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1. Executive Summary

1.1 The Proposal

The Northern Territory University (NTU) as part of its 10th year anniversary celebrations desires to construct an ornamental lake and ceremonial entrance to the university. 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. Ceremonial Drive will link Lakeside Drive with the University's Southern Ring Road to the north.

1.2 Name and Address of Proponent

The proponent for this project is:

The Department of Transport and Works – Construction Agency
Highway House
P O Box 61
Palmerston NT 0831

Contact: Dick Norris
Phone: 8999 3474
Facsimile: 8999 4601

1.3 Proposal Background and Justification

The lake and ceremonial entrance were one of the key concepts of the original Master Plan for the university outlined in the first master planning exercise carried out for the university. The first Landscaping Master Plan in 1992 outlined the landscaping plans for the lake and ceremonial entrance (See **Figure 1.1** Illustrated Landscape Master Plan). The lake was identified as an integral part of the ceremonial entrance to the University providing an attractive water feature on the site of an existing stormwater drain.

One of the site opportunities identified in the Landscape Master Plan was that:

"…*Water may be retained prior to entering Rapid Creek to reduce environmental risk and create aesthetic features. Tidal change may be utilised to create a feature of dynamic effect*…" (Cloustons 1992, p20)

In 1994 all previous master planning documents were brought together and revised. The revised Master Plan confirmed the importance of the lake and drive as a key concept of the Master Plan Stage 1. Selected excerpts of the Master Plan have been reproduced and are included in **Appendix F**. Significant sponsorship has been raised through the Northern Territory University Foundation that is now enabling the project to move from the Master Plan into reality.

The lake and ceremonial entrance proposal will provide the university and the community with a landscaped and attractive grand entry to the university. Currently the subject land is a stormwater drainage area servicing the university and nearby suburbs. The stormwater drain and surrounding area is unsightly and inaccessible due to coffee bush infestation and rubbish dumping. The project will improve the amenity

of the area by providing a landscaped surround to the lake, landscaping along the ceremonial entrance with a vehicle bridge across the lake and bicycle and foot paths.

In addition to creating an aesthetically pleasing passive recreation area, the proposal will provide a cleaner environment in adjacent coastal areas as gross pollutant traps will be constructed at the stormwater outlet to the lake to remove litter from the stormwater.

The ceremonial entrance will necessitate a new access point onto Lakeside Drive. This will not be an additional entrance, as the existing entrance to NTU from Lakeside Drive will be closed. To enhance existing traffic calming mechanisms, the construction of a roundabout is proposed at the new entrance. Traffic travelling at excessive speed has been an ongoing issue on Lakeside Drive and the roundabout will assist with traffic calming and safety through reduced speed. Assessment of the proposal's impact on traffic in the area indicates that the new entrance, and closure of the existing entrance, will reduce the amount of traffic along Lakeside Drive past the proposed new entrance to Dripstone Road. While along the section of Lakeside Drive – from Trower Road to the new entrance – no increase in traffic is likely.

A ceremonial grand entrance to the university will provide an access point to the University that opens up an area for passive recreation that is currently inaccessible. It will also provide a link between the university and the Alawa Recreational Reserve currently leased by the Council to the University.

1.4 Description of Project

The project entails the development of a formal entrance to the university featuring a lake and "Ceremonial Drive" which will incorporate a bridge across the lake. The proposal encompasses:

- A lake, weir and associated works;
- An entry road ("Ceremonial Drive");
- A roundabout, car parking and bicycle paths;
- A bridge across the lake;
- Landscape works;
- Lighting; and
- Associated services relocation.

The lake is proposed to be approximately 350m long and have an average width of 47m and an average depth of 1.6m. Pollution mechanisms and other environmental controls will be incorporated into the design to minimise the impact of pollution ingress to the lake and on the lake environment including reducing breeding areas for mosquitos.

The entrance road, "Ceremonial Drive", is proposed to be approximately 400m in length linking Lakeside Drive and the University's Southern Ring Road via a vehicle bridge across the lake. Ceremonial Drive will be landscaped and take the form of a two-way 8m carriageway and adjacent bicycle path.

