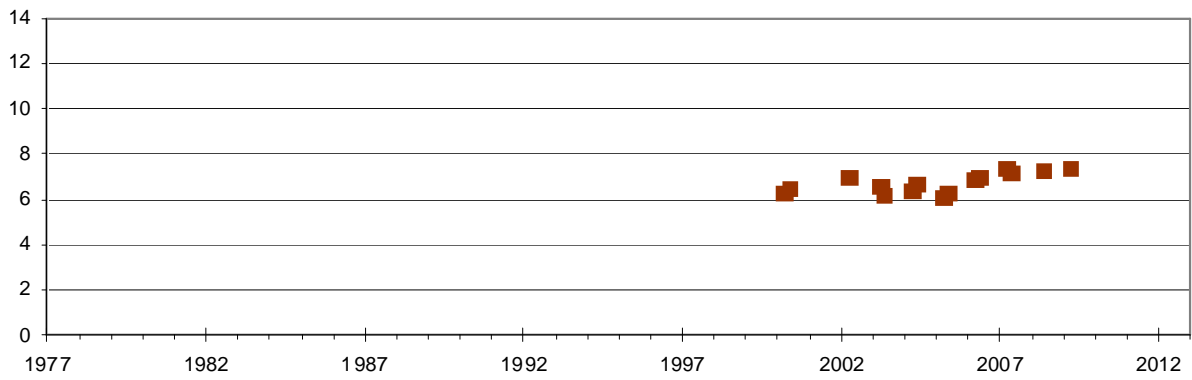
Parkeyerring is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

PILLENORUP

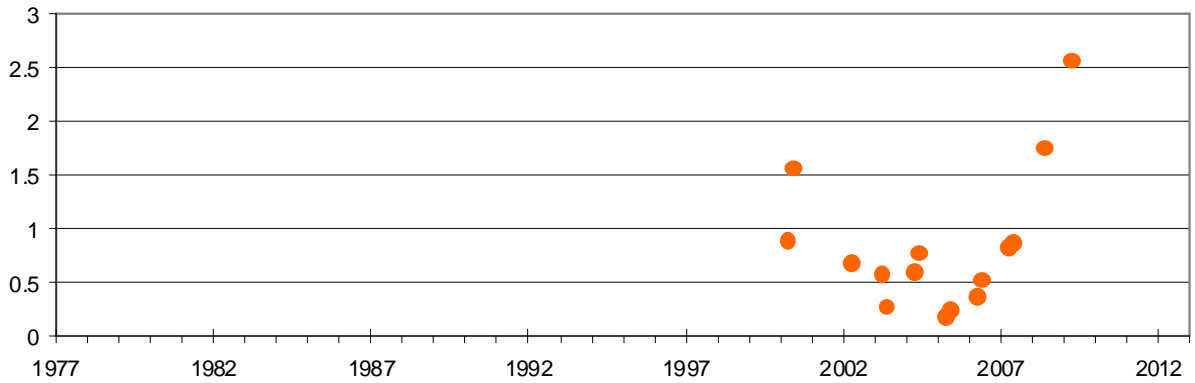
Depth mLD



pH



Salinity (ppt)



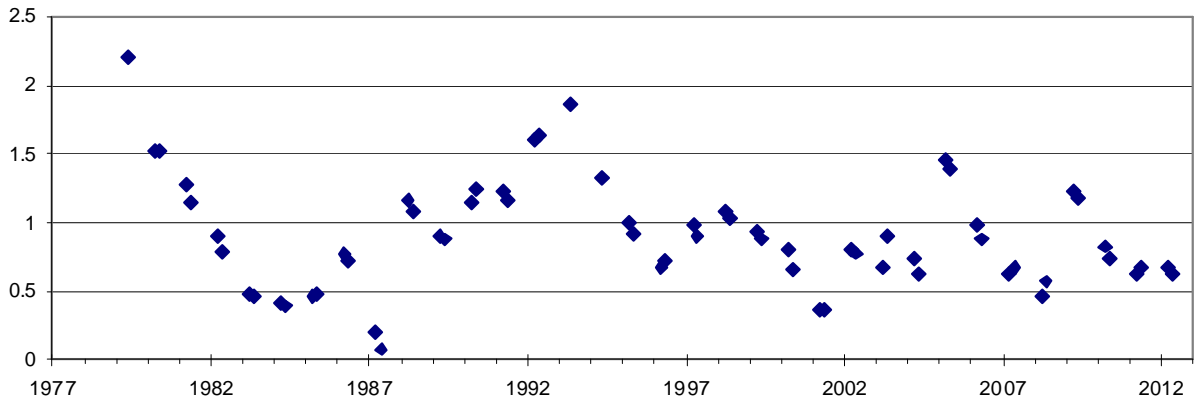
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

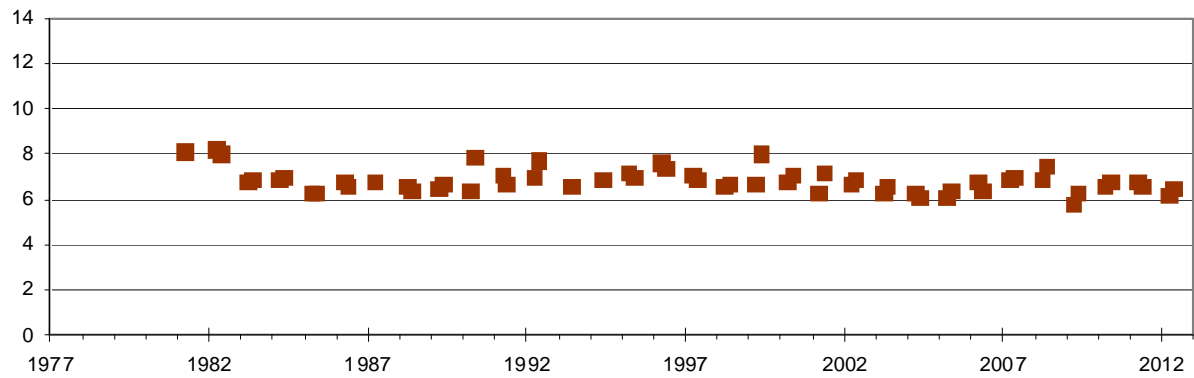
Pillenorup is in the Albany District of the South Coast DPaW Region

PLEASANT VIEW ^{IM}

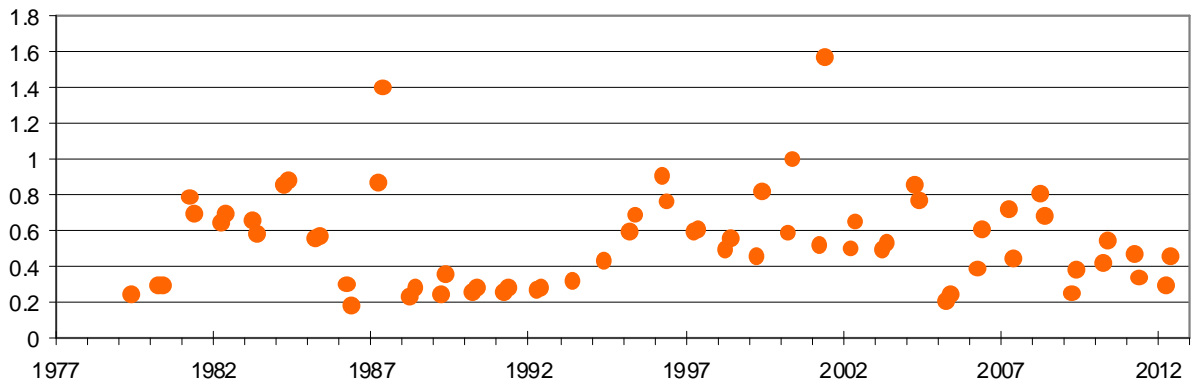
Depth mLD



pH



Salinity (ppt)



Notes:

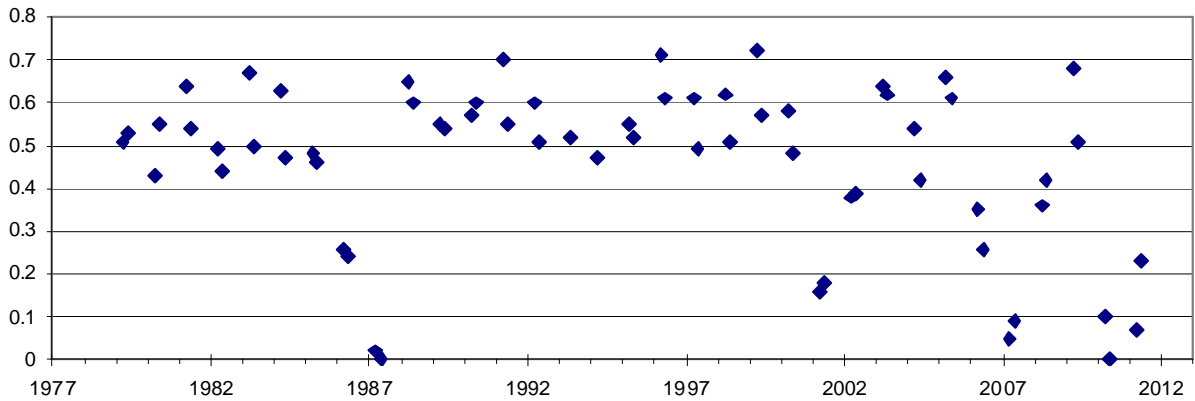
1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Pleasant View is a component of the 'Lake Pleasant View System', which is listed in the 'Directory of Important Wetlands in Australia'.

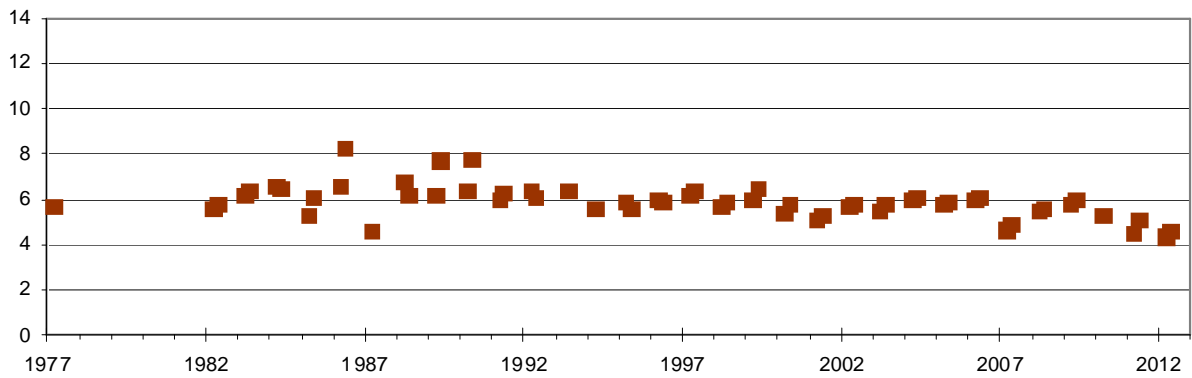
Pleasant View is in the Albany District of the South Coast DPaW Region

POORGINUP

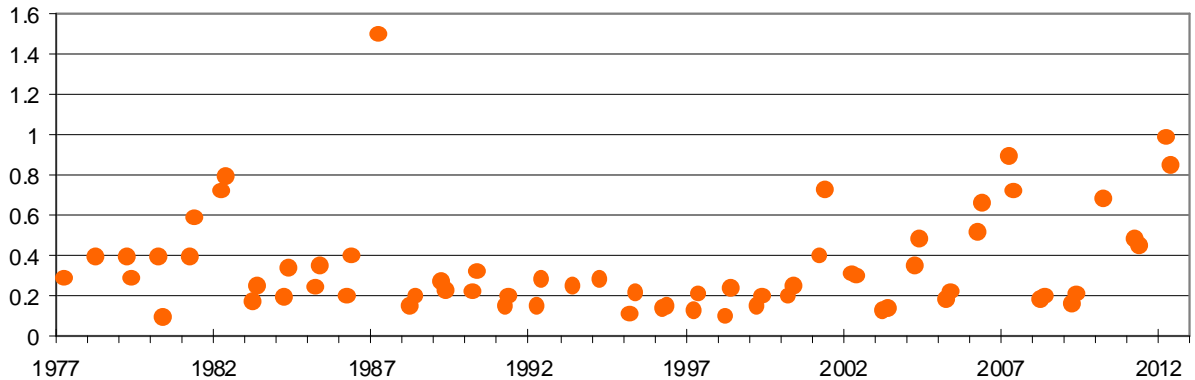
Depth mLD



pH



Salinity (ppt)



Notes:

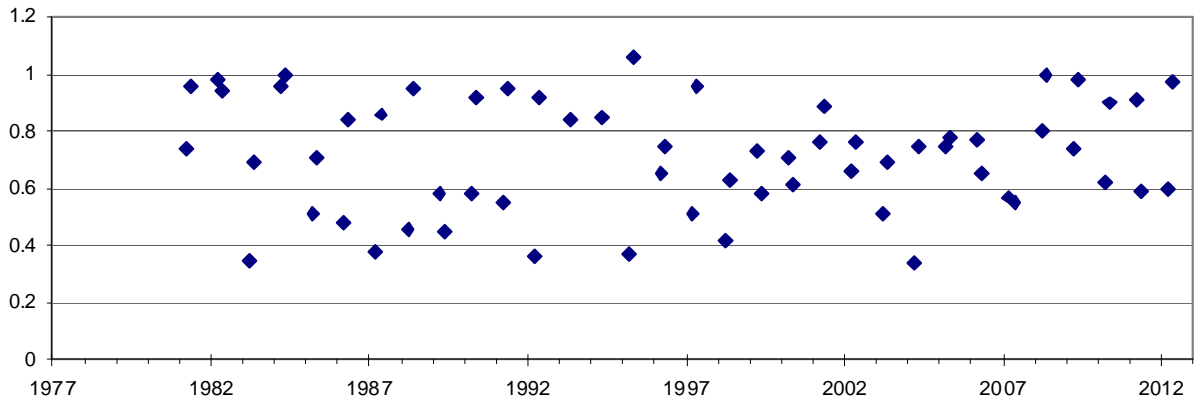
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Poorginup is a component of the 'Muir-Byenup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands, and is also a component of the 'Byenup Lagoon System', which is listed in the 'Directory of Important Wetlands in Australia'.

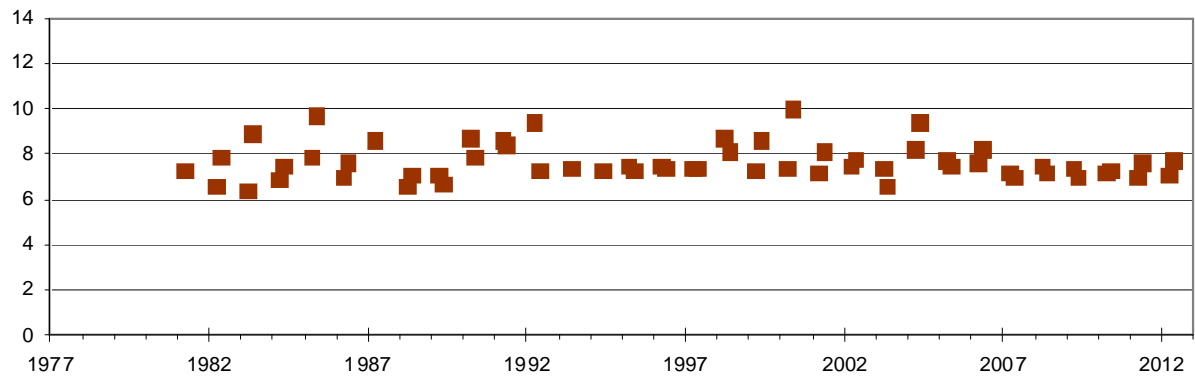
Poorginup is within the Muir-Unicup Natural Diversity Recovery Catchment and is in the Donnelly District (headquartered in Pemberton) of the Warren DPaW Region.

POWELL

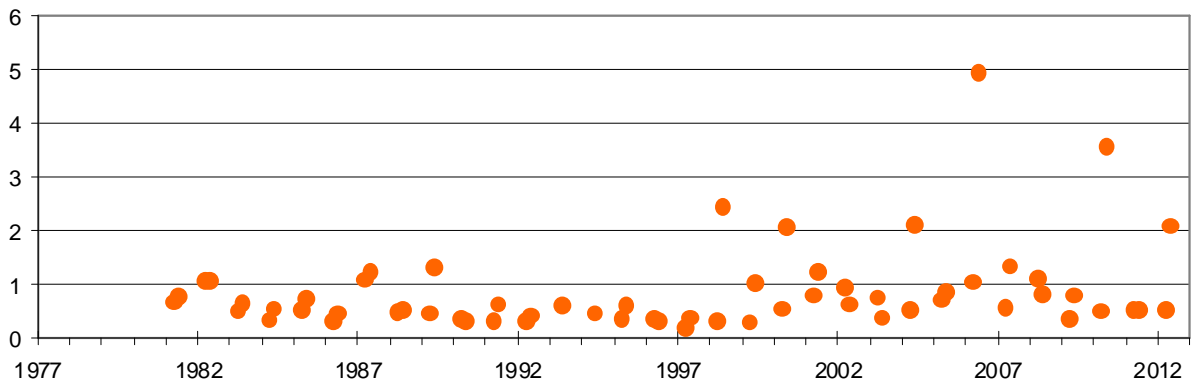
Depth mLD



pH



Salinity (ppt)



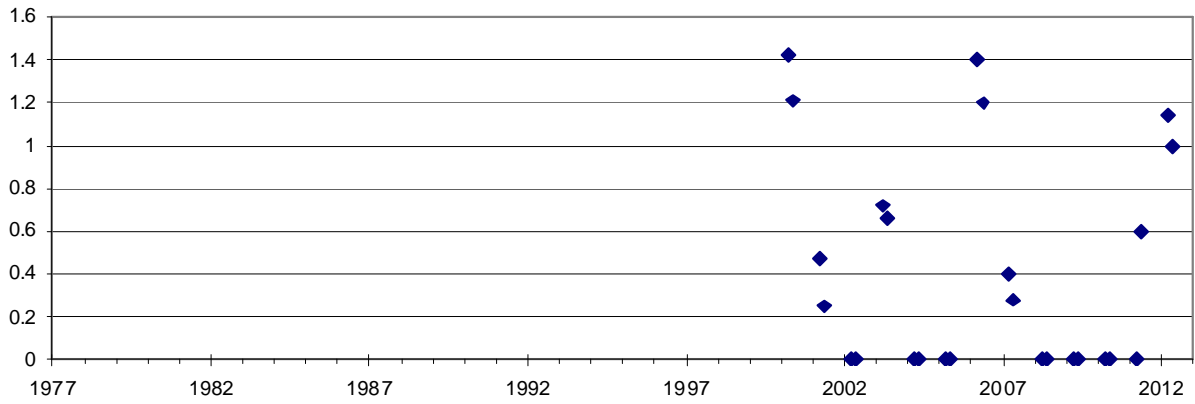
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

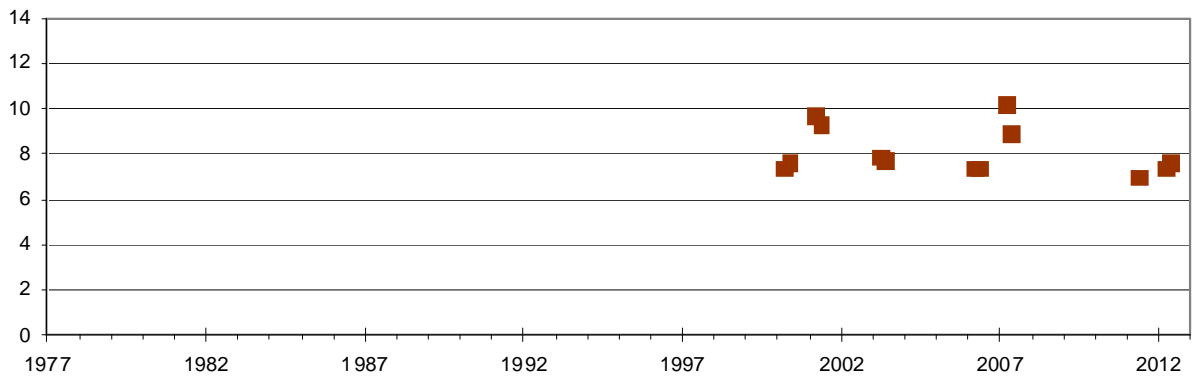
Powell is in the Albany District of the South Coast DPaw Region

