Capturing Indigenous Knowledge in Water Management Processes

Wudjuli Lagoon Case Study, Ngukurr, NT

L Watts
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This report was jointly funded by the National Water Commission and the Department of Sustainability, Environment, Water, Population and Communities. The views and opinions expressed in this publication are those of the authors and do not necessarily reflect those of the Australian Government or the Minister for Sustainability, Environment, Water, Population and Communities. While reasonable efforts have been made to ensure that the contents of this publication are factually correct, the Commonwealth does not accept responsibility for the accuracy or completeness of the contents, and shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of this publication.
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NAILSMA Knowledge Series
007/2012
Acknowledgements

This project was funded as part of the Northern Australia Water Futures Assessment (NAWFA). NAWFA is a multidisciplinary program being delivered jointly by the Department of Sustainability, Water, Population and Communities and the National Water Commission, in close collaboration with the Office of Northern Australia and State and Territory government agencies.

This case study was a collaboration between project partners, the landowners of Wudjuli Lagoon near Ngukurr community in the Northern Territory and representatives of the Northern Territory Government and the NT Environment Centre.

The project partners were Centrefarm Aboriginal Horticulture Ltd (Centrefarm), the Northern Land Council (NLC) and the North Australian Indigenous Land and Sea Management Alliance (NAILSMA), each with distinctive roles. Centrefarm is chartered with creating economies on Aboriginal land for the benefit of Traditional Owners and engages in all aspects of economic development from scoping and feasibility studies to business and strategic planning. Their role was to conduct the research for this study. The NLC has primary responsibilities under the Aboriginal Land Rights (NT) Act 1976 to ensure that Traditional Owners make informed decisions on land related matters. Their role was to oversee the governance of this project. As a peak body for the management of Indigenous land and sea in northern Australia, NAILSMA’s role was to manage the overarching project Capturing Indigenous Knowledge in Water Management Processes.

Indigenous landowners contributed both traditional and contemporary knowledge in water management processes as strong spokespersons and researchers, and as generous hosts of their country. Partners of this project are grateful to all Indigenous participants, who shared their experiences and knowledge in a spirit of working collaboratively with government and agencies to ensure the sustainable management of Wudjuli Lagoon.

Participants who contributed Indigenous knowledge include: Cherry Thompson Daniels, Clarry Rogers, Simon Ponto, Winston Thompson, Betty Joshua Roberts and her family: Marjorie, Marianne and William, Walter Rogers, Kevin Rogers, Alison Bush, Eric Roberts and Samuel Ponto. The project team greatly appreciate the efforts and contributions of landowners, especially escorting the team on country visits and participating in research consultation to highlight key cultural values of Wudjuli Lagoon, issues of concern and aspirations. Special thanks go to Bill Blackley, Chief Executive Officer of Yugul Mangi Development Aboriginal Corporation based in Ngukurr, who assisted with the coordination of the field work in conjunction with the rangers, all of whom work tirelessly to balance the contemporary pressures of natural resource management, including: Clarry Rogers, Winston Thompson, Simon Ponto, and Julie Roy.

The project team is also grateful to Bobby Nunggumajbarr, NLC Ngukurr Regional Office, for his time and efforts in coordinating research consultation with the landowners of Wudjuli Lagoon. Special thanks also to Kirk Whelan, General Business Manager of Ngukurr, who willingly shared his local knowledge about the area in question and assisted the project team with accommodation.
Project partners are most grateful for the significant in-kind support that the NTG and the NTEC provided, especially their participation in research consultations. These participants contributed valuable information that significantly enhanced western understandings of the area in question, and include representatives from the Department of Natural Resources, Environment and the Arts (Ian Lancaster, Chris Wicks, Brian Lynch), the Department of Resources, Plant Industries (Bob Williams, Warren Hunt and Cameron McConachie), the North Australian Indigenous Land and Sea Management Alliance (Tristan Simpson) and the NT Environment Centre (Stuart Blanch). The participation of Nerida Beard, Manager of Remote Community Water Planning with the Power & Water Corporation, and Jo Ellis, a Power and Water Corporation hydrogeologist, significantly enhanced the fieldwork conducted at Ngukurr through an open exchange of information with landowners about the operations of the sewerage treatment plant at Ngukurr community.

Project managers are additionally grateful for the funding they received from the Australian Government through the Raising National Standards Program, administered by the National Water Commission.

Lastly, the author acknowledges the skills and expertise of the project managers who made this case study possible, including Trish Rigby of NLC and Tristan Simpson of NAILSMA; and the project coordinators and researchers Vincent Lange and Lindy Andrén of Centrefarm. As an anthropologist, Lindy Andrén contributed significantly to the collection of data by recording all interviews and photos appearing in this case study, assisting with information exchange and co-ordinating project logistics.
**Executive Summary**

Water is central to the laws, culture and religion of the people of the Ngukurr region. For tens of thousands of years people lived a hunter-gatherer existence in which they conceptualised and developed a sustainable system of land and water management. The arrival of Europeans to the Australian continent brought a European rationalisation of the environment, including science and technology, the expansion of a capitalist economy, the emergence of formal hierarchical organisation and the elaboration of the legal systems (Adams 2003). These four dimensions guided the way Europeans understood the landscape and sought to master it. In the 21st century, this worldview has emerged as the dominant narrative in contemporary natural resource management models.

In the dramatic transition of land and water management regimes over a very short time frame Indigenous knowledge has received little recognition, and Indigenous histories and biogeography are rarely valued as significant data to the sustainable contemporary management of water resources. This study attempts to reverse this phenomenon by bringing attention to the narratives of the landowners of Wudjuli Lagoon, entitling the interests, knowledge, practices and values passed down through generations. Foremost, the research conducted in this study draws on traditional governance structures since these remain largely intact and continues to govern water management processes in an Indigenous context. Landowners are constantly drafting conservation plans in their minds, and this study captures an Indigenous perspective on the environmental problems, goals and locally-generated solutions that are part of this process and which display the inherent responsibility of landowners to ensure that Wudjuli Lagoon sustains future generations as it has served previous.

Informing this case study are a series of research consultations that provided an opportunity for landowners to define their relation to Wudjuli Lagoon, confirm governance structures, identify traditional uses, articulate issues of concern and express their aspirations for its future use. An important component of capturing Indigenous knowledge is to record the environmental change as observed by participants. Participants involved in this case study have experienced first-hand a profound change to their physical and social landscapes, observing environmental changes for well over 50 years of living on country by the values that underpin Indigenous management and policy. Participants shared their knowledge to define the value of Wudjuli Lagoon to the local people, including explaining traditional codes of access, food production and sustenance, and of recreational and social pursuits and the provision of medicines, all of which relate to cultural uses of water.

Local knowledge is acquired both by observation and through traditional teachings over long time frames where knowledge is passed down through generations (White 2010). Participants in this case study acquired their knowledge primarily aurally, recalling the information passed down to them by their forebears. Transmission of knowledge over these time frames serves to explain the seeming futility and ineffectiveness of short-term NRM projects or programs by contrast. However, the successful granting of the Lower Roper River Land Trust in 2003, under the *Aboriginal Land Rights (Northern Territory) Act 1976*, makes it foreseeable for landowners to continue to uphold their traditional practices and to determine suitable management processes in regard to Aboriginal tradition.
Research consultations conducted as part of this study involved field trips and semi-structured interviews in which participants used their observational powers and shared experiences to construct narratives, creating a picture of the lagoon’s past and its current biogeography and the changes to it over recent time. Having grown up at Ngukurr, landowners have spatiotemporal experience and a plethora of reflections to draw from. These observations and experiences were recorded on camera, transcribed and presented on the premise that landowners were best placed to speak on Indigenous livelihoods and to determine their future. Landowners also contributed knowledge simulated by cultural mapping and Indigenous groundwater modelling exercises, capturing a depth of knowledge that made the key values of country easily understood and which enabled revelations that informed the western understanding. For instance, Indigenous knowledge of groundwater modelling can play a critical role in monitoring water allocation, ensuring that high rates of water extraction do not threaten poorly known or possibly endangered wetlands (Watts 2008). Field trips, locality maps and digital images of the site in question served as communication tools to predict the effects of hydrological changes and to assess the potential of small-scale commercial development projects proposed to utilise the water resource. The experience of being on country and the use of appropriate communication tools enabled landowners to describe and analyse environmental changes in a way that inspired further investigation.

The methodology of the case study embraced the challenge of capturing Indigenous knowledge and presenting it to a range of scientific experts including hydrologists, hydrogeologists, horticulturalists and resource managers. At Ngukurr, landowners granted permission to present their perspective on the management of Wudjuli Lagoon to government and other agencies involved in resource management and development. Parallels between the two knowledge systems were drawn with respect to rainfall discharge, groundwater modelling, future uses, governance and water management processes, and the convergence of knowledge and transparent process indicated strong potential to integrate both western and Indigenous understandings within resource development.

However, to improve integration for the better management of the Northern Territory’s resources, this case study also identified barriers to the use of traditional knowledge alongside western science.
Key Recommendations

1. Reinstate the health of Wudjuli Lagoon through (i) implementing abatement programs that control feral plant and animal species and (ii) increasing land management practices and recreational activity.

2. Develop a set of management objectives and strategies that meet social and recreational requirements to sustain Indigenous livelihoods of Wudjuli Lagoon.

3. Undertake an environmental assessment of the impact of the sewerage treatment plant on the biodiversity of Wudjuli Lagoon.

4. Organise a full meeting of landowners, including both Traditional Owners and guardians of Wudjuli Lagoon, to uphold traditional decision making processes on the future use and management of the resource.

