

2. Description of Proposal

This section discusses features of the proposal in sufficient detail to allow an assessment of its environmental impact. Description of the proposal is presented together with an outline of how construction will proceed and how the facility will operate.

2.1 Location and Planning Issues

2.1.1 Location

The site for the proposed ornamental lake and ceremonial entrance is along the southern boundary of the University's Casuarina Campus, which is situated in the northern suburbs of Darwin, approximately 12km from the city centre (see **Figure 2.1**). Ceremonial Drive will link Lakeside Drive with the University's Southern Ring Road to the north.

2.1.2 Land Tenure

New land tenure arrangements are part of the proposed development to place responsibility and ownership of the lake with the University. The total area of land required for the development is approximately 4.7ha.

The existing lot numbers, ownership and area of land required for the development are as follows:

- ❑ Lot 9260 Town of Nightcliff - Northern Territory University land (area required is approximately 4700m²)
- ❑ Lot 8702 Town of Nightcliff - Vacant Crown Land, drainage reserve for Department of Transport and Works (area required is all of lot 8702 which is 9230m²)
- ❑ Part Lot 8640 Town of Nightcliff- Darwin City Council land, Alawa Ovals, with existing longterm lease to the University for recreational purposes (area required is 11,500m² of which 2935m², the area encompassing the lake, is required to be consolidated with the University's land)
- ❑ Part Lot 9375 Town of Nightcliff - Vacant Crown Land, Casuarina Coastal Reserve, No 1677 (Area required is 21,100m²)

The proposed development will require consolidation of lot 8702, part lot 9375 and that part of lot 8640 which is required for the lake with lot 9260 - University land. The remainder of part lot 8640 required for "Ceremonial Drive" will remain in the ownership of Darwin City Council as part of the existing long term lease to the University of Lot 8640 (See **Figure 2.2**).

The future land tenure over the required land has been discussed with the relevant landowners and support in principle sought and received, including Darwin City Council who have given the project "in principle support" subject to the demonstration of satisfactory drainage requirements.

Land tenure requirements are being addressed by the Department of Lands, Planning and Environment (DLPE) Land Administration for the Vacant Crown Land on lot 8702 (Drainage Reserve) and part lot 9375 (Casuarina Coastal Reserve No. 1677). A drainage easement will be created in lieu of the reserve and be lodged on the title of lot 9260. Partial revocation of the Coastal Reserve, part lot 9375, is required for the project as is assessment and acquisition, if required, of any native title interests. There is a current native title claim over all of lot 9375.

2.1.3 Planning Issues

Rezoning and subdivision/consolidation will be required for land consolidated with NTU land. In addition, the NT Consent Authority will assess a development application for the lake and associated works.

Rezoning would be required from O1 (Open Space) to CP (Community Purposes) for any land incorporated into lot 9260, NTU land, to avoid having multiple zones over lot 9260. Both zones are for the benefit of the community and allow passive recreation.

Council will of course have the opportunity to formally assess in detail any planning scheme amendment, subdivision/consolidation or development application for the project.

2.2 Design Layout and Standards

The proposed lake and ceremonial entrance design layout is illustrated in **Figure 2.3**. The project has been designed incorporating the existing stormwater drainage channel that separates the Alawa Ovals from the Casuarina Campus of the NTU. This channel which currently drains the surrounding northern suburbs including the Casuarina Square Shopping Complex, is required to continue functioning as a stormwater drainage outlet. The project has been designed to improve the aesthetics of the stormwater channel area while maintaining its full functionality. Furthermore, the quality of stormwater that enters the Rapid Creek will be improved through reduction of debris by construction of gross pollutant traps at outlets from the stormwater drainage lines.

2.2.1 Lake

A partially concrete lined drain currently exists in the location of the proposed lake, and occupies the drainage line of a former branch of Rapid Creek. A stormwater network that services Casuarina, Nakara, Wanguri, Wagaman and a part of Woodleigh Gardens feeds the drain. The drain (often referred to as the NTU Drain) runs approximately east-west and outlets into Rapid Creek. The total catchment area contributing to flows in the drain is approximately 275ha. Flow from the stormwater system is approximately 50m³/s in a Q₂ storm event (i.e. 50% probability of occurrence).

The proposal is to set the normal water level of the lake at an RL of 2.6 AHD (approximately 6.6m CD). The level of the lake will be controlled by a weir that outlets to the lower reaches of the drain and into Rapid Creek. The invert of the lake will be approximately RL 1.4. The average depth will be 1.2m and the lake will be approximately 350m long and have an average width of around 47m.