RANGE ROAD YATE

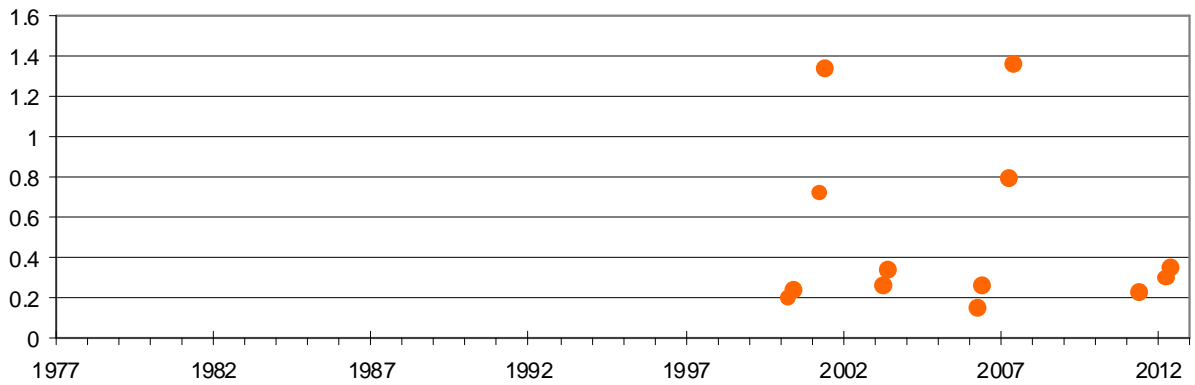
Depth mLD



pH



Salinity (ppt)



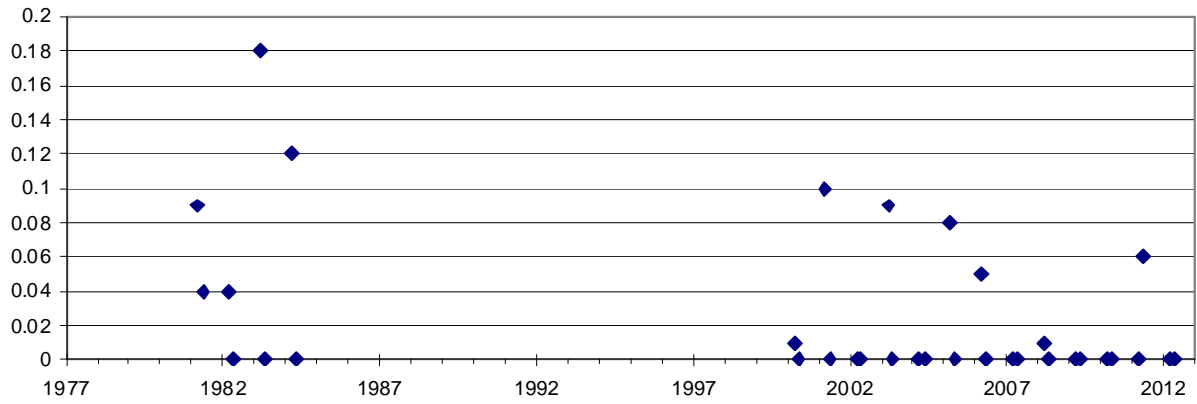
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

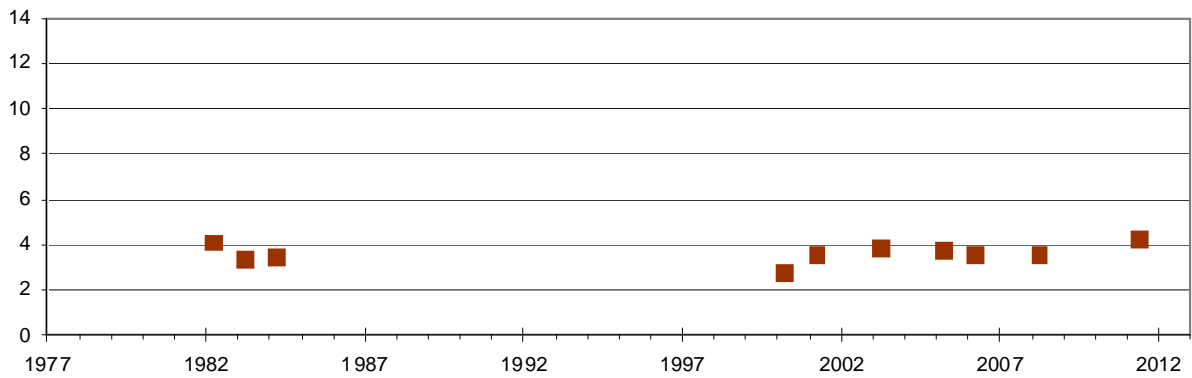
Range Road Yate is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPAW Region.

RED (BRUCE ROCK)

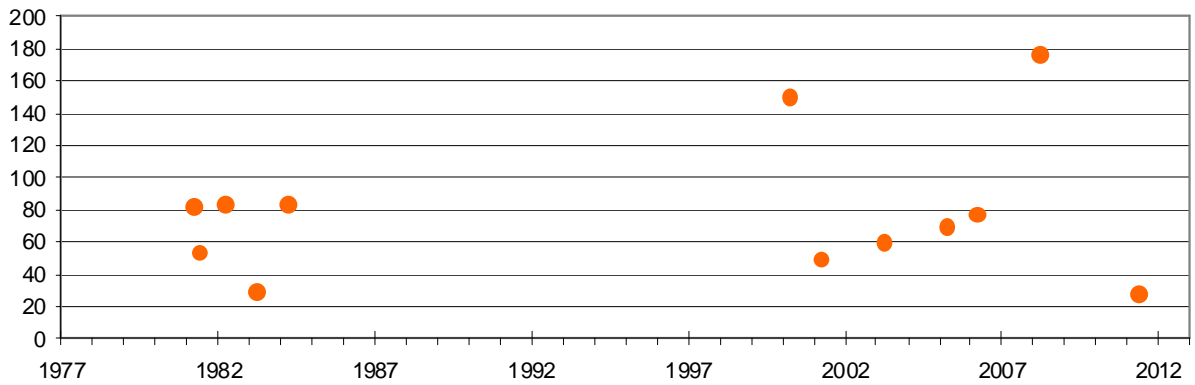
Depth mLD



pH



Salinity (ppt)



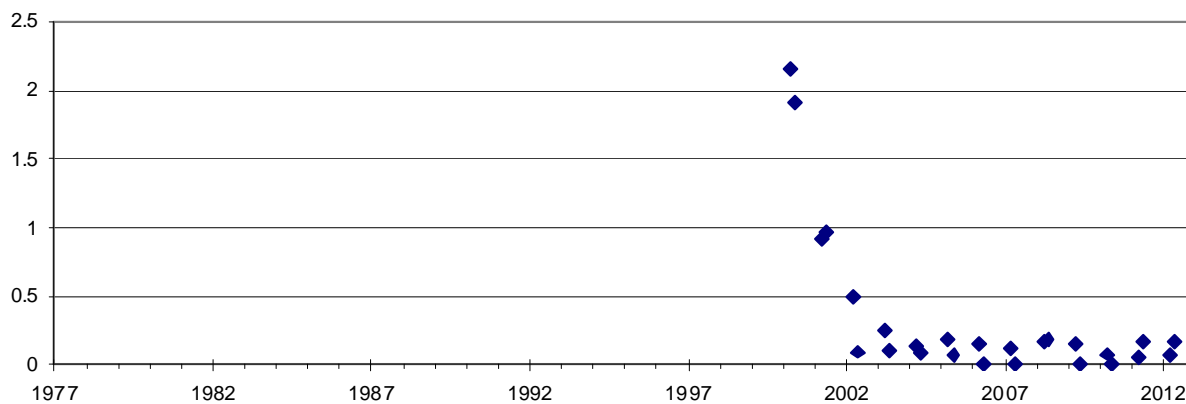
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

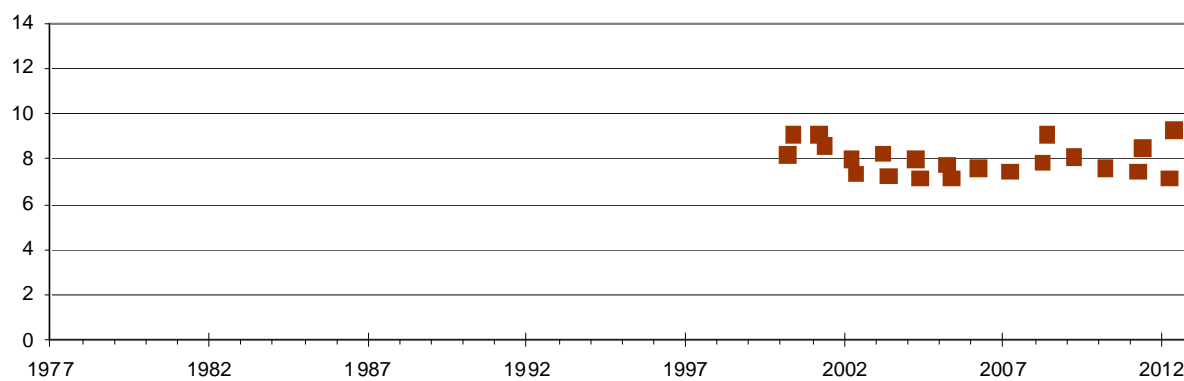
Red (Bruce Rock) is in the Central District (headquartered in Merredin) of the Wheatbelt DPaW Region.

RONNERUP ^{IM}

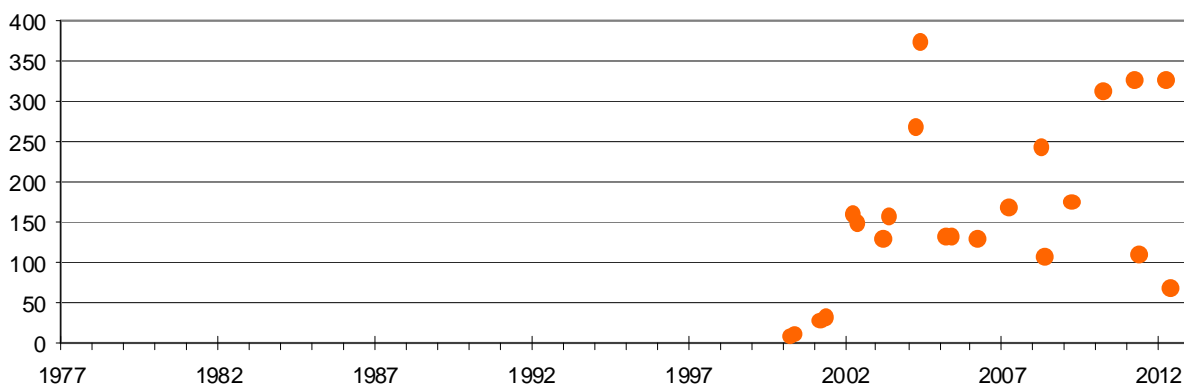
Depth mLD



pH



Salinity (ppt)



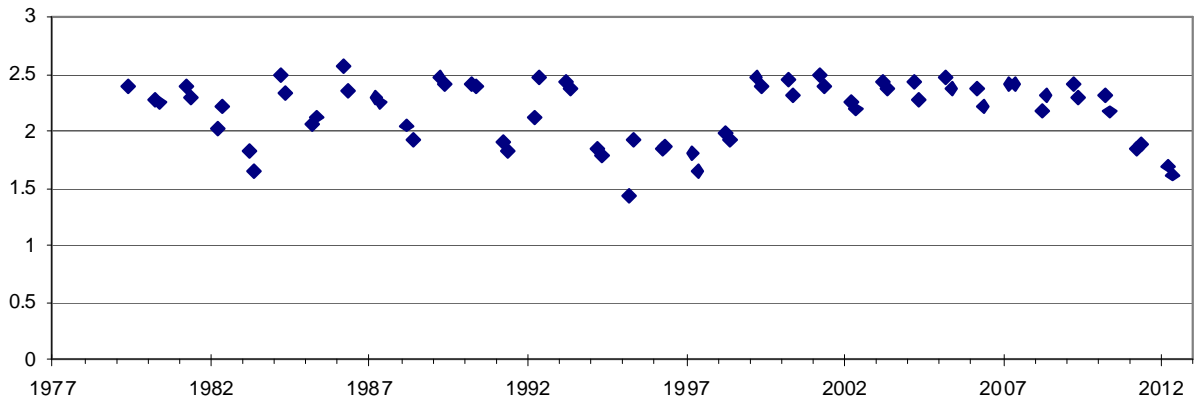
Notes:

1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

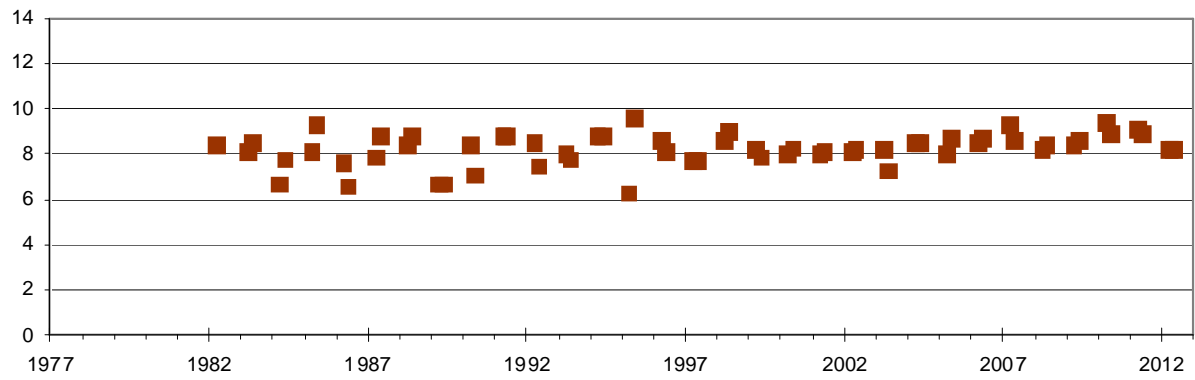
Ronnerup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

SHARK

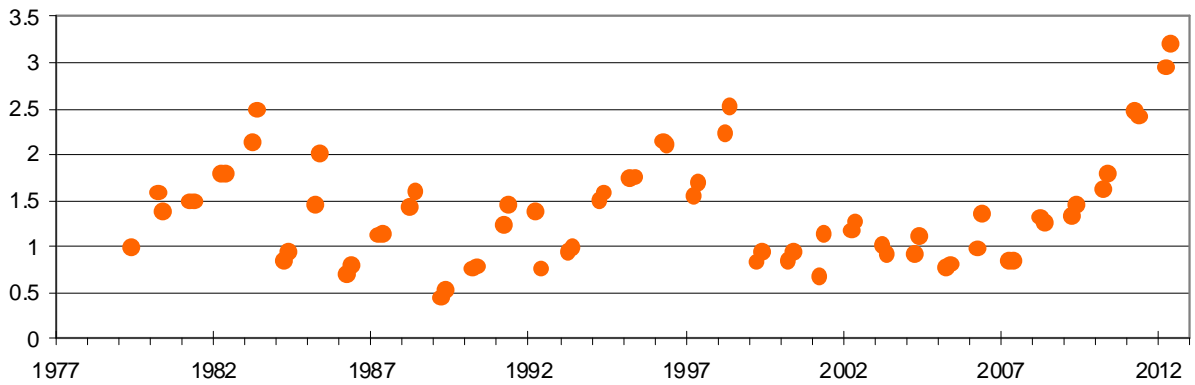
Depth mLD



pH



Salinity (ppt)



Notes:

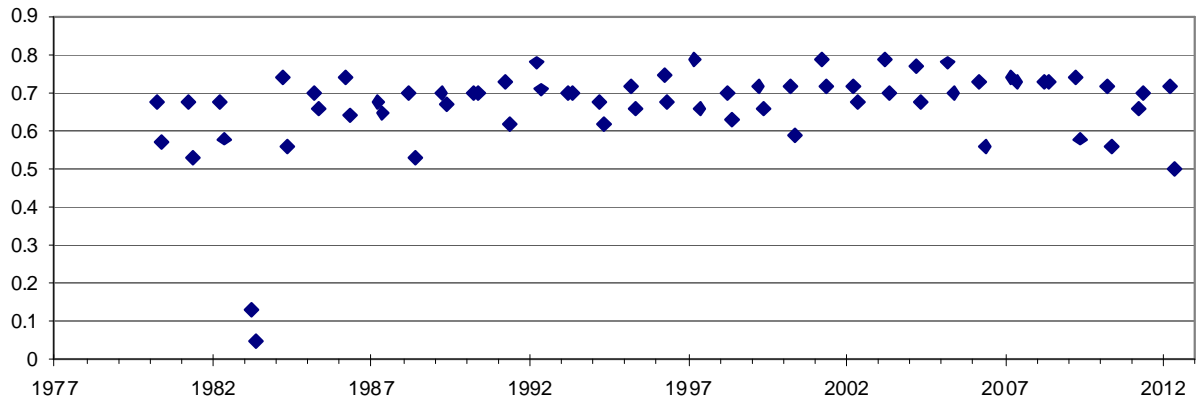
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Shark is within the Esperance Lakes Natural Diversity Recovery Catchment.

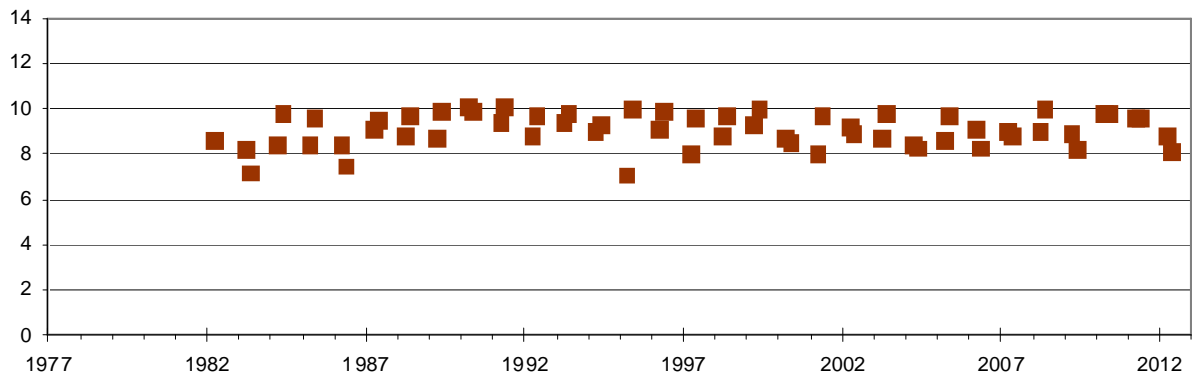
Shark is in the Esperance District of the South Coast DPaW Region.