5. Implement the second stage of the Ngukurr Economic Development Study, which tests identified economic opportunities for feasibility based on the identification of suitable soils and sustainable surface water resources.

6. Dependent on the outcomes of actions under recommendations 4 and 5, ensure that full business planning for a horticultural enterprise be conducted utilising the results of this Case Study and the Ngukurr Economic Development feasibility reports.

7. Develop co-management structures that integrate the social organisation of the landholding group, including its decision-making processes, as a means to communicate traditional knowledge in planning and policy processes for land and water resources (for instance, via ongoing research consultation).
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1. Background to Case Study

Prior to the commencement of this case study, significant engagement with Traditional Owners in relation to their aspirations on the future uses of Wudjuli Lagoon had already occurred through previous projects conducted by Centrefarm Aboriginal Horticulture Ltd and auspiced by the Northern Land Council.

In mid 2011, the NLC commissioned Centrefarm to undertake the first stage of a three-stage project to identify and conduct feasibility on future sustainable economic opportunities for Traditional Owners and residents of the Ngukurr community. During field-trips conducted under that project, Traditional Owners of the Ngukurr environs expressed ongoing interest in the use of Wudjuli Lagoon as part of a series of economic developments planned over at least forty years. Aspirations include commercialising the use of the lagoon in a manner that embraces sustainable traditional practices and draws on Indigenous understanding of the biogeography and hydrogeology of the area.

Traditional Owners and guardians are keen to reinstate the health of Wudjuli Lagoon, which they currently rate as poor, and the current study provided the opportunity to examine the lagoon and identify some of the causes of the observed degradation. Landowners examined Wudjuli Lagoon in a broader geographical context to show its important relationship to surrounding waterscapes, including the Roper and Wilton Rivers and associated lagoons. However, landowners distinguished Wudjuli Lagoon as a water source independent of both river and groundwater systems, and with a unique role to play in sustaining the life of the people and beings that inhabit the land. As mentioned earlier, a period of forty years has lapsed without an opportunity for landowners to express their economic aspirations or concerns about the sustainable management of Wudjuli Lagoon. This situation forms a sound basis to begin to identify a process for determining and integrating cultural knowledge in government management, planning and policy processes.

Practically, this project continues the previous work of Centrefarm as an example of an economic development project that is community driven and incorporates Indigenous knowledge to analyse and strategise risks and opportunities. This case study builds on Centrefarm’s three-stage project that has the following aims.

**Stage 1:** Identify economic opportunities.

**Stage 2:** Undertake a feasibility study that tests the viability and sustainability of identified economic opportunities.

**Stage 3:** Consult with landowners on the feasibility findings of each project.

Centrefarm completed stage 1 of this project at the end of December 2011 and subject to seasonal conditions and further funding, anticipates the completion of stages 2 and 3 by the end of 2012. Directed by the landowners, economic opportunities for the Wudjuli Lagoon identified in stage 1 included the potential for large-scale irrigated horticulture on approximately 120 -150 Ha of land, 5km east of the Ngukurr community, adjacent to the lagoon. Preliminary soil testing showed potentially suitable soils and given access to the lagoon, sufficient water supply. Although only a preliminary scoping of potentials, key opportunities and risks were identified for the development of such a horticultural enterprise.
Opportunities include:
1. the provision of fresh fruit and vegetables to local region and mines;
2. opening windows to meet southern market demands for large-scale cropping (e.g. bananas); and
3. employment.

The risks are:
1. Establishment capital (fencing, irrigation, bores, pumps, fertigation, power and packing sheet); and
2. Operational capital, such as:
   a) transport infrastructure;
   b) disease;
   c) flooding;
   d) water access;
   e) soil fertility;
   f) incursion feral buffalo;
   g) crop choice competition from other regions; and
   h) cost of transport adding to cost of produce outside local region.

Under its Indigenous Water Resource Management Program, the North Australian Indigenous Land and Sea Management Alliance (NAILSMA) sought expressions of interest for the development of four research case studies across North Australia. These case studies were aimed at improving the understanding of Indigenous water knowledge and management processes, contributing to the development of a framework demonstrating best practice integration of Indigenous people’s traditional water knowledge with western management, planning and policy. The proposed case studies were to involve consultations with Traditional Owners on small-scale land and water based activities relating to Indigenous knowledge across four identified regions, one of which included the lower Roper River/Gulf of Carpentaria region. Based on the previous research activity undertaken by Centrefarm the organisation submitted an expression of interest to explore further pathways of integrating traditional knowledge with economic development and was awarded the contract to conduct the Roper/Gulf case study.

This case study hypothesises that the success of small-scale economic development on Aboriginal land hinges on incorporating Indigenous knowledge throughout the three stages of development identified by Centrefarm: scoping; feasibility; and consultation. The case study also identifies key components of Indigenous knowledge that government management and planning processes need to encompass including: governance; traditional and contemporary uses; access rights; groundwater modelling; values; health assessments; issues of concern; and the aspirations of landowners. This case study has also identified how Indigenous landowners value western science, and how in most cases these knowledge systems converge; however, the active participation of landowners is as paramount to the success of livelihood development as is their ongoing participation and employment.
This case study adopted an applied approach through engaging government, agencies and landowners on equal terms within its research processes. The engagement of landowners involved a number of key steps: initialising consultation, building relationships, assessing the resource, developing cultural and social profiles, determining representation, formalising representation, considering landowners’ interests, and determining decision making processes. These steps enabled the researchers to capture Indigenous knowledge through the use of appropriate methodology using visual stimuli, for instance cultural mapping and field trips.

The research process that engaged governments and agency involved the following key steps: initialising consultation through invitation; building relationships; assessing the resource; acknowledging government management; planning and policy processes; and considering scientists’ perspective. Researchers facilitating the integration of Indigenous knowledge with western science relayed the Indigenous landowners’ perspectives as collated in the field consultations. This demonstrates the criticality of engagement in underpinning research practice and government management planning and policy processes, and stands out as the primary pathway for connecting polarised worldviews.

In relation to the area in question, the case study aims to: (1) utilise knowledge of traditional practices; (2) integrate Indigenous knowledge with western science; and (3) develop a context analysis that informs policy and water management processes. It makes a significant contribution to improving land and water management practices as it demonstrates the importance of landowners reaching consensual agreement in determining the viability of developing a horticultural enterprise at Wudjuli Lagoon, including assessing its opportunities and risks. This highlights that to achieve consensual agreement, it is important that third parties have a direct insight into the social organisation of the focus group, and that this is paramount both to capturing Indigenous knowledge and for developing successful partnerships within resource management.

1.1 Ngukurr Community

Ngukurr is located on a low-rise in Ngalakan Country, 70kms inland from the mouth of the Roper River. It is a major community in the region. The Church of England started the Roper River Mission in 1908 to offer a safe haven from the violence perpetrated against Aboriginal people in the region. It was the first missionary-managed settlement in East Arnhem Land. In 1940, the mission moved to the present site of Ngukurr to avoid flooding and in 1968, the Australian Government took over the mission. In 1988, the Yugul Mangi Aboriginal Corporation was registered to provide local government. In 2008, Ngukurr became part of the Roper Gulf Shire Council and the shire took over local government. Yugul Mangi began to focus more on the combined activities of wellbeing and economic development and became the Yugul Mangi Development Aboriginal Corporation (Andren, Lange et al. 2011, p.31).
‘Yugul Mangi’ is a collective encompassing the diverse cultures and language groups of the lower Roper River/Gulf of Carpentaria region, and comprising seven main language groups: Ritharrngu, Nunggubuyu, Ngandi, Alawa, Mara, Wandarrang and Ngalkakan. Transliterated into English, the term ‘Yugul Mangi’ means “we together as one”, symbolising the unification of seven nations who share a common colonial history from the early 1900s. Traditionally, and continuing today, each language groups comprises a multitude of clans, each with its own spiritual identity, designated land tracts and distinct ceremonial and social obligations. The overarching governance reflected in Yugul Mangi manages the diversities of a community founded on the collective co-operation of seven language groups. Today the common language spoken by the 21 clans represented in the Ngukurr community is Kriol.

In response to the Council of Australian Governments’ targets for closing the gap on Indigenous disadvantage, the Territory Government initiative, Working Future, focuses on developing the infrastructure of the biggest Indigenous remote communities in the Northern Territory. The plan is to develop properly serviced towns that draw parallels to most other country towns in Australia. The Northern Territory Government anticipates that these “growth towns” will become the hub of economic and service delivery, catering for growing Indigenous populations dispersed throughout their regions. Ngukurr is earmarked a growth town under this initiative.

As part of this planning, the Ngukurr Local Implementation Plan sets growth targets and the Territory Government commits to working together with key stakeholders to achieve these shared goals. Some of the key players involved in the current case study are signatories to the Ngukurr Local Implementation Plan. This shows the extensive involvement of the Wudjuli Lagoon landowners in the community planning of Ngukurr that commits both governments and community members to actions across seven areas of community life: early childhood, schooling, health, economic development, healthy homes, safe communities, governance and leadership.
However, the governance structures in place for the management of the Ngukurr community are not the same structures as those in place for governing Wudjuli Lagoon. Governance structures for Wudjuli Lagoon draw on traditional water management frameworks that are largely still intact today. In order to capture Indigenous knowledge of water management and to test its application to planning processes and policy decision making, an understanding of the traditional water management frameworks needs to be established.

