



Are bio-retention basins an example of cargo cult engineering?

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Bio-retention basins are standard practice water quality improvement measures, particularly in residential land development. In part this is due to their suitability as 'end-of-pipe' solutions downstream of traditional engineered drainage systems. Detailed design guidelines have been published by many Councils, particularly those in growth areas. These design guides follow all apparent precepts of scientific and engineering, outlining engineering requirements, maintenance path specifications, along with planting regimes and species. These formalities give the appearance of serious, evidence based engineering, but there is little checking or feedback to see if these systems actually work in practice.

The question needs to be posed, as an industry are we fooling ourselves while spending millions of dollars of developers' money, adding to housing affordability issues? Have we created 'cargo-cult' engineering, where we are creating something that has the appearance of engineering 'natural' features, while not achieving the purpose? Cargo cults are a phenomenon that has occurred most famously in the islands of the South Pacific where remote people's first encounter with western civilisation occurred during World War 2. The islanders would see these new people turn up, build infrastructure such as runways and control towers, which would then result in airplanes bringing materials and wealth to the island. They'd see this behaviour and think that all they have to do is build the infrastructure and planes would land with precious cargo. So they'd make things that looked like runways, build airplanes and towers, and they'd make headphones out of coconuts. This infrastructure would not have the desired result of bringing wealth to the islanders.

Bio-retention basins have become the standard water sensitive urban design feature for land development in Australia since the 1990s. To date there has been little information published on the overall effectiveness, constructability, maintenance and operation of the basins that is based on practical experience. Assessment of success and failure, and incorporation of lessons learnt into the design process is rarely undertaken by practitioners and designers. This approach should be seen as fundamental to the development of any new engineering discipline, such as stormwater treatment.

The design of bio-retention features is rarely assessed in terms of hydraulic operation during the range of rainfall events, or in terms of ongoing maintenance. This has often resulted in structures that do not operate as intended, create maintenance issues and are visually out of character with the 'natural' landscaped features.

Studies of the operational effectiveness of constructed detention basins are rare, with a severe paucity of available data collected in the field. This lack of documented evidence of the effectiveness of these key pieces of water quality infrastructure should be concerning when taking into consideration of the cost of construction and maintenance.

The objective of this investigation is to highlight the lack of scientific rigour and basis behind the engineering that goes into the design of bio-retention basins.

This investigation involves the systematic review of bio-retention basin design process, primarily those of the industry leading NSW local government authority Blacktown City Council. This review of the design guidelines along with an assessment of development approval and construction certificate conditions of consent identifies fundamental issues relating to the design and assessment process. Design guidelines are often too detailed on aspects such as maintenance access paths, while completely ignoring basin hydraulics and plant health. Conditions of consent are often too prescriptive, not outcome focused and require construction of infrastructure that will not provide stability during long-term wetting and drying periods. The health and viability of plants is not included in design guidelines or assessed as part of the approval process.

The results of this investigation highlight the need to undertake a review of the effectiveness of water quality measures in real world situations. Monitoring of the performance of these basins should be seen as a priority, with the likely cost of testing programmes anticipated to be orders of magnitude lower than potential cost savings in design and maintenance.