Environmental Investigations In Relation To Physical Habitat Modification For Mosquito Control In The Logan City Council Region

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Summary

The selective ditches intersect acid sulfate soils which are widespread at the site. There is no evidence that the selective ditches have any appreciable adverse impact on the environment. For example mangrove and grass continues to be prolific five years after physical habitat modification in May 1996. Based on this trend, it is not unreasonable to infer that there will be no adverse environmental outcomes in the future as a result of selective ditches, provided that the site is managed appropriately.

Background

Logan City Council has undertaken control of salt marsh mosquitoes for 20 years. Traditionally this has been by the dispersal of larvicides. In addition, Logan City Council has employed environmental solutions that do not use chemicals but rely on mechanical flushing of larvae and consumption by predatory fish, to control mosquito breeding in the saltmarsh environment. This reflects public concern about the use of chemicals that led to the development of Open Marsh Water Management (OMWM) methods that aimed to reduce mosquito populations to acceptable levels while actively maintaining marsh processes. Runnelling is a minor form of OMWM that consists of a network of very shallow "spoon shaped" parabolic channels (runnels) that facilitate enhanced water flow. Selective ditching is another type of OMWM for mosquito control, which entails the excavation of steep-sided, often narrow ditches up to 150cm in depth.

Acid sulfate soils are common along the east coast of Australia at elevations < 10 metres AHD (Saffigna and Dale, 1999; Saffigna and Cliff, 2001; Saffigna et al, 1996a,b; Willett and Walker, 1982). They contain iron sulfide (commonly known as pyrite) which is stable under anaerobic (waterlogged) conditions. However, exposure of the pyrite to air by agricultural activities, excavation, dredging or drought results in oxidation of the sulfide to form sulfuric acid. The acid and associated toxic by-products may lead to fish kills, damage to vegetation, and destruction of steel pipe and concrete infrastructure (dent and Pons, 995; Sammut et al, 1995) They represent a major environmental risk if managed inappropriately.

Potential Acid Sulfate Soils (PASS) are those soils that have potential to produce sulfuric acid when exposed to air (oxidised). PASS often exhibit a near neutral pH (pH – 7), however, when oxidized they form a sulfuric acid with a resultant lower pH. Actual Acid Sulfate Soils (AASS) are those soils that have already oxidised and have a very acidic pH (pH < 4).

Due to widespread community concern about the use of chemicals to control mosquito populations, the innovative and apparently innocuous physical habitat modification method for mosquito control has great appeal to local authorities, and is being progressively adopted. There has been a mounting tide of opinion amongst some government and public agencies, that physical habitat modification may disturb currently benign potential acid sulfate soils, and create environmental damaging actual acid sulfate soils.

Environmental Investigations Commissioned by Logan City Council

In Mid 1996, as part of the on-going physical habitat modification for vector control, Logan City Council undertook works to deepen and widen existing selective ditches to facilitate an enhanced flushing mechanism for control of mosquitoes at the Ferry Road site, Carbrook. These projects were established to assess the environmental impact of deepening and widening the selective ditches, particularly in relation to acid sulfate soils.

Conclusions

There was a high degree of compatibility between the conclusions from the three projects in relation to acid sulfate soils.

Acid Sulfate Soils Project

Actual acid sulfate soils were present to a depth of 1.5m and potential acid sulfate soils were present to depth of 8.5m. The high marsh (low elevation, northern section) was the only area where the selective ditches/runnels intersected PASS (Potential Acid Sulfate Soils). However, at one site in the low marsh (higher elevation, northern section) the selective ditch intersected AASS (Actual Acid Sulfate Soils).

There is strong corroborating evidence that the actual acid sulfate soils impacted on the pH of groundwater. Over the period April 1998 to August 2000 a pH of less than 4 was recorded nearly one quarter of the time. This outcome is not necessarily due to the prescence of selective ditches. Rather it is not unexpected where acid sulfate soils are ubiquitous throughout the landscape.

The Lake on Ferry Road site also has a low pH. Ross Quinn raised the possibility that acidity at the Ferry Road site could well be the result of input from off the site. There is evidence that the groundwater in the local area is acidic as a result of acid sulfate soils impact.

From a soils and geomorphology perspective it seems likely that many areas in the Logan City region that are lower than 10m above current sea level may have acid sulfate soils present. There was high spatial variability in the depth of acid sulfate soils at the Ferry Road site. This poses a problem for predicting the likely occurrence and depth of acid sulfate soils within the Logan City region.

Environmental Effects Project

After 2.5 years there were significant differences between the treatments (whether selective ditched "high" marsh, selective ditched "low" marsh or not ditched) for some variables. These were substrate pH, water table, groundwater salinity and pH. Of these pH is a possible cause for concern, although on average it has only infrequently been observed to levels less than pH4.

In general the selective ditched sites are wetter and more acid than the unditched ones. There are some apparent but relatively small effects on vegetation, which may be related to changes in moisture and salinity.

The dominant grass, marine couch, is generally taller in the selective ditched areas than in the unditched area. There has been general increase in the number and size of marine couch plants at all the sites, both selective ditched an unditched, over the two years of research.

Groundwater Investigations Project

There are two types of aquifers. The upper aquifer was the only one of concern. An impermeable plastic clay layer separates the two aquifers. The deepest aquifer type which exists under the property is associated with shallow sand lenses deposited within the alluvium. These aquifers are highly transmissive. The sand aquifers under the property are in contact with water in the river. However, these aquifers are generally separated from the upper clay aquifers by several metres of low permeability clay and are not expected to play a significant role in the groundwater regime.

Highly transmissive aquifers have been formed in the marine clays bordering the main selective ditches. Incoming surface water from the Logan River flows into and out of shallow aquifers on both sides of all selective ditches on the property during each tidal cycle. Based on the calculations of tidal flows, total volume of surface water exiting the property was approximately twice that which entered through points being monitored. The most likely entry point for the additional 5260kL is from the drain in the north where flow backs up against the weir.

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