A roundabout at the intersection of Lakeside Drive and Ceremonial Drive is also proposed. The roundabout will be offset to the north and landscaped to reduce traffic noise and visual impact for lots facing Lakeside Drive.

1.5 Potential Environmental Impacts

The potential environmental impacts and proposed management associated with each stage of the project are summarised in **Table 1.1**.

The proposed construction phase of the proposal will extend for approximately 20 weeks and will result in a number of short term effects such as the generation of noise and dust caused by earthworks.

The operation phase of the proposal has the potential to produce long term benefits through the improvement of the quality of water entering Rapid Creek and the removal of the exotic species coffee bush.

1.6 Summary of Management Commitments

There are very few potential environmental impacts associated with the project, and where possible such impacts have been managed at the design stage of the project. However, the proponent has proposed several management commitments to ensure the development of an environmentally sound project. A summary of the management commitments is presented in **Table 1.2**.

1.7 Structure and Scope of PER

This Public Environmental Report (PER) has been prepared to satisfy the requirements of the Northern Territory *Environmental Assessment Act*. The report provides concise and comprehensive information concerning the design, construction and operation, and the potential environmental impacts of a proposed ornamental lake and ceremonial entrance at the NTU. This information will enable environmental issues associated with the proposed entrance to be considered and will ensure that unnecessary and unacceptable harm to the environment is avoided.

This document has been prepared in accordance with the guidelines issued by the Minister for Lands, Planning and Environment (DLPE) in March 2001. The guidelines are presented in **Appendix A.**

The PER includes the following main sections:

SECTION 1: Executive Summary
This section outlines the background and justification of the proposal.

SECTION 2: Project Description
This section describes the locality of the proposed development and the specific elements of the project, including the design, construction and operation of the lake and associated infrastructure.

SECTION 3: Existing Environment
This section describes the existing environment occurring at, and in the immediate vicinity of, the site.

SECTION 4: Environmental Impacts
This section predicts the potential environmental impacts arising from the construction and operation of the ornamental lake and associated infrastructure.

Table 1.1: Summary of Potential Impacts Associated with the NTU Commemorative Lake Proposal

Construction Phase

Issue	Potential Impact	Environmental Management and Safeguards	Monitoring
Dust	Dust emissions from earthworks and vehicle movements reducing air quality.	If dust emission is a problem then dust suppression practices will be implemented.	Visually monitored by construction contractor. Ambient monitoring will be undertaken in response to complaints.
Noise	Construction activities may generate noise.	Construction will be carried out in accordance with Section 6 of Australian Standard 2436-1981. Construction Activities will be restricted to week days and daylight hours	Ambient noise monitoring will be implemented in response to noise complaints.
Surface Runoff and Erosion	Siltation of downstream drain and Rapid Creek from surface runoff and erosion.	Construction will occur during dry season. A temporary coffer dam will be constructed to prevent tidal ingress during construction. Stormwater flow will be divert around the construction site.	Regular inspection of downstream drain.
Acid Sulphate Soils	Leachate from acid sulphate soils impacting on the surrounding environment and causing corrosion and weakening of concrete foundations and sub-surface structures.	Investigate the acid forming potential of on-site soil to be disturbed . If potential acid forming soils are identified then an acid sulphate soil management plan will be implemented.	The acid potential of soil from lake site will be monitored prior to construction.
Vegetation clearance	Loss of significant vegetation through clearance and disturbance Loss of fauna habitat	No vegetation of conservation significance occurs on land to be cleared within the boundary of the proposed lake. A small area of remnant vegetation occurs within the proposed carpark area and will be cleared for construction. Area to be cleared mainly consists of coffee bush or poorly managed and disturbed native vegetation. Cleared Coffee bush will be burned to kill seeds and prevent potential re-growth. Clearance of vegetation will be limited to the extent necessary for construction works. Trees and plants to be retained will be clearly identified and protected during construction. Construction will be managed so as to avoid impacts to mangrove communities.	

