Assessment of the potential costs and benefits of water trading across northern Australia

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(Photo courtesy of W. Nikolakis)

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Summary

This report is the final of three reports and part of a two year project entitled *Establishing water markets in northern Australia: a study to assess feasibility and consequences of market-based mechanisms of water delivery* undertaken through the Australian National University's Crawford School of Economics and Government. The Tropical Rivers and Coastal Knowledge (TRaCK) hub funded this project under Theme 6.1 "Sustainable Enterprises". This research is also being done in collaboration with the North Australian Indigenous Land and Sea Management Alliance (NAILSMA).

This third report provides an assessment of the potential costs and benefits of water markets across northern Australia with consideration of efficiency, equity and effectiveness criteria. The region under focus is the tropical belt of northern Australia which comprises the jurisdictions of Queensland, Northern Territory and Western Australia, (with attention on the Gulf, Timor and North East drainage divisions).

Water trading is at a formative stage in northern Australia, with few (if any) recorded trades at the time of writing. Markets have been effective in southern Australia in providing flexibility to irrigators and supporting productivity through reallocation during drought. Markets under the National Water Initiative (NWI) are seen as an effective tool to optimise economic, social and ecological values associated with water.

There are preconditions for a water market to be effective. Important is for there to be low to medium transactions costs. A transaction cost is the costs involved in executing a trade that are above and beyond the actual price paid for the water (they can include travel time, fees, title searches and other costs). The potential for high and increased transactions costs is significant across northern Australia. A key reason for this is uncertainty over Indigenous rights and interests to water, which if not resolved could impose constraints on water markets. This suggests that there must be greater certainty around Indigenous involvement in water markets.

There are environmental costs associated with water markets. Experience in the Murray Darling Basin highlights there have been environmental impacts from water trading (though it is acknowledged that it is difficult to separate these impacts from the effects of drought and increased development). These impacts include increased salinity, and effects from the physical change in the timing and location of water use. One outcome of the development of water markets in southern Australia was the activation of sleeper and dozer entitlements- this meant more water was being used. Across northern Australia most rivers are not perennial, there is a reliance on groundwater and the expansion of storages is constrained There is the potential in northern Australia for environmental impacts from trade. These impacts include: increased salinity in-stream; water logging from more on-farm use; saltwater intrusion because of reduced flows; and during the dry increased nutrient loads could threaten the health of rivers. These issues can be addressed through management efforts. For example, in the Ord, water managers have increased dry season flows to disperse nutrients from agricultural activity.

Efficiency is key aim of water markets. Economic efficiency arises when all the gains from trade have been exhausted and the costs imposed on others from water use have been fully accounted for in the decision making of water users. Any assessment of efficiency of water markets, however, requires more than simply a comparison of quantified private costs and benefits. This is because, typically, water markets have been implemented only for consumptive uses of water and the effects of water use on downstream users and the environment have typically been ignored or not fully considered. Any assessment of efficiency in the north must seek to integrate customary or ecological values, but it is acknowledged that this is complex as these values are intangible and difficult to quantify.

Issues of equity are important in the transition to water access rights. In the north, equity should be given increased prominence because there is a significant Indigenous population in the region who are subject to chronic socioeconomic disadvantage. In allocating property rights to water there will need to be consideration of Indigenous Australians. Including Indigenous people in water markets through a structure that is

appropriate will offer challenges to policy makers. Quantifying the amounts of water to be provided for consumptive purposes and non consumptive purposes (such as spiritual values) is also complex. There will need to be considerable Indigenous community consultation to ensure principles of equity are upheld. Water planning should provide important parameters to ensure Indigenous customary aspirations are not threatened by water trading. There will need to be consideration of surface and groundwater connectivity, and the effect of extraction on groundwater dependent ecosystems, which are of high importance to Indigenous people in the region. These parameters should be reflected in trading rules. Ongoing Indigenous collaboration and engagement in water allocation is essential- such efforts should be underpinned by capacity development.

The concept of water markets can be politically contentious. In our first work for this project, community opposition was identified as a key barrier to the development of water markets by research participants. However, it is important to emphasise that a slender majority of all respondents in our second study agreed that water markets would be useful in their region. Indigenous respondents were more likely to agree that water markets would be useful. But respondents imposed conditions on how markets should operate. Respondents placed a high value on environmental and cultural assets, and Indigenous involvement in water markets was important. It was suggested by participants that there is required more community awareness on water reform and on water markets. There is little awareness that markets can support the optimisation of environmental, economic and social values to water (which is an overarching objective of the NWI).

Non market approaches may be more appropriate in some areas than markets. Markets are efficient in optimising the allocation of water where scarcity and competition exist. Markets may by themselves be incapable of achieving ecological or equity outcomes. A blend of approaches to allocating water may be more suitable. There is a growing trend in water management for increased collaboration and stakeholder driven governance approaches. Central to these approaches are inclusivity and capacity building. Collaborative efforts provide a structure for stakeholders to develop rules over allocation and management of water, as well rules for enforcement and compliance. Efforts will be

required to include Indigenous interests in collaborative approaches. A key barrier in the experience of collaborative approaches in New Zealand is uncertainty around customary rights to water. Uncertainty over customary rights exists across northern Australia, and has the potential to reduce collaboration between stakeholders and constrain water planning and management efforts. Resolving Indigenous rights to water through creation of Indigenous property rights may address this uncertainty.

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Abbreviations

COAG	Council of Australian Governments
CTH	Commonwealth
MDB	Murray Darling Basin
NAILSMA	North Australian Indigenous Land and Sea Management Alliance
NT	Northern Territory
NWC	National Water Commission
NWI	National Water Initiative
QLD	Queensland
TRaCK	Tropical Rivers and Coastal Knowledge network
WA	Western Australia

Glossary

Aquifer:	An underground geological formation which can yield quantities of groundwater for extraction.
Consumptive pool:	The actual volume of water made available for consumptive use, which generally set out in a water plan for the specific resource.
Consumptive use:	Water made available for private use, for both commercial and personal activities.
Cultural flow:	An allocation of water to be managed by Indigenous peoples to meet their unique customary aspirations in their traditional territories.
Effectiveness:	Effectiveness relates to the ability of water markets to achieve their desired objectives.
Efficiency:	Economic efficiency in simple terms is where the cumulative benefits of reallocation are greater than the costs
Environmental flow:	The amount of water necessary to maintain the health of a waterway and dependent ecosystems.
Equity:	A principle that prescribes a fair allocation and distribution of resources (such as water)
Native title:	Those rights and processes accorded under the Native Title Act (1993) (Commonwealth) to Indigenous Australians.
Sustainable:	The responsible management and allocation of water resources, guided by the aim of balancing all the competing needs for water.
Tradable commodity:	Something which is sold simply as a good and price is determined by supply and demand.
Transaction costs:	Are those costs above and beyond the cost for the good or service in a transaction. It may include title searches, trade approvals, negotiating and enforcing contracts

Unbundling:	Is part of the water reform process that separates water from land title and converts it into a water access entitlement or water allocation.
Water access entitlement:	An ongoing entitlement to exclusive access to a share of water from a specific consumptive pool defined in a water plan.
Water allocation:	The amount of water provided in a licence to use or for water access entitlements in a given period as identified in the rules of the specific water plan.
Water market:	Allows water trading to occur.
Water trading:	Involves the buying and selling of water access entitlements, also often called 'water rights'.
Water plan:	A statutory plan or government endorsed water allocation plan for both surface and groundwater systems which is developed using scientific assessment and done in consultation with stakeholders to support sustainable water use.

1. Project overview

This study, entitled "*Establishing water markets in northern Australia: a study to assess feasibility and consequences of market-based mechanisms of water delivery*," is a two year project, funded through, theme 6.1 of TRaCK. There are three tasks for this project:

1. Analyse current institutional arrangements and constraints for establishing water markets across Queensland, NT and Western Australia,[1]
2. Analyse key stakeholder attitudes and values relating to water trading and consideration of the implications for the establishment of markets,[2]
3. Assess the costs and benefits of introducing water trading to northern Australia ensuring consideration of efficiency, effectiveness and equity criteria. This assessment should include consideration of
    - Likely adoption rates
    - Administrative and transaction costs
    - Environmental consequences
    - Political feasibility
    - Social justice issues relating to Indigenous (non-market) livelihoods
    - Alternate non-market approaches to meeting north Australia's water allocation needs.

This report, Task 3 presents the costs and benefits of markets in the north.

