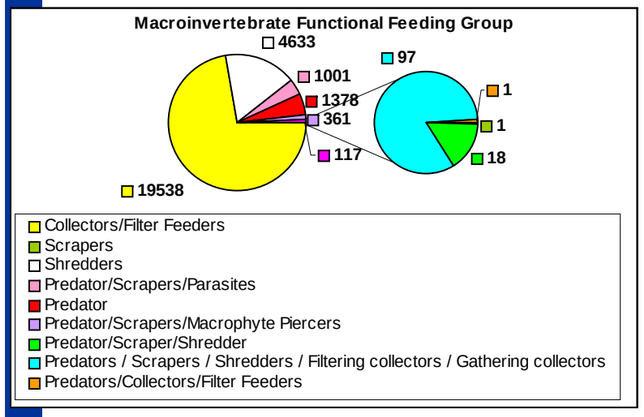
Campbells Swamp

South Coast Wetland Monitoring Project **June 2008**

Each group of Macroinvertebrate play a different role in the food chain, some feed on organic material (Shredders), others feed on fine organic particles (Collectors/filter feeders), others graze on algae (Scrapers), some feed on each other (Predators), others are parasitic (Parasites) and some are Macrophyte piercers that feed off living plants and algae fluids. These groups are called Functional Feeding Groups (FFG). Some macroinvertebrates fit into more than one of these groups, for example the Water Boatman is a Predator, a Scraper and a Macrophyte piercer.

A healthy wetland should have a representative of each functional feeding group. A loss or dominance in a particular group may indicate a change in ecology of the wetland. The composition of these groups at Campbells Swamp are displayed in the below graph.



Conclusion

Campbell's Swamp was previously fresh and perched above the groundwater table however salinities now range between brackish and brine. Groundwater investigations have confirmed the wetland is now a flow-through lake which receives groundwater discharge on the north western side and recharges to groundwater at the south eastern side. Water levels are higher than in the past and riparian vegetation may be stressed from inundation and salinity. Total nutrient levels are high and the available forms of nitrogen and phosphorus exceed guideline levels on some occasions. The main issues to consider for Campbell's Swamp are groundwater rise and salinity, nutrient levels and the impacts of the changed water regimes and water quality on the ecology of the wetland.

Some knowledge gaps were identified during the investigation, monitoring and data analysis for this wetland which should be addressed to improve understanding of the water quality and biodiversity and to detect changes over time.

The monitoring period was relatively short and some effects of previous and current land use change and management may not yet be evident. Macroinvertebrates would need to be identified to family or species level to allow more detailed analysis of ecological condition and relationship to other wetland characteristics. The hydrology of the wetland and its catchment is not fully understood or monitored, particularly the interaction between groundwater and surface water. A future monitoring program should be developed to address these issues.

Acknowledgements

The Department of Water would like to sincerely thank and acknowledge the following people for their assistance and contribution toward the South Coast Wetland Monitoring Program and production of this report.

- Michael and Gabriel Campbell for their support of the project and allowing access to the lake on their property.
- Ruhi Ferdowsian (Department of Agriculture and Food, Albany) and Kevin Hopkinson (Department of Water, Albany) for providing knowledge of the hydrogeology associated with Campbell's Swamp.
- Ania Lorenz, Sherrie Randall, Kevin Hopkinson, and Albany Department of Water team who conducted the monitoring.
- Kevin Hopkinson, Naomi Arrowsmith, Andrew Maughan and others for their support and editing assistance.
- Sherrie Randall and Tracy Calvert for data analysis and report compilation.

For further information please contact Tracy Calvert at the Department of Water Albany (08) 9842 5760.

Campbells Swamp

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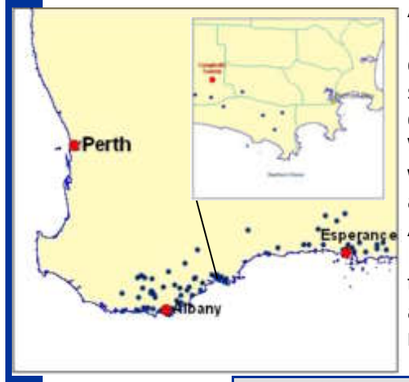
This report card summarises the Department of Water's current state of knowledge of the physical, chemical and biological characteristics of Campbell's Swamp based on the knowledge gained from investigation and monitoring conducted by the Department of Water through the South Coast Wetland Monitoring Program.