Traditional water management frameworks provide structures for managers to socially organise their group and to determine the decision-making processes of the cohort concerned. Therefore, an important engagement process is to recognise that Indigenous land managers are culturally obligated to adhere to the classificatory kinship relations embedded in the traditional water management framework and that this system is a key imperative to the sustainable management of water resources.

This case study shows that in capturing Indigenous knowledge, land managers first focussed on ensuring that the governance structures were in order before permitting discussion on the biophysical or socio-cultural aspects of the focus area.
2. **Indigenous Knowledge:**

Indigenous knowledge of Wudjuli Lagoon is inherently embedded in the hearts and minds of the middle-aged generation, who carry the highest level of social responsibility in relation to the protection and management of their water resources. This case study identifies the middle-aged landowners as key players, who have the primary responsibility to direct the management of Wudjuli Lagoon and mediate between Ngalakan society, non-Indigenous partners and the other Indigenous groups constituting the Yugul Mungi collective.

These key players assigned the responsibility of protecting and sustainably managing Wudjuli Lagoon. They are identified in this case study by name and have provided permission to publish their knowledge in this report through signing consent forms. In all aspects of Indigenous knowledge, the key players have clearly showed their authority to act and speak on behalf of the Traditional Owners of the site in question. In the contemporary world, such key players face the added complexity of mediating negotiations that integrate both statutory and customary laws, and the perspectives of western science. This shows the broad scope of the traditional management of water resources, in which key players have an increasing level of social responsibility to become involved in the negotiation of local knowledge at the interface of two systems of laws and knowledge (Rea and Anmatyerr Water Project Team 2008).

At Ngukurr, the nominated key players of Wudjuli Lagoon manage significant roles: synthesising local knowledge according to the nature and scope of the project, speaking on behalf of the cohort and mediating the interested parties in the increasing competition of water resources. More importantly, they convey the way the cohort conceptualises the landscape and how it relates to the traditional knowledge systems. Primarily, key players adopt a problem solving approach to negotiation over access and future use; they articulate the issues of concern, and determine the affirmative action’s that the cohort need to follow in order to reach consensual agreement. Key players have the highest status within the cohort and are deeply respected by its members for the high-level social responsibility they carry to uphold the sustainable management of water resources.

2.2 **Indigenous Governance of Wudjuli:**

The Traditional Owners of Ngukurr are the Ngalakan people, giving their name to the hill on which the town centres. The identified Traditional Owners of Wudjuli Lagoon are Ngalakan speakers, who culturally identify as the ‘Burdal, Milwarapara, Yutpundji group’, referring to the three major clans of the Ngalakan people. The primary custodians are the Ponto family and associated family groups, who have responsibilities for the management of Wudjuli Lagoon. These include the Roberts and Bush families. Consultants submitted relevant information about the case study to the NLC, which subsequently triggered a Land Information Request to identify Traditional Owners and Guardians of Wudjuli Lagoon. Key individuals identified are listed in Table 1 below.

The term *Mingirringi* is translated into English as ‘Traditional Owner’ and the term *Junggayi* is translated into English as ‘Guardian’ (Australian Office of the Aboriginal Land Commissioner and Olney 2003). In the customary system of land tenure, both *Mingirringi* and *Junggayi* have clearly
identified roles and responsibilities in the management of Wudjuli Lagoon, an important food producing and recreational site. *Mingirringi* (Traditional Owners) have responsibilities in managing access and general care and use of the site; *Junggayi* (Guardians) have responsibilities in organising the decision making processes and speaking on behalf of the *Mingirringi* in relation to any dealings or negotiation about the country.

In this case study and as per customary practice, the *Junggayi* speak on behalf of the *Mingirringi*, deal with the civil matters of consultation and decision making and are actively responsible for the organisation of future events and matters associated with country. In terms of making agreements about resource utilisation of Wudjuli Lagoon, *Mingirringi* cannot make decisions without consulting and obtaining the *Junggayi* consent. These distinct roles explain why most of the knowledge provided by the *Junggayi* focused on organisation and protocol with regard to the management of Wudjuli Lagoon.

A useful western analogy to the classification of Traditional Owner and Guardian draws parallels with the structure of a company, where the Traditional Owners are like shareholders and the Guardians are like managing directors.

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Table 2: Identified parties and potential stakeholders of Wudjuli Lagoon.

The inclusion of other interested parties that represent the broader social organisation of Yugul Mangi ensures that they also reap social and economic benefits from any potential development.
Nonetheless, Traditional Owners and Guardians insist that any further consultation in relation to the future use of Wudjuli Lagoon rests initially with the Traditional Owners and Guardians at a full meeting of all those who have traditional inherited rights, and that this process is paramount to attaining consensual agreement. Those with residual rights to Wudjuli Lagoon or who have expressed interest, for instance members of other language groups, are not involved in the first instance of consultation, and Traditional Owners and Guardians have the right to exclude other members if they see fit.

Considering the interests of the other language groups that constitute Yugul Mangi shows the complexity of governance at Ngukurr; and in relation to this case study shows how traditional governance structures adapt to accommodate transitions in land and water management regimes. The Traditional Owners and Guardians of Wudjuli Lagoon face the complexity of including the opinions and concerns of other language groups, who under customary law, do not have assigned or inherited rights to its management but who have rights to express their interests under the compact of the Yugul Mangi collective.

Following consultation with the Traditional Owners, Walter Rogers proposed the importance of consulting with the other six language groups represented in Yugul Mangi, due to their shared commitment of communal ownership. He outlined the consultative process, in which “agreement is [first] given by the Traditional Owners and then [second] the owners of the other six tribes” (Rogers, W 2012:5). He recognised that the notion of collective shared property significantly re-empowers all Traditional Owners of the region, reasoning: “that’s why we’re staying here - our country’s everywhere you know through the [uniting of] seven tribes” (Rogers W 2012:5).

The Traditional Owners and Guardians of Wudjuli Lagoon have a history of asserting Aboriginal rights, including native title and Aboriginal Land Rights, and because of this experience, seem well versed in two laws: statutory and customary. Under the Native Title Act 1993, a determination in favour of the Ngalakan people was made in 2002 for the claim of an area situated approximately 320km south east of Katherine. This township is commonly known as Urapunga and in 2005 an Indigenous Land Use Agreement was formed between the NLC, the Northern Territory of Australia, and the native title parties, the Ngalakan People. Walter Rogers, a Guardian of Wudjuli Lagoon, explained that most of custodians reside at Urapunga and as Guardian second in line to the site that he has been entrusted to act on their behalf. He stated that “we are holding it for them because some of them [indicating to the west] reside at Urapunga” (Rogers W 2012:9).

This socially inclusive approach to natural resource management ensures that all issues of concern and aspirations undergo debate in a transparent manner, and bases participation on the understanding that everyone with inherited rights has the right to partake in decision making processes. The role of the key player draws parallels to the role of the Speaker of the House of Representatives, where the principal duty of the Speaker is to preside over the House during routine debates. Key players have the constant task of organising the cohort, as social cohesion forms the basis of decision-making processes and it is the role of key players to ensure that all members involved are consulted. Walter Rogers advised:
“When you come back for the next meeting, you might go through the list of names that identifies both Traditional Owners and guardians and do it properly. Alternatively, [at a separate meeting] we could put the owners of the land in one area [on one side] and then the managers and the other mob, from the grandmother side [matrilineal moiety] on the other side. We’ll make the arrangement so when we have that meeting, we can ensure that we have everybody in place.” (Rogers W 2012: )

Subsequently, these arrangements were affirmed by Kevin Rogers, guardian and also second in line: “to ensure that we have everybody in place” (Rogers K 2012: ).

It is critical that in natural resource management models and administrative processes acknowledge the importance of Indigenous landowners’ decision making processes and more importantly, understand their relevance to capturing Indigenous knowledge and participation. During the field trips to capture Indigenous knowledge, key players spent more time directing the decision making processes to ensure that the social cohesion of the group remained intact, than they did offering detailed biophysical knowledge about Wudjuli Lagoon. Nonetheless, landowners consistently raised the health of Wudjuli Lagoon as an issue of concern. The key players regarded adequate consultation with the landowners as the highest priority because it ensures “no interference later on” (Rogers W 2012: ). This is particularly important for proposals on the future use of water resources where scientific based projects tend to focus on measuring the biophysical changes through implementing monitoring and measuring programs and give little attention to integrating Indigenous decision making processes.

The broader group of Traditional Owners consistently affirmed that both Walter and Kevin Rogers were the key informants for the group. Cherry Daniels instructed consultants to “go to Walter, Kevin Rogers, and my in law” (Daniels 2012:5) when a question was posed about the management of the site. Moreover, Walter Rogers informed us that his position in the social group was second in line to his older cousin, the most senior in charge of Wudjuli Lagoon. At this point, he reiterated that although he had the right to speak on behalf of custodians, no decision could be made without the presence of his elder cousin and that decision making processes were important to the success of any proposal, stating:

“It is important that we consult with the Traditional Owners first, and make them understand fully to enable them to consider the implications of the project, but the problem my elder cousin is not here. He is the eldest and the one who is in charge of this whole area, but he is not here.” (Rogers W 2012: )

Consultants presented a list of identified Traditional Owners to Walter Rogers, who claimed that the list was insufficient for reaching consensual agreement. This illustrates that what may look like a fair representation of Traditional Owners and Guardians from a western perspective, does not necessarily give fair representation from a constituent’s perspective. Traditional Owners acknowledge that Table 1 identifies some of the landowners but also commented that the list is nowhere near exhaustive since it does not include the later generations, who have inherited custodial rights to Wudjuli Lagoon in accordance with Ngalakan law.
Within this consultation, Traditional Owners requested that the NLC’s regional anthropologist update the genealogies to include third and fourth generations and that the younger generations are involved in future water resource management activities. Walter indicated that it was the responsibility of the cohort to ensure that they were well organised and this formed the request “for a future meeting to ensure that the broader group of Traditional Owners were all involved in the decision making process” (Rogers W 2012:10). He stated:

“Everybody should be consulted and I say, I’m really concerned that managers and the owners, and the elders are all present so we can make decisions for future generations, and that all the information is tabled at our first meeting so that there is no problem later on.” (Rogers W 2012:10).