[1] Task 1 examined institutional arrangements for water markets across northern Australia and the constraints present. This report is available at: http://www.track.gov.au/publications/registry/772

[2] Task 2 analysed stakeholder attitudes and values to water markets across northern Australia. This report is available at: http://www.track.gov.au/publications/registry/857

2. Introduction

Aims

Water markets are not widespread across the north. However, jurisdictions have committed to implement market regimes under the National Water Initiative (NWI). This report looks at the potential costs and benefits of water markets across the region. Our results are based on findings from two previous studies over the last two years on water markets in the north. These studies analysed institutional arrangements through in-depth interviews with opinion leaders, experts and policy makers (42 interviews in total); and examined stakeholder attitudes and values to water markets across the north (120 industry, Indigenous, government and recreational users). This final report collates the findings from these earlier studies and we consider these costs and benefits in light of efficiency, effectiveness and equity criteria.

We also discuss in our analysis likely adoption rates of water markets, administrative and transaction costs, environmental consequences; political feasibility (and costs); and social justice issues for Indigenous livelihoods. In conclusion we consider non market approaches that may be used across the north.

Background

The study region

The tropical belt of northern Australia is sparsely populated. It covers an area of more than one million square kilometres (or 25% of the Australian estate) and only hosts 2% of the nation's population (Carson et al., 2009). There is a prominent Indigenous population who own almost a third of the land base under a variety of tenures (Altman et al., 2009). Over half of the nation's annual runoff (100,000 GL) occurs in three drainage divisions in the region: the Timor Sea, Gulf and Northern North East drainage divisions (Petheram et al., 2010). The exploitation of these water resources has held a strong fascination for

some Australians (Pigram, 2006). But irrigated agriculture remains a minor land use, with pastoral activity covering approximately 90% of the landscape (NAWLT, 2009).

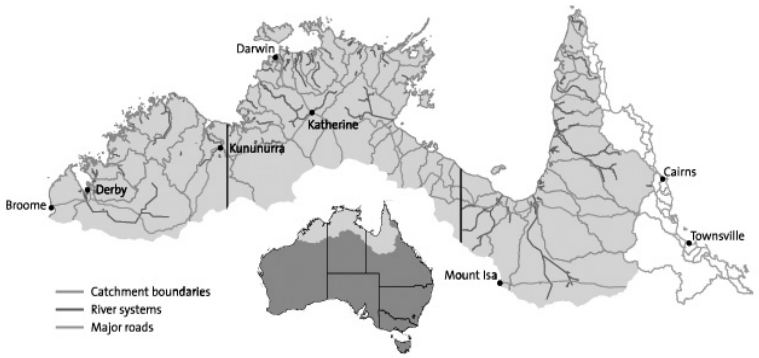
Development pressure

There has been a re-focused attention on the potential to exploit northern Australia's water resources for southern Australia's water security (Edmonds, 2007); and for expanded irrigation development in the north (North Australian Land and Water Taskforce 2009). The Commonwealth Government committed $195 million in 2008-2010 to the expansion of the Ord Irrigation project in the East Kimberley (Department of State Development, 2009).

A recent report delivered to the Federal Government by the North Australian Land and Water Taskforce (NAWLT) suggests that groundwater resources in the region could support the expansion of irrigated agriculture by anywhere from 100% to 200% in the region- or 20,000 to 40,000 hectares (NAWLT 2009). NAWLT (2009) identify that some 600 GL of groundwater could be available to support new consumptive uses. However, NAWLT emphasise that despite high rainfall, the north is for most of the year in water deficit- rain is seasonal, there are high rates of evaporation, and most rain falls near the coast which constrains storages (NAWLT 2009).

Creswell et al (2009) argue that the ecological costs of pursuing irrigated agriculture are too high in the region. They identify the strong reliance of customary and ecological values to groundwater in the dry season which may be threatened by extraction (Creswell et al., 2009). The implications from allocations are not well understood, so a precautionary approach has generally been taken in the north (Nikolakis and Grafton, 2009). It is suggested that going forward this precautionary approach be maintained, with allocation decisions based on best available science and community input (Hart, 2004).

Figure 1: Map of study region (source: Tropical Rivers and Coastal Knowledge network)



National water reform

The governance of water is a critical factor in the global water crisis (McKay, 2007). This governance problem for water management has been recognized in Australia for some time, culminating in the National Water Initiative (NWI) in 2004. The NWI, an inter-governmental agreement between the Commonwealth, states and territories, sought to create common standards in statutory water planning and to enable water trading; as well as encourage water accounting, metering, monitoring and pricing (among other things) (NWC, 2009b). Another important consideration in the NWI was the recognition in statutory water plans of the environment (see para. 37 (i) NWI for example) and Indigenous users (para. 52-54 NWI, 2004). States and territories are to account for these non consumptive uses.

Each state and territory in Australia committed to implement these reforms outlined in the NWI to water management. With its focus on property rights and market mechanisms, the NWI is considered to be the most important change in water policy

since Federation (Connell et al., 2005). While the creation of the NWI was a significant event the, NWI is a non binding legal instrument. The approach by jurisdictions to implementing NWI led reform has been uneven. This is particularly so for measures to encourage water trading (NWC 2009). In the north, Connell et al. (2009) suggest an incremental approach to reform and for the development of instruments such as water markets- this approach can encourage stakeholders to collaborate, and help avoid problems such as over-allocation and degradation of aquatic systems like that experienced in the MDB.

3. Institutional setting for water markets

Overview

Each state and territory in Australia is vested ownership and responsibility of water resources through statute. As described in section 2 of this report, the NWI encouraged a convergence in water policy and management among the states and territories, with a focus on the development of markets to encourage risk sharing and flexibility among users (NWC, 2009a). The potential to trade water exists in the three jurisdictions in northern Australia: this is supported in relevant legislation in the NT and Queensland, and in policy in Western Australia. [3] However, little to no trading has occurred across the region (see Table 1). Around 98% of total trade in water entitlements occurs in South-Eastern Australia (NWC, 2009b).

[3] *Water Act* (1992) (amended 2004) NT; the *Water Act* (2000) and Water Regulations 2002 in Queensland; and the *Rights in Water and Irrigation Act* (1914) (RIWI Act) provides the framework for water governance in the State, and an Operational Policy 5.13 provides for trade of water entitlement transactions in WA.

Table 1: Licenses and entitlements, trading and types of trade 2007-8 (NWC, 2009b)

	Volume of Licenses or Entitlements	**Volume of Trade (2008)**	**General types of trade available in plan areas**
NT	494,000 ML of licenses	0	• Temporary (annual) and • Permanent
QLD	3.6 GL of water entitlements	75, 968 ML ($57.7 M) most in southern QLD 44.5% was part of a property sale	• Permanent; • Lease and, • Seasonal water assignment (a temporary trade).
WA	2.5 GL of licenses	486 ML ($1 M) most in the south west of WA 57 % was part of a property sale	• Volumetric licenses can be traded in whole or in part to another eligible party (i.e. someone else who has access to land).

3.1 What is a water market?

A water market allows the exchange of water between willing buying and sellers. A seller may transfer whole or part of their water license or entitlement, or temporarily trade (or lease) whole or part of their allocation for the year. There has been an increasing focus by water managers on demand side strategies to deal with scarcity, and improve water use efficiency and productivity. Water markets are considered to be efficient in allocating water between consumptive users, but the effect of markets on non-consumptive users and third party impacts have been a major concern in literature (Saliba, 1987; Livingston, 1995). In commitments under the NWI, state and territory governments were to expand the use of water trading (NWI, para. 60 (iv) (b)). Trading under the NWI framework would occur within a plan which reflects social, economic and ecological considerations. Water entitlement holders would have a right to access an amount of the flow designated

for consumptive use in the plan (para 30 schedule D). Australia has been at the forefront of developing water markets to encourage efficiency and structural adjustment (Crase et al., 2004). There has been significant growth in water trading, with 1800 GL of water traded in 2008-9, at a value of $2.2 billion dollars (an increase of 95% from the previous year according to NWC, 2009 a).

Grafton and Peterson (2007) suggest that in the Australian experience there are significant gaps in understanding impacts of water trading. The authors suggest there is a common need to understand environmental flows and desired ecological outcomes, and more clarity on water pricing, transaction costs and the social impacts of water trading. The Northern Australia Land and Water Taskforce (2009) confirms the lack of data across the north to support planning, but views the implementation of NWI consistent water planning and trade as being important for managing water sustainably (NAWLT, 2009).

