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Groundwater dependent ecosystem pictorial conceptual model 'Oasis Spring'

Version 1.5

Oasis Spring

Oasis Spring is a permanent bauxite spring in Weipa Plateau supported by an aquifer overlying, but separate to, the Great Artesian Basin. Weipa Plateau is a remnant of the extensive, deeply weathered western coastal plains of Cape York Peninsula (Winders 2009). This plateau is an estimated 50 km wide with slight elevation of up to 15 m near the coast, rising to 70 m in the east (Winders 2009). The gently rolling hills of the plateau are dissected by discontinuous drainage and deep incisions that have been carved out by major rivers such as the Archer and Wenlock Rivers (Taylor et al. 2008; Fell 2009; Winders 2009).

Based on information collected during a drilling program conducted by Winders (2010), the following sequence of geological layers near Oasis Spring is consistent with the broader geological profile of the Weipa Plateau (Eggleton et al. 2008, Jell 2009, Willmott 2009).

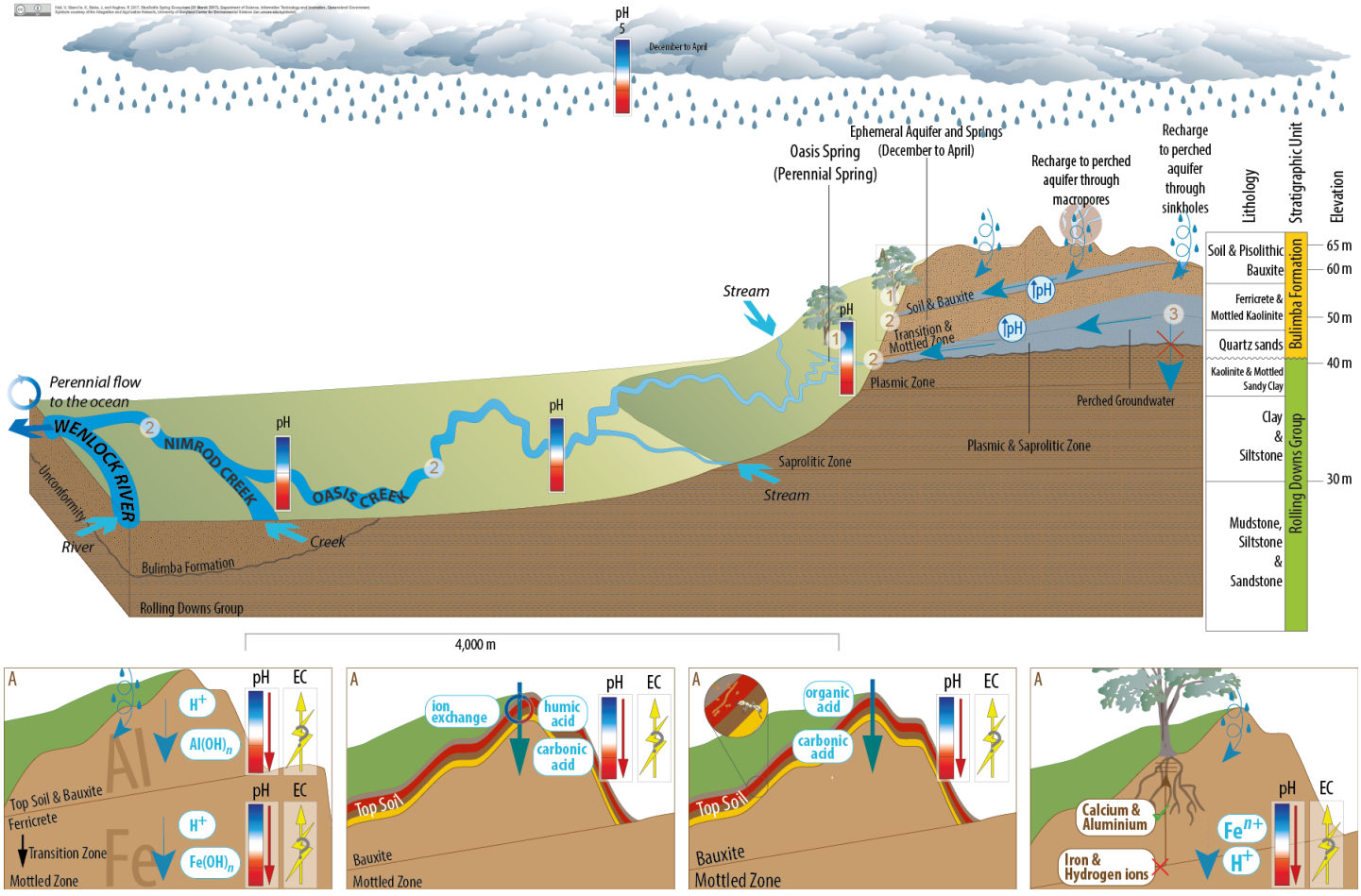
1. Soil – red and yellow kandosols (Eggleton et. al. 2008) mixed with bauxite pisoliths (i.e. small round bauxite pebbles).
2. Bauxite – a bauxite layer occurs directly below the soil layer and is characterised by pisoliths.
3. Ferricrete – a ferricrete layer, containing cemented iron-oxide and some pisoliths, occurs immediately below the bauxite.
4. Mottled Zone – a mottled zone consisting of iron-oxide and kaolinite occurs directly below the ferricrete layer.
5. Plasmic Zone (a) – a pallid or bleached zone of sandy clay consisting of an upper clay (kaolinite) and fine quartz sand unit underlain by a quartz, coarse sand to pebbly conglomerate with varying amounts of kaolinite.
6. Plasmic Zone (b) – a pallid or bleached zone of well-compacted clay (kaolinite).