The height of the weir has been determined as a compromise between the requirements for visual amenity and engineering and environmental constraints. A level of RL 3.0 would produce a more attractive visual setting as the level of the lake would be higher and more visible to observers. With an RL of 3.0m the depth of the lake would average 1.6m and light attenuation might impede the growth of macrophytes. However, by lowering the height of the weir to 2.6m, the frequency of tidal flushing is significantly increased, and most importantly, the length of periods when neap tides will not cross the weir is also significantly reduced (see **Section 4.2.1**). Both of these factors will improve water quality within the lake. The growth of aquatic vegetation is not a significant factor in shallow marine waters locally and the increased frequency of tidal flushing will maintain salinities at a high level during the dry season – the time of year when macrophyte growth is typically highest as turbidities are low. The salinity of the lake will be brackish during the dry season, and it is expected that a combination of tidal flushing and evaporation will maintain salinities at a level that prohibit the growth of aquatic macrophytes.

Dry seasons flows from the catchment area are likely to result from car washing, air conditioning plant condensate and lawn watering activities. Interception of low flows at pollutant traps, is proposed. Trash racks are proposed to remove debris at stormwater outlets to the lake.

The tidal range in Darwin is approximately from RL 4.0 (HAT) to RL-4.0 (LAT) AHD. Gently sloping shorelines and a high tidal range create a large area of intertidal zone, and the diurnal and monthly variations in tidal heights, lead to the development of a range of intertidal habitats based upon frequency of inundation and soil types. In the upper intertidal zone, local variations in microtopography create ephemeral shallow pools that are sometimes flooded by tidal water, or by freshwater during the wet season, or by both. Many of these ephemeral pools are ideal for mosquito breeding and can be utilised by a range of mosquito species. Accordingly, it is proposed to provide concrete hard edging to the sides of the lake above RL 2.4 AHD. The hard edges will also include any open unlined stormwater drain into the lake, as far upstream in those drains to the point where a stable lake level will occur.

Hard edging along the bank on the northern side will consist of the existing concrete lining. The western end of the north bank will have a series of concrete steps that will function as a seating and walkway area, as well as providing a surface that will impede the breeding of mosquitos. In addition, the design of the lake will not allow the formation of isolated pools and so mosquito-breeding areas will be prevented.

2.2.1.1 Pollution Control Mechanisms

Management practices for control of water quality within the lake will be put in place in order to reduce the load or concentration of pollutants. At present a number of smaller drains empty into the drain in the region where the lake will be formed. The quality of water currently entering the drain from these sources is unknown but is expected to be variable. During the wet season, these small sources would be discharging water draining from garden beds, areas of lawn, and the roadway and carparks. Apart from the potential from small spills of oil or other pollutants from motor vehicles, the potential contaminants may be pesticides, herbicides and fertilisers and sources of nutrients such as lawn clippings and leaf litter. Total loadings of potential contaminants are expected to be low, and the majority of contaminant loading will be discharged into the lake during the first months of the wet season. At

these times, the large volumes of water discharging will quickly flush through the lake and into Rapid Creek. During the dry season, water discharges from these sources would be minimal with the majority derived from runoff after watering of garden beds and lawns.

Review of current watering practices at the location would be undertaken with a view to minimising the input of contaminants and nutrients into the lake. Design of associated landscaping of the areas adjacent to the lake provides opportunities to implement management strategies that will reduce current inputs of contaminants and nutrients to the lake.

It is anticipated that a combination of tidal flushing and freshwater flows will be sufficient to flush nutrients, contaminants and bacteria from the lake over the weir and into the creek.

Gross pollution traps will be installed to remove litter from stormwater.

2.2.2 The Weir

A 40m reinforced concrete weir is proposed at the western end of the new lake. Water will overflow from the weir into Rapid Creek via the existing open drain. The weir level will be set at RL 2.6m. This RL will enable tidal back flush an average of 15 times per month.

The downstream side of the weir will require protection to control erosion from the overflow spillway. Protection will be designed for a 1 in 100-year storm event coinciding with a low tide and would comprise dumped rock protection.

2.2.3 Entry Road

2.2.3.1 Ceremonial Drive

A 400m long drive linking Lakeside Drive to the south and the Southern Ring Road to the north, is proposed. The drive will be two-way with an eight metre carriageway. The drive will be kerbed to restrict vehicular access onto landscaped areas. Vehicle access points will be provided to a purpose built car-parking area in the vicinity of the community centre (see **Figure 2.2**).