Issue	Potential Impact	Environmental Management and Safeguards	Monitoring
Introduced Weeds and Pests	The importation of weed species or seed material by vehicles.	A washdown procedure for off-road vehicles to be instigated if required.	The site will be regularly visually inspected for the spread or establishment of seed species during construction.
Mammals	Construction activities may impact upon bats that potentially inhabit stormwater drains flowing into the NTU open drain.	Further research work on the bat colonies that might roost in the NTU stormwater drain will be conducted prior to construction. Construction works adjacent to the stormwater drain that may disturb the bat colonies will be conducted later in the day.	Occurrence of bats at outlet of main drain pipes will be visually monitored by construction contractor.
Biting Insects	Increase in mosquitos and other biting insect numbers due to pondage of water and potential for creation of breeding sites causing potential public health problem through the transmission of diseases and public nuisance.	Construction to follow Whelan (1988) guidelines Dry season construction. A temporary coffer dam will be constructed to prevent tidal ingress during construction. Stormwater flow will be diverted around construction activities. Creation of significant habitat areas for mosquito larvae will be avoided.	Regular site inspection for potential breeding areas.
Social and Recreational	Increased traffic and disruption to local land users.	Local residents and NTU employees will be kept informed of any disruptions to access, traffic deviations, or changes to parking arrangements during construction. During construction, public access to NTU will continue to be via the existing entrance. Increase in traffic along Lakeside Drive due to construction activities will be minimal and not sufficient to a cause a local nuisance.	
Sites of Significance	Effects on any heritage or archaeological sites of significance	No historic, archaeological or sacred sites have been identified on the land proposed for redevelopment. No declared Places or Objects under the *Heritage Conservation Act 1991* exist on the site or have been nominated.	

Table 1.1: Summary of Potential Impacts Associated with the NTU Commemorative Lake Proposal (continued)

Operational Phase

Issue	Potential Impact	Environmental Management and Safeguards	Monitoring
Rapid Creek	Changing hydrological conditions affecting Rapid Creek	The lake will have minimal effect on the hydrological conditions of Rapid Creek. The weir will be designed so that present tidal flows within the unlined channel that connects the lake to Rapid Creek will be unrestricted. Similarly, the weir and lake will be designed to accommodate peak wet season stormwater flows.	
	Changes in downstream water quality	It is anticipated that downstream water quality flowing into Rapid Creek will improve as a result of the proposed lake. Gross pollutant traps will prevent floating litter entering the open drain and exiting into Rapid Creek.	
Stormwater Drainage System	Impact on stormwater drainage from surrounding suburbs	The lake will not adversely effect the operation of the existing stormwater drain. The lake and weir will be designed so that peak stormwater flows are not impeded.	
Aquatic Fauna	Restriction on the migration of aquatic fauna from Rapid Creek to where outflow from main stormwater drain enters NTU drain, due to placement of a damming structure across drain Fauna may be trapped inside lake at low tides. Crocodiles may be attracted to the lake.	The existing section of drain that is to be replaced by the lake, offers minimal habitat to aquatic organisms. The proposed lake development will result in an increase in the area and depth of water available. Movement into and out of the lake will still be possible for estuarine fauna due to design of the weir that allows tidal intrusion. A sign will be erected indicating the possible presence of crocodiles and a trap placed below the weir if required.	Aquatic fauna will continued to be monitored to ensure that movement is occurring across the weir due to tidal incursion and ingress.
Mammals	Colonies of bent-winged bats potentially roosting in stormwater drain flowing into NTU drain may be prevented from leaving drain.	Gross pollution traps will be designed to take into account movement of bats into and out of main stormwater water drains.	The bat colony will be monitored following development to determine impact of works and that on lake.