Groundwater discharge can occur where a permeable geological layer (e.g. Bulimba Formation) overlies a less permeable layer (e.g. Rolling Downs Group). At this site plasmic zone (b) is composed of well-compacted clay that acts to slow or prevent vertical groundwater flow. Given sufficient rainfall and recharge, this can result in groundwater accumulating above the clay and flowing laterally until it is discharged to the surface (e.g. Oasis Spring). In addition, groundwater may accumulate on less permeable kaolinite in other geological layers (e.g. mottled zone) and flow laterally until it is discharged to the surface or able to continue vertical movement.

Oasis Spring occurs in a 240-metre arc at approximately 40 metre elevation near the contact between the Bulimba Formation and underlying the less permeable plasmic zone of the Rolling Downs Group. A relatively deep perennial gully incises the spring head at approximately its centre point and this becomes the main spring watercourse (Oasis Creek). Oasis Spring coalesces into a main stream approximately 100 metres downstream of the spring head. Oasis Creek flows into Nimrod Creek which then joins the Wenlock River in its freshwater, non-tidal reaches. In addition to the clear running streams, permanently saturated ground exists in parts of the spring's eastern flank. Oasis Spring features strong perennial flow at the spring head and downstream for 800 metres even during the peak of the dry season. In 2008 permanent flow into Nimrod Creek was observed until August, although this flow slowly declined as the dry season progressed.

Lyon and Franklin (2009) have indicated that the water draining from the springs is acidic with an observed pH of 3.8 at the point of discharge and noted that the pH of the groundwater decreases with increasing distance from the spring. A number of factors have been identified that may contribute to spring acidity including rainfall acidity, chemical weathering, plant activity, decay of vegetation, termite activity, bacteria activity and fungi activity. Recent research supports the contribution of anerobic microbial degradation to groundwater chemistry (Leblanc et al. 2015). In addition, isotopic values at the spring suggest groundwater has meteoric origins, representing a mix of rainfall events (Leblanc et al. 2015).