2.2.3.2 Roundabout

A roundabout on the intersection of Lakeside Drive and Ceremonial Drive is proposed. This will not be an additional entrance, as the existing entrance to NTU from Lakeside Drive will be closed. The roundabout will be offset to the north to reduce the impact on property access to Lots 2026 and 2027 facing Lakeside Drive.

The roundabout will enhance existing traffic calming mechanisms. Traffic travelling at excessive speed has been an ongoing issue on Lakeside Drive and the roundabout will assist with traffic calming and safety by reducing vehicle speeds.

Based on the design speed for Lakeside Drive, the distance from the roundabout to the Gove Street intersection of 70m is considered adequate. The roundabout has been constructed based on anticipated traffic volume and although located on a bend, there will be sufficient distance from both directions to sight the roundabout when travelling at the design speed for Lakeside Drive.

2.2.4 Carparks

2.2.4.1 Carpark (North West)

The NTU Master Plan nominates a future 158 space carpark to the north west of the proposed lake and bridge. The carpark will have a single point of entry/exit onto the Southern Ring Road. The carpark has been designed to include all kerbing and drainage as well as a 14mm aggregate spray seal.

2.2.4.2 Carpark (South West)

An informal carparking area exists to the south west of the site. However, patrons using the Alawa Community Hall building (which has a floor area of around 400m²) between the hockey field and the football oval, currently park in the shade of the trees. No fixed carparking facilities exist in this area.

In accordance with Division 6 of the Darwin Town Plan, parking for 20 cars will be provided. The location of this proposed car park is shown in **Figure 2.2**. Note this carpark is Council and not NTU property.

While the layout of the carpark is yet to be finalised, it has been assumed that it will be spray sealed and kerbed, with stormwater drainage provisions.

2.2.5 Bicycle Track

The Master Plan layout shows the cycleway on the western side of Ceremonial Drive. Given that the lake will probably attract pedestrian traffic viewing the lake from the bridge vantage point, consideration will be given to placing the cycleway on the eastern side of the bridge. The changeover from west to east should occur around 70m south of the bridge.

2.2.6 Bridge and Associated Works

Four proposals were assessed for the new vehicle bridge over the lake, namely box culverts and a culvert arch bridge with five, four and three arches. The three arch option has been selected for design.

The culvert arch bridge will incorporate roadworks, railings and a pedestrian walkway. Flow during a Q₁₀₀ storm event have been assessed at 160m³/s and the bridge must have a flow area of around 80m².

The prefabricated arch bridge will be constructed of either prefabricated spandrels or facades to provide an aesthetically pleasing end wall treatment.

2.2.7 Landscape Design

Landscaping for the lake and ceremonial entrance to the University has been detailed in the *Northern Territory University Landscape Master Plan, 1992*.

The Landscape Master Plan aims to integrate development across the Casuarina Campus that reflects the quality of its natural setting, whilst noting that the campus is not a greenfield site with even the adjacent mangroves comprising areas of regrowth on mudflats that were cleared earlier (Guinea 1988). In addition, the Plan aims to reflect vegetation diversity and the extremes of the dry tropics and demonstrate a

commitment to the quality of the outdoor environment in keeping with investment in campus buildings and infrastructure (Cloustons 1992, p21).

Ceremonial Drive is planned to be developed with a tree enclosed corridor which opens out with views across the lake. The Tamarind Tree is proposed for all the road corridors. The Landscape Master Plan proposes a range of vegetation, native and exotic, taking into account poor soils and maintenance issues as well as creating a campus environment that clearly articulates the pre-eminent educational role the University plays in the community.

Specifically the landscaping planting results in the removal of introduced coffee bush, while minimising the impact on the existing mangrove population.

2.2.8 Services

2.2.8.1 Lighting

Street lighting and associated works is required in addition to decorative lighting, including special lighting under bridge handrails.

Two public lighting concepts have been considered. This segregation was required to comply with the asset owners: NTU and Darwin City Council. The roundabout intersection public lighting concept has been designed to comply with Category V, V3.

The public lighting schemes illuminating Ceremonial Drive have been designed to comply with Category V, V4.

Category V4 – Sub Arterial principal roads which connect arterial or main roads to areas of development within a region, or which carry traffic directly from one part of a region to another part. Category V4 – Used when there is a mixture of pedestrian and vehicular traffic, there is only a moderate volume of traffic (see **Appendix B**), vehicles are at low speeds and there is only low traffic generated from abutting properties.

