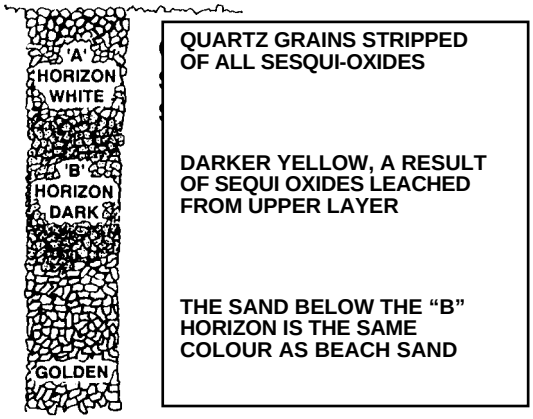
Explaining Some Aspects of Fraser Island's Fresh Water

This FIDO Backgrounder No 15 describes the complex interaction between the water and the soil. This helps explain why there is so much water and the role organic material plays in determining the colour and to some extent the nutrient status of the water. Other curiosities such as water age are also explained.

Fraser Island has an abundance of fresh water. Sand dunes are great reservoirs of fresh water. In the saturated layers of sand, (the water table) spaces between the grains enable water to occupy about a third of the volume

Water Repellence: Sand should be as porous as a sponge, However dry sand on Fraser Island tends to repel water. This result of organic material in the sand. Water seems to roll off dry sand rather than be absorbed by it. Water seems to roll across the top of the sand surface and dry sand grains cling to the drops until the repellence finally breaks down. During this repellent stage significant surface erosion occurs. It is worse on disturbed areas.

To reach the underground water table, rain and runoff water has to pass through the various layers of soil. In this process many chemical changes take place which affect its colour and chemical properties. Most of these occur in the "B" Horizon in the soil profile.



The "B" Horizon: Beach sand grains have a distinctive sandy colour. This is because white quartz silica grains are covered with a fine film of sesqui-oxides. These are derived from iron. Over time the sesqui-oxides are stripped from the surface sand and become concentrated deeper down in the soil profile (the "B" Horizon). Thus the surface soil becomes white (unless discoloured grey by humus). This is the "A" horizon. The sand below becomes deeper yellow. The colour of the "B" horizon becomes darker the deeper it occurs in the soil.

Nutrients in the "B Horizon": The sesqui-oxides carry powerful negative charges. These attract and hold any positive ions in the soil. Since essential plant nutrients such as phosphate and potash are positively charged ions, the "B" Horizon contains is critical to plant nutrition. The "B" horizon also contains a small amounts of aluminium.

"Black" Water: Surface water may be coloured by organic material. Although the organic material gives water a reddish or tea colour. This has no bearing on its drinking quality. Scientists describe this organically discoloured water as "black". (Examples: Lake Boomanjin, Bogimbah Creek)

"White" Water: When water percolates through the ground, the organic colloids (which dries out to fine black dust). These colloids react with minute fractions of aluminium in the "B" horizon and are precipitated out. After losing all the organic colloids in the "B" horizon the water becomes clear. It is known as "white" water. (Examples: Lake McKenzie, Wanggoolba Creek).

Blended Water: Some surface water may be a blend of both black water and white water when new organic material is added after water has already been through the "B" horizon. (Examples: Ocean Lake and many creeks.)

Nutrient enrichment: As water passes through the "B" horizon where the aluminium is concentrated, it collects some of the precious plant nutrients held there. Thus when the groundwater emerges in springs and streams, it is clear and slightly richer. Thus much "white" water will have nutrients and minerals not found in rain water. This is evident by the lusher vegetation growing near springs and streams such as Eli and Wyuna Creeks.