Northern Australia remains at the frontier of water management. There is a pressing need to consider the potential effect of water markets across the north; especially given the increased attention on the region as a food bowl or source of water for southern Australia. There are a range of ecological and customary values linked to water that could be threatened by increased water extraction for consumptive use. This work undertakes an exploratory analysis of the potential costs and benefits of water markets, with a focus on equity and environmental outcomes.

4. Costs and benefits of water trading

We take a broad assessment of costs and benefits in this report, examining ecological, social and economic outcomes, including non-market customary outcomes. This reflects the inter-disciplinary nature of water research. Drawing on scholarly literature, we first identify some of the costs and benefits associated with water markets where they occur (such as in southern Australia). The second part of this section provides an analysis of the

potential costs and benefits of water markets across northern Australia. We must emphasise the *potential* costs and benefits because it is too early in the north Australian context to identify any actual costs and benefits of trading. At the time of writing, there had been little (if any) water trading across the region. However we draw on data from two earlier reports in this study which provide empirical findings for this analysis (see Nikolakis and Grafton, 2009; and Nikolakis et al 2010).

4.1 Overview

Water is not like other commodities and water markets must be accompanied with robust institutional and regulatory arrangements. Water markets will not solve all problems nor are they suitable for every situation, but markets can provide an efficient response to changing trends in demand; and can encourage investment and provide security to users (Thobani, 1997). As pressure increases on water supplies, users demand more reliability and the margin for error in managing ecological assets heightens. Under certain perspectives, water markets are seen to overcome resource misallocation associated with 'rule' based management. Pigram (1993) suggests that users will opt for more efficient use- this self interest rather than command and control is argued to be the most "reliable way for generating efficiency" (Pigram, 1993: 1314). But water markets are prone to failure and should be underpinned by robust institutions which improve security of the resource, but at the same time considering transaction costs, which can impede markets (Livingston, 1995).

In southern Australia, water markets have supported adjustment in drought. The NWC (2010 b) identifies that in the MDB water markets have enabled the purchase of entitlements to improve environmental flow; impacts from trade include increased in-stream salinity; and where trading between users involves changing the timing and location of water use- the NWC suggests these costs are small compared to the benefit of environmental buy back. Table 2 identifies some of the environmental outcomes from water trading in the MDB. In terms of social impacts, it is difficult to discern the effects of markets from broader impacts of drought, but the NWC found that water trading has

supported structural adjustment and provided flexibility to irrigators during drought (NWC, 2010 a). The NWC identifies that agricultural productivity was sustained because of water markets in the MDB (NWC, 2010a).

Table 2**:** Impacts of trading on the environment in the MDB (information sourced from NWC, 2010 a)

Environmental impact from trade	**Description**
Overall impacts	Trading can have an effect if it results in physical changes in flows, resulting in different timing and location of use.
Water use and flows	The impacts on flow from trading have been minimal compared to that from drought and development. Water has generally flowed downstream in trade.
Key environmental assets	There is no evidence that the timing and location of flows from trading has had an effect on important sites (such as Ramsar-listed wetlands)
In-stream salinity and groundwater	Trading has increased in stream salinity. Attempts have been made to offset this through the Basin Salinity Management Strategy. There is little groundwater trading in the MDB. Surface water trade may increase groundwater recharge in some areas.
Other environmental impacts	Increased water use efficiency may reduce return flows to the environment- which in turn may improve water quality.

Jurisdictions such as the Western U.S and Chile have established water markets. Reallocation through trade has shown to support economically efficient adaptation to drought and cross sector trade between irrigation and urban users (in the Colorado Basin, see Livingston, 1995). Trade in the Western US is steadily increasing, but third party impacts (so those affected by a trade but who are not party to a trade) continues to impede the effectiveness of markets (Donohew, 2009). The outcomes from Chile's water

markets can be observed over a period of three decades, with benefits including greater security to irrigators which increased investment in high value fruit crops, increased autonomy to irrigator associations who have maintained infrastructure competently, and greater flexibility offers more options to users- but it must be noted that most trade at the time was linked to land sales because of high transaction costs (Crane, 1994). In Chile, the use of markets has not encouraged the investment in water use efficiency as expected (Crane, 1994) and there has been a transfer from small farms to larger entities (Trawick, 2003). Bauer (2004) suggests a balanced approach in assessing results from Chile, while markets have encouraged investment, there has also been speculation and equity issues with the concentration of water rights in monopoly users. Institutional arrangements in Chile tend be weak on supporting environmental and social outcomes, and are not considered to be consistent with principles of integrated water resources management (Bauer, 2004).

Markets require robust institutions to minimise impacts. Chong and Sunding (2006) outline that imperfect water markets (those not supported by appropriate institutions) can have effects such as third party impacts and increased transaction costs. This is especially where there is connectivity between groundwater and surface systems, with impacts on the environment and downstream users. The authors' state that water is not a regular commodity as quantity is only one consideration. Crase et al. (2004) view markets as compounding ecological problems by encouraging the use and activation of sleeper entitlements. This point emphasises that markets to be effective, need flexibility in trade, but at the same time require adequate institutions and regulation to protect third party users (particularly the environment and non consumptive users) with minimal transaction costs (NWC, 2009 b). Accounting for and integrating third party users remains an important challenge to water markets in Australia and abroad, as policy makers attempt to balance the need for efficient trade with protecting the environment and third party users (Donohew, 2009; NWC, 2009b; Saliba, 1987).

4.2 The potential costs and benefits of water markets across northern Australia

Markets are at a formative stage in northern Australia, with little to no trading at the time of writing. There have been studies to assess perceptions of water markets such as Straton et al. (2009). There is also our previous work on the feasibility and viability of water markets across northern Australia. Apart from this work data is generally limited as to the performance of water markets. For this report we rely on our previous research and other scholarly literature.

Our first report for this study provided an analysis of institutional arrangements for water markets in the region (see Nikolakis and Grafton 2009). Interviewees argued that establishing market frameworks was proactive. Interviewees suggested that having effective water plans and markets in place would provide flexibility and risk sharing as demand matures. This is very different to the situation in southern Australia where markets have been used to claw back entitlements in systems that are historically over-allocated. Interviewees in the study also suggested that having a cap on extractions and a price for water would create the right incentives for efficient water use (Nikolakis and Grafton, 2009).

Table 3: Irrigation areas in the TRaCK area (source: Petheram et al., 2008c)

Area	Size (ha)	Product
Katherine Douglas Daly – groundwater	2,200	Perennial horticulture, field crops (maize, peanuts, fodder)
Ord River Irrigation Area	13,000	Sugarcane, sandalwood, annual and perennial horticulture

In the second report for this study, we examined stakeholder attitudes and values (see Nikolakis et al., 2010). One hundred and twenty stakeholders from government, Indigenous, industry and recreational user groups participated in the study from across northern Australia. A key finding from this report was that Indigenous respondents saw the development of water markets as offering a potential revenue stream for the many disadvantaged communities across the region (Nikolakis et al. 2010).

Table 4: Some potential costs and benefits from water trading in northern Australia (sourced from Nikolakis et al., 2010)

Ecological	Costs • Increased salinity and water logging • Physical changes to flow caused by different timing and location of water use – may increase sediment and nutrient loads which can effect ecological assets, particularly in the dry. • Saltwater intrusion in rivers because of reduced flow • Incentive to sell water or apply it on farm- in particularly the activation of sleeper or dozer entitlements- less water kept in stream • Impact of dry season extraction on aquatic and riparian environments and groundwater dependent ecosystems Benefits • Defined ecological thresholds • Improved knowledge of resource base from planning and monitoring • Ability to purchase water for the environment to maintain a net downstream movement of water during drought

Social	Costs • Failure to recognize non consumptive uses • Structural adjustment- impact on marginal activity- this could limit diversity • Entrench inequity for Indigenous groups Benefits: • Flexibility to irrigators • Reallocation during drought can support productivity and employment
Economic	Costs • Increased homogeneity in production • Increased red tape and costs on business • Increased barriers of entry Benefits • Certainty to growers encourages investment • Reallocation supports productivity during drought • Highest and best use • More area under production because of increased water use efficiency and the ability to trade to other parts of the plan area • For some Indigenous interests there is the potential for economic opportunities through water trading or water based enterprise development

In Nikolakis et al. (2010) nearly half of respondents associated the following benefits with water markets:

i. Highest and best use
ii. Increased water use efficiency

iii. Greater flexibility to users
iv. Improved knowledge of the resource

Twenty three stakeholders identified that markets could provide certainty to horticulturists, which would encourage development in the region. This is emphasised by a respondent that:

> "*For farming you need a 10 to 15 year outlook. You need all the resources to be there, all your ducks in a row. Particularly with tree crops, you might not see a return for 7 years on some trees."*

While sixteen respondents felt that water markets could provide economic opportunities to meet Indigenous economic aspirations. A respondent articulates that:

> *"…if water goes to Indigenous people to manage environmental and cultural values and has involvement in the commercial side, it could be beneficial."*

Almost 70% of Indigenous respondents in Nikolakis et al. (2010) believed that the economic benefits of water trading would be significant for Indigenous communities.