Accompanying this document are appendices that provide more detailed information about the wetland monitoring program, terminology of wetland classification, parameters monitored, methodology and the ANZECC&ARMCANZ guidelines used in this report.

Funding for this program has been provided through the South Coast Natural Resource Management Inc. - supported by the Australian Government and the Government of Western Australia.

About Campbell's Swamp

Campbell's Swamp is located near the coast approximately 33km west of Bremer Bay in Western Australia within the Dillon/Coastal catchment and smaller sub-catchment of Bitter Water Creek. The wetland is at approximately 70m AHD (Australian Height Datum) and the area receives an annual average rainfall of 560mm.



	GPS Location Coordinates		
Wetland Suite	*Easting*	*Northing*	*MGA Zone*
Pabelup Suite	686719	6197673	50

Campbells Swamp

Campbell's Swamp is located on privately owned land, within a catchment of approximately 12km^2. The wetland lies within a within a fenced wetland vegetation buffer zone that extends approximately 40-140m from the wetland edge.

Vegetation in the upper storey consists of *Eucalyptus occidentalis* (Yates) along with *Melaleuca cuticularis* (saltwater paperbark). There are a number of dead trees around the rim of wetland as well as regeneration of Melaleuca and Yates.

Vegetation around Campbell's Swamp with regenerating

Approximately 90% of the catchment has been cleared of native vegetation for cropping, livestock and tree plantation.

Water quality monitoring commenced in November 2005 and included physical, chemical and biological parameters as outlined in the appendices.

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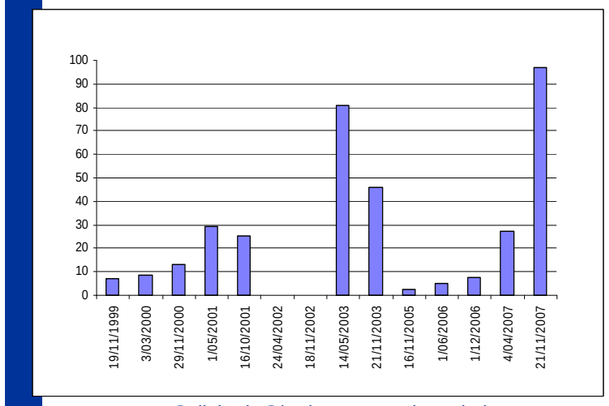
Wetland Classification

Wetland type	*Water Salinity*	*Consistency of Salinity*	*Size (Metres)*	*Shape*
Lake	Subhaline - Hyposaline - Mesosaline	Poikilohaline	Macroscale 890 x 1200	Ovoid

Classification of Campbell's Swamp has been evaluated on the basis of guidelines developed by V & C Semeniuk Research Group. For further explanation please refer to the appendices.

Salinity

Salinity over the sample period ranged between brackish (4.9mS/cm) to brine (97.2mS/cm). Fluctuations in salinities relate to seasonal variation in rainfall, evaporation and water level variation.



Salinity (mS/cm) over sample period

Campbell's Swamp was formed due to land subsiding and wind driven lunette (crater like) formation. Water enters Campbell's Swamp through surface and sub surface flow, through the creek line to the north and, now, through groundwater. During high rainfall events saline water can overflow from Yellilup Swamp in the south west and, although rare, from Peacock's Wetland to the north.

The wetland was previously fresh, perched above the groundwater and only seasonally or intermittently inundated depending on rainfall. Due to groundwater rise the wetland basin is now permanently inundated (except through very dry years) and connected to the groundwater. This was inferred through groundwater investigations which revealed that groundwater discharges into the swamp on the north-west side due to an upward pressure head. Groundwater head was 0.57m above the wetland bed confirming connection with the groundwater. In contrast groundwater levels at the south eastern end of the swamp were 4.1m below the swamp bed which suggests the swamp is recharging the groundwater at that point as a 'flow through' lake.

Trees are receding from the margins of the swamp potentially due to increased inundation and salinity.

While there are comparable salinities between the lake and groundwater (saline groundwater), higher salinities in the swamp relate to low water levels and high evaporation.