2.2 Indigenous Uses of Wudjuli:

The Murray Darling Basin including its wetlands and flood plains provided food, medicinal herbs and raw materials to local Indigenous people for thousands of years before European settlement discovered the river’s value. Similarly, Wudjuli Lagoon along with its wetlands, flood plains and higher grounds was a central place for local families to congregate, harvest and prepare food and preserve livelihoods. Nummerloori, Costello and Nulawan are three other lagoons near Ngukurr community that also have ecological and cultural significance, but what distinguishes Wudjuli Lagoon from them is its popular use as a hunting and gathering zone combined with recreational and leisure activities. Walter Rogers confirmed that Wudjuli is specifically “a hunting area for the people just to get food” and that people hunted for geese, ducks, birds, fish and a vast array of fresh food, always in plentiful supply (Rogers W 2012:4). The evidence provided by participants suggests that Wudjuli Lagoon is a “traditional camping ground” primarily used for recreational, social and subsistence purposes, sustaining life by providing food and highly valued Indigenous livelihoods.

Today local people continue to use Wudjuli to source food and medicinal herbs. However, anecdotal evidence suggests that over the last thirty years, activity around the lagoon has reduced significantly. This case study offers a few reasons for this decline in Aboriginal presence and land management practice.

Wudjuli Lagoon is highly valued for its role in sustaining the physical health and social wellbeing of people since time memorial. In more recent times non-traditional commercial uses have included a garden developed by the missionaries that involved Aboriginal participation. Cherry Wulumirr Biblinyji Daniels, Guardian, referred to Wudjuli Lagoon as the local supermarket presenting a picture of hunting, gathering, preparing food and socialising saying “people used to come here all the time” (Daniels 2012: ). As a young girl, she swam amongst the billabong’s water lilies in their natural glory, spectacular and colourful flowers that are culturally significant to Indigenous people across east Arnhem Land. Tropical water lilies were important to the many living creatures that regularly habitat the lagoon, providing a regular food source. Cherry claimed that water lilies were a staple food in her diet, as pasta and breads are staples in the diets of western people. They were an important food source for feeding people at ceremony time and the women would prepare a special
dish of bush damper made from ground lily seeds as staples, accompanying other prepared dishes. Cherry Daniels stated:

“We would grind the lilies and then eat them, especially during ceremony time. While the ceremonies were on, we [the women] would go right out into the billabong, gather them, bring them in, and lay them out to dry. We peeled the stems, picked out the seeds from the flower heads, and dried the seeds. After drying the seeds, we ground them to make damper. We used three kinds of lily pods; one has a black seed and one has a brown seed and the other produces red seeds. We would even mix them together to cook damper.” (Daniels 2012:)

She went on to describe thick reed beds growing around the edge of Wudjuli Lagoon noting that these reeds were important to the ecological health of the billabong, allowing maximum water catchments and filtration of pollutants, especially during the wet season. They were also used by women who wove the fibrous reeds and plaited them into beautifully designed mats and pillows stuffed with sedge grass, also collected from the edges of the lagoon. The women extended these traditional practices and made hats out of the grass-like plants, intrigued by the hats that missionaries always wore.

Photo image 3: Lilies floating on Wudjuli Lagoon

Cherry remembers Wudjuli Lagoon providing an adequate supply of food in dry times, even when the lagoon’s water level was quite low. Men would stand in the middle of the lagoon to spear fish or drag wired nets across the water. It was also a haven for rare species that inhabit wetlands: “long neck turtles, rare birds, like Jabirus, Pelicans, Brolgas, Cranes, Kites and many more” (Daniels 2012:2). Sadly, Cherry claims that “they are not here now” and points to the overspill of the sewerage channelled from the treatment plant into the lagoon.
Since Power and Water installed the sewerage treatment plant in 1976 that utilises a spillway for treated sewage that feeds directly into Wudjuli Lagoon, Cherry claims “the billabong has been polluted from the sewage”, and the dramatic reduction in lilies is only one ecological effect. In her belief, the overspill of sewage into Wudjuli Lagoon has disturbed the ecological balance, resulting in a decrease in native species and a dominance of increaser species such as weeds and feral animals. Cherry indicates that under such conditions, the local Indigenous people are less inclined to pursue recreational endeavours and this has reduced Indigenous livelihoods. Traditional Owners raised a number of concerns about the impact of the sewage on the lagoon, including a lack of consultation about its implementation, design and a subsequent lack of monitoring of the site over the past 36 years. The landowners provided a fuller explanation, see in section 2.4.

Cherry observed that environmental change has been rapid since the 1970s and identified several possible causes. The significant reduction of water lilies is particularly distressing, especially given their high value in Indigenous livelihoods. In the 1960s, Cherry claims that lilies were abundant and the lagoon appeared at peak health; the water was clean, fit for drinking and well oxygenated for water plants to thrive in. Traditional Owners also face the added challenge that in the Northern Territory, it is illegal to take waterlilies from their natural environment; this questions the protection of customary rights to harvest water lilies for Indigenous livelihoods. Lilies flourish in environments that have good carbon and oxygen exchange between the air and water, the right balance of plants and fish, and from growing in association with oxygenating plants like grasses or reeds.

Cherry describes the health of Wudjuli Lagoon in 2012 as “dirty, unclean” and personally she feels it is not safe to eat the products harvested from its waters (Watts 2012). The consultation identified the environmental degradation of Wudjuli Lagoon as a major concern of landowners and identified the protection of sites from environmental degradation a key value.

The above documentation of environmental changes to Wudjuli Lagoon drew on participants’ observational powers but to determine its future use, landowners assessed if the lagoon was independent or dependent of groundwater, including the nearby river systems. This involved an exercise of Indigenous groundwater modelling utilising key health indicators.

2.3 Indigenous Groundwater Modelling:

Participants reported that the current wet season (2011/12) was the driest since 1913. However they stated that even in severe drought, the Roper River does not turn overly brackish at Ngukurr and that “it takes a lot to turn the river brackish” (Rogers W 2012: ). The reduced flow of the Roper River in low rainfall season does “allow salt water to migrate 114km up river to Ngukurr” (Sumner 2008:4), making it unfit for human consumption, and Kevin Rogers remembered carting water from the Wilton River during the 1960s drought. At this time the community took its water from the Roper River, before the government installed the first bore in 1967. Kevin indicated that the severity of the 1950s and 60s droughts have not repeated since.

Indigenous groundwater modelling assesses if surface water is dependent or independent of groundwater and river systems. Participants examined the connectivity of Wudjuli Lagoon to the
Roper River and evaluated that it had indirect connectivity with both groundwater and river systems. A clear satellite photo image (see photo image 4) of Wudjuli Lagoon and its surrounding waterways enabled participants to discuss rainfall and groundwater flows with consultants. This modelling tool also assist landowners predict the impact of alternative hydrological or development scenarios for determining future use.

Guardian Walter Rogers established that Wudjuli Lagoon was a permanent water source as it “doesn’t usually go dry” (Rogers W 2012:2). This was affirmed by Simon Ponto, one of the Traditional Owners. Cherry Daniels recalled seeing the lagoon get very low until it became “mucky and muddy” but claims that it “never dries up” (Daniels 2012:2). However, one time during the severe drought of the 1950s, Cherry and Kevin Rogers both remembered seeing Wudjuli and Yawurrwada Lagoons severely depleted. Cherry commented that “both billabongs went right down and there was only mud at the bottom of it” (Daniels 2012:2).

The cultural mapping exercise undertaken by Walter Rogers, Guardian of Wudjuli Lagoon, shows rainfall discharge, flowing from Yawurrwada Lagoon and around the west of Ngukurr hill (Rogers W 2012). In high rainfall seasons, water flows over the road near the airport turnoff and continues to run along the runway to join a series of lagoons situated at the south eastern end. The overflow from this flooding flows easterly, through a defined channel that spills into Wudjuli Lagoon. The sewage spillway line also enters the system at this point, between the airport lagoon and Wudjuli Lagoon (Andren 2012).
Walter Rogers stated that Wudjuli Lagoon receives discharge from the Roper River when it floods but he established that it is independent of groundwater: “is what we get from the rain” (Rogers W 2012). This indicates that rainfall recharge is central to the replenishment of Wudjuli Lagoon “and comes from everywhere” (Daniels 2012) stating:

“Sometimes it stays low until the next wet season. When the rain comes, it fills the billabong up again, expanding the water levels right up to the banks we are now sitting on. After rain, we come straight down to collect the lily roots because they are in abundance after rain.”

(Daniels 2012:6)

The last excessive wet period Kevin Rogers remembers occurred in the 1940s, when the land surrounding Ngukurr hill was inundated with water, creating an island effect to the extent that Kevin’s “grandfather had to sail across with a dugout canoe” (Rogers K 2012:7). Only in big wet periods does Wudjuli Lagoon overflow, as described by Cherry Daniels, east towards Walmudga Creek and south east and south west into the Roper River (Daniels 2012:6).