Issue	Potential Impact	Environmental Management and Safeguards	Monitoring
Biting Insects	Potential for the creation of Biting Insect breeding sites within the lake. Potential public health problem through the transmission of diseases. Impact on recreational uses from biting insects. Public nuisance	Careful attention to design and maintenance of concrete edges of lake to avoid the creation of significant habitat areas for mosquito larvae.	The lake and surround will be monitored regularly following construction to identify any potential biting insect breeding habitat.
Social and Recreational	Increased traffic and associated safety issues.	The impact on the existing road network is minimal when traffic enters the existing road network at Lakeside via a roundabout arrangement.	

Table 1.2: Summary of Commitments

Pre-construction and Construction

Issue	Objective	Commitment	Timing	Whose Advice	Measurement Compliance Criteria
Environmental Management (ref 5.1)	To ensure environmental management in accordance with key objectives.	An EMP will be prepared following receipt of environmental approval.	Prior to commencement of construction	DLPE	Issue of Construction EMP.
Dust (ref 4.1.2)	To protect the surrounding land users such that dust emissions will not adversely impact upon their welfare and amenity.	Appropriate dust control measures will be implemented should dust levels prove to be an issue.	During construction	DLPE	Site Inspection
Noise (ref 4.1.3)	To protect the surrounding land users such that construction related noise will not adversely impact upon their welfare and amenity.	Any complaints related to noise will be investigated and appropriate corrective action implemented to rectify the situation.	During construction	DLPE	Site Inspection
Surface and Sub surface Hydrology and Water Quality (ref 4.1.4)	To maintain existing quality of surface waters during construction	All construction activities will be undertaken during the Dry Season. Water quality will be monitored during construction to ensure it meets appropriate Australian water quality standards.	During construction	DLPE	Site Inspection and water quality guidelines met
Soils – Acid Sulphate Soil (ref 4.1.5)	To prevent acid generation in soils due to the disturbance during construction	Testing will be undertaken prior to construction to confirm the absence of acid sulphate soil. Should acid sulphate soils be encountered prior to construction or at any time during construction, an acid sulphate soil management plan will be developed and implemented with approval from DLPE.	Prior to construction During construction.	DLPE	Issue of acid sulphate assessment report.
Flora and Fauna – vegetation clearance (ref 4.1.6)	To minimise vegetation clearing associated with construction.	Clearance of vegetation will be limited to the extent necessary for construction works. Trees and plants to be retained will be clearly identified by the Parks and Wildlife Commission of the Northern Territory and protected during construction.	During construction During construction	DLPE DLPE	Site Inspection Site Inspection.

Issue	Objective	Commitment	Timing	Whose Advice	Measurement Compliance Criteria
		Construction will be managed so as to avoid impacts to mangrove communities.			

Issue	Objective	Commitment	Timing	Whose Advice	Measurement Compliance Criteria
Flora and fauna – weeds and introduced species (ref 4.1.6)	To prevent the introduction or spread of introduced species during construction	Coffee Bush and other noxious weeds will be removed wherever possible during construction and burnt to kill seeds and prevent potential re-growth. A weed control program will be developed prior to construction for the duration of the construction phase. As part of this program, the site will be regularly visually inspected for the spread or establishment of weed species.	During construction During construction	DLPE DLPE	Site Inspection Site Inspection
Flora and fauna – biting insects (ref 4.1.6)	To prevent creation of breeding habitat for biting insects during construction.	Regular site inspections for potential biting insect breeding areas will be conducted during construction. Larvacides will be used where necessary to control breeding.	During construction During construction	DLPE	Site Inspection
Flora and Fauna – bats (ref 4.1.6)	Minimise the impact to bats during construction.	Survey will confirm the existence of the bat colonies. If the existence of bats is confirmed then: ❑ The presence of, and potential impact upon bats will be carefully monitored during the construction phase; and ❑ Timing of construction works will take account of potential impacts on bats.	Prior to final design and before construction During construction	DLPE	Issue of bat monitoring report.
Storage and Handling of Materials and Waste (ref 4.1.7)	To ensure hazardous materials and waste are handled, stored and disposed of appropriately.	All hazardous materials will be stored and disposed of in accordance with relevant standards and legislation. All waste materials will be removed from sites and disposed of in a manner	During construction During construction	DLPE	Receipt of waste at DLPE approved sites.