Organic Precipitation in Lakes: "Black" water can be made "White" without necessarily passing through the "B" horizon. While standing in the lakes small quantities of aluminium in the lake bed is also precipitating out organic colloids. These then sink to the bottom of the lake and add to the humus seal which forms the bed of the lake. The "coffee rock" such as is found at Poyungan and Yidney Rocks represent the material typical of lake beds. This is just sand (silica) grains bound by the

Lakes such as Lake McKenzie are filled with "white" water. However, that water lacks the nutrients found in the springs and streams because it hasn't passed through a "B" horizon.

Chemical Purity: The water in the freshwater lakes, particularly the perched lakes, is of special quality. Because it missed the nutrient dose from a "B" horizon it lacks a number of basic ions. This results in them having some of the chemically freshest water to occur in any natural water bodies in the world. Using soap containing phosphates will change the chemical properties of the water and degrade one of the World Heritage values of Fraser Island. Particular care needs to be taken to avoid adding anything to the water which contains phosphorus.

The Water table: Water is stored in the acquifers of the regional water table and lakes. The regional water table may emerge springs to form large streams such as Bogimbah or Eli Creeks. Where the water table rises above the land surface as at Ocean or Wabby Lakes these lakes become "windows" in the water table. These have a higher level of phosphate in them than "perched" dune lakes.

Age of Water: As a general rule black water, representing mainly surface runoff is relatively young and white water is older. Scientists have traced radio active isotopes released by nuclear testing in Australia in the 1950's in the white water emerging in springs. This revealed that the white water emerging from Cooloola's dunes in springs Island was about 80 years. On that basis the mean residence time of Fraser Island water in the dunes would exceed 100 years. It may therefore take 200 years for some water to emerge.

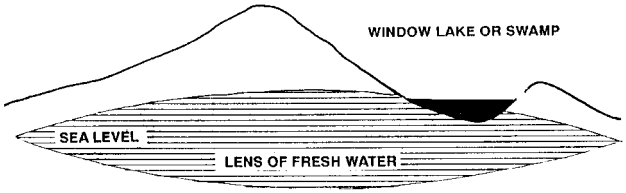
Fraser Island's Unique Dune Lakes

The lakes of Fraser Island represent critical World Heritage values. This FIDO Backgrounder No 15 describes three kinds of lakes on Fraser Island of these lakes and their special characteristics.

Australia, the world's driest and flattest inhabited continent has a dearth of freshwater lakes. There are relatively few lakes regions outside Tasmania. Yet Fraser Island has an abundance of lakes. Each lake has individual character and charm. Some are surrounded by heathlands, others by open forest, some surrounded by rainforests; some have startling white beaches; some have water the colour of tea, others have crystal clear water to depths of 10 metres.

Ages of lakes: The lakes have been around for eons. Sediments found in one Fraser Island lake was aged to 300,000 years. That makes it the oldest lake sediment discovered in coastal Australia. Other research shows that some of the lakes have catchments which extend little further than the lake surface. Almost as fascinating is the fact that many of the lakes retain almost every contaminant ever to enter the water. This has been established at Hidden Lake by measuring the retention of radio-active fallout from the 1950s.

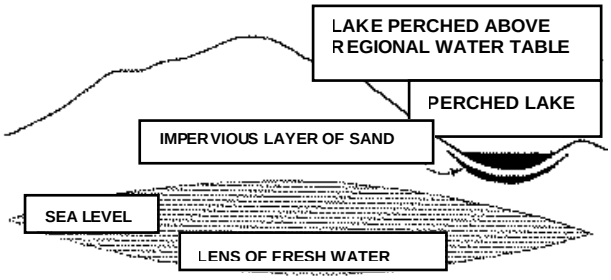
Window lakes are formed where the land surface dips below the actual water table, leaving a window into the water table. All lakes north of Orchid Beach on Fraser Island are classic examples of window lakes but there are others.