In the management of the lagoon, landowners purport that Wudjuli benefits from the rainfall recharge system and that any extraction for commercial use must be replaced by artificial recharge to ensure that the lagoon always has a significant store of water to sustain the health of the lagoon and to ensure that traditional livelihoods and recreational uses persist. Eric Roberts, Traditional Owner, purported that horticultural commercial development involving irrigation is sustainable when wet periods prevail and in the “big floods” (Roberts 2012). Kevin Rogers considered it best to draw water from the Roper River to replenish Wudjuli Lagoon. Collectively, landowners need to consider whether it is best to use groundwater than river water to supply proposed horticulture farming.

Walter Rogers described that groundwater flow starts in the wet areas, closer to the river and is connected to the Roper River (Rogers W 2012). Kevin Rogers identified the sound of the flow as an important indicator to assess groundwater flows, stating that “when everything is quiet, you can hear the flow of water. Our family, my father and mother used to hear that rush of water going through” (Rogers K 2012). The sound of the flow could be heard at the sewage spillway and land south of this region and it drained in the wet areas, west of Wudjuli Lagoon (Rogers K 2012).

2.4 Issues of Concern:
As indicated earlier, the major concern of landowners is the environmental degradation of Wudjuli Lagoon. In the process of articulating their concerns, landowners indicated the following possible causes:

- decline in land management practices;
- decline in local recreational activity;
- lack of co-management arrangements to developing programs and commercial enterprises that control feral animals and invader species;
- lack of consultation with Indigenous landowners about the design and construction of the PAWA sewerage treatment plant and lack of regular monitoring to assess its impact; and
lack of coordinated abatement programs that integrated Indigenous knowledge with western science.

All five issues point to social processes influencing environmental change, and are underpinned by a decline in Aboriginal presence and an associated reduction in land management activity.

Traditional Owners made a preliminary assessment of the health of the water resources using an index of indicators comprised of health determinants. In this case study, an overall assessment of the health of the water resource based on a rating scale did not take place, but landowners developed the following indicators drawn from their knowledge and experiences in semi-structured interviews both individually and in group situations, including the:

- shape of lagoon;
- sediment in the water;
- water quality;
- flow characteristics;
- sound of flow;
- movement of water;
- safety level of eating fish and food from the lagoon;
- uses of the lagoon;
- taste of water;
- abundance and diversity of species;
- riparian vegetation; and
- safety level of drinking water.

From this preliminary assessment participants articulated the issues of concern outlined below.

2.4.1 Environmental Degradation:

Aboriginal landowners are concerned about the pressures of introduced flora and fauna on Wudjuli Lagoon, especially their dominance over the native species critical to sustaining ecological balance of the lagoon. Competitive pressures between ‘decreaser species’ (species that decreased in abundance) and ‘increaser species’ (species that increased in abundance) have created an imbalance between perennial grass and shrub biomass, most notably in the riparian zone of the lagoon. Observation suggested the decreaser species were native and the increaser species were introduced water plant weeds, indicating that a sizeable proportion of the native biota is significantly affected by the introduction of increaser species associated with the impact of the trampling and rampaging of feral animals.

About 25 weed species have been identified in the region, 10 of which are water plant weeds and include some of the worst aquatic weed threats in Australia: Alligator weed (*Alternanthera philoxeroides*) and Cabomba weed (*Cabomba caroliniana*). Some of the common known affects of introduced water plant weeds include the obstructing of waterways, the reduction of fish production, the harbouring of mosquitoes and the disruption of the recreational life of local people.
Decades ago, the riparian zone of Wudjuli Lagoon were laden with fruits and berries, in such quantity that the area served as a larder. Cherry Daniels described “picking handfuls of black, green and yellow plums, black and white berries and assorted fruits from vines” (Daniels 2012), and children could just help themselves by shaking the trees. Today, the scarcity of natural bush foods and bush medicine is of great concern, and Cherry noted significant changes to the riparian zone of Wudjuli Lagoon that is now sparse of native vegetation.

Simon Ponto, Traditional Owner, indicated that the abundance of weeds is a symptom of the poor health of the lagoon and seriously impacts on the social and economic value that his family place on Wudjuli (Ponto 2012). Although some landowners feel that it is safe to drink the water and eat the fish, other landowners feel that it is not safe, and yet others were not so sure. The weeds inundating the banks of the Wudjuli Lagoon restrict access for hunting and recreational purposes. These weeds also flourish along the sewage spillway, and landowners believe that this is major health issue for the Wudjuli ecosystem. Referring to the sewage treatment ponds, Walter Rogers stated:

“That the rubbish from the ponds, which are channelled down the sewerage spillway, create a rife environment as indicated by the height of the weeds that line spillway channel. This rubbish feeds directly into Wudjuli Lagoon.” (Rogers W 2012).

Cherry Daniels also reported a disappearance of bush medicines within the region and this has significantly reduced traditional health practices and the utilisation of natural bush remedies to heal headaches, eye infections and digestive imbalances.

Currently, landowners do not utilise Wudjuli Lagoon to the same extent as they did forty years ago. Now it is a case of scavenging for natural bush foods further afield, out in the plain areas (Daniels 2012) and visitations to the lagoon have been minimised to coincide with school holiday periods of
the educational year and occasional recreational activities attended by fewer community members. Compared with its traditional use, hunting and gathering is now infrequent and fishing is the only major activity. Aboriginal landowners reported that they hunt for longneck turtles, geese, ducks and bream at Wudjuli but that activity has shifted to Yawurrwada Lagoon, which is also a local hunting site (Rogers 2012). This partially abandoning of Wudjuli Lagoon is of great concern and the decline in visitation and associated Aboriginal land management practices reflects the poor health of the site. To ascertain the cause of its degradation would require integrating an extensive environmental impact assessment that builds on the local knowledge provided in this report.

The presence of birds and the relative diversity of species serve as water diviners in Indigenous cultures and are important to signalling the health and supply of water resources. Cherry observed that birds such as brolgas, pelicans, magpie geese and ducks frequently inhabited Wudjuli Lagoon in the past but these are rarely sighted today. She believes that environmental change is the cause of this. The lagoon used to thrive with a diverse range of edible reptiles, including goannas, lizards, geckos, turtles, dtellas, skinks and snakes. These have also reduced or disappeared, overtaken by invader species, including the cane toad. Walter Rogers noted that crocodiles now inhabit the lagoon and regarded this as an environmental problem (Rogers W 2012). In the past crocodiles did not habitat Wudjuli Lagoon and their presence impacts on planning for its future use.

It is known that significant weed species are known to occur in the Gulf Fall and Uplands region of the Northern Territory (encompassing the Ngukurr community), and that these thrive in nutrient rich water, producing luxuriant growth, expanding rapidly and forming obstructive mats that clog the tributaries that channel water into the Roper River during rain time. Aboriginal landowners are concerned that rich nutrients filter into the lagoon from the sewage treatment site but since there has been no baseline scientific monitoring of the lagoon, the exact nature and extent of this problem cannot be specified. Landowners mentioned the occurrence of bull rushes that had not previously existed, and the Power and Water scientists attributed their presence to a possible increase of nitrogen and phosphorous levels in water entering the lagoon from the sewage treatment plant.

Weed identification assessments are required to determine the degree of weed density, to ascertain water-flow impediment and to measure growth rates of increaser species.

2.4.2 Feral Animals:

Feral animals inhabiting freshwater areas such as creeks, billabongs and swamps is a widespread problem throughout the region. The Traditional Owners believe that the impacts of feral animals are another significant ecological threat to Wudjuli Lagoon that carries social and cultural consequences. Of primary concern is the impact of feral animals on bush tucker such as longneck turtle and lilies. Places of ecological importance such as fresh water billabongs are important to the ceremonial, cultural and recreational activities and due to the lack of protection of this site, such activities have significantly declined.

The absence of fencing around the perimeter allows feral animals uncontrolled access the lagoon, destroying natural habitats and increasing the risk of disease and weed transmission. Of particular
concern are Buffalo (*Bubalus bubalis*), horse (*Equus caballus*), donkey (*Equus asinus*), and pig (*Sus scrofa*) whose predation was described as rife. Feral pigs have a tendency to congregate around water sources because of their extreme sensitivity to heat, and their digging and ploughing behaviour to locate food makes Wudjuli Lagoon susceptible to soil loss, weed establishment and the extinction of small mammals, birds, reptiles and soil invertebrates. It is well known that feral pigs are particularly destructive to agricultural zones and Aboriginal landowners expressed the aspiration to develop and implement management strategies to control feral pigs prior to any commercial development proceeding.

Aboriginal landowners purported that increaser species are encroaching the lagoon, this combined with a lack of abatement plans has resulted in a significant decline in Aboriginal recreational activities and this reduction is the most significant threat. Recreational activities such as fishing, swimming, weaving, cooking, hunting, foraging and socialising have traditionally ensured the presence of Aboriginal people in the area. In the past it was reported that visitation to the area was constant, whereas today, Aboriginal landowners reported a dramatic decline in visitation. This illustrates the link between social processes and environmental change: the decline in Aboriginal land management practices caused by the absence of Aboriginal presence and the general exclusion of Aboriginal landowners or knowledge from the current natural resource management models are seen as contributing to land degradation in the area. All of these increasing pressures on Wudjuli Lagoon threaten the survival of rare and endangered species but equally threaten the maintenance and development of Indigenous livelihoods.