Forty eight respondents in the study felt that water trading in the region would increase the financial cost of regulation, administration and monitoring of the system. These costs would be passed on to producers, whose operations would become marginal. A government respondent suggests that:

> *"At the present time, only a fraction of the water planning and management costs incurred by the Queensland Government are passed on to water users."*

If the costs of water management and planning were passed on to industry this would impose constraints on irrigation. An irrigator argues from the experience of water markets in southern Queensland that:

> *"Traditional irrigators it has been shown cannot afford to buy in [to water markets]. They are outcompeted by coal mines. So there is a transfer in water from low to high value uses which have higher economic returns. This has social implications."*

These social implications no doubt refer to the decline of family farms in marginal areas. This change then leads to a reduction of services (schools, hospitals and financial services) in an area and a further migration of people. The result is community decline.

The study identified concerns among twenty six respondents who felt that trading would result in environmental impacts. For instance, a respondent suggested that water trading:

> *"…goes hand in hand with increased water extraction and ecological impacts such as pollution of river systems."*

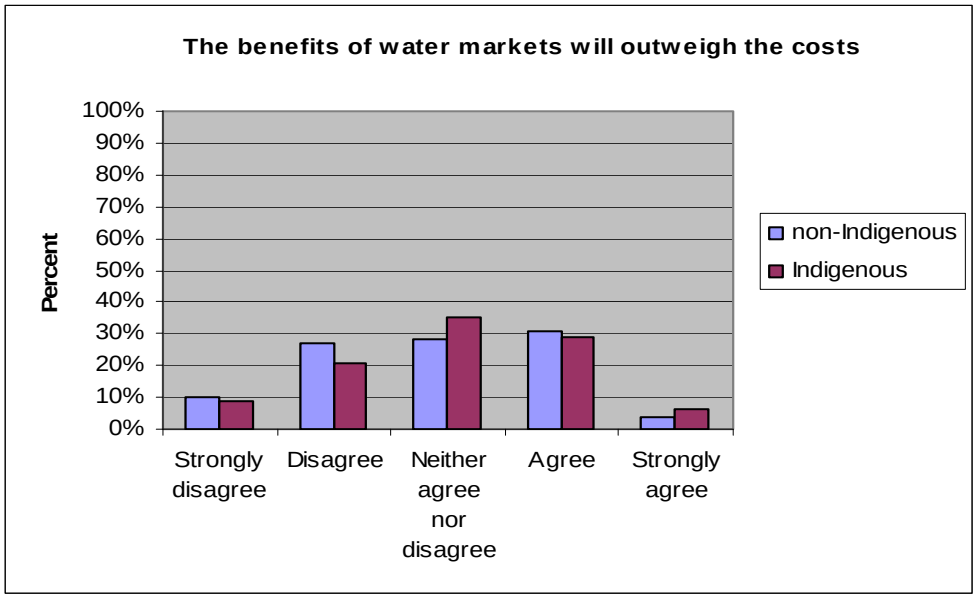
There were references made to the situation in the MDB where the integrity of the system has been threatened. These respondents tended to attribute water trading with environmental decline in the MDB, rather than seeing trading as a tool to address the consequences of over-allocation and drought.

There were concerns of a decline in water quality and community health from water trading, particularly the health of communities reliant on these water sources. There was a fear that Indigenous people would be marginalised from water resources and unable to meet their cultural obligations.

Overall there were mixed responses as to whether the benefits of water trading would outweigh the costs in northern Australia. Around one third of respondents neither agreed

nor disagreed; a third of respondents agreed and another third disagreed. This suggests there remains uncertainty as to the effect of water markets. Without adequate data or experience such a view is well founded.

Figure 2: Respondents from Nikolakis et al. (2010) who agreed that the benefits of trading would be higher than the costs



Those respondents who agreed that the benefits of water markets would outweigh the costs focused on the improved efficiency and the re-allocation of water to highest and best use. Imposing a price on water it is argued would change user behaviour. This 'economic argument' is explained by a respondent:

> *"The economic arguments for allocating resources through market like mechanisms are very strong. The key advantage include[s] an increase in net returns (surpluses) to society, better resources, and a transparent signalling (price) mechanism. The incentives that water markets create include better exit signals for less productive performers, as well as more flexible opportunities for new developments…Water trading enables users to make considered decisions about water use, and…sees the value of their water as a secure asset."*

A respondent sums up the view that having a market framework in place may not be urgent but is proactive, the respondent articulates:

> *"At this point in time the level of water use and competition for water is relatively low, thus the cost of market establishment appears greater than the perceived benefit. However, the potential for significant accelerated…water use in some areas is recognised, largely depending on significant developments. Careful monitoring of* [the] *level of use should provide a useful signal on timing of market establishment."*

Such a view suggests an incremental approach to introducing water trading, akin to the approach in Western Australia of categorising systems (from C1 to C4 which is fully allocated). The underlying message is that having a market framework in place is prudent and can take effect as demand for water matures.

4.3 Efficiency

Efficiency is viewed as a defining characteristic of an effective water market. Economic efficiency arises when all the gains from trade have been exhausted and the costs imposed on others from water use have been fully accounted for in the decision making of water users. Competitive water markets allow water to be transferred from lower to higher value consumptive uses thereby increases the aggregate value of what is produced from the use of water. Thus, restrictions on trade reduce economic efficiency. By ensuring that water has a price over and above the cost of delivery, water markets can also promote water-use efficiency (Qureshi et al., 2010). This is because if a farmer can undertake an investment or practice that can reduce water use at a cost less than the price of water in a water market, this will be done because it will increase the farmer's net returns. Thus, the higher the price of water in a water market, the greater the number of water use efficiency investments and practices will be undertaken.

Any assessment of efficiency of water markets, however, requires more than simply a comparison of quantified private costs and benefits. This is because, typically, water markets have been implemented only for consumptive uses of water and the effects of water use on downstream users and the environment have typically been ignored or not fully considered. In other words, as articulated by Saliba (1987):

> "If all values associated with water are encompassed in property rights, then market prices will reflect social values, and rights holders will be faced with the full opportunity of their water use and transfer decisions. Efficiency requires that external effects of a transfer be internalised into market decision making" (1116).

Jackson (2005) describes that Indigenous values to water tend to be distinct from non Indigenous values, as well they are intangible and difficult to quantify. This may offer challenges to integrate these customary values into the water property right (and for this to be reflected in the price of water). Therefore, any assessment of efficiency in the north must seek to integrate values, like customary or ecological values, which are difficult to quantify, to provide an accurate assessment.

4.4 Effectiveness

Effectiveness relates to the ability of water markets to achieve their desired objectives. The NWI led reforms were focused on optimising economic, social and ecological outcomes, with markets supporting the achievement of objectives set out in water plans (Connell et al., 2005). Across the north there will be a diverse set of objectives for markets, tailored to local economic, social and ecological considerations. Measuring whether markets are achieving the desired objectives is difficult in the north Australian context- there is little data for which to measure or evaluate the performance of markets. Markets are at a formative stage, there have been no trades (none unattached to a sale of property) and it is premature to make an assessment of the effectiveness of markets. However, drawing on experience from literature on water markets in southern Australia

and abroad, we assess the potential for markets to achieve social, economic and ecological outcomes.

It is clear that the effectiveness of markets will be constrained (or at least influenced) by structural factors, location, demographic and economic trends. They will not necessarily be useful across all of the north. But in our previous work, respondents and interviewees emphasised the importance of having functioning institutional arrangements in place to avoid the problem of over-allocation (Nikolakis and Grafton, 2009; Nikolakis et al., 2010). Markets can integrate environmental values for water and rules to protect cultural values (Nikolakis and Grafton, 2009). Regulation can underpin markets by specifying limits, such as the location of trade and for encouraging social and economic stability (Pigram, 1993).This issue of over-allocation has appeared in aquifer extraction in the NT, with efforts by government to cap use and to facilitate trading in the Tindall aquifer allocation plan. The plan emphasises the need for adaptive management as groundwater trading has its unique challenges, and the ecological effects of trading intra-aquifer are not well understood (Straton et al., 2009).