Issue	Objective	Commitment	Timing	Whose Advice	Measurement Compliance Criteria
		acceptable to the DLPE			
Social and Recreation (ref 4.1.8)	To minimise impacts to the surrounding community and employees of NTU.	Local residents and NTU employees will be kept informed of any disruptions to access, traffic deviations, or changes to parking arrangements during construction. Any complaints will be investigated and responded to promptly	During construction During construction	DLPE DCC	No complaints are received from local residents or employees related to disruption during construction.

Issue	Objective	Commitment	Timing	Whose Advice	Measurement Compliance Criteria
Aboriginal Heritage (ref 4.1.9)	No impact on Aboriginal heritage sites.	In the event that a site of potential Aboriginal heritage significance is discovered during construction, all works will cease in the vicinity of the site pending consultation with the Aboriginal Areas Protection Authority and the Heritage Conservation Branch of the DLPE.	Prior to construction	Aboriginal Areas Protection Authority Heritage Conservation Branch, DLPE	Sacred site certification has received for the site.

Operation

Issue	Objective	Commitment	Timing	Whose Advice	Measurement Compliance Criteria
Environmental Management (ref 5.1)	To ensure environmental management in accordance with key objectives.	An EMP will be prepared following receipt of environmental approval.	Prior to commissioning of lake	DLPE	Issue of Construction EMP.
Surface Hydrology and water quality (ref 4.2.1.2)	To prevent contamination of surface and lake waters	A water monitoring program will be developed to ensure lake water does not become contaminated or depleted in oxygen.	Operation	DLPE	Water monitoring report prepared.
Stormwater Management (ref 4.2.1.2)	To prevent contamination of the lake and downstream areas as a result of stormwater flow	Gross pollutant traps will be used to ensure stormwater entering the lake is free from litter and other gross pollutants.	Operation	DLPE and DCC	Site Inspection
Flora and Fauna – vegetation clearance (ref 4.2.3.1)	Provide appropriate rehabilitation of the site following construction.	All cleared areas will be rehabilitated and landscaped in accordance with the Landscape Master Plan.	Operation	DLPE	Site Inspection
Flora and Fauna – aquatic fauna (ref 4.2.3.3)	Not to impact on movement of aquatic fauna into and out of lake.	The weir will be built to a height that allows tidal intrusion and thereby access for fish and other estuarine organisms. Tidal intrusions will promote water mixing and maintain a brackish water habitat during low flows.	Operation	DLPE	Design and construct documentation Site Inspection.
Flora and Fauna – bats (ref 4.2.3.4)	To minimise impacts of proposed lake on bats	A monitoring program will be implemented following construction to determine the impact of the development on roosting bat communities.	Operation	DLPE	Bat monitoring report prepared.
Flora and Fauna – biting insects (ref 4.2.3.5)	To minimise potential for creation of breeding areas for biting insects	The lake and surrounds will be regularly inspected following construction to identify any potential biting insect breeding habitat.	Operation	DLPE	Records indicating no increase in biting insect breeding.
Flora and Fauna – weeds and pests (ref 4.2.3.1)	To prevent the spread or establishment of weed species due to construction	The site will be regularly visually inspected for the spread or establishment of terrestrial or aquatic weed species during operation.	Operation		Records indicating no increase in terrestrial or aquatic weed species.

SECTION 5 *Environmental Safeguards and Management*
This section describes the environmental management plans that will be developed for the construction and operational phases of the project and describes the monitoring programmes that will be implemented to evaluate the adequacy of these provisions.

SECTION 6: *Glossary*

SECTION 7: *References*
This section lists the references researched in preparing the PER.

1.8 Studies Undertaken as Part of PER

This PER draws heavily on previously existing information. As such, no new site-specific surveys have been undertaken during the preparation of this document, with the exception of a vegetation survey in the area of the proposed weir and carpark, and a site visit to observe aquatic fauna within the drain.