### 2.4.3 Concept of Ownership:

An important issue of concern to landowners is the recognition of their concept of property ownership, which describes who has rights and ownership of valued resources (Young 1998). Wudjuli Lagoon is viewed as a common property resource shared by people but with rights and responsibilities to manage its use, access, maintenance and protection being assigned to clearly identified Traditional Owners and Guardians.

A key role of Traditional Owners is to mediate access codes in relation to the lagoon and they have additional responsibilities because it is a perennial water source. Traditional Owners of perennial water sources, especially those rich in food resources, carry a higher burden of management where they face the important consideration of ensuring the subsistence of surrounding clans. Wudjuli Lagoon is a common property resource, shared by community but Traditional Owners can also assert the right to exclude others from access on the basis of preservation of that resource.

This brings attention to the processes observed in the installation of a sewage treatment plant in 1976 and its direct impact on Wudjuli Lagoon. Cherry Daniels was very vocal about both the socio-cultural and biophysical consequences of the sewage treatment plant. She iterated that the lack of consultation with landowners over its establishment and operation has contributed to the degradation of Wudjuli Lagoon. If the landowners had been consulted a more suitable alternative design might have been negotiated. Illustrating the lack of consultation regarding the establishment of the plant, Bill Blackley, CEO of Yugul Mangi, recalls the confusion in the community when a cheque arrived at the then local council addressed simply to ‘D.Daniels’ for $1.5m. It transpired that
this was a payment to the Community Governance Council in compensation for the land utilised to construct the sewage ponds. He added that a car carrying 3 tonnes of explosive used to excavate the ponds, also turned up at the community without notice or warning.

Another impact of the site and design of the plant was highlighted by Cherry Daniels who claimed that when the wind blows in the dry season, the smell is unbearable (Watts 2012). Cherry remains vehemently opposed to the treated sewage spilling into Wudjuli Lagoon, especially when its traditional use is as a highly valued and significant food producing area, and customary law specifically separates waste products from food production. She attributed most of the negative environmental change observed at Wudjuli Lagoon to the impact of the plant and the failure of Power and Water to monitor the health of the lagoon on an ongoing basis. She stated:

“No one asked us. They just went on and installed the plant without us knowing and pleased themselves. They reckon they can put us down, us blackfellas, because we are blackfellas and they as white people, can go over us. I hate that. I hate people who do not respect Aboriginal people. I only really speak to people who come and try to help us. People who think they can overrun us and do whatever they want on Indigenous land sickens me. People who respect us, come and help us, is when we Aboriginal people will do the same. We will respect them too. I am very sorry those are very hard words but…”

(Daniels 2012)

The community had scant understanding of how the three-tiered sewerage treatment plant works, but the personnel from the Power and Water Corporation invited to participate in the case study were able to inform landowners of its operation and participants were greatly appreciative of this explanation. As a result of this demonstration, rangers and constituents felt more confident to negotiate with Power and Water over the ongoing monitoring of Wudjuli Lagoon. This illustrates the importance of educational programs around major infrastructural developments such as sewage treatment plants, especially those that directly affect the environment. Such activity will help to redress the era where consultation with Indigenous landowners hardly occurred, and will also address Indigenous landowners’ concerns for the better management of Territory’s water resources.

2.4.4 Recorded Sacred Sites:

During the field trips, consultants shared information with the landowners regarding the recording of a sacred site at Wudjuli Lagoon by the Aboriginal Areas Protection Authority (AAPA). The area in question is shown in map 1 (see below) and is listed by AAPA as a recorded sacred site. AAPA information indicates that the site is significant according to Aboriginal tradition and is therefore deemed a sacred site within the meaning of the relevant Act. Traditional Owners and Guardians were intrigued to know how AAPA came to determine such information when according to them no sacred site is associated with the lagoon.

The landowners disputed the validity of AAPA’s information, claiming that there are no customary rites associated with Wudjuli Lagoon; that Dreaming tracks do not pass through the area, and there are no customary stories associated with it, in other words, there is no Dreaming for Wudjuli
Lagoon. Sacred sites are associated with religious and cultural life and embody the mythologies of the land and water. It was incomprehensible to the landowners that Wudjuli Lagoon should hold a sacred site since there are no stories related to it. Walter Rogers referred to the known Wallaby Dreaming track that passes by Yawurrwada Lagoon on its way from Urapunga, and to the multitude of sacred sites known to be associated with other water sources but it was universally confusing to the group that there was an AAPA recorded site at Wudjuli.

The unrestricted access to Wudjuli Lagoon also indicates the absence of sacred sites. Walter Rogers reinforced that the lagoon “is a hunting ground for us and everybody hunts there” (Rogers W 2012). As mentioned above the code of access relating to Wudjuli Lagoon is open, such places, specifically designated for food production and recreational uses are highly valued for their resources but commonly do not hold religious and cultural values and are therefore void of sacred sites.

Landowners expressed their main concerns about the issue as: (1) the AAPA information is false; (2) landowners do not understand how the sacred site came to be recorded; and (3) that it misrepresents the traditional use of the site. The Guardians quickly attempted to rectify this situation by contacting AAPA in an attempt to speak with relevant personnel but they were not available. The group resolved to pursue this matter at a more convenient time.

Map 1: AAPA record of a Recorded Sacred Site at Wudjuli Lagoon (area in pink)
Source: Aboriginal Areas Protection Authority, Darwin NT.

2.5 Aspirations:
Aboriginal landowners expressed their aspirations for the management of Wudjuli Lagoon in ways that demonstrated the upholding of key cultural values, and assisted the consultants to identify the
needs of the group in collecting, maintaining, using and communicating traditional knowledge in planning and policy processes.

Traditional Owners and Guardians aspirations fell into two clearly defined but interrelated fields: (1) environmental management; and (2) commercial development. This case study discusses each dimension separately to ensure the clear reporting of landowners’ aspirations to government and other agencies. These aspirations form the basis of landowners’ environmental goals that provide a platform for integrating cultural knowledge in government management, planning and policy processes and enabling the economic development of the region. This holistic approach suggests the importance of providing Indigenous landowners with renewed opportunities to articulate both issues of concern and aspirations in the management of water resources.

An important aspiration of landowners involved reinstating the traditional use of the lagoon as a recreational and food resource that in turn would improve the health of the lagoon. Increasing traditional practices were identified as bringing greater social and economic benefits to local people, including a better diet of natural bush foods, enhanced physical and social activity through walking, collecting, cooking, fishing, hunting and gathering. Increasing land management practices and access to the lagoon was felt to bring long term environmental benefits as well, particularly in the development of feral animal and plant abatement programs to directly tackle invader species; and it was felt that the commercial development of a well planned and executed horticulture enterprise would sustain and enhance the traditional economic function.

2.5.1 Environmental Management:

This section focuses on landowners’ aspirations in terms of environmental management. The clear message was that an integrated approach led by the community is best practice. Individual aspirations differed between men and women but as a collective, the cohort unanimously agreed on the need for greater protection of the area by restoring sustainable practices and developing enterprises that maintain the biodiversity of the environment. Of relevance to this case study was the protection of surface water in the vicinity of Ngukurr community. This rated highly as has already been demonstrated in previous projects that aimed to protect freshwater sites (e.g. work done with the NT Environment Centre and in association with the Centre for Aboriginal Economic Policy Research where a Greening Australia grant was obtained to monitor the ecological outcomes of fencing three lagoons: Nummerloori, Costello and Nulawan).

Incorporating western science in land and water management practices is not a new approach to the Ngukurr community. It is also important to identify the shared learning generated through previous experiences to improve the process of integrating Indigenous knowledge in environmental management projects. For instance, in the lagoon health monitoring project, the Yugul Mangi rangers determined base conditions of the fresh water resources through measuring ground features, water quality, collecting plant samples and estimating water lily abundance. It is important that Indigenous concepts, knowledge and priorities receive equal recognition in such projects and in policy and planning activities. Doing so ensures that uses accord with Indigenous common property regimes and that Indigenous knowledge regarding the maintenance and protection of sites is reflected in development plans.
This suggests the importance of establishing co-management structures within environmental management projects to support the concept of shared/collective ownership. Integrating landowners’ governance structures and aligning them with government structures and processes will result in a holistic, integrated resource system. The point of convergence is when both domains identify common sets of goals in relation to conservation and development and:

“The establishment of workable negotiation processes to facilitate information exchange: and co management approaches, processes whereby Indigenous and non-Indigenous people pool appropriate knowledge and skills to draw up plans for resource management in ways acceptable to both sides.” (Young 1998:6)

For Traditional Owners to pursue environmental goals in both conservation and economic development they need to collaborate with a vast range of stakeholders and interested parties. This calls for greater cooperation between landowners and stakeholders which will take considerable effort by all involved. However, it is vital to safeguard Indigenous rights of subsistence at the same time as maintaining and developing future livelihoods that value Indigenous perspectives and knowledge.

This brings us to stakeholder identification, which recognises other parties’ conservation and development interests in Wudjuli Lagoon (see Table 2). It shows that the land-holding group of Wudjuli is forming new relationships with scientists, governments, agencies and subsidiary groups.

2.5.2 Commercial Development:

Traditional Owners perceive that the use of Wudjuli Lagoon, described as a “local food bowl” (Roberts 2012), is not to change, and that its traditional role of providing food to the community should persist. As Kevin Rogers commented earlier, “we want to keep Wudjuli as our hunting ground” (Rogers K 2012:8).