While the ambition of the NWI is to manage economic, social and ecological outcomes, across the north, a fourth consideration should be added - customary outcomes. Customary considerations offer great uncertainty to water planners and managers: primarily these values are intangible and distinct, so are difficult to quantify for policy (Jackson, 2005). Customary values are at heightened risk from the operation of markets, for there is little data on groundwater and surface water interaction, or understanding of the effect of extraction on groundwater dependent ecosystems (which are highly important to Indigenous people across the region for customary purposes: see Cooper and Jackson, 2008; Touissant et al., 2005). Efforts are being made in the Northern Territory at present to understand a ‘cultural flow’ in water plans for Indigenous groups in the plan area; as well as understand the amount of water that will support Indigenous economic outcomes. This last point is very important to Indigenous people across the region - water is anticipated by Indigenous people as providing one way to address Indigenous socio-economic disadvantage (see Nikolakis et al., 2010).

In other jurisdictions markets have supported the achievement of economic, social and environmental outcomes. For example, most recently the NWC (2010a) in a 10 year study on social impacts of trading in the Murray Darling Basin (MDB) found that markets in the MDB have optimised economic, social and environmental values to water. Water trading supported productivity through reallocation of water during drought-economic modelling identifies a $220 million increase in Australia's GDP through reallocations of agricultural water in 2008-9. Inter-regional trading was particularly important during this period. However, literature emphasises the importance of robust institutional arrangements to support effective water markets (Easter, 2004).

4.5 Equity

Equity prescribes a principle of fairness in the allocation and distribution of resources. There has been a tendency to focus on efficiency rather than equity in assessing the performance of water markets. The principle of equity is identified as an important element of water management (Syme et al., 1999) and a key concern for water markets (Saliba, 1987). Ward and Pulido-Velazquez (2008) assert that achieving equity is the biggest challenge confronting water policy makers. Focusing on efficiency according to Ingram et al. (2008) fails to address and integrate values that are not easily quantified (such as spiritual values). Such issues are particularly important for Indigenous Australians who are said to have more non use values to water than non Indigenous Australians (Venn and Quiggin, 2007).

It is important to emphasise that issues of equity are significant for all. There is a well-founded concern that equitable access to water is becoming increasingly difficult on a global scale. Gleick (1996, 1998) argues that access to water should be a basic human right supported by legislation based on his review of international statements, agreements and State practice. Over the last decade water privatization, especially in the developing world, has spurred alter-globalisation and anti-privatization campaigns centred on

establishing access to water as a human right (Bakker, 2007). It is only recently, on September 30, 2010, that the United Nations officially declared access to water as a legally enforceable right (OHCHR, 2010). While their declaration refers primarily to the basic needs required to sustain life, the implications of this declaration sets an important global precedent for water equity. As Indigenous Australians across northern Australia are subject to socio-economic disadvantage, the issue of equitable access to water is particularly acute.

The consideration of equity becomes more important as property regimes develop for water. Before the creation of a market the benefits of water are distributed among consumptive and non consumptive users. Shifting towards a system of tradable rights can require trade-offs between consumptive users, and between consumptive users and non consumptive users. Those users who are allocated entitlements equal or greater to the amount they previously had access to are considered winners. While those assigned less water or no water at all are considered to have lost- for these users must purchase water to get access. For Indigenous people this is an issue of acute importance, for as Taylor et al (2010) argue, Indigenous groups in the northern tropical rivers region are the 'have nots' in the socio-economic system. If they do not have access to water there will be considerable consequences for their livelihoods. This loss is inter-generational. The situation in southern Australia provides a valuable lesson: Indigenous groups in the Murray Darling Basin have not been provided access to water, and the price of water has increased to the point where there are significant barriers to entry into the market (Jackson et al., 2009).

During this period of market based reform, Jackson and Altman (2009) identify an acute need to ensure that water allocation is equitable. The authors suggest further analysis is required on the impacts of excluding Indigenous people from water markets. The NWI (2004) explicitly recognised Indigenous access to water. The NWI states that water plans wherever possible should make provision for Indigenous social, spiritual and customary objectives, and recognise native title rights (see paragraphs 52 to 54 NWI 2004). While this recognition is important, Jackson and Morrison (2007) state that there was little

Indigenous involvement in the creation of the NWI. Another critique is that while there may be expectations that the NWI would support improved Indigenous access to water, there is no legal grounding for this to occur. The movement to greater Indigenous access to water has been slow acting and has not met the expectations set out in reform (NWC 2009). Durette argues that it is "…unlikely that new water policies, especially those relying on market mechanisms, will result in an equitable allocation that reflects the interests and values of Indigenous Australians in water" (Durette 2008: viii). Ignoring Indigenous interests reinforces inequities and is inconsistent with broader policies to 'Close the Gap' (Nikolakis, 2011).

In some cases Indigenous social and economic interests to water have been recognised. The *Cape York Peninsula Heritage Act* (2005) provides for an Indigenous reserve for social and economic purposes. As well, in the Northern Territory an Indigenous reserve for economic purposes was earmarked in the Tindall Water Allocation Plan. This approach is supported by Craig (2007) who believes water markets should have a restorative element—such an approach can support ideals of social justice and equity. Water for economic purposes is an important objective for Indigenous interests across the north, and groups have been publicly advocating for the realisation of this objective (see the NAIEWFF, the Mary River Statement, 2009). Taylor et al (2010) argue that addressing Indigenous socio-economic disadvantage will require more than rolling out a northern development paradigm- but requires policy makers to support social, ecological and economic factors that are important to Indigenous people's wellbeing in the region. Water is obviously central to this.

Relying on markets to address equity issues can be fraught with difficulties. Bjornlund and McKay (2002) argue that water markets are prone to failure and require adequate regulation and robust institutions to influence behaviour. Third party impacts and social impacts from the development of markets have received some coverage in scholarly literature. However, much of the analysis has been conducted by government authorities, particularly in the context of the Murray Darling Basin. The National Water Commission (NWC 2010 a) examined the social impacts of water trading. The study found that social

impacts cannot be attributed to water trading alone, any social impacts in rural communities must be considered in light of broader economic, technological and social trends. A key finding is that trading is providing a mechanism to optimise economic, social and ecological values to water, and that markets have provided flexibility to irrigators which has been critical in drought (NWC, 2010 a). Such work reveals impacts from markets that are both temporal and spatial, which imposes conditions on assessments.

In northern Australia, markets are at a formative stage (two decades behind southern Australia) but there has been some work into assessing equity issues. Straton et al (2009) in a study of irrigators in the Northern Territory found there were concerns around the monopolisation of water resources in transition to markets, with a subsequent decline in communities. Irrigators in the study wanted constraints on the speculation of water. Irrigators viewed markets with suspicion and did not believe markets could help achieve environmental outcomes.

Our earlier work (Nikolakis et al., 2010) identifies a number of equity related issues to the development of water markets. These are:

- Nearly half (48%) of all respondents felt that current water management arrangements were not equitable. We define equitable as all parties being treated equally and fairly under the water management regime. Indigenous respondents were more likely to disagree than non indigenous respondents that water management is equitable in their region (67% compared to 40%).
- Another question put to respondents from government and Indigenous groups is whether the interests of Indigenous communities in the region are reflected in water management policies. Seventy three percent of Indigenous respondents disagreed (of these 29% strongly disagreed).

- Most respondents felt that water policy and consultation mechanisms failed to involve Indigenous people adequately, this was particularly so with Indigenous respondents.
- It is clear from our findings that Indigenous respondents thought the status quo for water management was not equitable.
- Just over half of Indigenous respondents thought water markets would be useful in their region
- There is support for Indigenous involvement in water markets among all stakeholders who responded
- Over half of all respondents felt that the benefits of trading would be significant for Indigenous communities. Among Indigenous respondents over two thirds felt that the benefits of water trading would be significant.
- Indigenous groups had aspirations to use water for development. Eighty seven per cent of Indigenous respondents agreed that their community will develop a water based enterprise (such as a market garden or horticulture enterprise).

Our findings highlight from our earlier work that almost half of all respondents thought the status quo to be inequitable. This was even more so among Indigenous groups who overwhelmingly believed water management to not be equitable. Water markets, if they included Indigenous interests were seen as having the potential to provide substantial benefits to communities and encourage enterprise development.