2.2.8.2 Sewerage

The NTU Casuarina Campus is serviced by a series of 150NB and 225NB internal trunk sewers. These drain into public trunk sewers from the Nakara and Brinkin areas. These public trunk sewers are located, in part, on NT grounds. A majority of the NTU flow enters the Nakara system which, in turn, feeds the Brinkin system. The system gravitates from north to south.

The existing sewer trunks have a junction just north of the existing drainage reserve. From that point, a 450NB gravity pipe feeds across the reserve, to the east of the oval and connects with the existing 600NB sewer along Lakeside Drive.

The existing sewer crosses the drain marginally above the Lake's proposed water level. Three options were considered and the proposed option is to leave the existing sewer crossing in place.. This option requires that the lake be narrowed at the crossing point in order to retain the present ability of the sewer line to self support.

2.3 Construction Phase

2.3.1 Construction Phase - Program

Construction of Ceremonial Drive and the lake will be undertaken during the dry season to allow the completion of earthworks under dry conditions. A temporary coffer dam will be constructed to prevent tidal ingress to the lake work site. The dam would be removed prior to the start of the wet season.

The staging of the various construction elements which would be arranged to match available funding, would involve:

- ❑ Construction of Ceremonial Drive, the intersection and culvert bridge over the lake;
- ❑ Construction of the temporary coffer dam with material won from borrow pits within the lake area;
- ❑ Construction of temporary sediment collection basin and low flow culvert passing through the coffer dam;
- ❑ Progressive excavation of the lake;
- ❑ Construction of the concrete weir and low flow culvert;
- ❑ Alteration of the trunk sewer and construction of the pedestrian bridge;
- ❑ Adjustments to other services;
- ❑ Construction of perimeter walls;
- ❑ Construction of the gross pollution traps; and
- ❑ Removal of the temporary coffer dam.

Standard construction equipment consisting of bulldozers, excavators, trucks, rollers and cranes would be utilised during project construction.

The duration of works involved for the construction of the lake is likely to be in the order of 20 weeks.

2.3.2 Construction Phase - Works

Construction works will be undertaken in standard industry specifications to ensure that the works and extent of activities meet appropriate environmental standards. The contractor will be required to prepare and implement an environmental management plan that will include an erosion and sedimentation control plan to ensure conformance with environmental commitments.

Site clearing which will be staged to suit the work schedule, will encompass land for road, lake and perimeter walling, the temporary coffer dam and reasonable adjoining strips to allow for construction activities. The construction of the temporary coffer dam will involve the clearing of an area approximately 30m wide downstream of the permanent weir. This area would be rehabilitated after removal of the coffer dam, and a strip of the creek bed immediately below the permanent weir would be protected by rocks to prevent scour.

Topsoil removed from areas affected by construction will be stripped and stockpiled for later use.

Ceremonial Drive would be constructed in accordance with the accepted practices required by Department of Transport and Works and local authorities in regard to engineering, environmental and traffic control.

2.4 Operational Phase

2.4.1 Maintenance requirements and operations

Ownership of the whole lake area has been incorporated into the NTU site to reduce complexity with regards to maintenance requirements and operations. However, the ownership of the stormwater drain will remain with the Darwin City Council and NTU will be required to set up a maintenance contract with the Council with regards to clearing of gross pollution traps and any other stormwater drain issues.

NTU will be responsible for maintenance of the lake, weir and bridge. This will be part of their ongoing facilities management program and will include:

Road Maintenance

Road and verge maintenance would be included in the current maintenance programmes undertaken by the NTU and DCC.

Maintenance and operation of the lake

Periodic inspection and removal of rubbish collected in the gross pollution traps would generally be concentrated in the wet season due to large stormwater run off flows and floating debris during this period. Floating debris could also be introduced from time to time by the tidal flushing of the lake, and may require containment through the use of a floating barrier.

Silt from overland run-off could tend to accumulate in the lake due to the slowing of the stream flow. The deposition of silt should be checked periodically, initially on an annual basis. This may require draining the lake at neap tides via the low flow culvert prior to the wet season.

2.4.2 Predicted Recreational Uses

The commemorative lake is designed for passive recreational uses as well as ornamental and aesthetic purposes. As such, predicted recreational uses include walking and cycling around the lake, thus linking into the future walking trail development as identified in the Rapid Creek Management Plan (Darwin City Council and Greening Australia, 1994).

Swimming, fishing and boating will not be permitted in the lake. Appropriate signage will be erected advising the general public of these regulations.