The commercial development of a horticultural enterprise is not a new phenomenon for Aboriginal landowners responsible for the management of Wudjuli Lagoon. The current generation of elders, now in their 60s and 70s recall cherished childhood experiences associated with Wudjuli Lagoon, and in telling their stories, this generation tickle with laughter as they recall playing truant from the Mission school and heading straight to the market garden established by the mission. This garden was located on the higher ground adjacent to Wudjuli Lagoon and the children used to pick and eat the peanuts growing there, even though they knew it was prohibited. Picking the peanuts at the farm was as natural as picking the array of fresh wild fruits growing naturally in the riparian zone of the lagoon. Blackberries, whiteberries, black plums and green plums were some of the fruits the elders reported eating. A sprinkler system was installed to water the market garden, which extracted water directly from the lagoon. Cherry Daniels reported that the Mission did not always rely on the sprinkler system because the water levels of the lagoon were sometimes too low. In such times the local people filled buckets of water from the lagoon and watered the gardens by hand.
The recreational benefits that Wudjuli Lagoon provides have brought enjoyment to generations. In close proximity to settlement, children absconded to this place to find refuge, to indulge in the delights of both cultivated and naturally harvested foods and play games for untold hours until sunset traditionally beckoned them to return home. Wudjuli was a paradise for these children; they could freely go there without seeking permission each time they felt like wandering off, feeling assured that they would not get into trouble if they entered the area without being accompanied by an adult. Its codes of access for children were relatively flexible, unlike other local areas that are out of bounds for children without adult supervision, including areas of Yawurrwada, Nummerloori, Costello and Nulawan Lagoons.

Landowners of Wudjuli Lagoon have strongly expressed their desire to develop a commercial horticulture enterprise and Centrefarm is currently investigating this prospect in conjunction with the Northern Land Council. Landowners support such a development, subject to a feasibility study and further consultation involving a full meeting of Traditional Owners and Guardians to integrate Indigenous traditional decision making processes in any enterprise development.
3. **Parallels with Western Understandings**

This section of the case study reports the scientific understanding of groundwater and dry season surface water modelling of Wudjuli Lagoon and examines the site in question in the light of proposed potential primary industry development. The meetings held in Darwin on Friday 17 February 2012 brought together a diverse range of scientists with expertise in horticulture, ecological management and water resource management, including hydrogeology, geology, agriculture, horticulture, geomorphology and physical geography; and provided data and interpretation on the Wudjuli resource from a western perspective. Participants examined the same photo imagery map (see photo 4) used by Traditional Owners to contribute on Indigenous knowledge.

The purpose of the juxtaposition of western science and Indigenous knowledge is to ascertain if common understanding can be reached between the two approaches and to develop a fundamental data set that integrates both, to guide the sustainable development of Wudjuli Lagoon. This section will assist with identifying pathways that integrate traditional knowledge with western science by drawing parallels between the two knowledge systems, especially in hydrology and land use patterns, and by synthesising the considerations presented by both the Indigenous and the western domain.

Wudjuli Lagoon has received minimal attention by western science in terms of monitoring, water testing, ecological assessment and groundwater modelling, despite the tertiary sewage treatment plant channelling recycled sewage directly into the lagoon. Recent reports prepared by Water Resources Branch, DNRETAS include Sumner 2008, which investigates groundwater and bore water supply to Ngukurr community, and Zaar 2009, a broader water study of the Gulf Region. Neither reports table specific information about Wudjuli Lagoon.

### 3.1 Hydrogeology:

Participants discussed the impact of salinity levels on water supply and the connectivity between groundwater and Wudjuli Lagoon. Discussion indicated that the primary issues from a water resource perspective are: (1) groundwater supply; (2) water movement; and (3) the impact on public water supply of commercial use of the lagoon.

The first concern that participants expressed was the potential for competing interests between the proposed commercial development and the town water supply. Ian Lancaster, Water Controller DNRETAS, stated:

> “Our advice is that public water supply is from groundwater and that it is slowly getting saltier and saltier because of the presence of salt aquifers. This indicates that the current use of water at Ngukurr is unsustainable and a new supply of drinking water will need to be found.” (Lancaster 2012)

Landowners did not perceive that the use of Wudjuli Lagoon for commercial purposes would affect the town water supply, deeming the lagoon an independent resource and therefore unrelated to the town water. Hydrological data substantiated the observations made by landowners, reporting...
extreme dry times in the 1950s in which Wudjuli Lagoon went dry and the town carted water from the Wilton River instead of utilising the Roper as the drinking water source. Ian Lancaster stated:

“We’ve got a gauging station just upstream of Roper Bar which is called Red Rock. It ceases to flow. Back in the 60s it ceased to flow every year from ’66 through to 1970 and again in ’73. Since then it has had a reasonable flow... If you go back to those time like the 50s and 60s, from what we have been told about the salt-wedge that comes right up past, they actually had to cart water for drinking water.” (Lancaster 2012)

Chris Wicks, Water Resource Manager DNRETAS, proposed: (1) artificial recharge to Wudjuli Lagoon from the Roper River during the dry season to maintain water supply to Wudjuli; and (2) the ample supply of rainfall discharge from the catchment area to replenish Wudjuli Lagoon as water is extracted to support the horticulture plot. Walter Rogers, Guardian, had proposed the same approaches with emphasis that Wudjuli Lagoon remains replenished at all times. Chris Wicks stated:

“It probably recharges every year with an average rainfall and it probably does not take very much to fill it. If you think about the fact that the catchment area is going to be huge, that alone (referring to the high country) at 800 ml of rain is more megalitres of water flowing across that country than that lagoon can hold.” (Wicks 2012:10)

Walter Rogers advocated the importance of keeping the water levels full at Wudjuli to maintain its health and its traditional use as a recreational and hunting ground and that this supply would need to be drawn from the Roper River in dry times (Rogers 2012). Ian Lancaster agreed with Walter’s synopsis saying that “using the lake and then topping it up when needs to be, or when available, from the river” was a viable option. He substantiated:

“You know the use of the river-water for any sort of irrigation project is ok at the moment in these wet climes, we’re undoubtedly in a wet climate at the moment up here and CSIRO advice that we’re likely to remain this way through to 2030... but if you did have those awfully dry years it would be a problem for irrigation, you wouldn’t be able to it would be too salty, nor would you want to suck that salty water and put it in a freshwater billabong.” (Lancaster 2012)

The scientists questioned the connectivity between Wudjuli Lagoon and the groundwater and stated that they could not tell if Wudjuli Lagoon was independent or dependent, but proposed a volumetric survey of the lake, depth by cross-sectional area. Cherry Daniels argued that Wudjuli Lagoon used to be deep but it is now quite shallow and its size was round but its shape has changed due to environmental change (Daniels 2012). It is critical to the survey that its evaluation considers the observational changes made by landowners.

3.2 Water Quality, Quantity and Management:

Before the meeting, participants had examined the potential of the site for commercial development and expressed that they were at first sceptical of the proposal because the lagoon was
too shallow “only a half a metre or a metre deep” and they imagined a horticulture plot of thousands of hectares (Lancaster 2012).

When consultants clarified the relatively small-scale nature of the proposed commercial enterprise (up to 180Ha) this changed the perspectives of the participants and assisted them to focus on key issues: (1) water quantity and quality; (2) the size and depth of the lagoon; and (3) management of the water used to feed the horticulture plot and its impact on the lagoon.

Participants discussed these issues in light of their concern for water scarcity and salinity, a broader problem for the Ngukurr region because of the Roper River’s limited water flow and lack of inflows into the river.

Altering the form of Wudjuli Lagoon to enhance water quantity was one option proposed. Warren Hunt, Industry Development and Extension Leader, Plant Industries DOR, posed the question “so if Wudjuli Lagoon is not a sacred site and the water flows this way and it is high ground here, what’s the opportunity of putting a wall in here and raising the height of it?” (Hunt 2012:4). If the rainfall discharge is greater than the capacity of Wudjuli, creating higher banks would increase its capacity to supply quality water (Wicks 2012). However, landowners were opposed to modifying the lagoon particularly to the concept of damming it, not wishing to interfere with its natural features in any form; a view supported by Stuart Blanch (Director, NTEC) who noted the impact of changes in water levels on vulnerable native aquatic plants (Andren 2012).

Instead, Walter Rogers proposed three options to irrigate the proposed commercial venture, all of which uphold the traditional use of the lagoon and maintain its current form. First, he proposed to leave Wudjuli in its natural state and draw water from an old bore located to the north of the high country, which has previously been used for pumping or from another bore, a bit further out, north east of the high country. The second option was to pump water from the river into the lagoon, to replenish the water extracted to water the horticulture plot. Thirdly, a large tank could be built on the higher ground where it is not prone to flooding which would hold water for irrigation. Kevin Rogers agreed, and confirmed the dual purpose of such a tank: “you can pump into the lagoon as well as supply water to the farm” (Rogers K 2012).

Underlying this rationale, both Guardians were ensuring that local people continue to have open access to the lagoon for recreational and food gathering pursuits and traditional management, thereby maintaining its health and traditional purpose whilst simultaneously utilising it for new economic purposes.