STATION (with Salinity axis 0-350ppt)

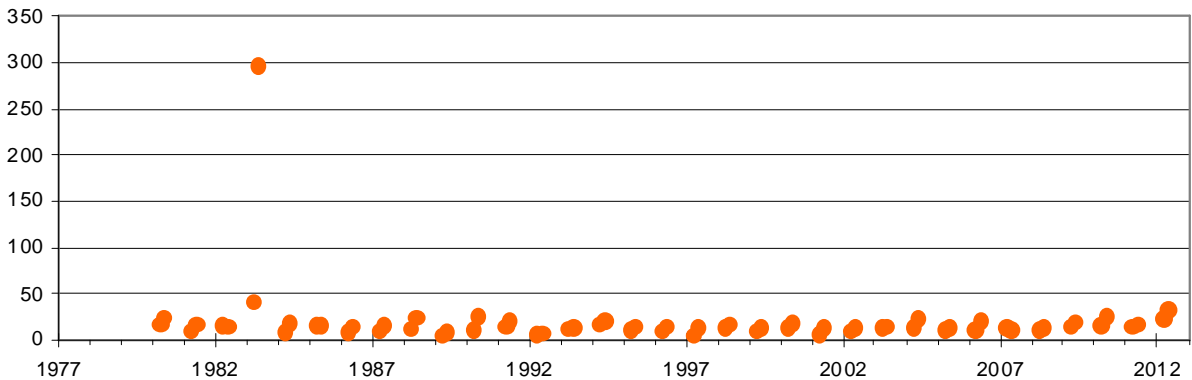
Depth mLD



pH



Salinity (ppt)



Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

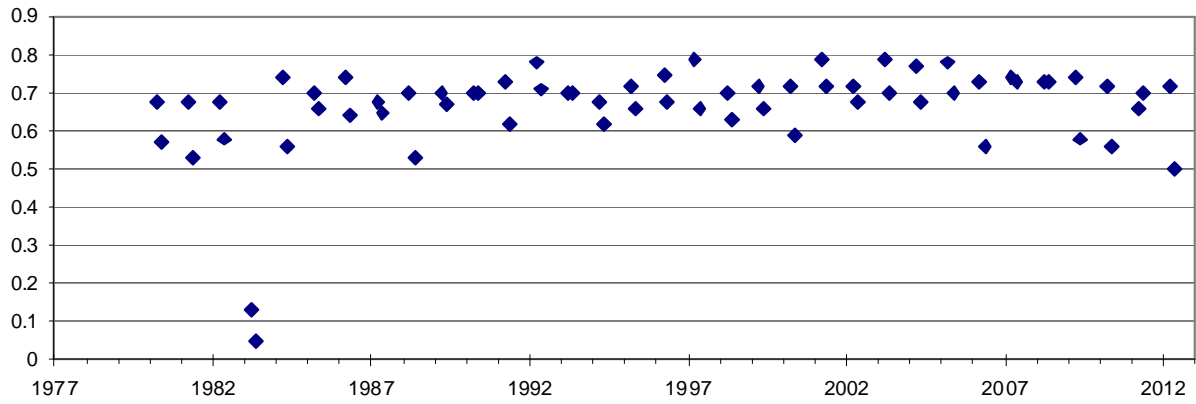
Station is a component of the 'Lake Warden System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

Station is also a component of the 'Lake Warden System' listed in the 'Directory of Important Wetlands in Australia'.

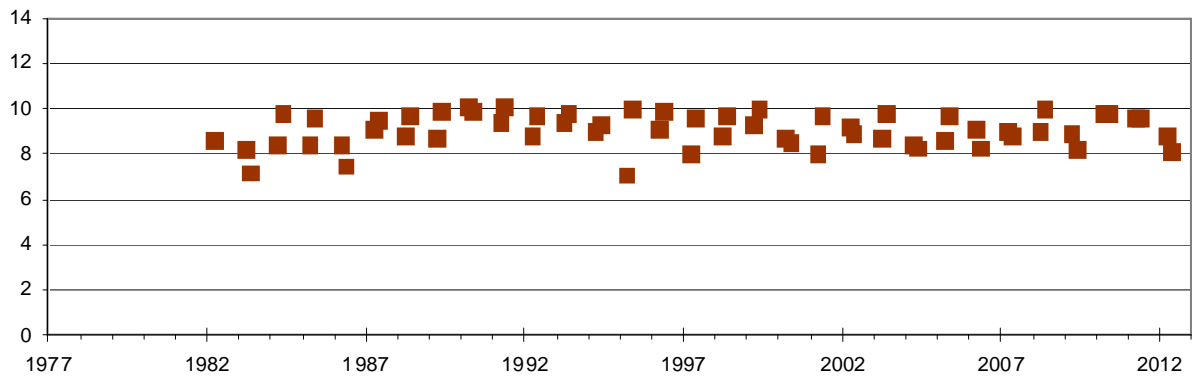
Station is within the Esperance Lakes Natural Diversity Recovery Catchment and is in the Esperance District of the South Coast DPaw Region.

STATION (with Salinity axis 0-50ppt)

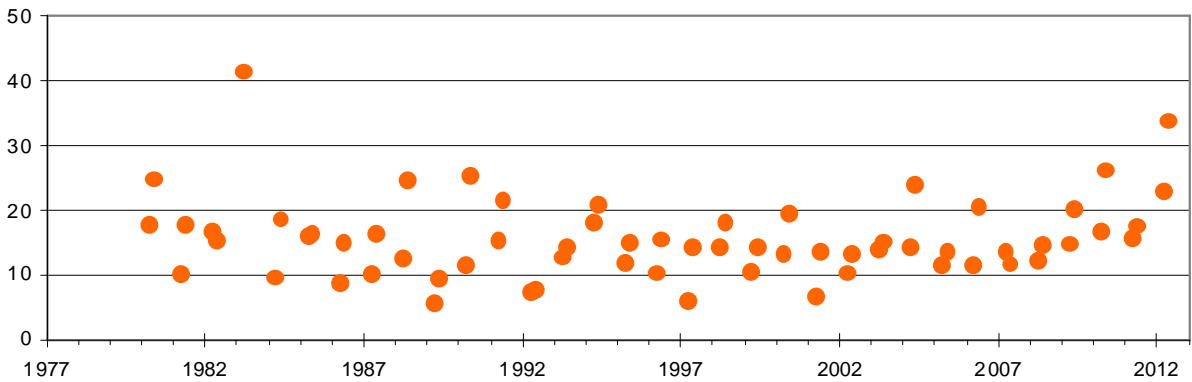
Depth mLD



pH



Salinity (ppt)



Notes:

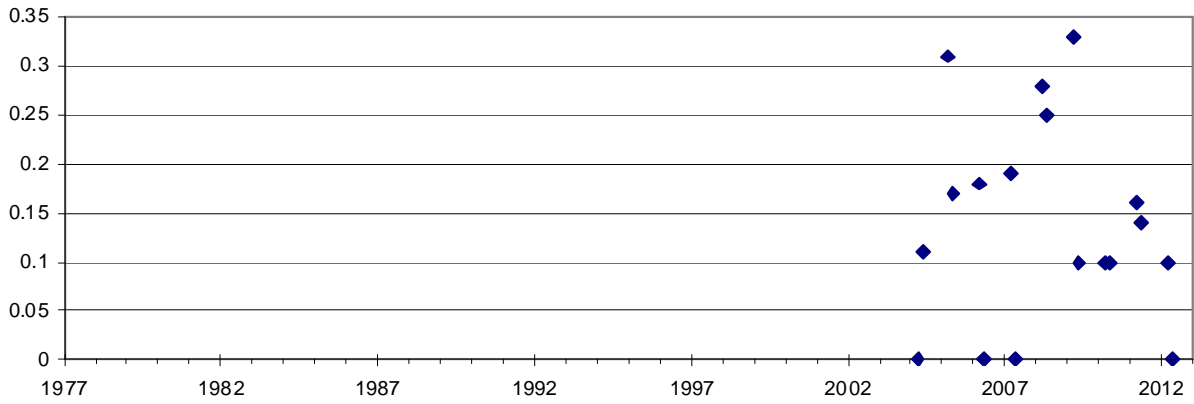
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Station is a component of the 'Lake Warden System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

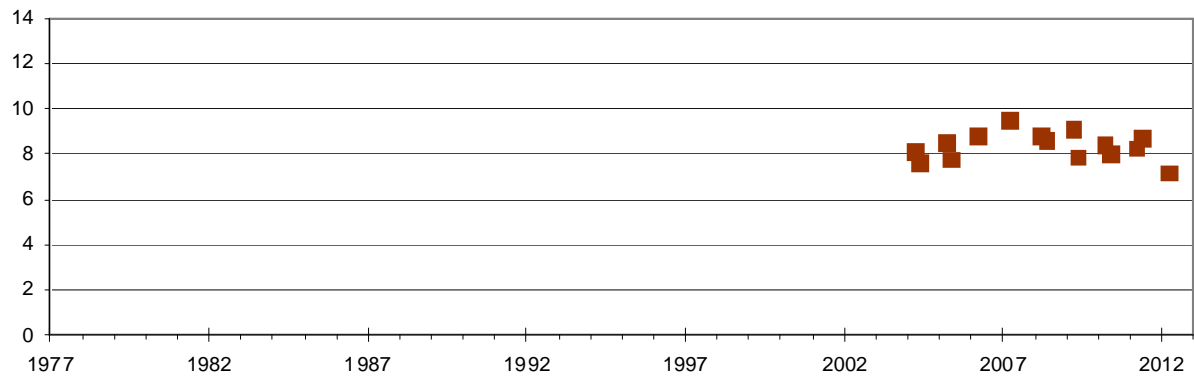
Station is also a component of the 'Lake Warden System' listed in the 'Directory of Important Wetlands in Australia'. Station is within the Esperance Lakes Natural Diversity Recovery Catchment and is in the Esperance District of the South Coast DPaw Region.

TAARBLIN (NORTH)

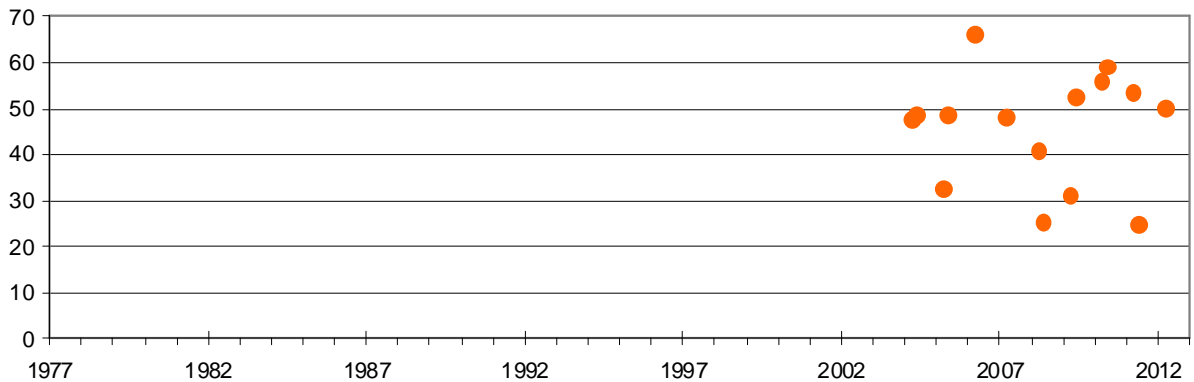
Depth mLD



pH



Salinity (ppt)



Notes:

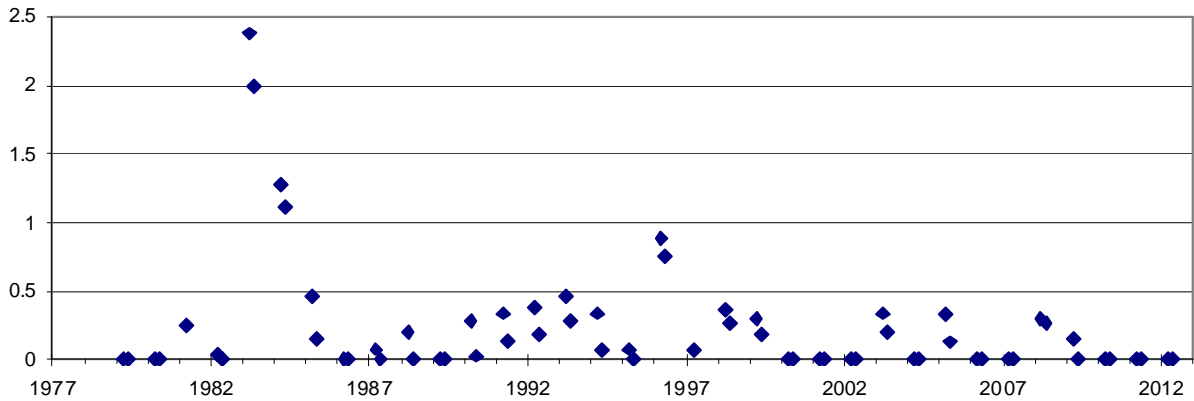
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Taarblin (North) is a short distance downstream from, and receives pumped, bypassed and potentially overflow water from, the Toolibin Lake Natural Diversity Recovery Catchment.

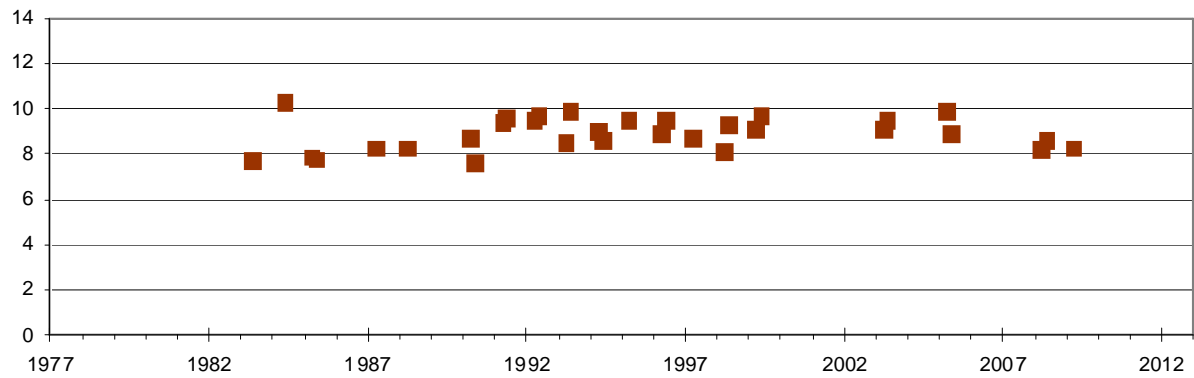
Taarblin (North) is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaw Region.

TAARBLIN (SOUTH)

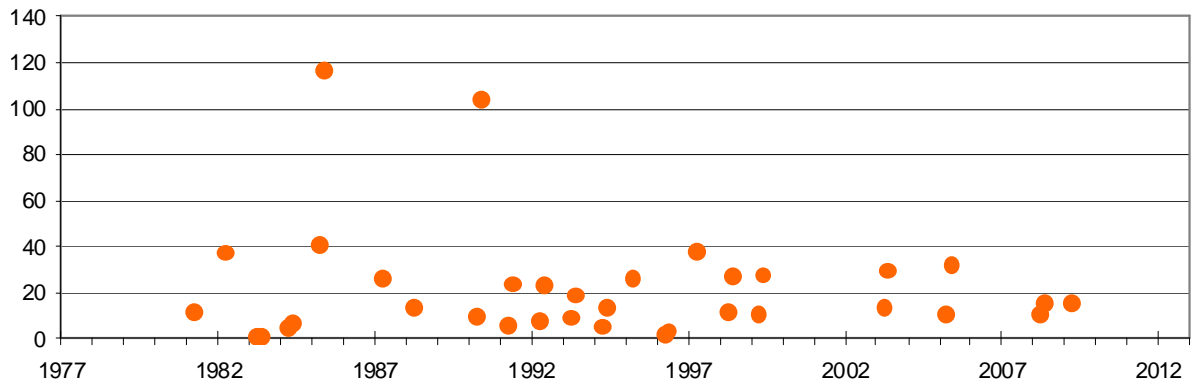
Depth mLD



pH



Salinity (ppt)



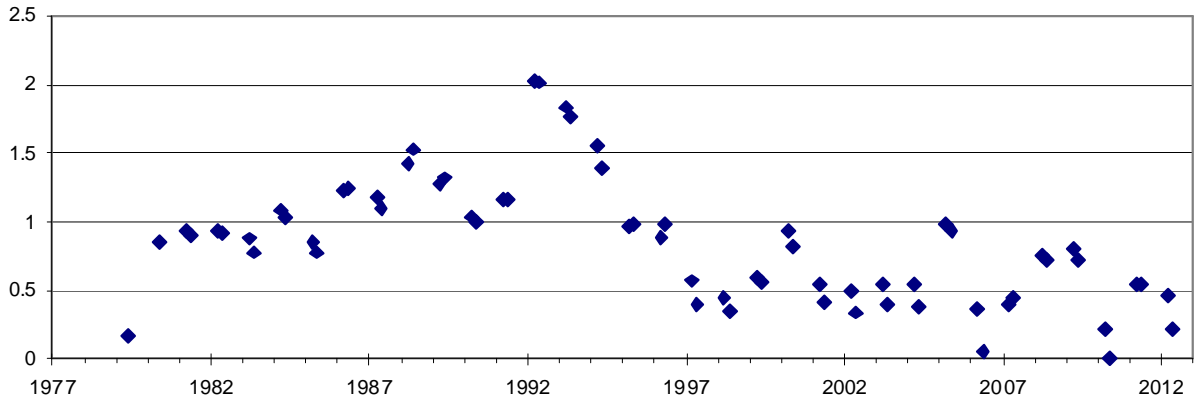
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

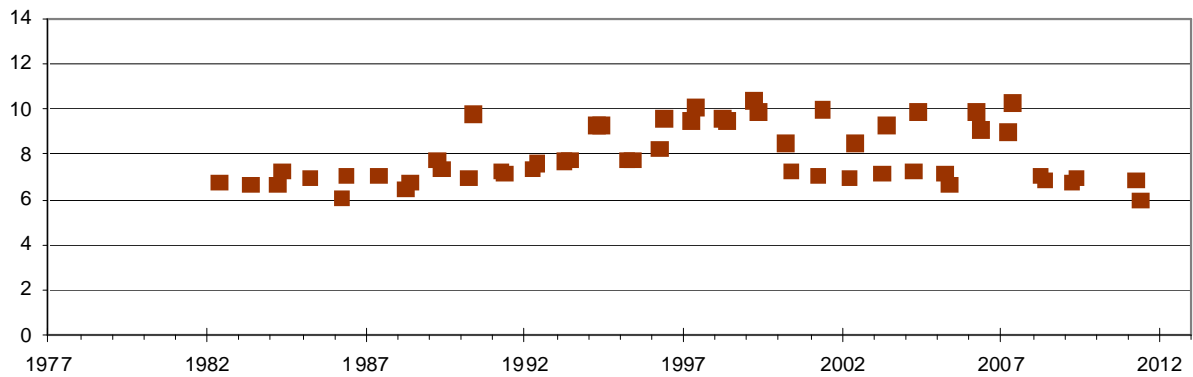
Taarblin (South) is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

THOMSONS

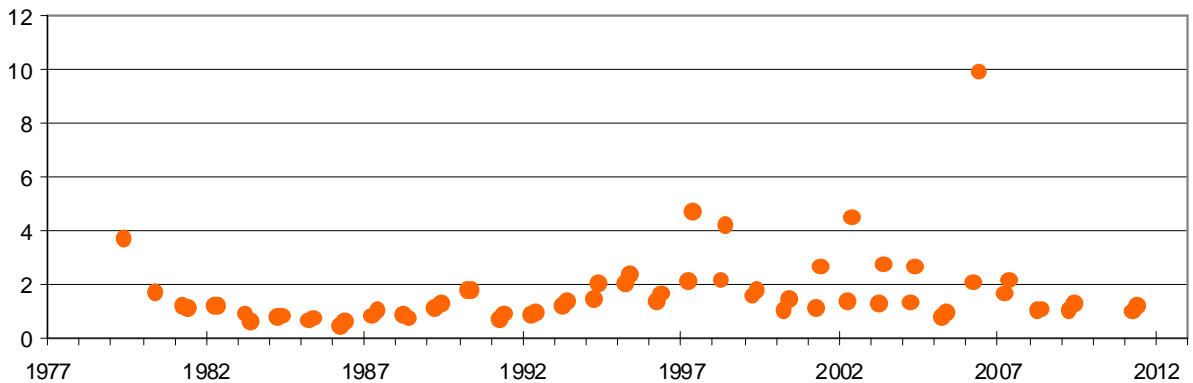
Depth mLD



pH



Salinity (ppt)



Notes:

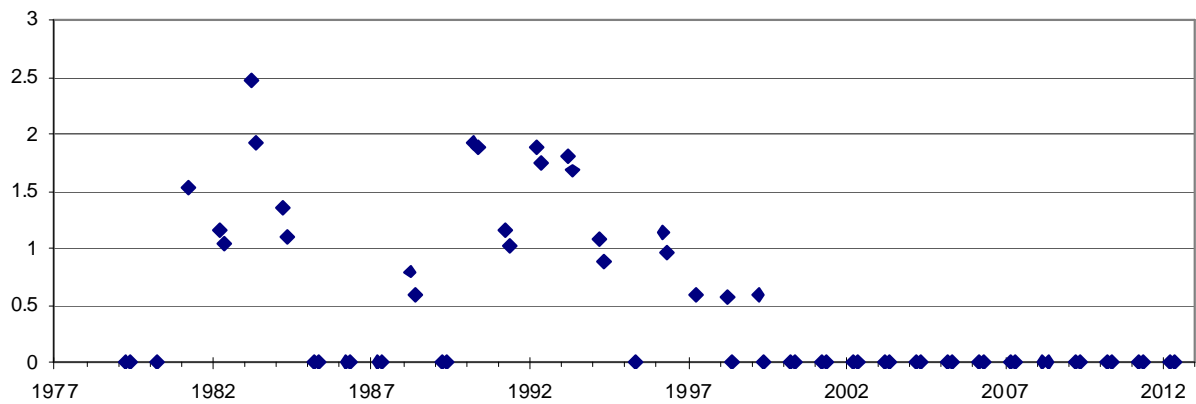
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Thomsons Lake is a component of the 'Forrestdale and Thomsons Lakes' system, which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands, and is also listed in the 'Directory of Important Wetlands in Australia'.