4.6 Administrative and transaction costs

Transactions costs are the costs of enforcing and exchanging property rights. These costs would include, but not limited to, title searches, trade approvals, negotiating and enforcing contracts, as well as time, phone calls and travel required to complete a

transaction (Livingston, 1995). Stavins (1995) identifies transactions costs in a market as the difference between the buying and selling price of the commodity. Some transaction costs are necessary to promote certain market behaviour and prevent market failures, including trade approval processes, but the objective should be to minimise transaction costs (ACCC, 2008). Low transactions costs are seen as a precondition for an effective market Grafton et al. 2009). It is suggested that progress on NWI market-led reform is slower because of "transaction costs inhibiting the implementation of innovation" (Martin et al., 2008: iv).

The NWI is a significant reform and its focus on markets is innovative. But a criticism levelled at the NWI is that it is complex and does not provide sufficient guidance on how trade should proceed. Connell et al. (2005) argue that the complexity of the NWI fosters uncertainty and renders any institutional reforms open to "litigation by aggrieved third parties who will have enhanced standing under the NWI" (Connell et al., 2005: 94). Without a clear process for dispute resolution this could impose constraints on trading. The authors also argue that the NWI does not appropriately support coordination and compatibility in trading regimes between the states, this limits the potential for increased inter-state trading (this point is identified by the fact inter-state trade has been restricted as has trading water outside of districts NWC 2009). These four institutional impediments identified by (Martin et al., 2008) are said to generate high transaction cots for water markets:

(1) complexity in institutional and regulatory framework
(2) political and administrative instruments
(3) Processes in obtaining licenses or amendments to planning and administrative arrangements
(4) Conflict and lack of effective coordinating mechanisms

McCann and Easter (2004) provide a typology of transaction costs as they relate to water markets, as well as the chief determinants of higher transaction costs:

- Research and information: uncertainty around resource and third party impacts

- Enactment or litigation (initial transaction): third party impacts, lack of clear right, weak rule of law and low social capital
- Design and implementation: cross sector transfers, poor infrastructure, complex legal arrangements
- Support and administration
- Contracting (second order transactions): weak rule of law, low social capital, lack of storage capacity, no water registry
- Monitoring and detection: low social capital, poor monitoring equipment, distance, disagreement on water rights
- Prosecution/enforcement: poor conflict resolution, weak governance, hydrological uncertainty.

There are ways to reduce transaction costs. An accurate water entitlement register can provide a record of transfers and ownership, supporting property rights and providing information to buyers and sellers (ACCC, 2008). A National Water Marketing System (NWMS) sought to create standardised registers in each jurisdiction that will provide inter-operability between registers in different jurisdictions. Each jurisdiction in northern Australia has a functioning register for entitlements and is party to the NWMS.

Markets may cope with predictable and proportionate costs and delays. Allocations or short term trades may be impacted most by high transaction costs. In each jurisdiction across northern Australia, trades are to be approved by the relevant Department official (such as the Water Controller in the NT) or the Ord Irrigation Cooperative. Given the small size of markets this requirement may not impose significant transaction costs. But the small scale of markets means administrative costs may be proportionally higher. At this stage there have been no trades to approve so there is little practical insight into this issue.

In northern Australia, Altman with Branchut (2008) argue that water trading regimes should recognise and accommodate Indigenous interests. They argue that there could be challenges to transfers that interfere with Indigenous rights, particularly under the Native

Title Act where Indigenous rights and interests to water have not received a great deal of attention. The result of claims and litigation could mean an increase in transaction costs in water markets. Such a situation can be avoided by recognising and accommodating Indigenous interests in the consumptive and non consumptive pool (such as through the recognition of cultural water).

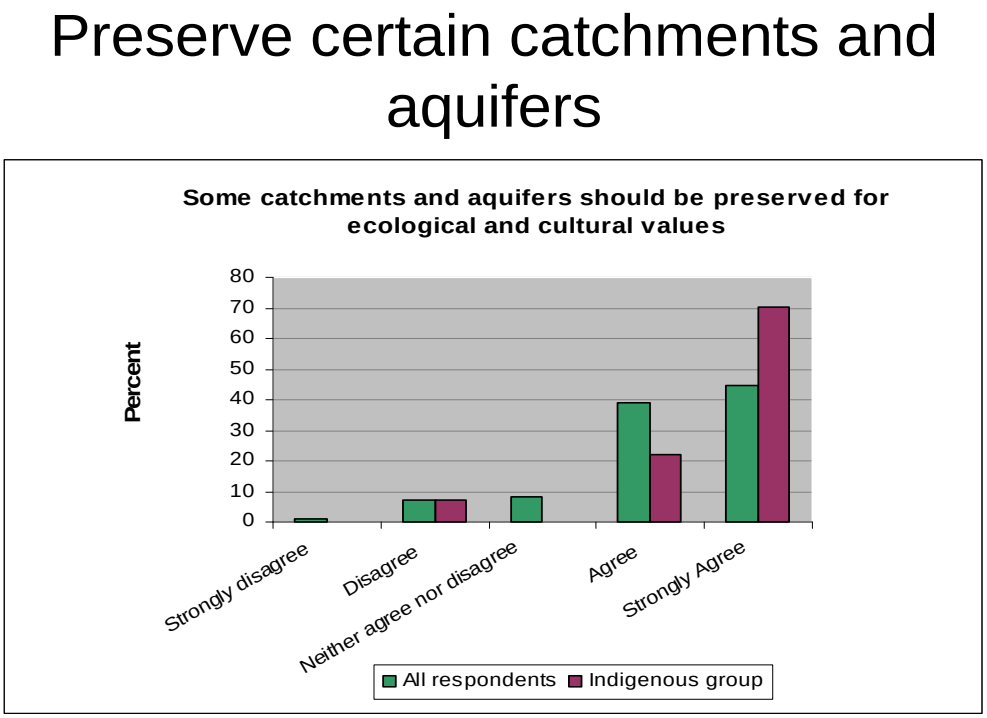
4.7 Potential environmental consequences of water markets across the north

Institutions should be responsible for managing market failure, such as externalities on the environment from water trading. Management efforts to offset salinity levels associated with water trading in southern Australia have proven to be effective (NWC 2010b). Managing for impacts from trade on north Australia's aquatic systems is important. Public awareness of the value of tropical rivers is increasing: there is an emerging recognition in society that healthy free flowing rivers are vital to "human wellbeing and cultural identity" (Jackson et al, 2008: 275). This point was confirmed in earlier work where there was overwhelming support among all respondents (81% agreeing) for the preservation of certain catchments and aquifers for their unique values (Nikolakis et al., 2010) (see Figure 3). The rivers and wetlands across northern Australia have international recognition for their unique cultural and ecological values. McJannet et al (2009) identify that there are 87 important wetlands in the region, with 8 RAMSAR listed sites in the Timor Sea drainage division alone.

Across the region there is little understanding on ground and surface water connection, and the link between environmental flows and ecological assets (and groundwater dependent ecosystems) also requires much deeper exploration. McJannet et al (2009) argue that their work across the north indicates that even minor changes in the flow regime will affect water quality, sediment and nutrient loads in systems, with consequences for environmental assets. Brodie and Mitchell (2005) highlight that extreme nutrient loads and sediments due to agriculture in Australia's tropical rivers

(where flow is seasonal and episodic) has caused some rivers to become eutrophic. The authors suggest improved management to avoid this. In the regulated Ord Irrigation district the dry season flows are elevated to dilute and disperse nutrients from irrigation activity (Doupe and Pettit 2002). Increased pressure for irrigation development and climate change place a level of urgency on research to understand flow thresholds and connectivity, and to test these against a variety of scenarios (Hamilton and Gehrke 2005).

Figure 3: Respondents from Nikolakis et al (2010) who agreed that certain catchments and aquifers should be preserved



Davidson (1969) describes that development in northern Australia has been hindered by poor soils, unreliable water supplies and remoteness from markets. However, Hart (2004) predicts that any future agricultural expansion in Australia must be in northern Australia because of water and land availability (as opposed to the scarcity problem in southern Australia). The storage and consumptive use of water and the pursuit of economic efficiency and maximising economic returns in irrigated agriculture is often at odds with

the ecological integrity of riverine systems (Tisdell, 2010). Hart (2004) proposes a measured approach to increased irrigation in the north using best available science (especially scenario planning) and decisions based on precautionary principles. Such an approach can mitigate ecological risk from inappropriate irrigation practices, especially for aquatic ecosystems. Limitations on trade to catchments or aquifers (or plan areas which is the case in each jurisdiction) can help reduce the effect of moving water around and jurisdictions have imposed restrictions on trade, such as in the NT there are constraints on upstream trade.