On consideration of the data from the Roper River gauging station and the proposed development as outlined by the landowners, it was clearly felt by the scientists that there would not be any impediment to the granting of a Surface Water Extraction Licence. Ian Lancaster commented:

“*The surface water extraction licence is generally based on, because we don’t have a heck of a lot of data, is based on 20% of the available flow, you would base that at Red Rock, so as I say… you can see pretty clearly at the moment, late dry season it’s still running at 3 or 4 cubic metres per second, 3 or 4 thousand litres per second, and so 20%*
is what we allow, so that would mean, if its only 3000 litres per second, 20% is quite a lot... I don't see too many issues; do you Chris, with a SWEL (surface water extraction licence) for them? There'd just be constraints, in other words the SWEL would say something like “once the river at Roper Bar” because that’s where we’ve got our recorder and its telemetered, you can see it on the internet “once that reaches 1 metre a second, of this particular gauge height, all pumping must cease” that’s the sort of condition... well, I don’t really see any show-stoppers from a water resources perspective.” (Lancaster 2012)

Discussion among scientists at the meeting also referred to efficient crop options, soil quality and horticulture plot size. Comments were made regarding the impact of the proposed Mataranka developments planned for further upstream which will utilise a major inflow to the Roper River thereby potentially reducing its flow downstream. Ian Lancaster stated that “we cannot afford to have the river drying up unnaturally which will impact on their [Ngukurr’s] water supplies” (Lancaster 2012:7). This raised the issue of resource competition, which had not been mentioned in interviews with landowners.

3.3 Human Resourcing:

Scientists considered human resourcing the proposed horticulture plot as a key issue of concern, identifying the need to build up human capital, including the skills and knowledge about farming among the local people. Cherry Daniels discussed the community’s previous experience in establishing and maintaining the old market garden especially in dry times. She asserted “there was always someone looking after the peanut farm” (Daniels 2012:3).

It was agreed that locating the farm away from the community would reduce likelihood of interference. Interestingly, potential raiding or destruction of the garden was not a concern expressed by the landowners. Instead they rated restoring the health of the lagoon through the control of feral animals and invader species a higher priority.

3.4 Environment:

Stuart Blanch of the NT Environment Centre raised a concern regarding the impact of land clearing for the proposed economic development. He noted that in mid February, John Wonarski, internationally renowned researcher in biodiversity and conservation, presented the Native Vegetation Management Bill on behalf of the Northern Territory Government. This piece of legislation aims to strengthen environmental protection through regulating land clearing that lowers biodiversity. According to Mr Wonarski, re-growth regains biodiversity within 12 years as vegetation species return and trees develop enough maturity to offer hollows for wildlife, including endangered species such as the Red Goshawk, owls, and small and medium sized arboreal nesting mammals. Relevant to this case study, is the “notional” threshold for land clearing of 200Ha with favour being given to small-scale high return developments.

The landowners had already proposed a conservation plan opposed to blanket land clearing. Instead it was stated by Kevin Rogers that the proposed development retain a reasonable proportion of vegetation around the edges of the plot, in which the uncleared land serves ‘like a
buffer zone’ (Lange 2012). He stated: “instead of clearing the whole area, we clear a portion. We clear the middle of the plot and keep a thick border of vegetation around it” (Rogers K 2012:8). In addition, the protection of the carbon bank in such vegetation shows the conservationist values of landowners. It also shows that the development of new legislation, which includes mechanisms to protect the environment, converges with Indigenous values.

The Wudjuli Lagoon ticks off a number of conservation considerations. Firstly, the plans are below the threshold for land clearing. Secondly, the intention to instigate feral animal and weed control programs including fencing the lagoon will mitigate the environmental impact of further land clearing. Thirdly, the clear intention to preserve remnant vegetation in corridors, or on some areas of good soils where the trees are mature and larger, demonstrates consideration for the impact of any economic development (Andren 2012).

3.4 Considerations:

The integration of western and Indigenous understanding raised considerations important to determining the future use of Wudjuli Lagoon, including:

1. whether the impact of a horticulture enterprise would result in less water in the lagoon even though it is replenished by river water and rainfall discharge;

2. what monitoring programs would be required to establish base line data for Wudjuli Lagoon;

3. how to ensure salt-water does not intrude Wudjuli Lagoon if it is being replenished from the River;

4. given that rapid rises and falls in water levels significantly affect native aquatic vegetation, what baseline and monitoring processes need to be established to ensure that the water levels of the lagoon are not altered more than x cm per week;

5. what the limits are on water extraction;

6. what the levels of nitrogen and phosphorous from the tertiary settling pond at the sewage plant are, and whether there are heavy metals present in the water;

7. whether the groundwater near Wudjuli Lagoon is connected to other aquifers, and if so, how deep these are and what their connections to the surface are;

8. given that irrigation mobilises salts in the soil, whether this will impact the quality of the groundwater used for drinking water supplies; and

9. how to support an environmental assessment on the impact of the sewage treatment plant on the biodiversity of Wudjuli Lagoon.
4. **Barriers to Partnerships:**

The case study pinpointed a number of barriers to integrating Indigenous knowledge in water planning and policy management, as outlined below.

1. **The importance of recognising the value of the social processes of landholding groups and their respective decision making processes is rarely understood or considered important, yet it remains a key imperative to Indigenous water resource management.** To ensure successful partnerships:

   a) Traditional Owners need to be clearly identified through both Land Interest Request provided through Land Councils and subsequently confirmed by Traditional Owner and local stakeholders;

   b) landowners need to be provided the opportunity to direct research consultations or meetings with potential collaborators in accordance with their issues of concerns, aspirations and their needs on the sustainable management of water resources;

   c) that government management, planning and policy processes provide platforms (for instance, professional research consultation) that enable landowners the opportunity to provide Indigenous knowledge in an informal context and which is later tabled into government reports and management plans;

   d) a greater understanding of the roles and responsibilities of members assigned with inherited responsibilities will considerably improve understanding of the organisation of the landholding group and how best to work with traditional governance structures; and

   e) it is important to recognise that the social cohesion of the group is important to Indigenous water management processes and it is important to ensure that consultation occurs with the broader Traditional Owner group especially in relation to making decisions about its future use.

2. **It is important to understand the value of qualitative data to collating Indigenous knowledge, including the recording of participants’ histories, observations, narratives, experience and local anecdotal knowledge to establish a baseline of data, derived from long-term scales of teaching.**

3. **Ensuring that data collection strikes a balance between quantitative data and qualitative data is an important process for integrating traditional knowledge alongside western science.**

4. **The appropriate use of communication tools to simulate discussion, for instance, photographic satellite imagery or cultural mapping enhances communication, and communication approaches must aim for participatory discussion as opposed to conclusive answers.**
5. It is important to recognise the Indigenous community’s spirit or desire to collaborate with
government, agencies and respective stakeholders and partnerships are best developed through
the exchange of knowledge and by solving identified problems on a shared basis.

6. Different approaches to groundwater modelling and impact assessments between technical
experts and Indigenous participants can impose restrictions. Technical experts tend to rely on
measuring or monitoring to produce scientific evidence and Indigenous assessments rely on
observation, customary law and transmission of knowledge through generations. Information
exchange between Indigenous and western understanding is critical for integrated water
management processes.
5. Conclusion

The case study concludes that although the methodology used to capture Indigenous knowledge draws on effective communication tools, the results obtained from this engagement were achievable because of the sustained efforts of Centrefarm via NLC and the project team to develop trusting relationships with landowners.

Engagement that exchanges information in ways that respect Indigenous cultures is the key to identifying pathways that integrate traditional knowledge with western sciences, and forms the basis for successful partnerships. Indigenous cultures are naturally respectful of others, especially those who show a willingness to engage, exchange information and enter a dialogue. Therefore, the display of apprehension or being overcautious or oversensitive results in a lack of engagement and is probably the most significant barrier to integrating cultural knowledge in government management, planning and policy process.

Cherry Daniels clearly expressed the anger she felt towards agencies that did not adequately engage landowners, especially in relation to infrastructural development that directly affects the environment. Governments and agencies need to build confidence in Indigenous communities by building relationships with stakeholders and creating opportunities to enhance Indigenous/non-Indigenous dialogue. The context does not need to be formal, but discussion needs to be frank, direct and honest, and it is important to acknowledge any slip-ups, even when the problem was inherited from another era.

This case study shows that engagement with landowners that considers the needs of the landholding group is based on negotiation. Negotiation is integral to creating pathways, enabling community groups to collect, maintain and communicate traditional knowledge in planning and policy process. There are numerous Indigenous projects from across Australia that aim to develop sustainable management through negotiation or coexistence. For instance, in this case study, landowners negotiated that Centrefarm conduct a full meeting of Traditional Owners to make a decision on developing a commercial enterprise that utilises Wudjuli Lagoon. Nancy Fraser argues that negotiation must assist in “conceptualising struggles for recognition so that they can be integrated with struggles for redistribution” (Fraser 1995). The frustration for Wudjuli landowners is that they have aspired to economic development under partnership arrangements for over 40 years without success.

There needs to be greater provision for collaborative research projects, such as this case study, that encompass an applied dimension in which landowners are given opportunity to maintain sites and develop programs that remEDIATE environmental degradation. Therefore, collaborative research projects need to incorporate longer timeframes and encompass well-planned incremental stages that support community driven sustainable solutions for future resource use and management. This includes developing monitoring programs that balance qualitative and quantitative data, for example: recording Indigenous histories and perspectives on environmental change alongside weed identification assessment.
Developing greater understanding of the conservationist ideologies of landowners recognises that the protection of sites is a key cultural value in Indigenous management. However, within this framework, there is scope for sustainable development. Developing partnerships that have co-management governance arrangements that value Indigenous input into planning and management, and support the aspirations of landowners, is bound to increase economic activity on Aboriginal land. Identifying the roles of participants and formalising the Aboriginal representative body through complementary Memoranda of Understanding will ensure successful partnerships that integrate traditional knowledge with western science.
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Looking after Our Country... Our Way

North Australian Indigenous Land and Sea Management Alliance Ltd
ABN 80 149 061 174

www.nailsma.org.au

ISBN 978-0-9808524-4-8