Hydrogeology of Oasis Spring



Ecology of Oasis Spring

A 1 2 Closed rainforest on permanently moist substrate (i.e. spring head)

Dominant Species

Calophyllum bicolor
Horsfieldia australiana
Syzygium angophoroides

Calophyllum bicolor

Calophyllum bicolor

Significant Species

Canopy: *Calophyllum bicolor* (national significance); *Myrsine benthamiana* (regional significance)

2nd tree layer: *Calophyllym bicolor* (national significance); *Macaranga polyadenia* (state significance); *Myrsine benthamiana* (regional significance)

Shrubs: *Calophyllum bicolor* (national significance); *Artobotrys carnisopetalus, Macaranga polyadenia,* and *Memecylon hylandii* (state significance); *Fagraea racemosa, Myrsine bethamiana* and *Pternandra coerulescens* (regional significance)

Ground cover: *Blechnum orientalis* and *Taenitis blechnoides* (regional significance)

B 1 2 Tall open forest on permanently moist substrate (i.e. spring margins)

Dominant Species

Lophostemon suaveolens
Syzygium angophoroides
Xanthostemon crenulatus

Hydriastele wendlandiana

Significant Species

Canopy: *Memecylon hylandii* (state significance); *Myrsine bethamiana* (regional significance)

Sub canopy: *Macaranga polyadenia* and *Memecyclon hylandii* (state significance); *Myrsine bethamiana* and *Pternandra coerulescens* (regional significance)

Shrubs: *Blechnum orientalis* and *Taenitis blechnoides* (regional significance)

Ground cover

C 1 Tall woodland on deeply weathered plateaus (regional ecosystem 3.5.2)

Dominant Species

Canopy: *Corymbia nesophila*, *Eucalyptus tetrodonta*

Sub canopy: *Eucaluptus* spp., *Grevillea glauca*

Shrubs: *Acacia* spp., *Eucalyptus* spp.

Ground cover: *Alloteropsis semialata*, *Eulalia mackinlayi*, *Heteropogon triticeus*, *Sarga plumosum*

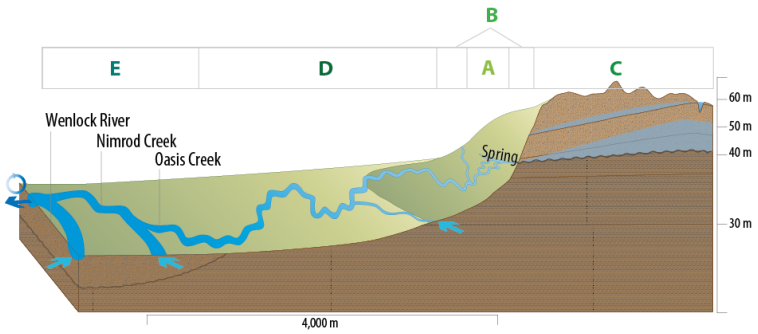
D 2 Open woodland on rolling plains (regional ecosystems 3.5.7x2a and 3.9.4a)

Dominant Species

Canopy: *Corymbia darksoniana*, *Corymbia dallachiana*, *Corymbia disjuncta*, *Eucalyptus leptophleba*, *Eucalyptus tetrodonta*

Sub canopy: *Grevillea glauca*, *Grevillea parallela*, *Melaleuca viridiflora*, *Parinari nonda*

Ground cover: *Capillipedium parriflorum*, *Eriachne* spp., *Eulalia mackinlayi*, *Heteropogon contortus*, *Heteropogon triticeus*, *Sarga plumosum*, *Schizachyrium* spp.