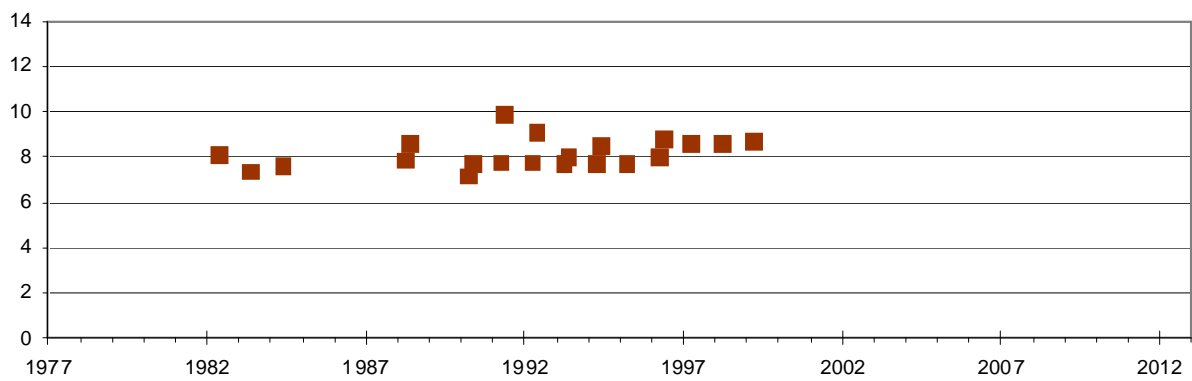
Thomsons is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DPaW Region.

TOOLIBIN^{IM}

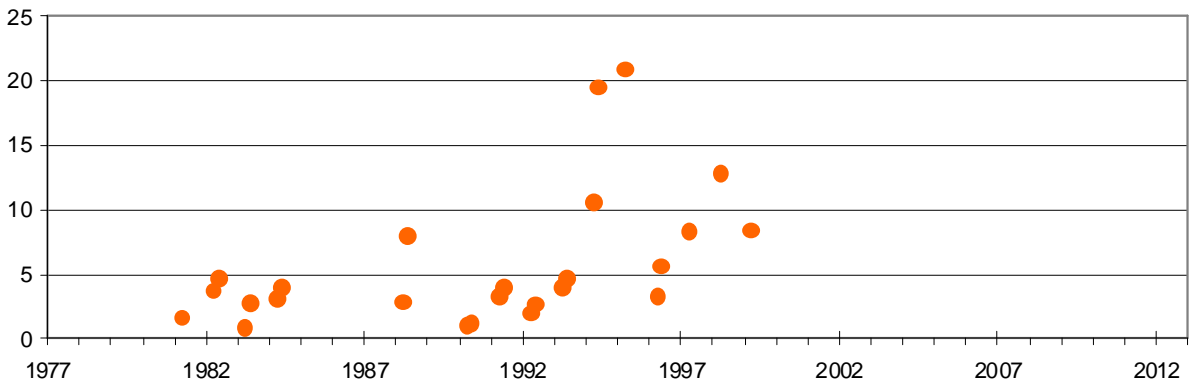
Depth mLD



pH



Salinity (ppt)



Notes:

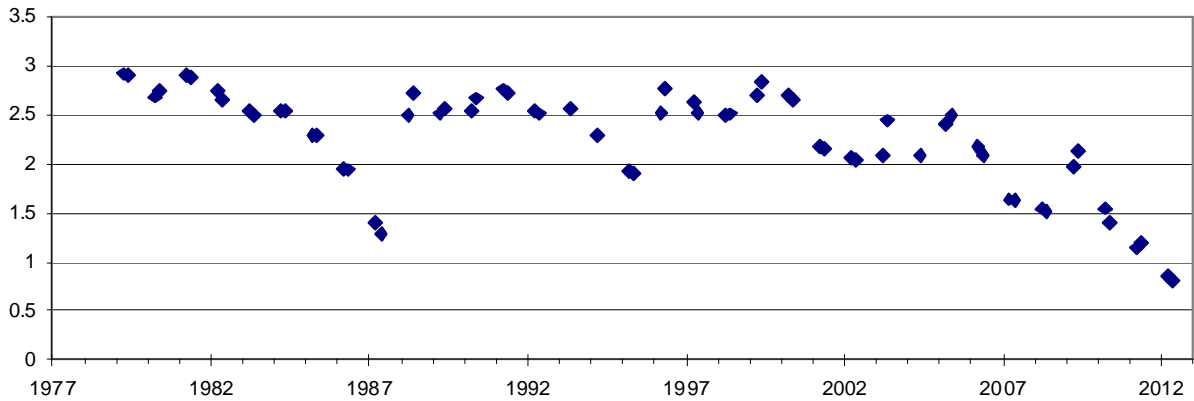
1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Toolibin Lake is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands and is also listed in the 'Directory of Important Wetlands in Australia'.

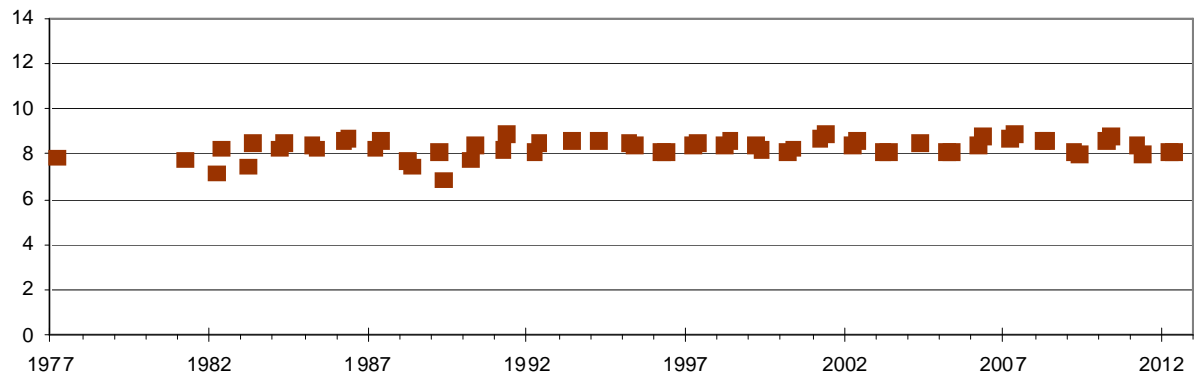
Toolibin is in the Toolibin Lake Natural Diversity Recovery Catchment and is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

TORDIT-GURRUP

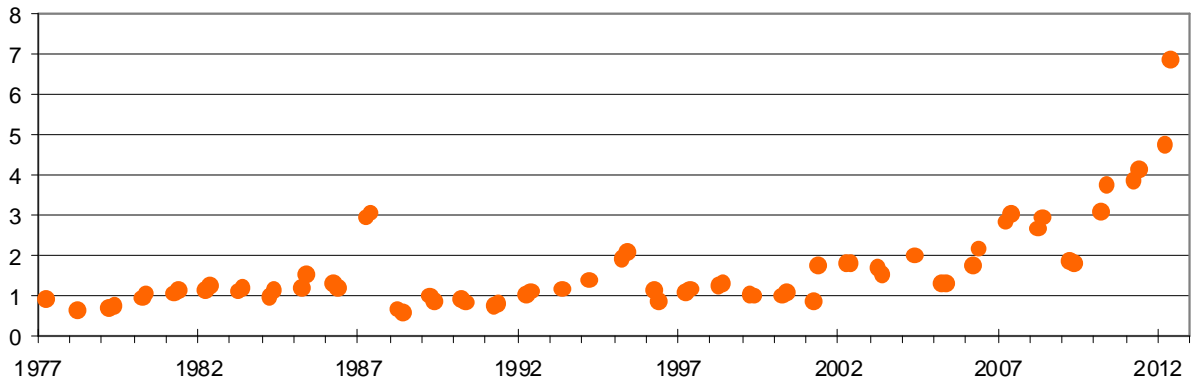
Depth mLD



pH



Salinity (ppt)



Notes:

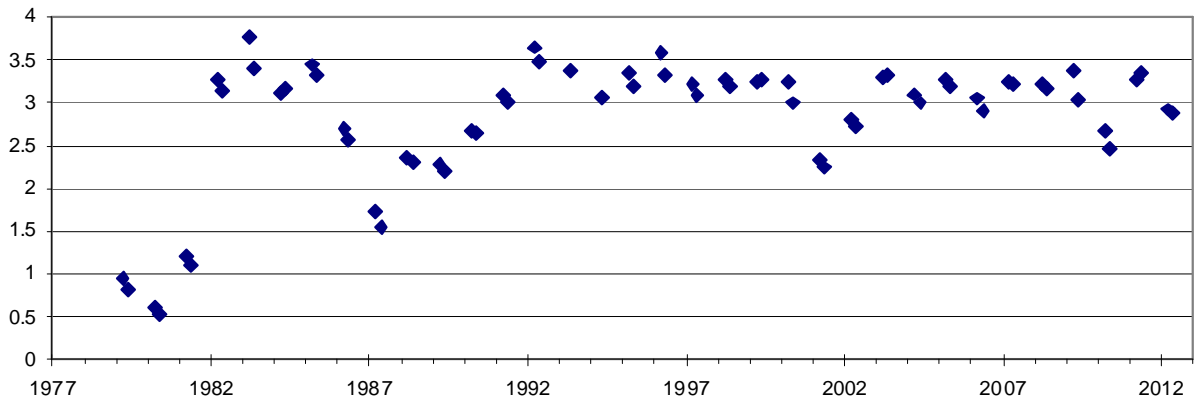
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Tordit-Gurrup is a component of the 'Muir-Byenup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands, and is also a component of the 'Byenup Lagoon System' listed in the 'Directory of Important Wetlands in Australia'.

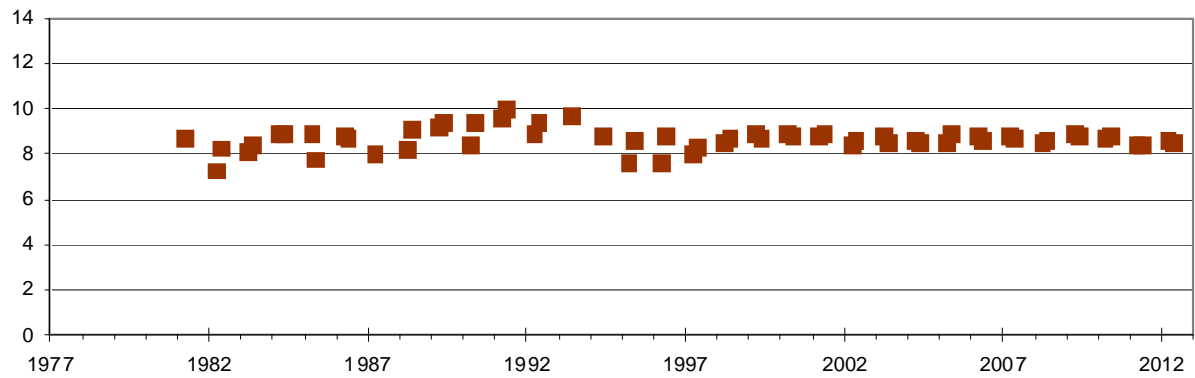
Tordit-Gurrup is within the Muir-Unicup Natural Diversity Recovery Catchment and is in the Donnelly District (headquartered in Pemberton) of the Warren DPaW Region.

TOWERRINNING^{IM}

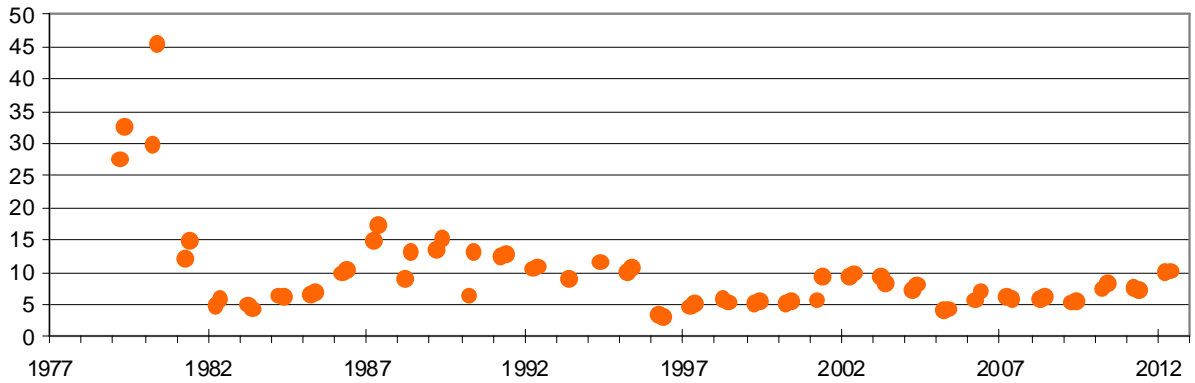
Depth mLD



pH



Salinity (ppt)



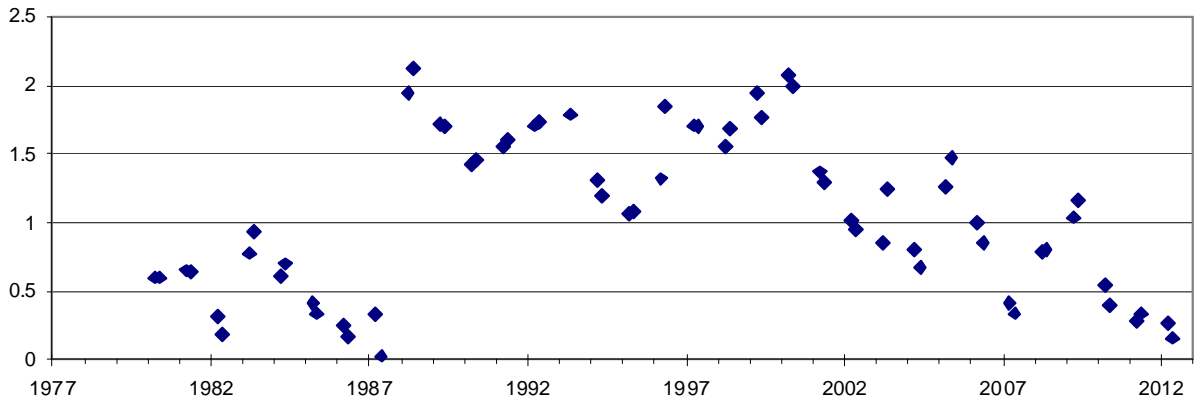
Notes:

1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

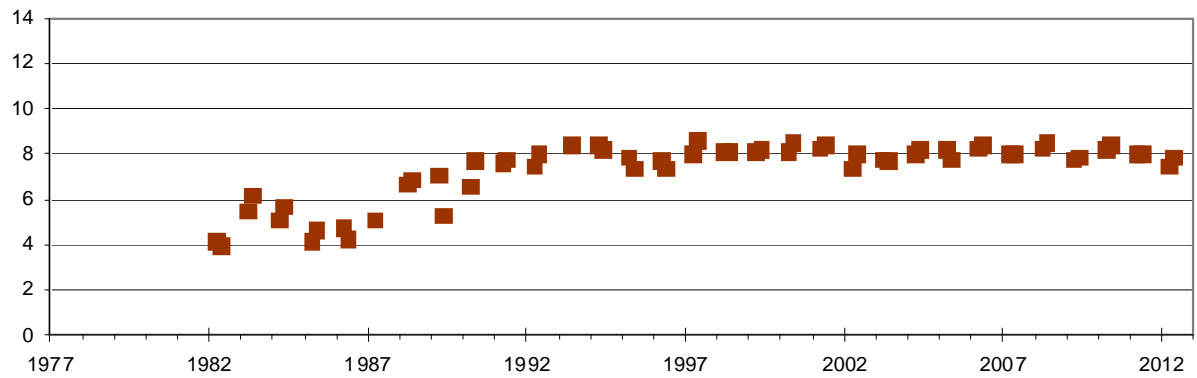
Towerrinning is in the Wellington District (headquartered in Collie) of the South West DPaW Region.

UNICUP

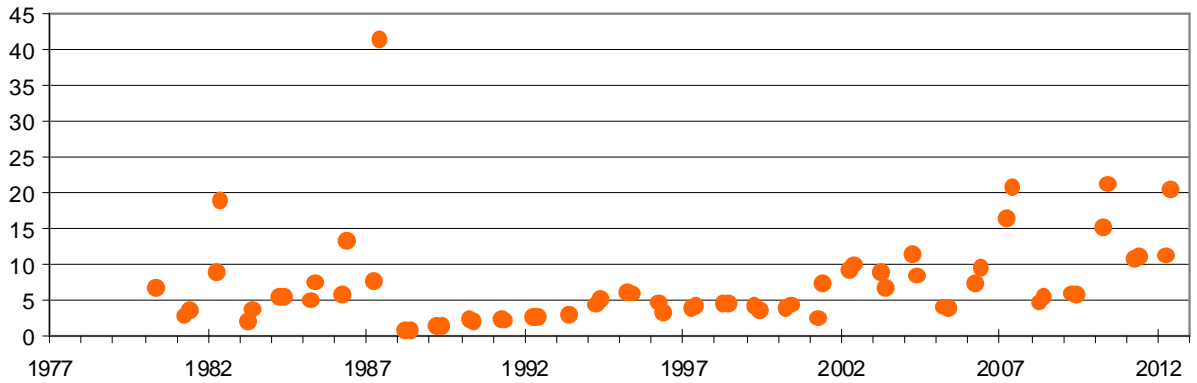
Depth mLD



pH



Salinity (ppt)



Notes:

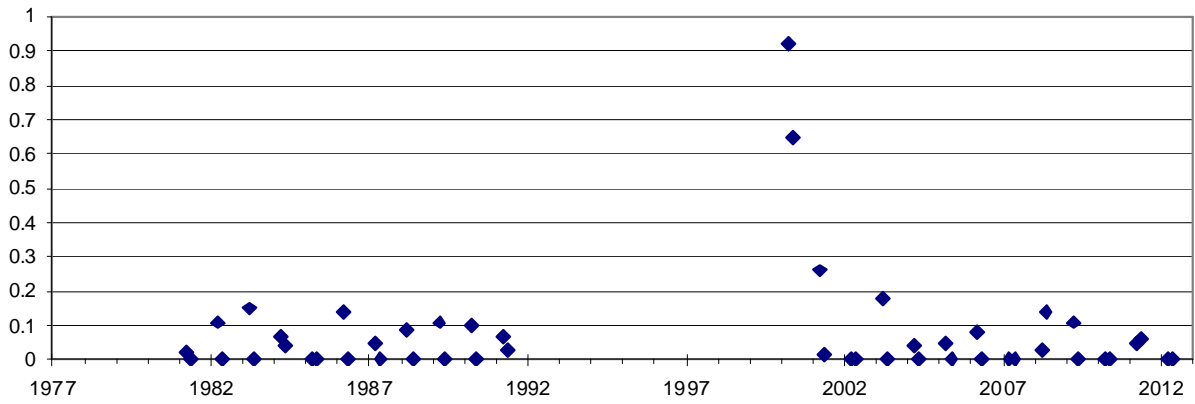
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Unicup is a component of the 'Byenup Lagoon System', which is listed in the 'Directory of Important Wetlands in Australia'.