Window Lake (e.g. Ocean lake)

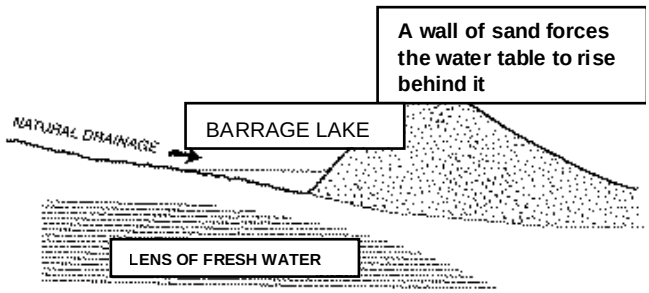
Perched lakes occur where the water is held at an elevation in the dune well above the general water table by an impervious organic layer. Perched lakes can be likened to like perching a saucer above a much larger body of water. While perched dune lakes exist outside the Great Sandy Region, there are very few anywhere else in the world. Most lakes on Fraser Island south of Lake Bowarrady and Poona Lake in Cooloola are examples of perched lakes.

The perched lakes form when the normally permeable sand has the grains cemented by organic material. Initially this depression develop a crude forest litter seal. Holding "Black" water. This is followed by the organic colloids in the water being precipitated to form into humate rock. This humate rock gradually gets thicker as more and more organic very fine colloids are turned to sediment which in turn becomes a cementing agent. Thus depressions, sometimes more than 100 metres above the underlying regional water table begin to permanently hold water and become perched lakes.



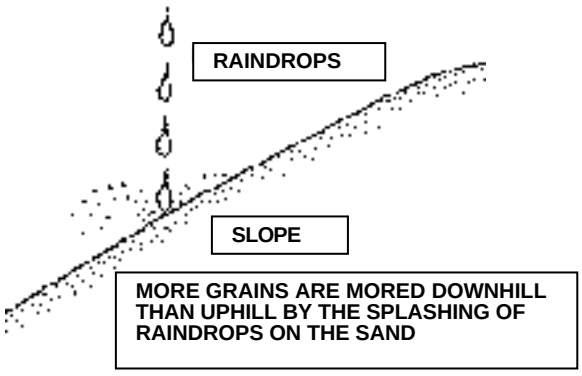
Perched Dune Lake (e.g Lake McKenzie)

Barrage lakes are formed by a sandblow forming a barrier to back up water higher than it otherwise would be. They are really a variation of a window lake where the water-table is forced higher as a result of the However, these lakes contain white water from the regional water table. Wabby Lakes are barrage lakes. Both are in an active state of change. In the case of Wabby Lakes the barrage, a sandblow, is invading the lakes. In the case of Deepwater, as the stream drains the dunes it is carrying away some of the barrage which is holding back the lake. Eventually the barrage will disappear.



Barrage Lake (e.g Wabby Lakes)

Splash Effect: Eventually all lakes in dune systems will fill in as a result of millions of raindrop splashes. Every time a raindrop impacts on the surface, it causes grains of sand to bounce (a process known as saltation). Evidence of this can be found on the legs of every table and chair left on the sand, even if the sand is covered with litter or vegetation. While most grains of sand don't bounce very high, some reach up to 50 centimetres above the surface. More grains will fall back to earth on the down hill side of the pint of impact. The effect of this is to result in closed depressions and lakes at the bottom of slopes progressively accumulate grains of sand which have bounced down the slope over eons. Thus in time lakes die.



Dune Lake Features: Some features of the dune lakes result from the internal currents which result from the wind. This is because sand is more easily relocated by wind and current than hard rocks and clay, more common mediums holding lakes. Beaches in the down-wind end of lakes are just one formation more common in dune lakes. Behind each beach is usually a lunette (a crescent shaped foredune). Waves not only help form beaches but they result in currents as the lake tries to maintain levels. These littoral current transport sand around the edge of the lake. Further from the beach centre these internal currents lose energy and velocity and thus their capacity to move sand. The sand which had been carried then settles out and establishes sand spits. Lakes McKenzie and Benaroon have well developed spits resulting from this process.