

16 February 2012



Director General
Department of Planning
23-33 Bridge Street
SYDNEY NSW 2000

Attention: Matthew Daniel

Dear Sir

**MODIFICATION TO DA 4
SECTION 75W MODIFICATION LEWIS LAGOON
PENRITH LAKES SCHEME**

I refer to Mr Richard Pearson's letter dated 16 December 2011 with regards to the Section 75W Application lodged by Penrith Lakes Development Corporation (PLDC) as requested by the Department of Planning and Infrastructure and the Penrith Lakes Working Group, in relation to the use of an existing water body, known as "Lewis Lagoon" as a Water Quality Control Pond.

As requested, please find attached Browns Consulting expert advice with regards to the water quality control functions of the pond and a cheque for \$5000 to cover the Assessment Fee.

If you have further enquiries, please contact Mr Joe Bevacqua on 4729 0044.

Yours Sincerely

Mick O'Brien
Project Director

Penrith Lakes Development Corporation Ltd

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Our Ref: X05054



Manager Planning and Infrastructure
Penrith Lakes Development Corporation
89 – 151 Old Castlereagh Road, Castlereagh
NSW 2749

6 February 2012

Attention: Joe Bevacqua

Dear Mr Bevacqua

**Penrith Lakes North Scheme Drainage
Lewis Lagoon**

The Penrith Lakes Scheme North Scheme Drainage Concept Design 2005 identified the use of Lewis Lagoon to provide additional pre-treatment for the North Scheme Drainage. The North Scheme Drainage concept and redesign of Lewis Lagoon was undertaken as part of the Castlereagh Road realignment project as Lewis Lagoon had to be moved away from the proposed road alignment. The Lewis Lagoon currently performs as a water quality control pond and treats the water from the upstream catchment prior to discharging into the Wildlife Lake, this letter provides clarification of the purpose of the Lagoon as part of the Penrith Lakes Scheme.

This addendum to the report provides a response to the Department of Planning & Infrastructure request for assessment of Lewis Lagoon as a functioning water quality treatment pond (dated 16/12/2011).

The scheme directs flows from North of Vincent Creek, Anderson Creek catchment and the North Catchment South of Smith Road to a water body identified as Lewis Lagoon, refer to Figure 1. Landuse throughout the catchment is generally rural and rural residential with sections of the Castlereagh Road Relocation also draining to the lagoon.

The flows pass through a number of minor ponds and vegetated buffer strips prior to entering Lewis Lagoon. And as a result the flows off the catchment experience a high level pre-treatment; resulting in reduced velocities, which allow sediments and other attached pollutant to settle and infiltrate the soils. Further treatment is also provided via filtration through the dense vegetation. Additional nutrient uptake associated with the dense vegetation would occur.