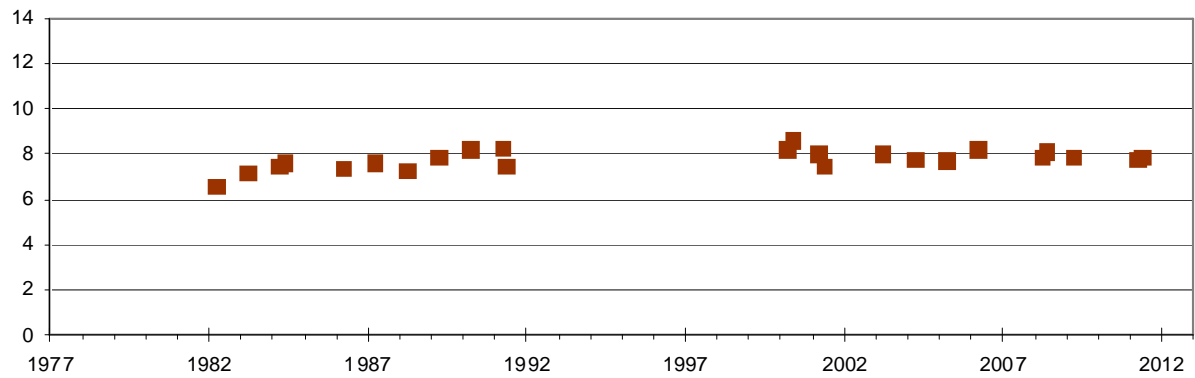
Unicup is within the Muir-Unicup Natural Diversity Recovery Catchment and is in the Donnelly District (headquartered in Pemberton) of the Warren DPaW Region.

VARLEY

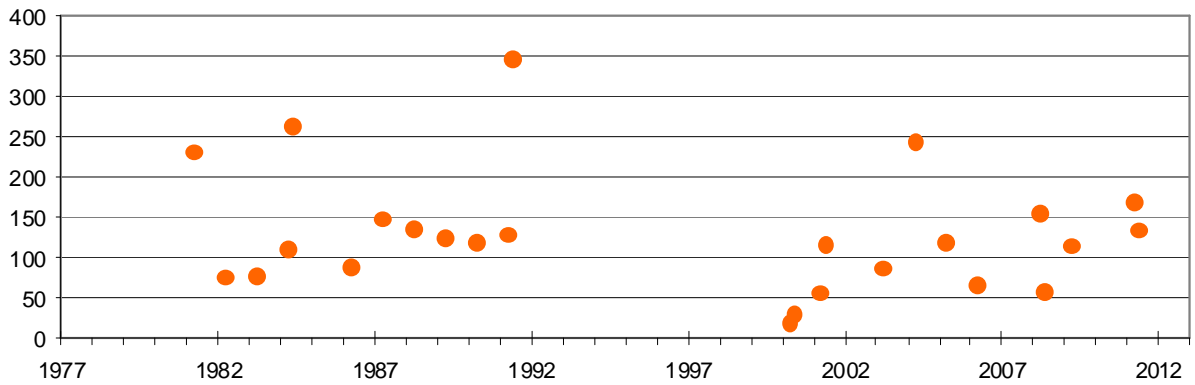
Depth mLD



pH



Salinity (ppt)



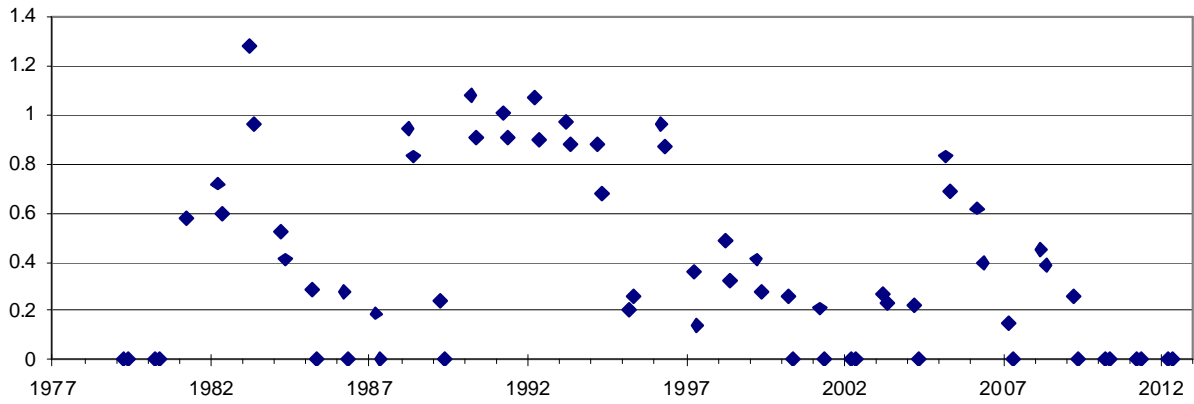
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

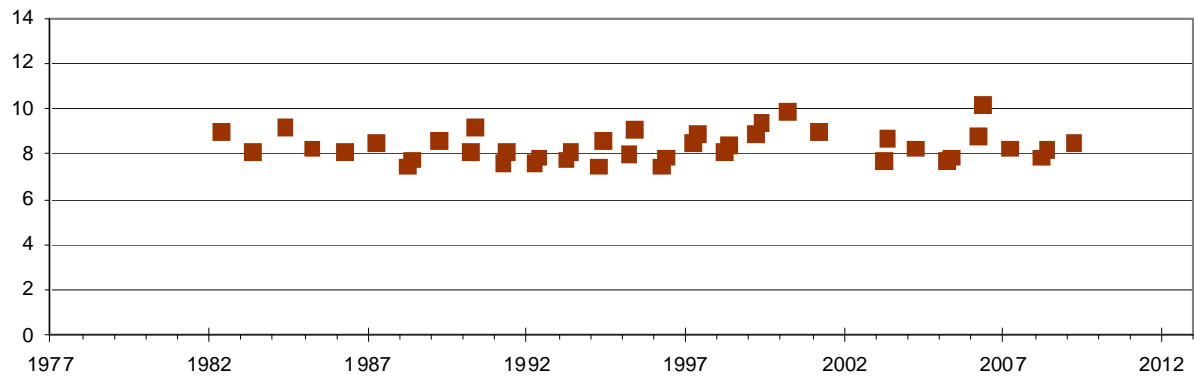
Varley is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

WALBYRING

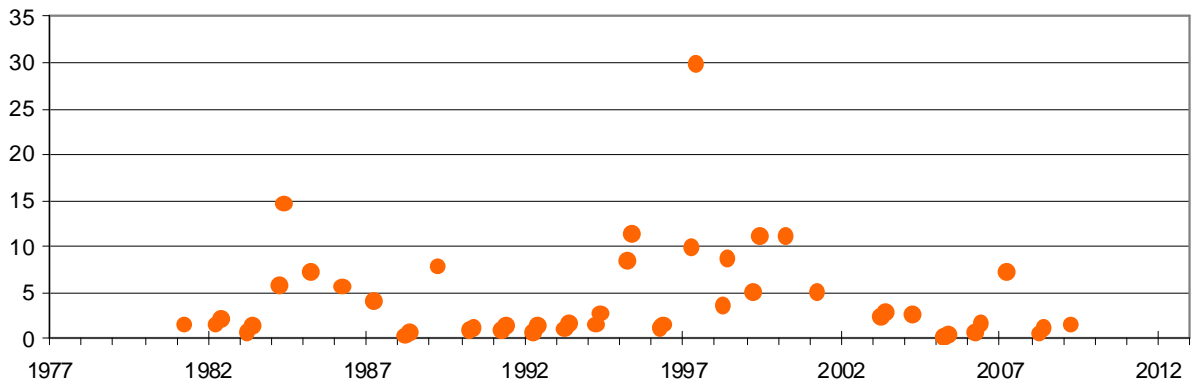
Depth mLD



pH



Salinity (ppt)



Notes:

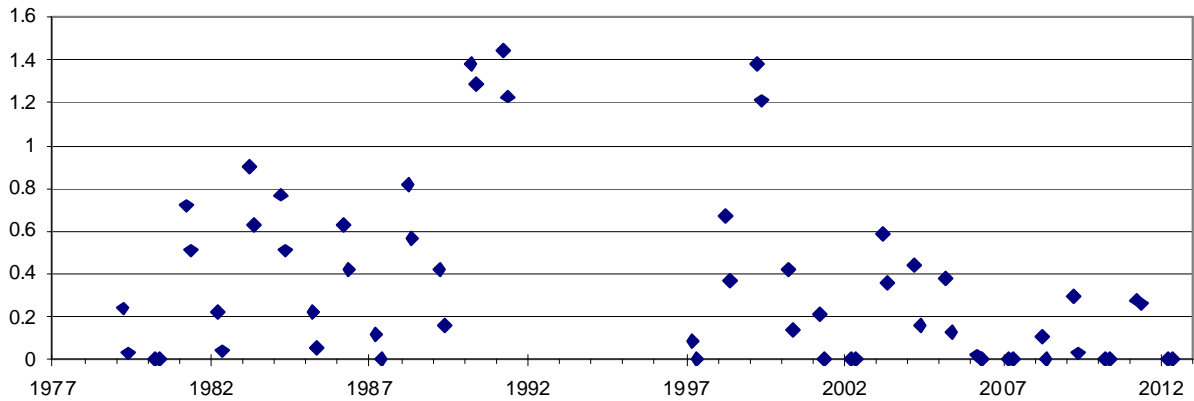
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Walbyring is a short distance downstream from, and potentially receives overflow water from, the Toolibin Lake Natural Diversity Recovery Catchment.

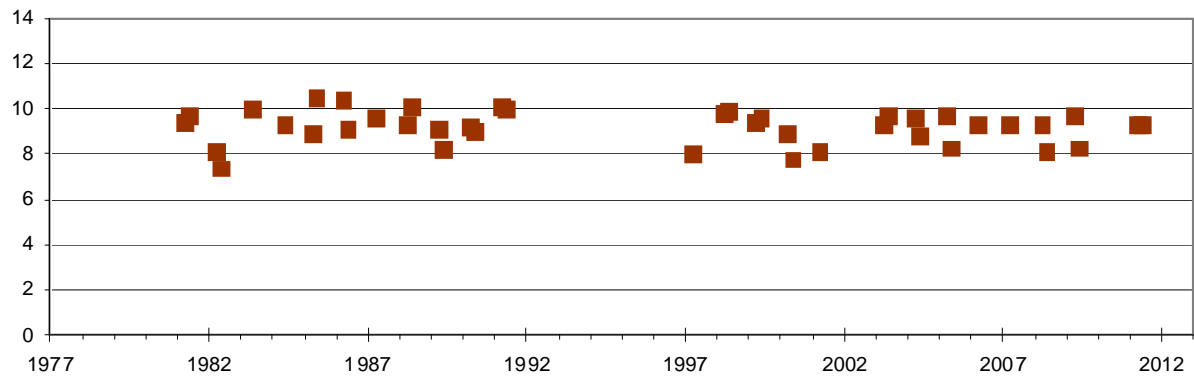
Walbyring is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

WALYORMOURING^{IM}

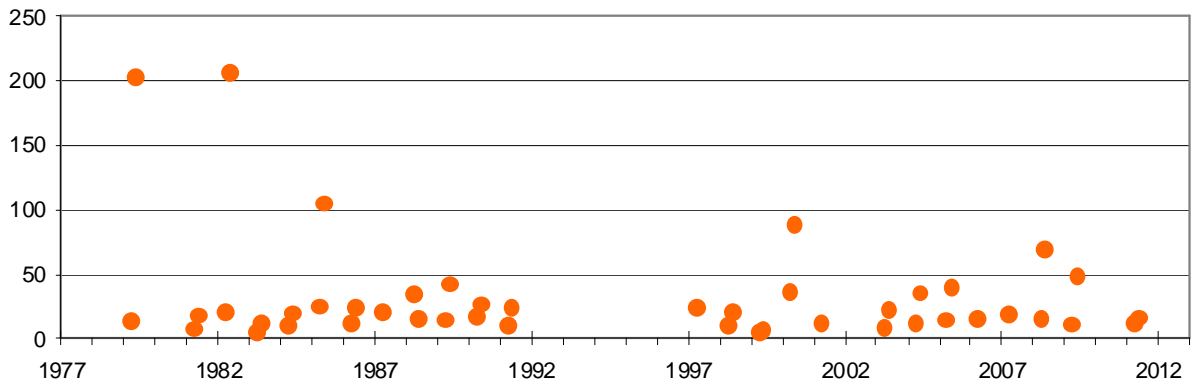
Depth mLD



pH



Salinity (ppt)



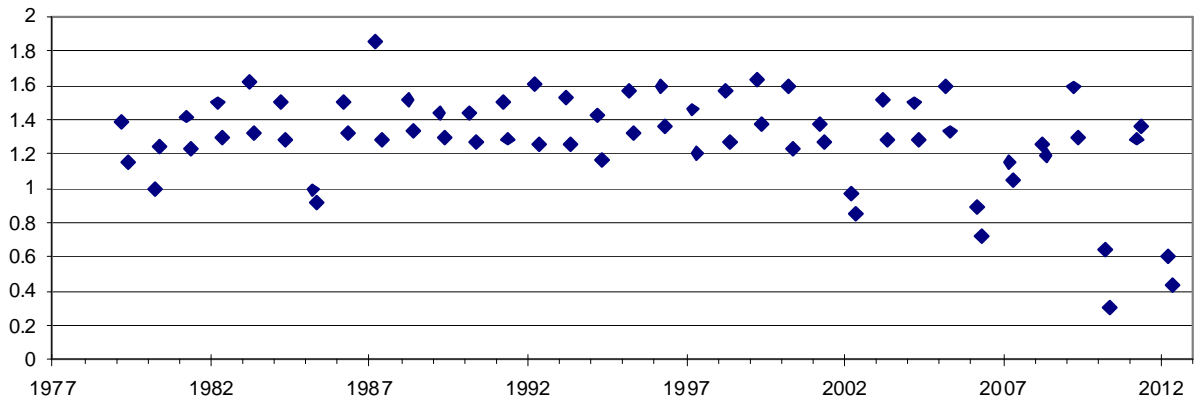
Notes:

1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

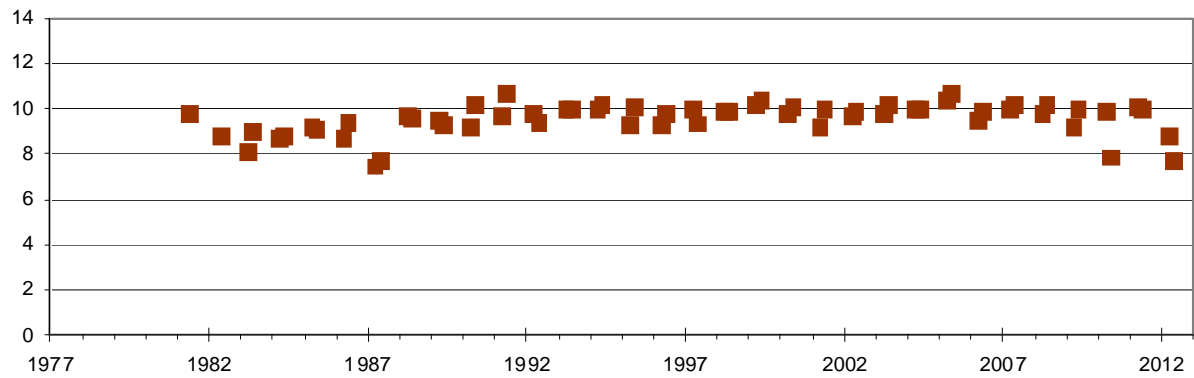
Walyormouring is in the Central District (headquartered in Merredin) of the Wheatbelt DPaW Region.

WANNAMAL

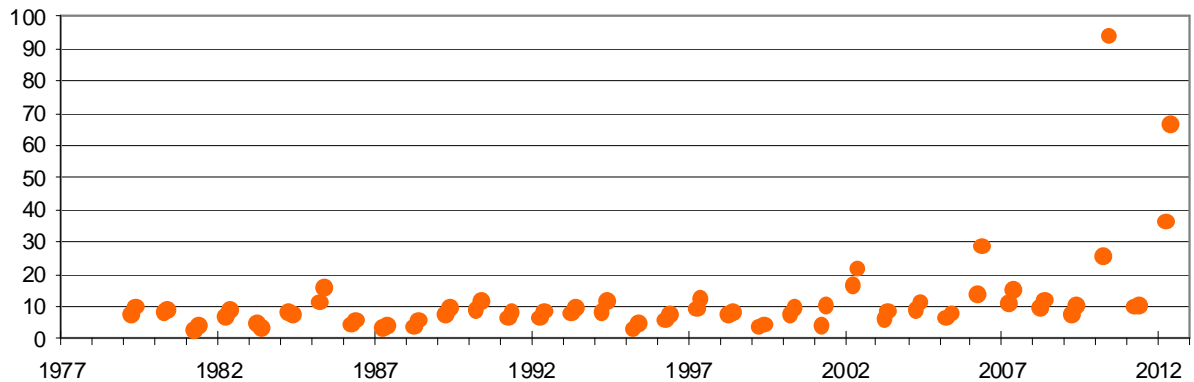
Depth mLD



pH



Salinity (ppt)



Notes:

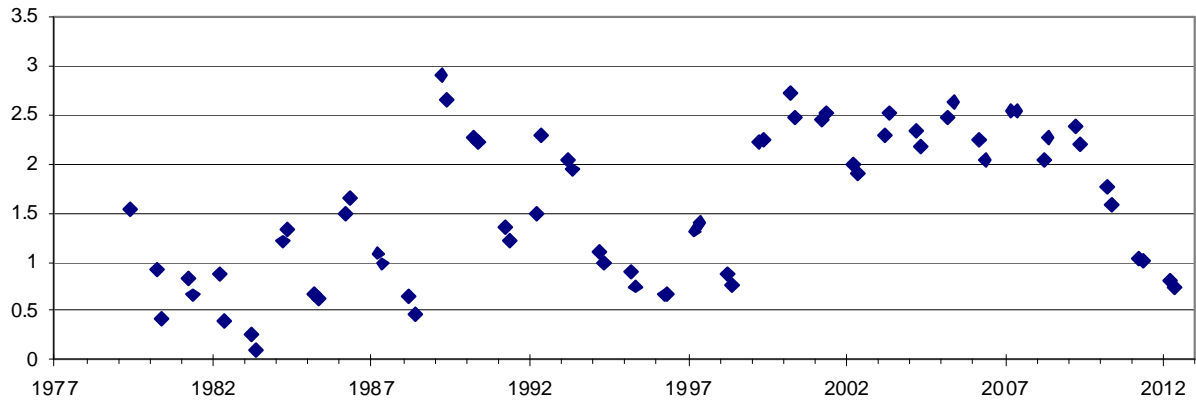
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Wannamal is a component of the 'Wannamal Lakes System', which is listed in the 'Directory of Important Wetlands in Australia'.

