Progress Report SP 2016-005

Hydrological function of critical ecosystems

Ecosystem Science

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Context

Biodiversity conservation requires an understanding of ecological processes that include balances and fluxes of water, energy and biogeochemistry. These processes are considered in a number of coarse scale ecological assessment and management frameworks, but these frameworks are difficult to apply at finer, or local, scales where an appreciation of hydrological variation is important. To increase confidence in applying coarse scale management frameworks at finer scales they need to be verified by results from targeted, critical, local scale ecosystem investigations. Critical ecosystem sites selected where dominant processes driving their behaviour are complex, but not unique, with results feeding back into coarser scale frameworks to reduce uncertainty and predict areas where ecosystems have a similar hydrological function and response to change. The project will investigate the hydrological function of local scale critical water dependent ecosystems, determine and improve our understanding of dominant hydrological processes controlling their physico-chemical sensitivity and responses to change and feed the results back into coarser scale ecosystem management frameworks. Local scale sites will be selected where ecohydrological data can be collected and integrated with existing biophysical datasets and information to optimise the transferability of hydrological results and outcomes to other areas.

Aims

- Determine ecohydrological management zones for Walyarta mound springs that have a similar hydrological function based on the sensitivity to changes in aquifer discharge (rate, volume and water quality).
- Develop strategies to manage Swan Coastal Plain claypans based on changes in hydrology induced by reductions in average winter rainfall, vegetation cover and anthropogenic controls.
- Review 1987 predictions of deleterious groundwater - estuary interactions and nutrient fluxes to estuary sea grass in Swan Estuary Marine Park at Lucky Bay and assess the broader scales risks.

Progress

- A two year hydrogeochemical, hydrogeophysical and numerical modelling investigation has confirmed that the majority of Walyarta springs are sustained by ‘older’ groundwater that moves to the surface through fracture systems.
- Eil Eil spring has been instrumented with hydrological monitoring equipment to understand the role of hydrology in maintaining the invertebrate communites.
- Hydrological information from satellite imagery has been used to develop a map showing the frequency of inundation of Lake Walyarta and to select surface water monitoring locations.
- Natural and anthropogenically altered surface water flows have been mapped and assessed at Brixton Street Wetland.
- Recommendations for closure and maintenance of tracks have been made.
- A study of groundwater and surface water interactions was undertaken and included the installation and monitoring of three bores and surface water levels within selected clay pans.
- A ground hydrogeophysics (electromagnetics) investigation mapped groundwater quality variation and transmissive zones in the aquifer that have potential to export nutrients to the Swan estuary.
- Groundwater sampling and analysis of Department of Water Bore IF14 show groundwater nitrate levels are elevated between 14 and 20m below ground level, where the geophysics indicated the aquifer is more transmissive.

Management implications

- A surface water monitoring program for the Walyarta (Mandora Marsh) mound spring TEC will allow regional staff to understand the hydrological dynamics of the system and track changes in water quality

and quantity. This information will enable Parks and Wildlife to provide inter-agency advice on the need and extent of a groundwater protection zone for mound springs.
- Hydroecological information including the monitoring program will be transferable to other areas of the Kimberley Region and used to assist in the preservation of the TECs.
- Knowledge of hydrological function of the Brixton Street Wetland complex will increase the department's capacity to develop management actions to reduce environmental impacts on TECs, other significant ephemeral wetlands and threatened flora on the Swan Coastal Plain. This will allow for the provision of more effective inter-agency advice on the potential environmental consequences of developing land within the Guildford Clay Formation.
- An improved understanding of groundwater as a source of the nutrient fluxes into the Swan Estuary Marine Park will enable more informed spatial targeting of seagrass sampling and monitoring. It will provide an improved basis for developing robust hydrological monitoring programs on the Swan Estuary foreshore.

Future directions

- Complete the numerical modelling and assess monitoring requirements for mound springs identified as being the most sensitive to hydrological change.
- Download and interpret the hydrological data and information in surface water and groundwater data logger data from Eil Eil spring to understand the dynamics of spring moats and their connectivity with groundwater.
- Following 2017 winter rains, download and interpret hydrological data at the Brixton Street Wetland complex from loggers to increase understanding of claypan hydroperiods and their seasonal connectivity with shallow groundwater.
- Intergrate ground hydrogeophysics and groundwater hydrochemistry results for Swan Estuary Marine Park-Lucky Bay, report findings and recommend management strategies.