Nutrients

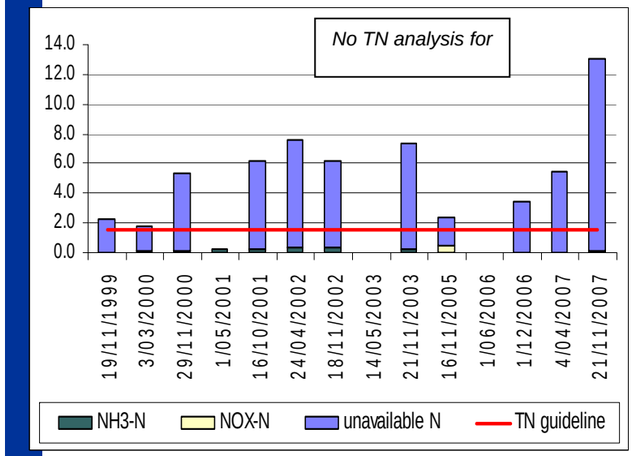
Total Nitrogen (TN) concentrations ranged between 1.8-13mg/L which exceeded the guidelines developed for ecosystem protection for southwest Australian wetlands for slightly disturbed systems of 1.5mg/L on all sample occasions.

Dissolved inorganic nitrogen fractions of ammonia (NH_3-N) ranged between 0.018-0.34mg/L which exceeded the recommended guideline value of 0.04mg/L on six of the twelve sample occasions. Total oxidised nitrogen (NOx-N) ranged between 0.010-0.38mg/L which exceeded the recommended guideline value of 0.1mg/L on one sample occasion.

Bird footprints at Campbells Swamp

Campbells Swamp

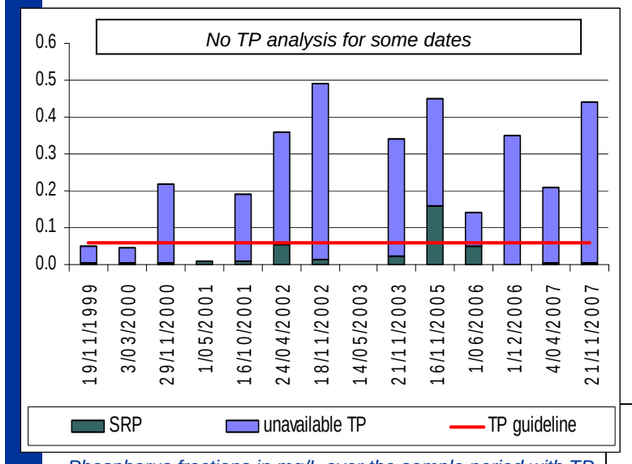
South Coast Wetland Monitoring Project June 2008



Nitrogen fractions in mg/L over the sample period with TN guideline illustrated

Total Phosphorus (TP) concentration ranged between 0.046-0.49mg/L which exceeded the water quality guidelines of 0.06mg/L on ten of the twelve sample occasions.

Soluble Reactive Phosphorus (SRP) (form of phosphorus available for uptake by plants) ranged between 0.005-0.16mg/L which exceeded the recommended water quality guideline value of 0.03mg/L on two of the twelve sample occasions.



Phosphorus fractions in mg/L over the sample period with TP guideline illustrated

Nutrients are recycled naturally through the swamp due to uptake and assimilation of nutrients by plants and animals and through release of nutrients for example through microbial breakdown of organic material.

Being very large and exposed to wind action, turbulence may also resuspend sediments and release nutrients. Nutrient stores in the catchment may also enter Campbell's Swamp through drainage flow from the north west drainage line, surface runoff, sub surface flow and through groundwater.

Substrate photo of Campbells Swamp taken 21st November 2008

Macroinvertebrates

Twenty three groups of macroinvertebrates were found at Campbells Swamp during the monitoring period of which the most abundant included; Cladocera (water fleas), Ostracoda (seed shrimp), Copepoda (copepods), Amphipoda (scuds), Acarina (spiders/mites), Notonectidae (backswimmers), and Corixidae (waterboatmen).

Other groups of less abundance were found including; Oligochaeta (aquatic worms), Gastropoda (snails/limpets), Conchostraca (clam shrimp), Isopoda (slater like), Anostraca (fairy shrimp), Decopoda (shrimp/prawn/crayfish), Epiproctophora (dragonflies), Zygoptera (damselflies), Coleoptera (beetles) adult, Coleoptera (beetles) larvae, Chironomidae (non-biting midge larvae), Ceratopogonidae (biting midge larvae), Culicidae (mosquitoe larvae), Other Diptera (fly larvae), Lepidoptera (aquatic catepillars/moth larvae) and Trichoptera (caddisflie larvae).

The diversity of macroinvertebrates found over the sample period ranged between four to nineteen groups with a median of ten, which rates as average based on the Ribbons of Blue Wetland Habitat Score.