E 2 Notophyll vine forest (regional ecosystem 3.3.5a and 3.3.25a)

Dominant Species

Canopy: *Acacia midgleyi*, *Acacia polystachya*, *Buchanania arborescens*, *Carallia brachiata*, *Corymbia tessellaris*, *Dillenia alata*, *Eucalyptus leptophlena*, *Lophostemon suaveolens*, *Mallotus polyadenos*, *Syzygium forte*

Ground cover: *Heteropogon contortus*

Amphibians

Regional significance:
Graceful Tree Frog (*Litoria gracilenta*)
White Lipped Tree Frog (*Litoria infrafrenata*)
Wood Frog (*Rana daemeli*)

Introduced:
Cane Toad (*Rhinella marinus*)

Birds

National significance:
Rose Crowned Fruit Dove (*Ptilinopus regina*)
Wompoo Pigeon (*Ptilinopus magnificus*)

State significance:
Grey Goshawk (*Accipiter novaehollaniae*)
Palm Cockatoo (*Probosciger aterrimus*)
Rose Crowned Fruit Dove (*Ptilinopus regina*)
Wompoo Pgieon (*Ptilinopus magnificus*)

Regional significance:
Brown Backed Honeyeater (*Ramsayornis modestus*)
Lovely Fairy Wren (*Malurus amabilis*)
Papuan Fromouth (*Podargus papuensis*)
Tawny Breasted Honeyeater (*Xanthotis flaviventer*)
Torres Strait Pigeon (*Ducula bicolor*)
Tropical Scrub Wren (*Serricornis becarri*)
Yellow Billed Kingfisher (*Syma torotoro*)
Yellow Breasted Boatbill (*Machaerirhynchus flaviventer*)
Yellow Spotted Honeyeater (*Meliphaga notata*)

Cyanobacteria

sources of nitrogen

Scytonema sp.
Symplocastrum sp.

Fish

Regional significance:
Aru Gudgeon (*Oxyeleotris aruensis*)
Banded Rainbowfish (*Melanotaenia trifasciata*)

Mammals

State significance:
Spotted Cuscus (*Spilocuscus maculatus*)

Regional significance:
Cape York Melomys (*Melomys capensis*)
Red Legged Pademelon (*Thylogale stigmatica*)

Introduced:
Feral Pig (*Sus scrofa*)

Reptiles

Regional significance:
Macfarlane's Skink (*Carlia macfarlani*)
Northern Tree Snake (*Dendrelaphis calligaster*)
Shiny Skink (*Glaphrymorphus nigricaudis*)

Oasis Spring habitat ecotone viewed from Oasis Spring vents (Water Planning Ecology, Department of Science Information Technology and Innovation)

Water quality sampling at Oasis Spring outflow (Water Planning Ecology, Department of Science Information Technology and Innovation)

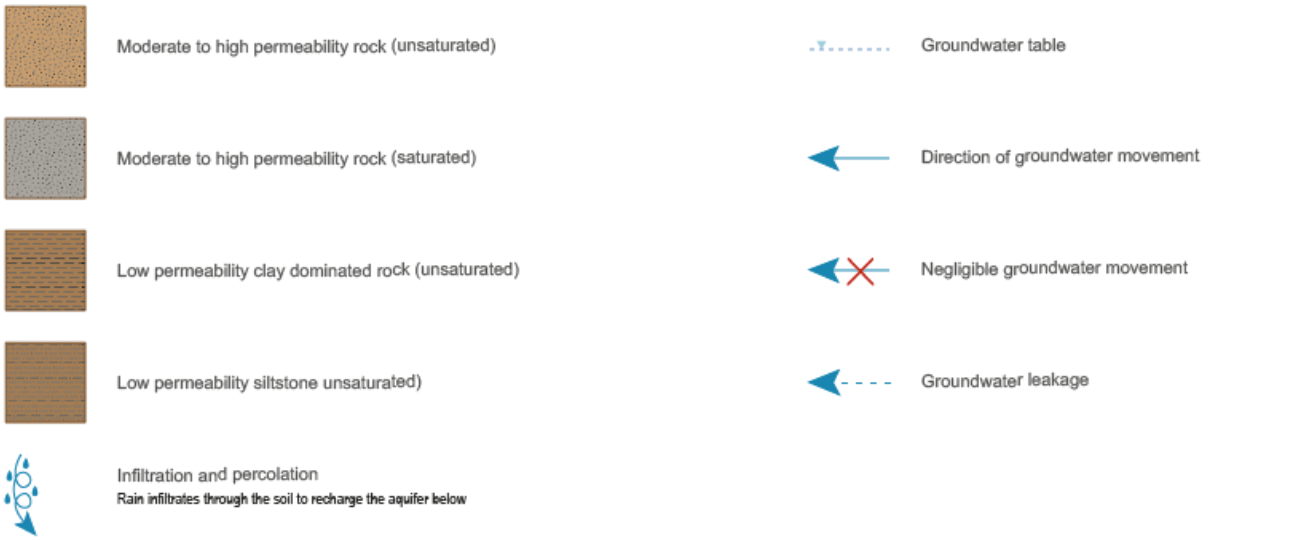
Oasis Spring outflow creek (Water Planning Ecology, Department of Science Information Technology and Innovation)