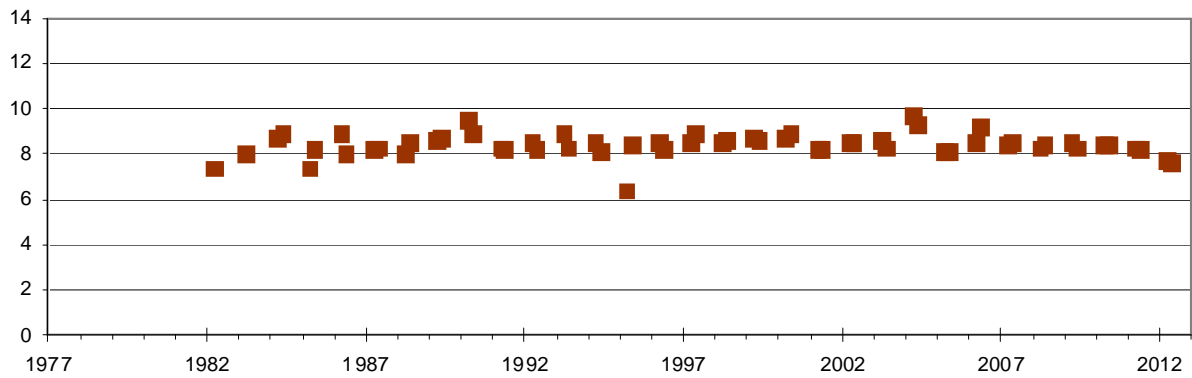
Wannamal is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DPaW Region.

WARDEN

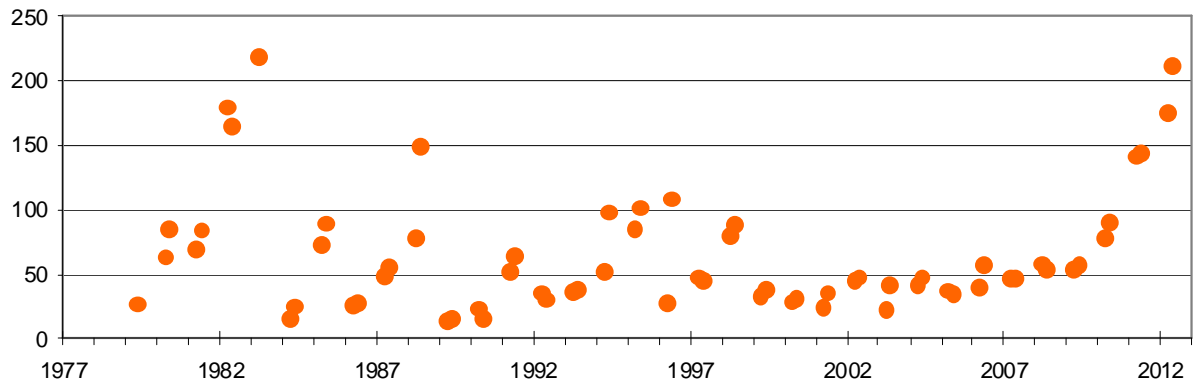
Depth mLD



pH



Salinity (ppt)



Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

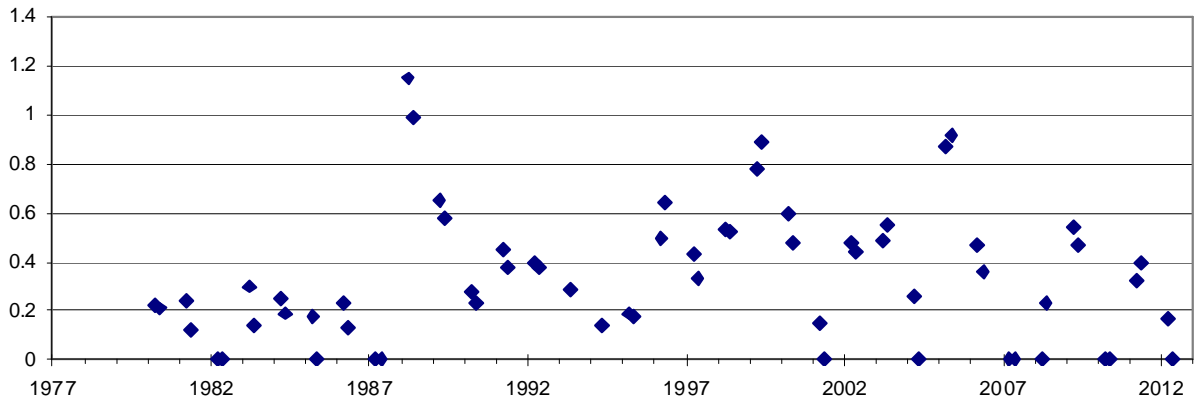
Warden is a component of the 'Lake Warden System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

Warden is also a component of the 'Lake Warden System' listed in the 'Directory of Important Wetlands in Australia'.

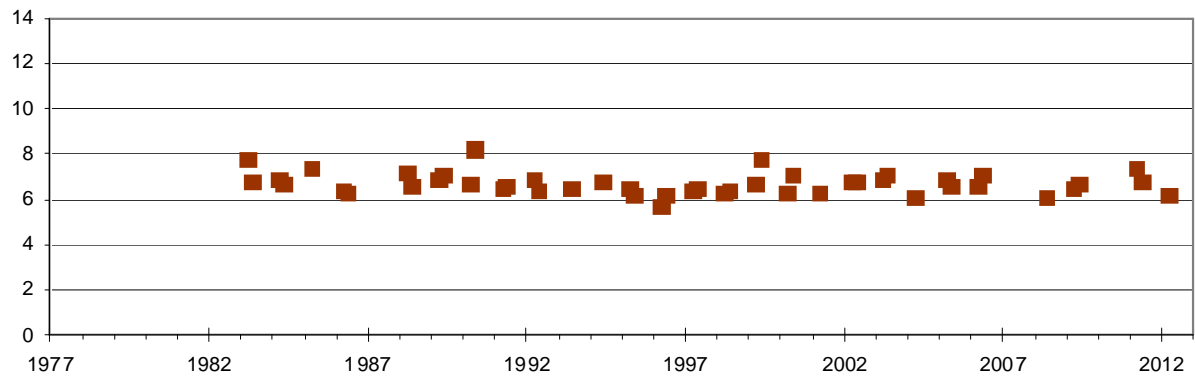
Warden is within the Esperance Lakes Natural Diversity Recovery Catchment and is in the Esperance District of the South Coast DPaW Region.

WARRINUP

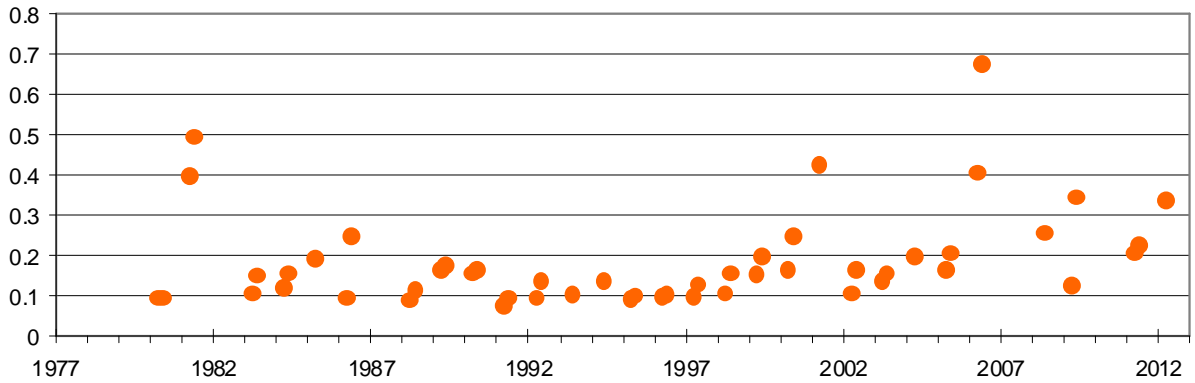
Depth mLD



pH



Salinity (ppt)



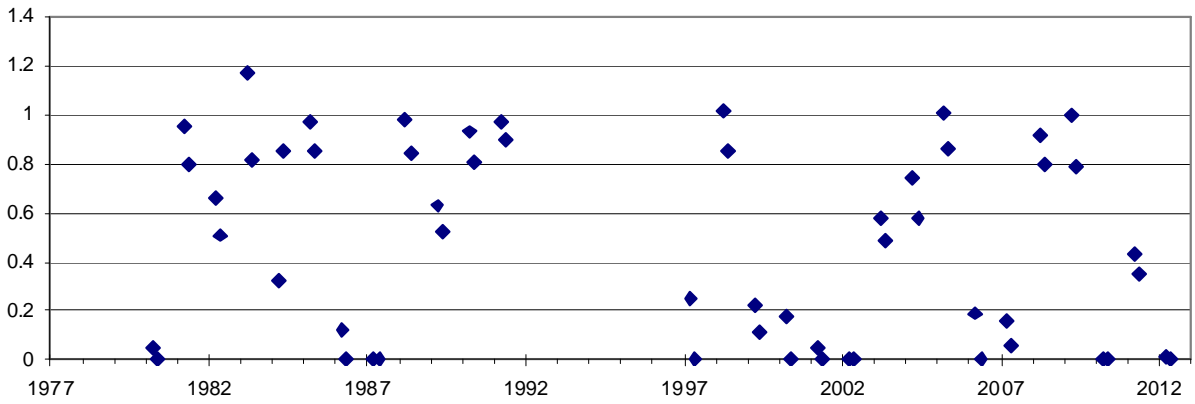
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

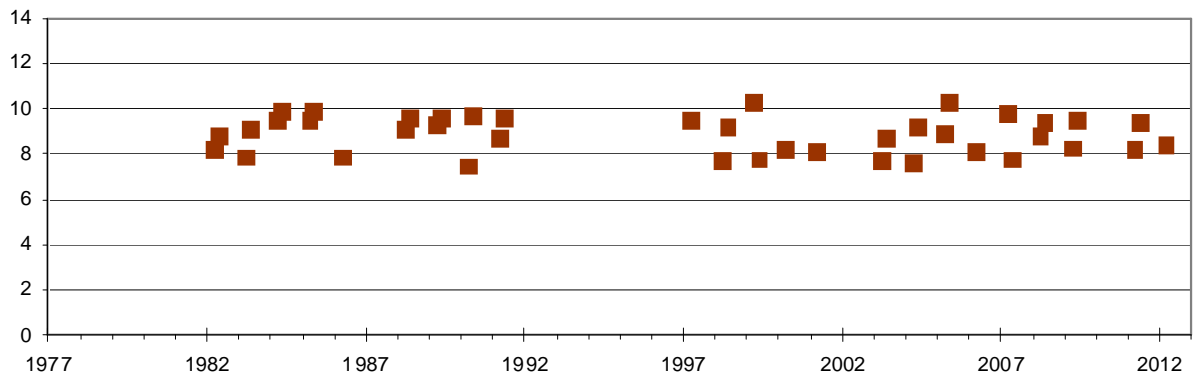
Warrinup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaw Region.

WEST ARTHUR 5456

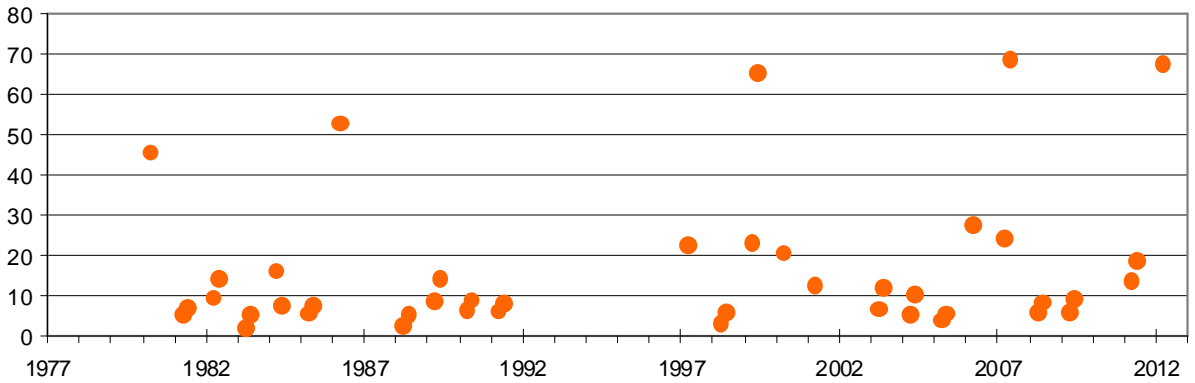
Depth mLD



pH



Salinity (ppt)



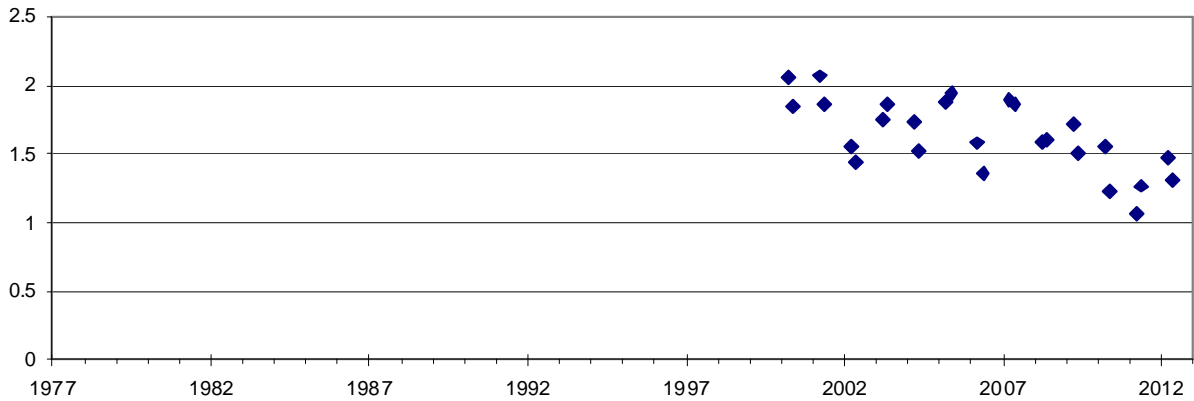
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

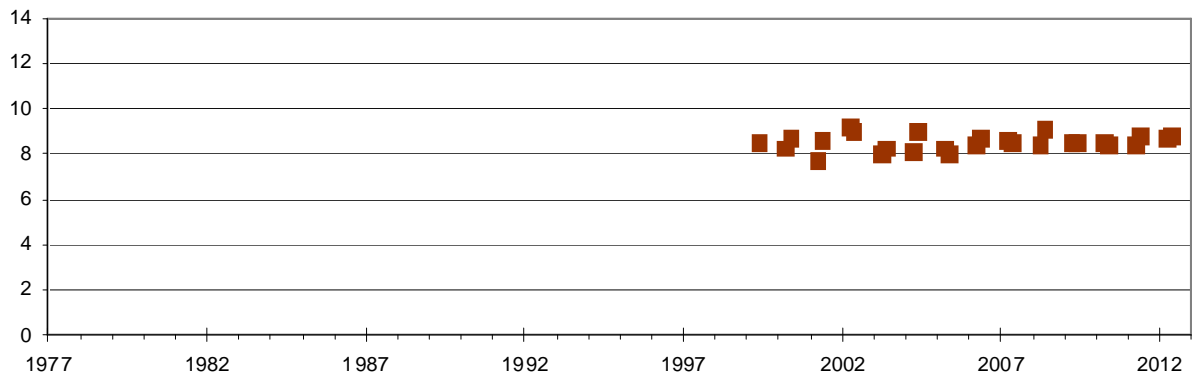
West Arthur 5456 is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaw Region.

WHEATFIELD ^{IM}

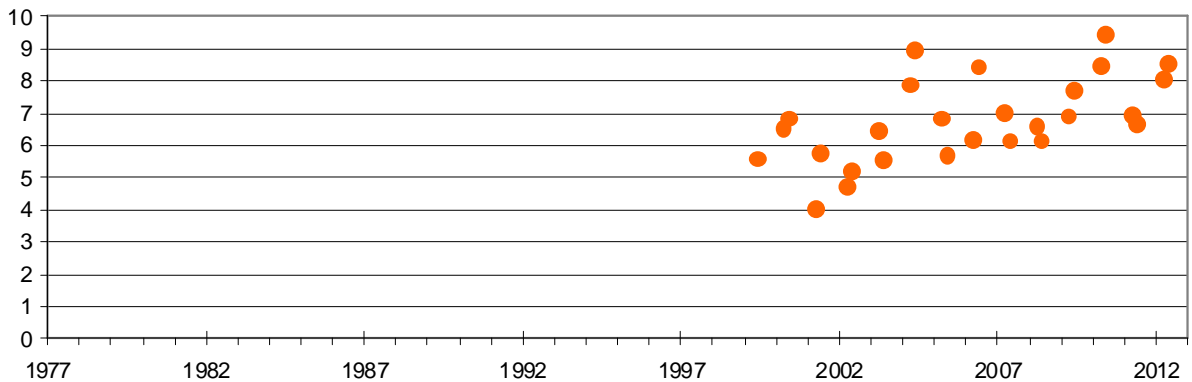
Depth mLD



pH



Salinity (ppt)



Notes:

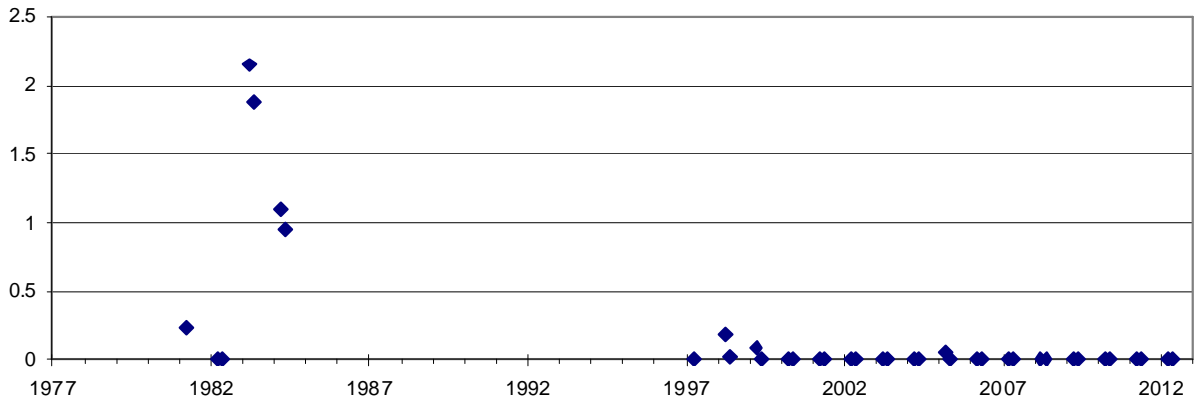
1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Wheatfield is part of the 'Lake Warden System' listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands and is also part of the 'Lake Warden System' listed in the 'Directory of Important Wetlands in Australia'.

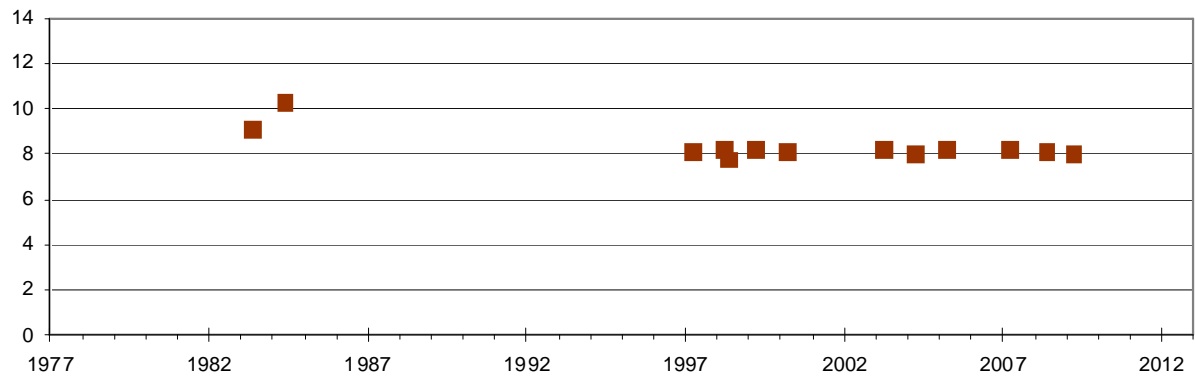
Wheatfield is within the Esperance Lakes Natural Diversity Recovery Catchment and is in the Esperance District of the South Coast DPaW Region.