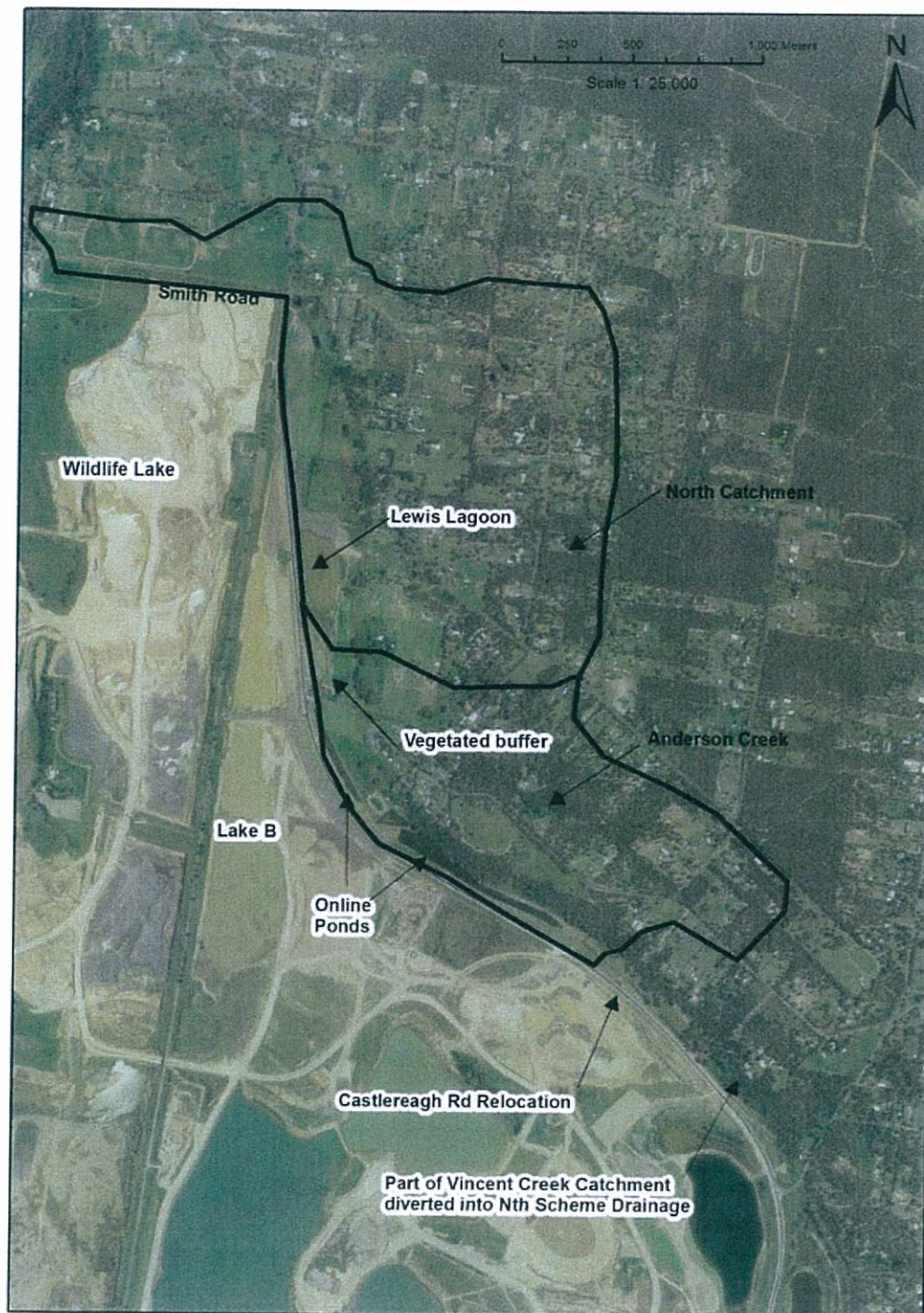


Figure 1: Aerial photo



Figure 2: Vegetated buffers upstream of Lewis Lagoon

The flow from the ponds and buffer strips enters Lewis Lagoon, flows from the East enter via a swale and flows along Anthony Creek and adjacent to Castlereagh Road are deflected into the pond via a constructed swale, high flows bypass are directed under Castlereagh Road into the Wildlife Lake. The pond achieves its pollutant removal primary through sedimentation; the low velocities allow for the settlement of sediment and attached pollutants. Evidence of macrophyte growth appears to be present in the pond, and further vegetation along the batters provides nutrient uptake.



Figure 3: Vegetated batters surround Lewis Lagoon

The treatable flows are detained in the Lewis Lagoon, until the water level builds above the outlet and discharge into the Wildlife Lake.

Based on sedimentation principles involving hydraulic efficiency, this pond is expected to remove 100% of sediment as fine as medium silt (32 μm).

The hydraulic residence time is estimated at 33 days (13 days is typically the minimum desirable time for good treatment), which accounts for the adequate removal of suspended solids. The estimated hydraulic loading rate of the pond is 25 $\text{m}^3/\text{m}^2/\text{y}$, which is recommended by the NSW EPA (1997) to achieve TN removal.

The MUSIC model was developed as part of the work undertaken in 2005. Lewis Lagoon was modelled as a pond and included the buffer strips. The modelling showed removal of total suspended solids, total phosphorus and total nitrogen. Following removal efficiencies were taken from the modelling results;

	Sources	Outflow from Pond	Removal Efficiency (%)
All of the North Drainage Scheme Treatment Train			
Total Suspended Solids (kg/yr)	97,400	14,400	85.2
Total Phosphorus (kg/yr)	216	84.5	60.9
Total Nitrogen (kg/yr)	1,630	913	44.1

Source: Penrith lakes Scheme North Scheme Drainage Concept Design (Brown 2005)

The results show effective removal of suspended solids and nutrients. The results are considered conservative as they only allow for sedimentation and do not include the removal associated with nutrient uptake or any ultra violet disinfection that may occur within the pond.

The stormwater discharge from the proposed 2.4 ha pond meets ANZECC guidelines for recreation water quality (only TSS is relevant). Faecal Coliforms is another criteria, although this cannot be modelled in MUSIC (although bacteria often attaches onto particulates so removal of TSS also has some positive removal of bacteria). Furthermore, ANZECC criteria are only applicable to the receiving water body, in this case the water quality in the Wildlife Lake.

No physical stressor trigger values are provided for wetlands, which would be more appropriate for Lewis lagoon. Wetlands would be expected to exhibit higher stressor values, such as Lewis Lagoon.

During the concept design an analysis was undertaken to size the lagoon to optimise the treatment performance while ensuring flow into the Wildlife Lake. The 2.4 ha pond, provides a improvements to the water quality and ensures low flows reach the Wildlife Lake.

The permanent pool within the Lewis Lagoon also minimises the opportunity for re-suspension of sediments and any attached pollutants.

SUMMARY

Overall, the Lewis Lagoon meets 'best practice' sizing methods such as hydraulic residence and hydraulic loading rate assessments such as that recommended by the EPA. The estimated water quality performance in MUSIC achieves ANZECC guidelines for recreational water quality with regard to suspended solids (measure of turbidity).

The Lewis Lagoon was designed and currently operates as a water quality control pond.

Yours sincerely

Brown Consulting (NSW) Pty Ltd

A handwritten signature in blue ink, appearing to read 'Troy Eyles', is written over the company name.

Troy Eyles
Senior Engineer