Geology legend

Moderate to high permeability rock
Stores and transmits groundwater through void spaces in the rock

Low permeability rock

Groundwater hydrology legend



Groundwater dependent ecosystems legend

Citation

Queensland Government (2017) *Groundwater dependent ecosystem pictorial conceptual model ‘Oasis Spring’: version 1.5,* Queensland Government, Brisbane.

Content derived from work by Hall V, Glanville K, Blake J, and Hughes R (Department of Environment and Heritage Protection).

References

Eggleton R.A. and Taylor G. 2008. Effects of some macrobiota on the Weipa bauxite, northern Australia. Australian Journal of Earth Sciences: *An International Geoscience Journal of the Geological Society of Australia*. 55(S1):71-82.

Eggleton R.A., Taylor G., Le Gleuher M., Foster L.D., Tiley D.B. and Morgan C.M. 2008. Regolith profile, mineralogy and geochemistry of the Weipa bauxite, Northern Australia. Australian Journal of Earth Sciences: *An International Geoscience Journal of the Geological Society of Australia*. 55(S1):17-43.

Eggleton T. and Taylor G. 1998. Editors: Selected thoughts on 'laterite". Canberra: Cooperative Centre for Landscape Evolution and Mineral Exploration, Australia.

Fell D. G. 2009. Flora survey of freshwater spring forests, Steve Irwin Wildlife Reserve, Cape York Peninsula, Australia. Australia Zoo.

Jell J.S. 2009. Review of the geology of the Wenlock River Basin with particular emphases on the XX Springs Complex, Cape York, Queensland.

Laffan S.W. 2002. Inferring the spatial distribution of regolith properties using surface measurable features. The Australian National University, Canberra.

Leblanc M., Tweed S., Lyon B.J., Bailey J., Franklin C.E., Harrington, G. and Suckow, A. 2015. On the hydrology of the bauxite oases, Cape York Peninsula, Australia. *Journal of Hydrology.* 528: 668-682.

Lyon B. and Franklin C.E. 2009. Natural Values of Perched Bauxite Springs. Australia Zoo.

Taylor G., Eggleton R.A., Foster L.D. and Morgan C.M. 2008. Landscapes and Regolith of Weipa, Northern Australia. Australian Journal of Earth Sciences: *An International Geoscience Journal of the Geological Society of Australia*. 55(S1):3-16.

Willmott W. 2009. Cape York Peninsula: Areas of International Conservation Significance. The Geological Story of Cape York Peninsula. Report for the Department of Environment and Resource Management, Queensland Government.

Winders M. F. 2010. Further Submissions Concerning the Boundaries to the Coolibah Springs Complex, Wenlock Wild Rivers Declaration. Department of Environment and Resource Management, Queensland Government.

Winders M.F. 2009. The Wenlock River. A submission supporting its Proposed Declaration as a Wild River. Department of Environment and Resource Management, Queensland Government.