Petheram et al (2008b) assessed 99 unregulated rivers across northern Australia for their potential for development. While streamflow is comparatively high, their study recorded significant annual variability and drought magnitude relative to other systems around the world. This means irrigation in the north would require storages (where groundwater is not sufficient). The potential for storages is highly constrained, and on farm storages are hindered by environmental flow regulations that limit extraction to certain times of the year. Despite northern Australia producing 64% of the nation's runoff, it can generate only 45% of Australia's potentially exploitable yield- because of high evapo-transpiration, restrictions on water storage and episodic stream flow (Petheram et al, 2010). In contrast to Hart (2004), Petheram et al (2010) suggest maintaining the focus on southern Australia to sustain Australia's irrigation potential.

Petheram et al (2008b) point out that because of high evaporation in the north, irrigation during the dry is essential. High evaporation rates mean perennial pasture requires up to 80% more water than in the MDB. Petheram et al (2008b) discern that 40% of Australia's potentially exploitable water is located in northern Australia, and that if all of this was used up to 25% of Australia's irrigation area could theoretically be in northern Australia. However, the authors impose social, customary and ecological caveats, which would reduce this area considerably. There is a reliance in much of northern Australia on groundwater, but aquifers are not well understood (recharge, discharge and lateral groundwater flow) (Petheram et al., 2008c). The impacts of extraction could potentially have significant downstream consequences on groundwater dependent ecosystems and

Indigenous communities (Straton et al, 2009). Another key issue in the north is that the mining and resources sector, which is a significant part of the economy (some $9.1 billion), is not subject to water licenses and not counted within caps in plans. This makes accounting for water difficult and increases the complexity of planning (NAWLT, 2009).

In parts of tropical Queensland, salinity has been a problem associated with irrigation which requires appropriate regulation to manage (see Lower Burderkin in Petheram et al., 2008a). The interaction of aquatic species such as fish with increased extraction is of utmost importance to Indigenous and non Indigenous Australians (with commercial fishing worth around $160 million per annum). Floods are vital to productivity of marine species such as prawns and crabs, and unimpeded streamflow is vital for fish migration and breeding (NAWLT, 2009). There has been modeling to understand the effect of increased extraction on systems in the north. Chan et al (in press) examined extraction scenarios on dry season flows and the consequences for important native fish species in the Daly River, in the NT. They found that if all entitlements were fully utilized in the Daly during the dry season that Barramundi and Sooty Grunter numbers would be reduced to unacceptable levels. These fish species are important to Indigenous and recreational fishers, and the Barramundi is an important commercial fishery. The effect on ecosystems and livelihoods could be significant if such conditions are realized.

Approaches to deciding the amount of water for the environment

The NWI sets out an approach to managing water which balances economic, social and ecological interests (see paragraph 2, NWI, 2004). A statutory water plan is recommend to allocate water between economic, social and ecological interests, and the NWI provides that trade-offs between these interests should be decided by best available science, socio-economic analysis and community input (see para. 36, NWI, 2004). Water plans are intended to secure ecological outcomes by identifying ecological assets and the water management arrangements to support these assets (see para. 37 NWI, 2004). Tomlinson and Davis (2010) suggest that despite national reforms set out in the NWI to

achieve environmental outcomes in water planning, progress has been slow to date by states and territories and aquatic ecosystems remain under threat.

Water plans under the NWI are to be adaptive (par. 25, NWI, 2004) and recognize connectivity between surface and groundwater (par. 23 (x) NWI, 2004). The ambition of the NWI is to achieve sustainable extraction. But identifying a sustainable yield is complex. There are data issues around how much water is available at both temporal and spatial scales. Particularly across northern Australia where data on stream flow or aquifer recharge is often non existent or scant at best (NAWLT, 2009). Then deciding tradeoffs between consumptive and non consumptive uses represents significant challenges, where many non consumptive uses are not well understood (such as ecological thresholds and water for spiritual purposes).

Table 5: Examining environmental regulations related to trade in the region (drawn from NWC 2010b)

Jurisdiction	Approach to environmental water
NT	Generic approach of 80-95% of water resources allocated to the environment 80-20 rule is in effect in groundwater and surface water systems. 80% of annual recharge and stream flow must be left for the environment.
QLD	Section 46 (4b) of the Water Act 2000 (QLD) sets out environmental flow targets (thresholds met before allocations are made) Water Resource Plans sets out ecological and social objectives monitored and revisited every 10 years in surface flow areas. In Queensland the environmental objectives for groundwater have not been decided, while for surface flow an independent scientific panel determines the amount of water for the environment.
WA	Ecological water requirements are set out in Statewide Policy No. 5 Environmental Water Provisions Policy for Western Australia. The NWC (2010) identifies that groundwater scientific assessment is based on the size of aquifer, connectivity and ecological values; while determining environmental water requirements for surface water there are three methods used: 1. Flow events method: applies ecological values, hydrologic analysis and hydraulic modelling. 2. Building block approach: identify a flow regime that supports a healthy system 3. Wetted perimeter method: relationship between discharge and wetter perimeter (perimeter of the cross sectional area that is wet)

4.8 Political feasibility and likely adoption rates

The political feasibility of water markets has been explored in our earlier work (see Nikolakis and Grafton 2009; Nikolakis et al., 2010). In our second report, we found that half of respondents in our study (n=120) agreed that water markets would be useful in their region. Some 55% of Indigenous respondents agreed that water markets would be useful. This suggests some acceptance of markets among respondents. In the same study, this support for markets was qualified in open ended responses, with forty seven respondents (of 120) suggesting that community opposition is the major obstacle to the feasibility and viability of water markets (Nikolakis et al., 2010). There were concerns around water being privatised and monopolised, as one respondent elaborates:

> *"The general community is fundamentally opposed to water markets as they view the resource as a community resource to be shared and not one which should be commodified, bought and sold by those with access and the means to do so."*

These concerns were also identified in work by Straton et al (2009) in Katherine (NT) where horticulturists had negative perceptions of water markets. There were concerns that water would be monopolised by dominant interests and speculated with. As well, horticulturists were concerned about the applicability of a system from southern Australia to a north Australian context. At the same time the horticulturists were in favour of more secure entitlements, more efficient administrative processes and a better scientific understanding of water resources which could inform planning. This suggests that there are elements of water markets that may be acceptable to horticulturists (such as a secure property right in the context of a water plan informed by best available science and consultation). The stigma of markets appears to be an issue that stirs concern.

In our second report it was raised by respondents that community opposition is linked to a lack of awareness. Some respondents offered that government would need to address

this with education and awareness programs to build broader support for water markets. Those respondents that showed support for water markets tended to be older respondents, with a higher education; and these respondents considered themselves to have a high level of understanding of water management. Indigenous respondents were also more likely to support water markets. However, while over half of all respondents agreed that water should be a tradable commodity, only 34% of Indigenous respondents agreed that water should be a tradable commodity. Indigenous respondents were also more likely to disagree that land and water title should not be separated (Nikolakis et al., 2010). This reflects holistic Indigenous world views of water as being inseparable from land (Jackson, 2005). The support for markets reflects an emergence of Indigenous economic aspirations which as Jackson and Morrison (2007) describe sit side by side customary aspirations.

These findings suggest that in-principle there is a small consensus in support of water markets. But this agreement is couched in values such as environmental protection and equity. The work highlights the growing importance of economic development to Indigenous people in the region to address Indigenous disadvantage. Water is seen as one opportunity to support economic outcomes, but there are caveats to how this development is to occur- with opposition to separating land and water title, treating water as a commodity.

4.9 Social justice issues relating to Indigenous (non-market) livelihoods

The expansion of water trading is likely to have implications for Indigenous livelihoods which are often focused on aquatic resources across the north. The experience for Indigenous people with irrigation in northern Australia has not always been constructive. The Ord Irrigation scheme in northern Australia developed in the 1950's had a significant effect on the Miriwung Gajerrong peoples who are displaced by the dam from their homelands (Barber and Rumley, 2003). Indigenous values to water are diverse across the

north, with water integral for customary, spiritual, social, economic and recreational aspirations. Water is also central to Indigenous mythology and Indigenous worldviews conceive of water, land, sea and all living creatures as one living entity (Armstrong, 2008; Toussaint et al., 2005). Indigenous values are subjective and intangible, distinct from western perspectives (Jackson, 2005). The rivers and wetlands across the north have significant amenity values to local people, and the cultural values attached are highly valued even by urban Australians (Zander et al., 2010).