WHITE (NARROGIN)

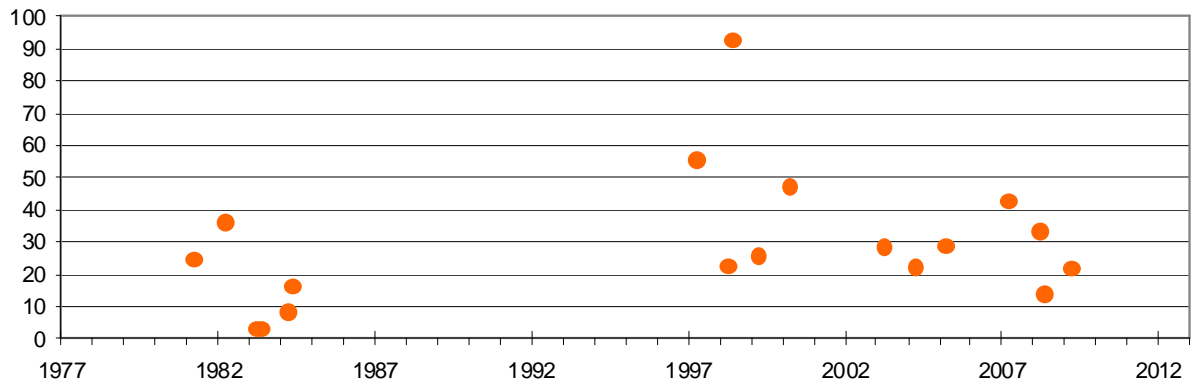
Depth mLD



pH



Salinity (ppt)



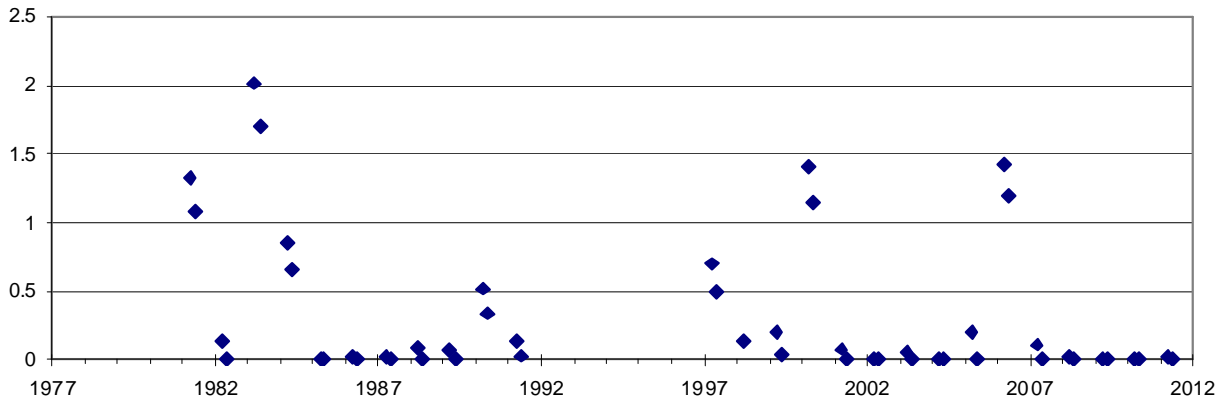
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

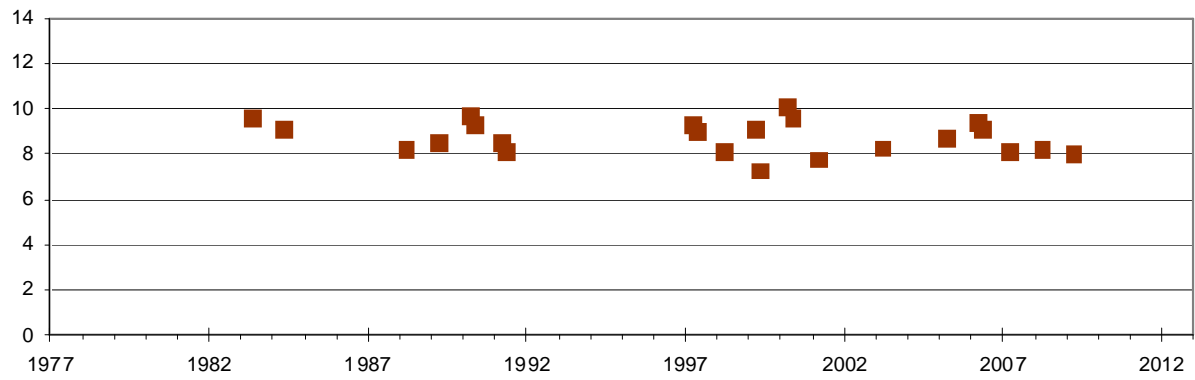
White (Narrogin) is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

WHITE WATER

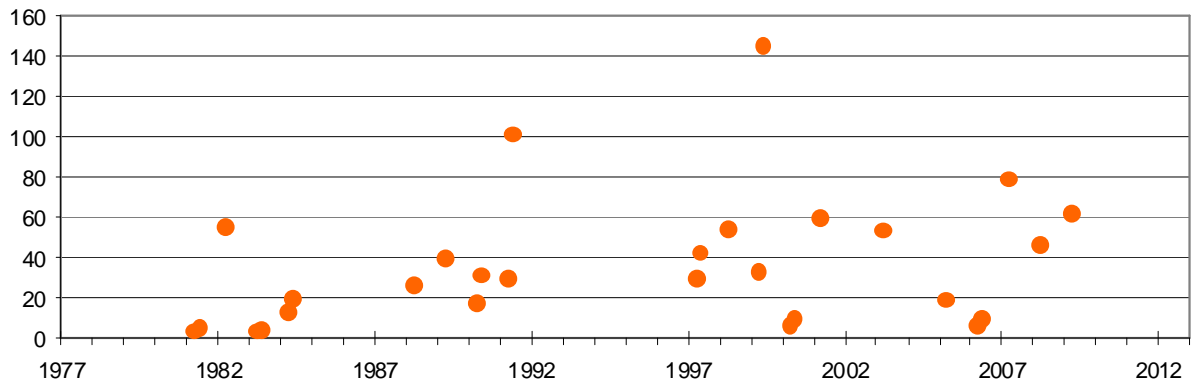
Depth mLD



pH



Salinity (ppt)



Notes:

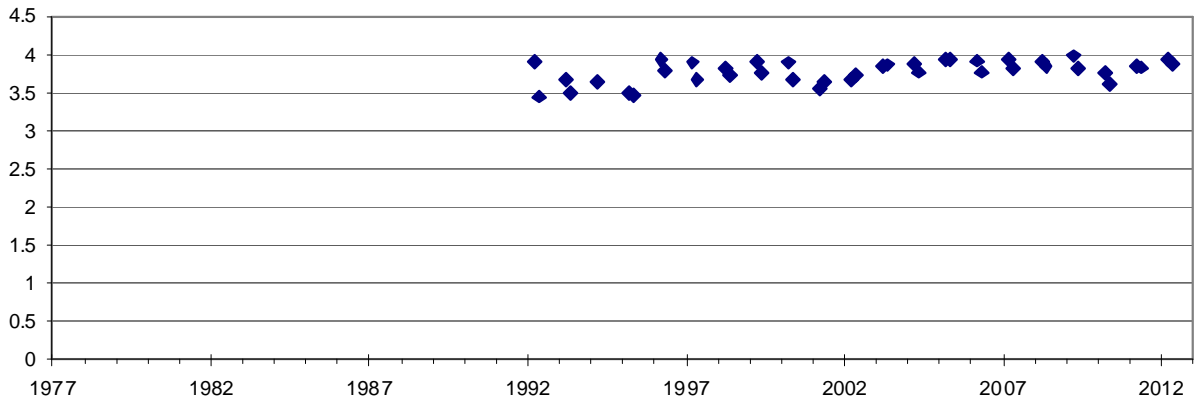
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

White Water is a component of the 'Yealering Lakes System', which is listed in the 'Directory of Important Wetlands in Australia'.

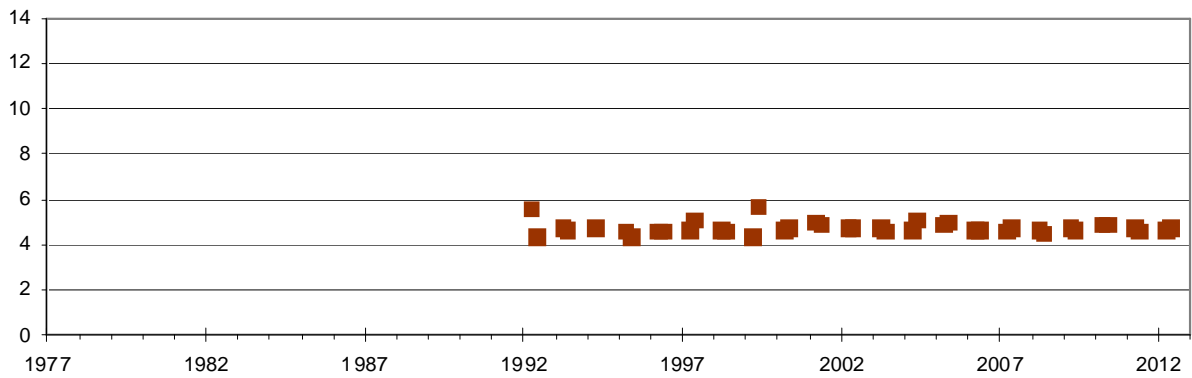
White Water is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

WILSON

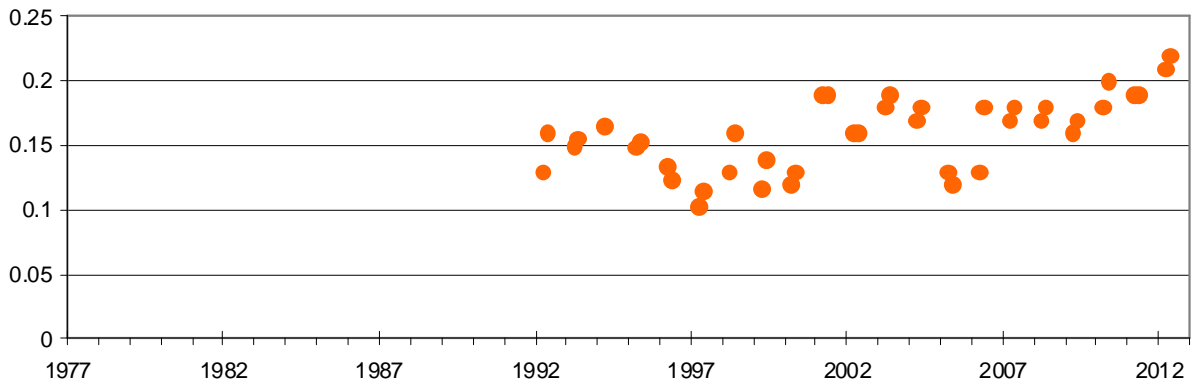
Depth mLD



pH



Salinity (ppt)



Notes:

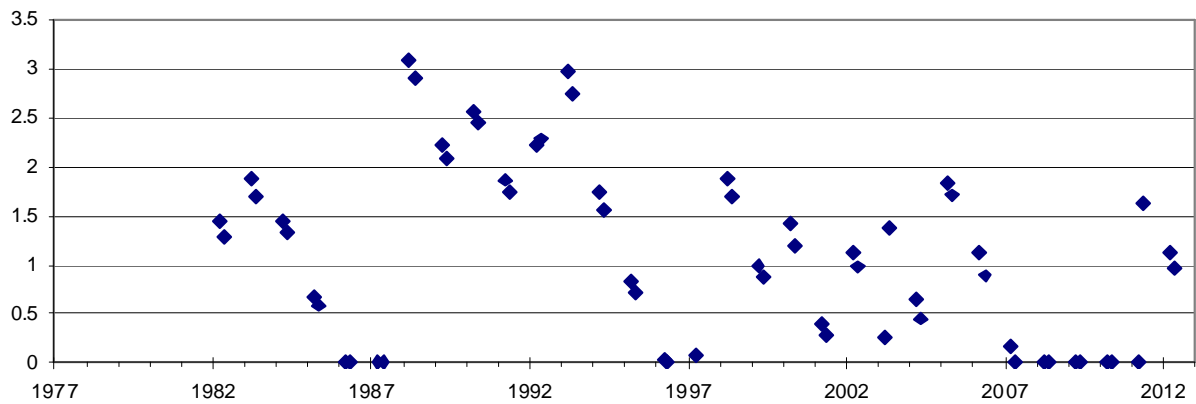
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Wilson is a component of the 'Gingilup-Jasper Wetland System', which is listed in the 'Directory of Important Wetlands in Australia'.

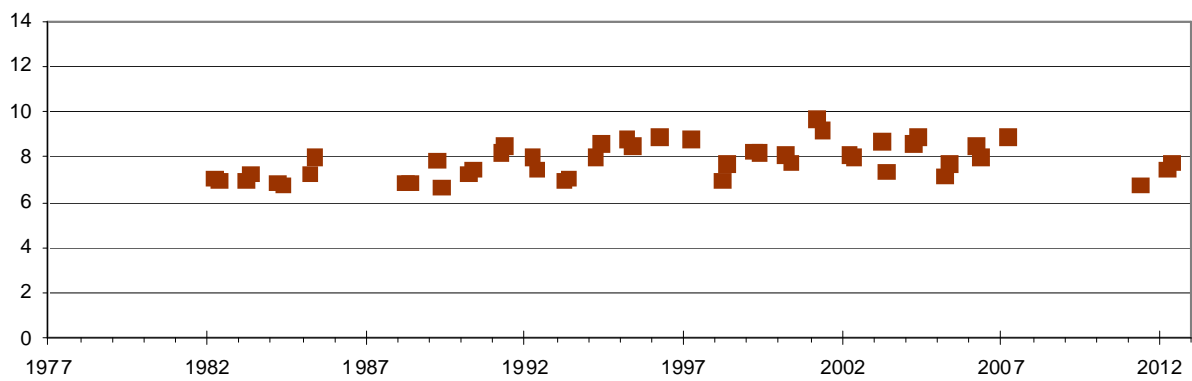
Wilson is in the Donnelly District (headquartered in Pemberton) of the Warren DPaW Region.

YAALUP^{IM}

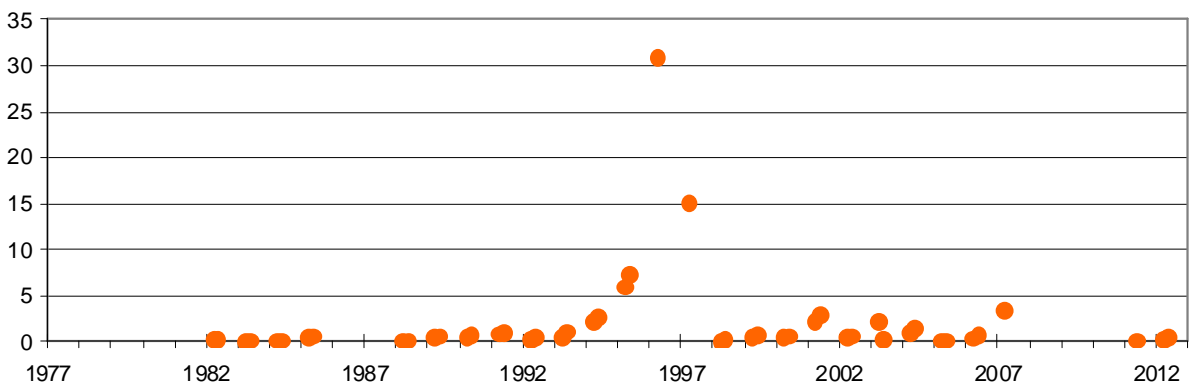
Depth mLD



pH



Salinity (ppt)



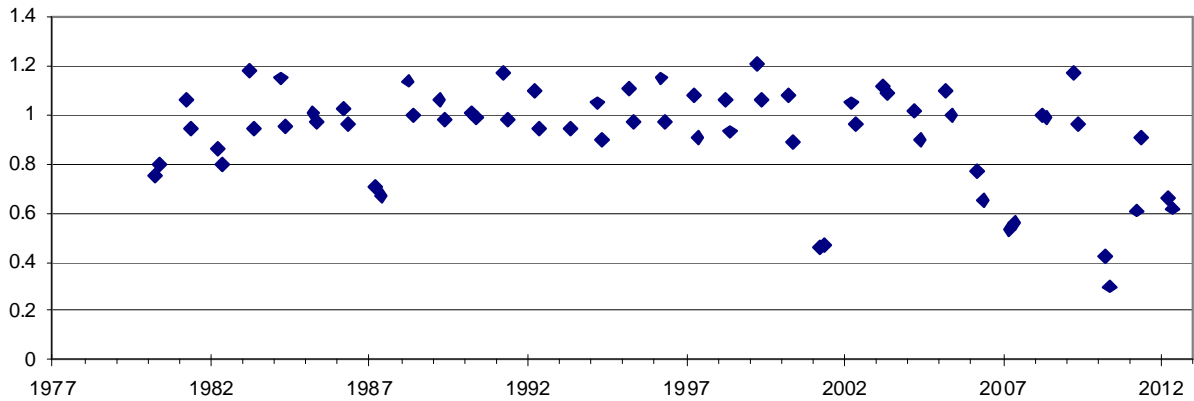
Notes:

1. ^{IM} indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

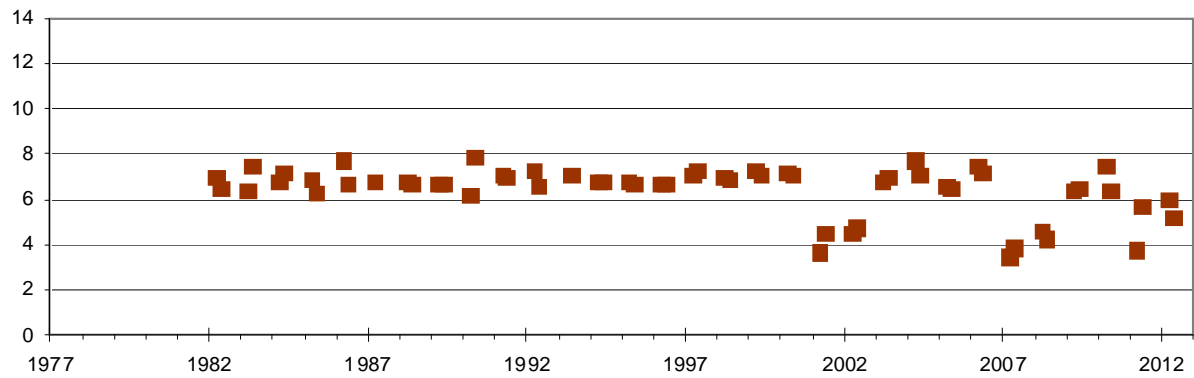
Yaalup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaW Region.

