

Date: 16 July 2009
To: Terry O'Neill
From: Ian Hollingsworth
Subject: 42213719: Waterfront beach soils investigation

Context

The Darwin media (15 July 2009) drew attention to a subsurface layer of discoloured grey sandy material in the artificial beach in the Waterfront Precinct. This attention arose from public concern that the discolouration was associated with contamination and chemicals identified during the site remediation process. The Darwin Waterfront Corporation responded to the initial concern with the opinion that the situation was due to anoxic conditions - a natural result of the low energy coastal environment in the waterfront beach and lagoon. The Darwin Waterfront Corporation also instigated an independent environmental investigation by URS to:

- identify the causes of the sand discolouration, i.e. whether it was due to natural processes
- screen for potential chemicals of concern in the discoloured sand.

URS used diagnostic soil properties from Soil Taxonomy (Keys to Soil Taxonomy 7th Edition, United States Department of Agriculture Natural Resources Conservation Service, 1996) to identify whether natural soil forming processes associated with anoxic (or waterlogged) environments were responsible for the sand discolouration.

These are called "aquic conditions" in soil science and produce aquic soil properties – a result of anaerobic microbial activity in anoxic environments that reduces oxidised forms of iron and manganese and sulfate. Soils with aquic conditions experience prolonged saturation and can be characterised by observing free water in an auger hole or pit and recording soil colours that have a chroma (colour saturation) of 2 or less, i.e. dark grey. Odours are associated with reduced forms of sulfur. The grey colours indicate chemical reduction of iron in the sand. The iron minerals in an oxidised state produce the yellow to red colours that we see in the beach material.

URS sampled the discoloured sand layer from below the waterline and lagoon water to screen for a broad range of potential metal, organic and hydrocarbon contaminants.

Site Investigation

Ian Hollingsworth (Certified Practising Soil Scientist, Level 3) and Steve McAleer (Environmental Engineer) described the field morphology of the discoloured sandy material at Waterfront beach on the morning of 16 July 2009 and collected discoloured subsurface samples (10 sites around the beach) and water samples (3 samples from the lagoon).

The subsurface sand discolouration in the beach environment is associated with the shallow water table – approximately 10 (Plate 1) to 300 millimetres. The subsurface sand discolouration in the lagoon environment is associated with the depth to anoxic conditions – approximately 10 millimetres below the surface near the waterline. The field pH was 8.5 to 9.0. An odour and greasy

feel to the discoloured material is typically associated with microbial products of the mineral reduction process.

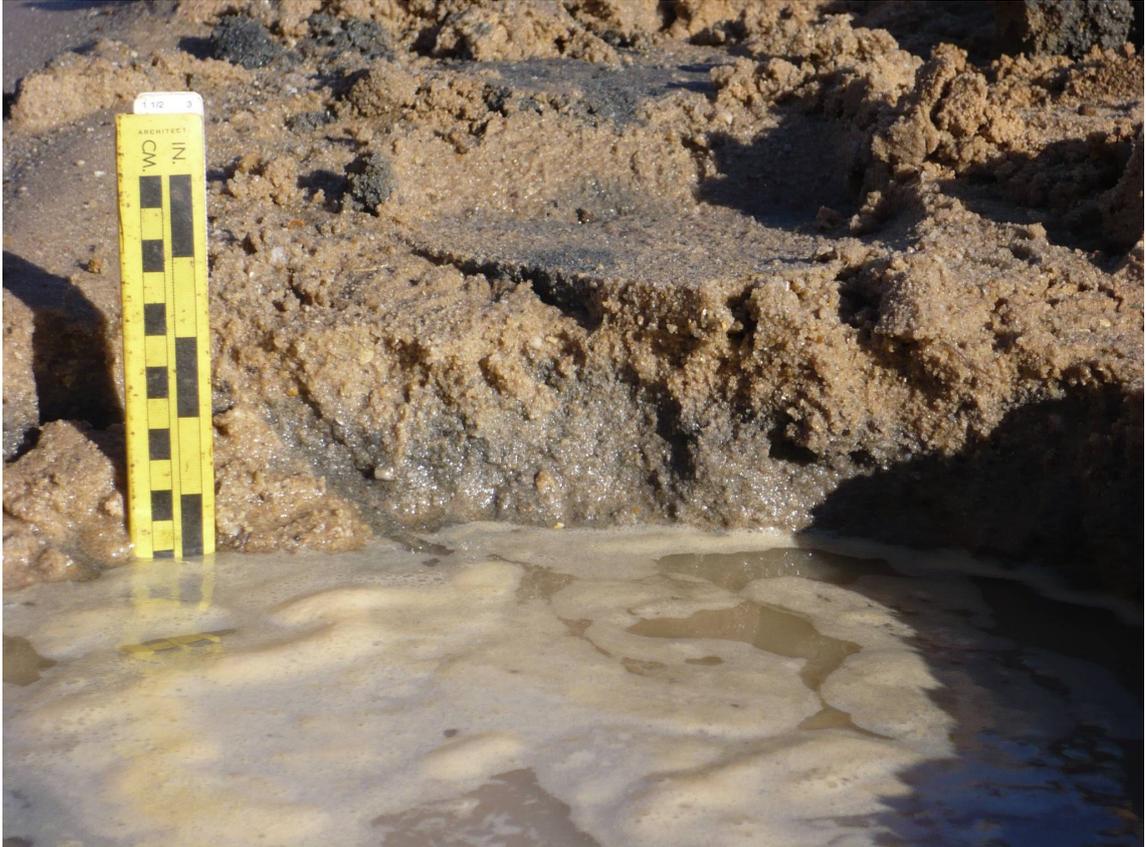


Plate 1. Sand discolouration begins approximately 10 mm below the surface, associated with a water table

Notwithstanding the above analysis extensive samples have been taken and sent to a National Association of Testing Authorities (NATA) registered laboratory to confirm our view that there are no harmful substances present.

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The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works



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