YARNUP

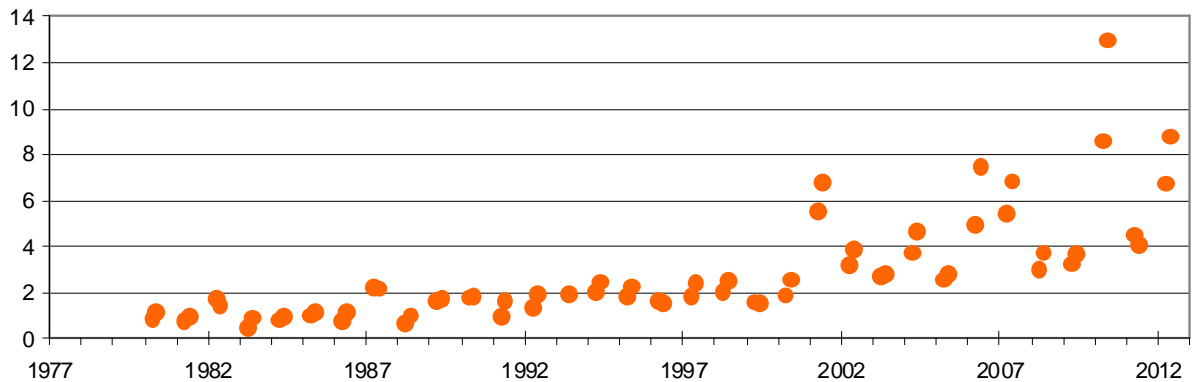
Depth mLD



pH



Salinity (ppt)



Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

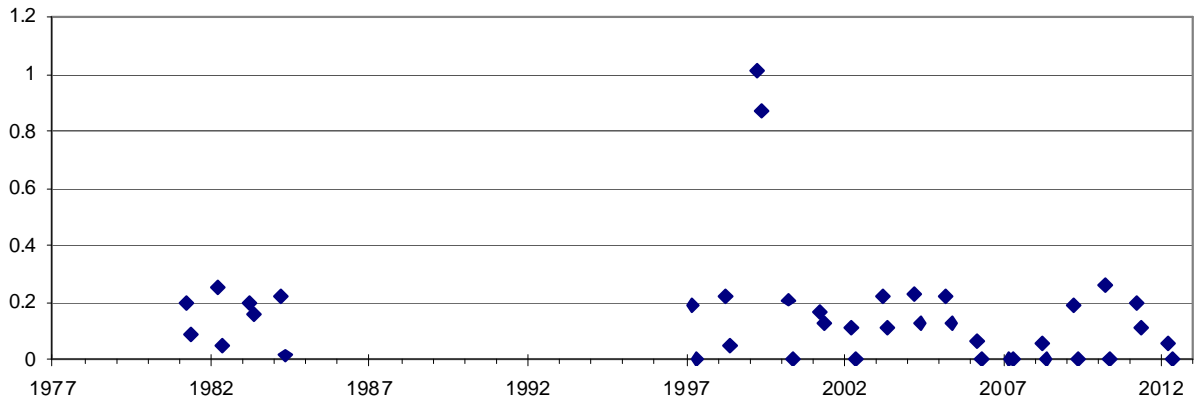
Yarnup is a component of the 'Byenup Lagoon System', which is listed in the 'Directory of Important Wetlands in Australia'.

Yarnup is within the Muir-Unicup Natural Diversity Recovery Catchment.

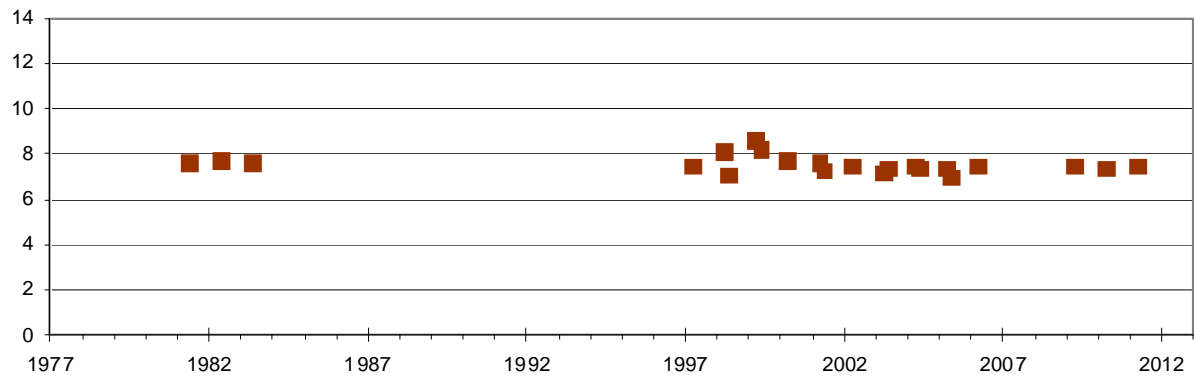
Yarnup is in the Donnelly District (headquartered in Pemberton) of the Warren DPaW Region.

YARRA YARRA

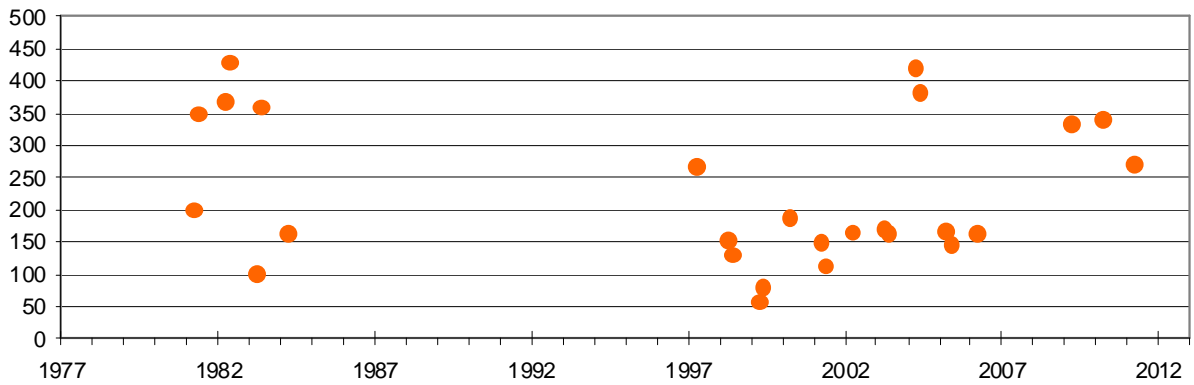
Depth mLD



pH



Salinity (ppt)



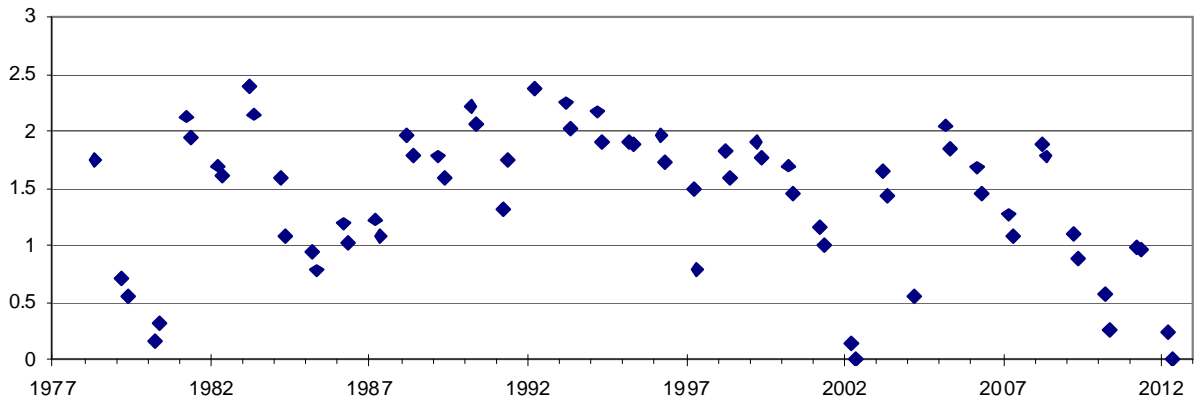
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

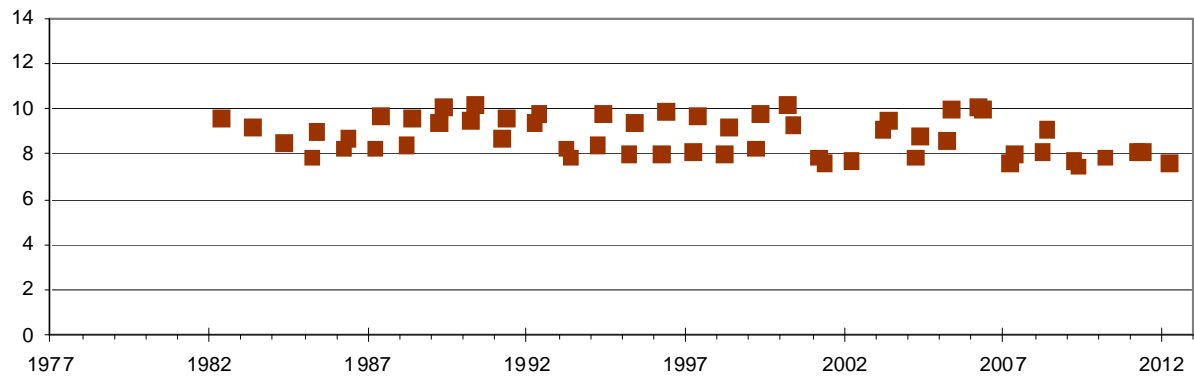
Yarra Yarra is in the Moora District (headquartered in Jurien Bay) of the Midwest DPaW Region.

YEALERING

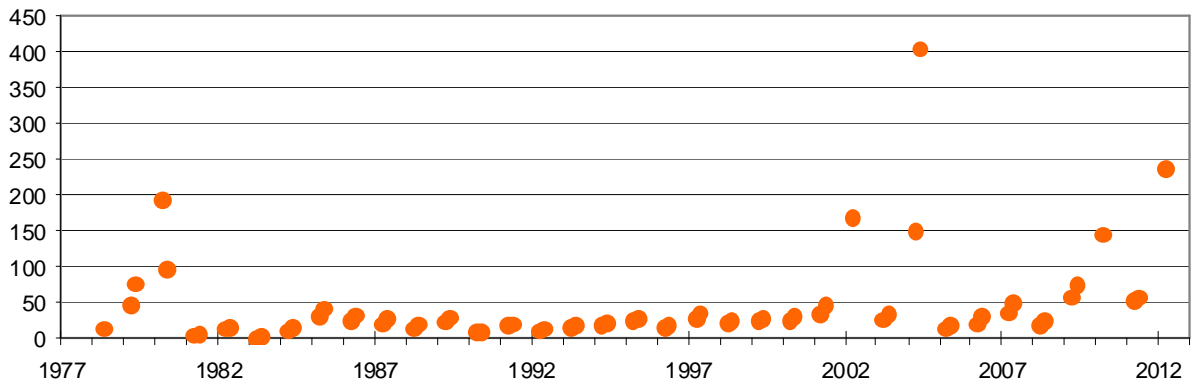
Depth mLD



pH



Salinity (ppt)



Notes:

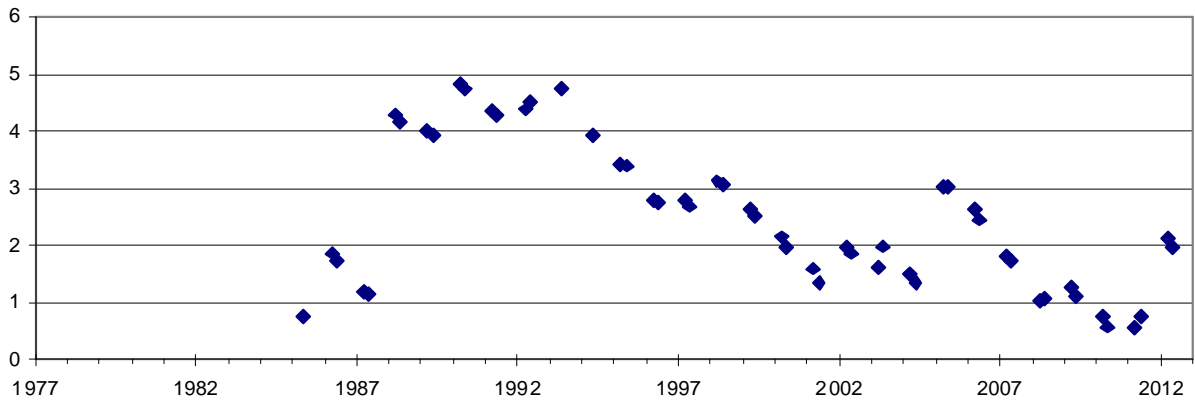
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Yealering is a component of the 'Yealering Lakes System', which is listed in the 'Directory of Important Wetlands in Australia'.

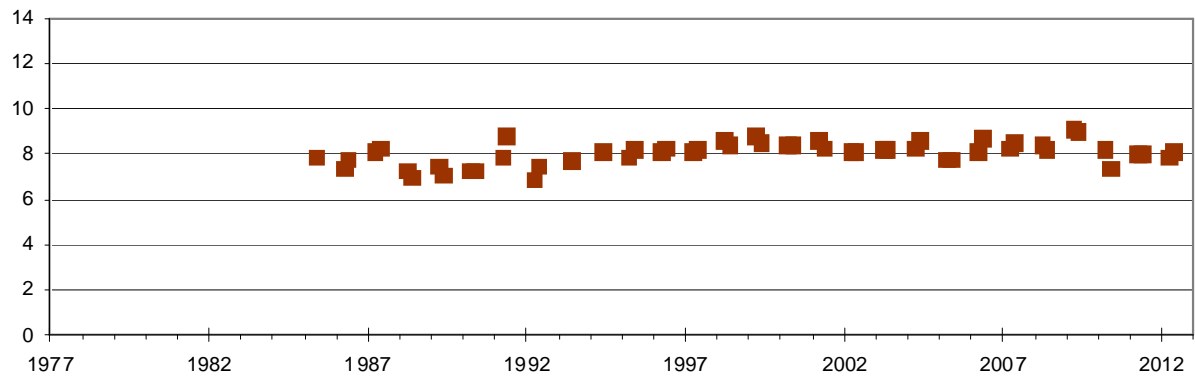
Yealering is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DPaw Region.

YELLILUP

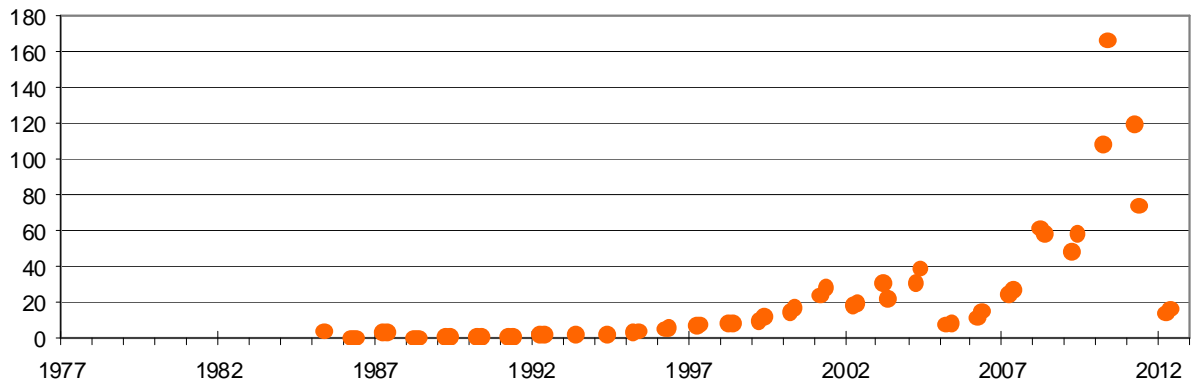
Depth mLD



pH



Salinity (ppt)



Notes:

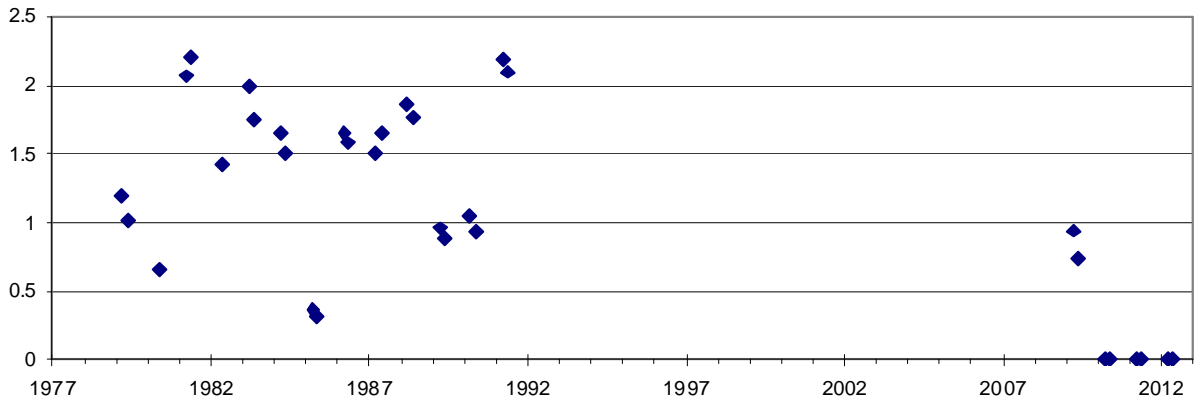
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Yellilup Lake is a component of the 'Yellilup Yate Swamp System', which is listed in the 'Directory of Important Wetlands in Australia'.

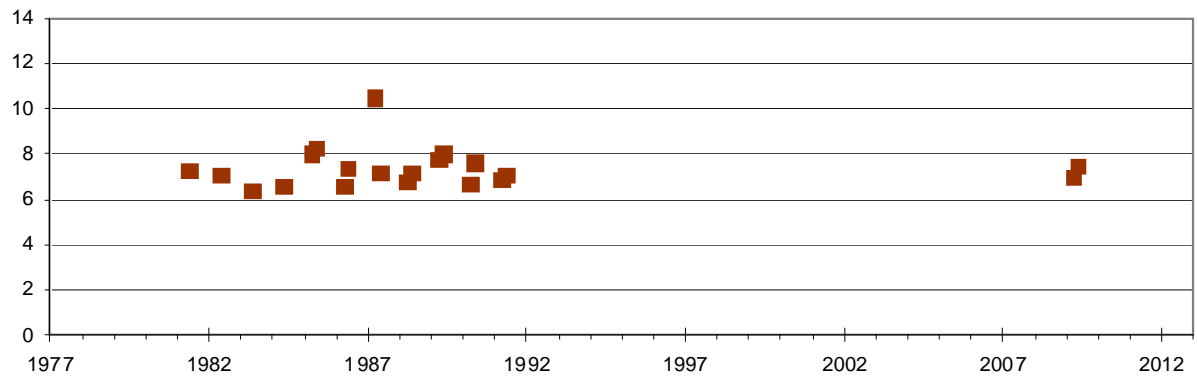
Yellilup is in the Albany District of the South Coast DPaW Region

YURINE

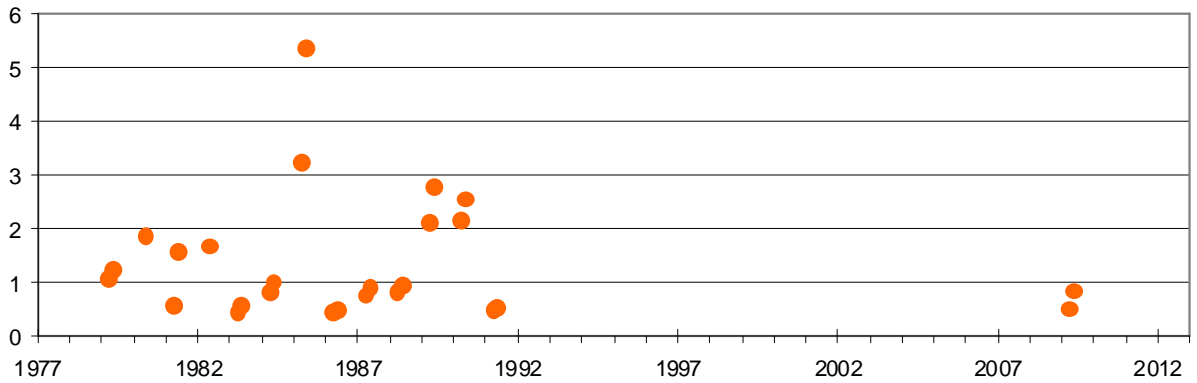
Depth mLD



pH



Salinity (ppt)



Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Yurine is in the Swan Coastal District of the Swan DPaW Region