In response to a potential increase in agricultural expansion in northern Australia, Indigenous groups across northern Australia came together and prepared the Mary River Statement. This statement calls for a collaborative approach between Indigenous peoples in northern Australia and Governments to develop "[an Indigenous] water entitlement and allocation… to satisfy our (i) social and cultural (ii) ecological; and (iii) economic needs" (NAIEWFF, 2009). If water is increasingly treated as an economic good to be bought and sold there is the potential for impacts on Indigenous livelihoods. Our previous work highlighted that water which would have previously been left in the environment may likely be used if the water has a price, as incentive emerges to use or sell water (Nikolakis et al., 2010). Sleeper entitlements or licenses may be activated, which means more water being applied on farm, with less left in rivers or aquifers. The potential customary impacts are highly interdependent with environmental consequences given the reliance of the customary economy on healthy ecosystems. As well, cultural sites like *jilas* or springs may be affected by more extraction, with consequences on people's stories and cultural obligations (the importance of these cultural sites are discussed in Cooper and Jackson 2008; and Toussaint et al. 2005).

There are fears that as markets develop, Indigenous people will be alienated from water resources (Armstrong, 2008). Altman (2004) argues that Indigenous customary values must be recognised and integrated into water markets. If not, the author suggests that legal challenges may impose significant transaction costs on water markets. Some aspects of reform go directly against Indigenous world views. The separation of land and water title for example runs counter to the holistic perspective of Indigenous Australians

(Altman with Branchut, 2008). McLean (2007) focuses on approaches which incorporate principles of justice in water management. The author suggests that a cultural flow which includes water for customary, domestic and economic purposes could remedy past injustices and support equitable outcomes. A cultural flow is a concept that finds its origin in southern Australia, and highlights that Indigenous customary aspirations related to water are distinct from the environment. It also highlights that management of water is an objective for Indigenous Australians, not only to protect culture, ecological and hydrological integrity, but also to deliver economic outcomes.

5. Alternate non-market approaches to meeting north Australia's water allocation needs

This section explores whether there may be alternatives to a market based approach to water allocation in northern Australia. Markets are at one extreme of decentralized control while 'command and control' approaches are at the other. Command and control is characterised by centralised decision making. Markets are characterised as being best suited to allocating scarce water resources; allowing individuals to adjust quickly to changing water availability (Grafton et al., 2009). While the pre-conditions for a water market may not exist across much of the north (i.e. scarcity and sufficient demand), a market may work in combination to support other approaches to manage resources sustainably. Alternatives which could work in combination with markets include nested governance, as well as a collaborative and stakeholder focused approach. Grafton et al. (2009) reflect that holistic approaches to water resources create institutions that reflect diversity and local conditions, and the optimal blend of policy instruments is dependent on local conditions and objectives for the specific area.

Despite a focus on markets in the NWI, there are limitations in relying on markets to govern resource allocation. Bell and Quiggin (2008) canvass the argument that market based instruments are limited by transactions costs, and uncertainty, and that pricing and trading may not effectively support environmental objectives (and may even encourage

increased water use through the activation of dormant entitlements). The authors suggest increased public involvement and meta-governance, where markets are treated as an "active public-private partnership" (Bell and Quggin, 2008: 726). This meta-governance model would see the state as central to setting objectives, managing risk, providing information and supporting governance arrangements- effectively managing the governance of markets as opposed to devolving control to market based instruments. This view sees a supporting role for government to manage the externalities from market failure.

Effective institutions to managing water limit the costs of managing the resource; makes decisions aligned with social and political values; the institutions decisions are viewed as legitimate on collective decisions; they manage the resource sustainably for future generations; and they create stability to encourage long term private sector investment (Reeve, 2003). Agarwal (2002) proposes a management framework for common pool resources (building on various institutional frameworks). The framework includes: institutional arrangements with local rules, enforcement and monitoring; sustainable management, where extraction is linked to recharge (in the case of groundwater); and the external environment, where the role of forces such as the state, technology and markets should be carefully managed, a supportive approach to local users producing conservation outcomes and a nested approach to governance.

Nested approaches to governance recognise the interdependencies between different water users, including both consumptive and non consumptive users in decision making. A nested approach establishes more formal arrangements between these stakeholder groups to make binding rules about use of the resource, monitoring compliance and enforcing rules (Marshall, 2008; Ostrom 1990). Nested approaches are polycentric, and efforts between different interests are coordinated in partnership with government (Marshall, 2008). In a study with irrigator in Katherine in the NT, Straton et al (2009) found that informal norms and values (i.e. social connections) have an important effect on market institutions, particularly for common pool resources like 'groundwater'. The authors call for increased participation of communities in water resource management

and planning as they found norms and values provide important checks and balances on water users. Such an approach can augment regulation, and enforcement and compliance procedures. It is argued that such a participatory approach improves the information available to users which can help minimise information asymmetry. Information asymmetry provides a barrier to efficient trading and increases transaction costs (Straton et al., 2009). There are many benefits to these cooperative or nested approaches, but there is also the potential for high transactions costs and accountability issues remain - there is the potential for certain interests to dominate (Huitema et al., 2009). It is important to get governance right in these models, and if consensus is required then there may be delays or inaction- so dispute resolution mechanisms are important. It would be important to ensure capacity building efforts encourage Indigenous participation in collaborative or nested approaches.

An approach to consider in northern Australia is a local and stakeholder governance engagement approach. The trend in water management is for a more collaborative and stakeholder focused approach, given the potential for political controversy and litigation associated with water resources policy (Loux, 2011). In New Zealand the Canterbury region has pursued a collaborative approach which encourages robust public engagement with a broad cross section of stakeholders, collaboration is genuine (with equity and fairness at its core) and consensus is sought in deciding water allocation and management (Memon and Weber, 2008). Such an approach seeks to encourage community ownership in resource decisions and to support compliance, particularly on issues such as water quality and efficiency.[4] The authors identify seven principles to successful collaboration by providing participants with a genuine stake in outcomes (sourced from Memon and Weber, 2008):

- Inclusiveness: involving all stakeholders increases legitimacy, enhances problem solving and supports policy implementation.
- Formal binding collective choice rules with a purpose: promoting fairness, equity and collective gains. Decisions developed collaboratively should be binding and -

[4] Loux (2011) identifies collaboration as a structured approach to meeting water resource challenges, and developing policies and plans.

with all participants having a veto power. This encourages collaboration and stakeholder 'buy in'.

- Ongoing or repeat games: the collaborative is rooted in an ongoing process, so it is helpful for stakeholders to be ongoing entities who interact regularly with other stakeholder and have a vested interest in long term outcomes.
- Participant norms: the collaborations are aligned with norms and these norms are enforced when there is a breach of compliance (norms include integrity and honesty).
- The Leadership Element: collaborative capacity builders. A distinctive style of leadership is necessary for successful collaborative governance. The approach tends to be persuasive and inclusive, and is attentive to the needs of all stakeholders.
- Credible commitment: involves a consistent and genuine commitment to the process over the long term. Such a commitment builds trust and legitimacy.
- Technical expertise and beyond: Integrating and applying a broad knowledge base: local and multi-disciplinary knowledge, as well as technical expertise combine to be important to collaborative processes. Integrating and distributing this knowledge among stakeholders is a useful function of collaborations.

Learning from the efforts in Canterbury there are barriers to the effectiveness of a collaborative approach to water management and allocation (drawn from Memon and Weber, 2008). First there may be little incentive for stakeholders to cooperate (some stakeholders may not identify water as scarce); second the efficacy of such an approach is dependent on trust and social capital; stakeholders do not have scientific capacity to participate as 'equal' partners to a collaborative approach; collaborative approaches are highly dependent on leadership, and such qualities are uncommon; and there is enormous uncertainty and complexity around Maori customary water rights (Memon and Weber, 2008). How such uncertainty affects collaborations in New Zealand works in two ways: first non Indigenous stakeholders are reluctant to engage with Maori because of unresolved rights and title; and second the uncertainty makes water resources planning and management complex (Memon and Weber, 2008). This latter issue, around

customary water rights, remains a key issue across northern Australia (see Altman with Branchut, 2008 for further discussion). But it is identified as important to resolve the issue of Indigenous rights and title to water through recognition of these rights and interests- and engaging Indigenous groups in collaborative processes is important for 'inclusivity'.

For Indigenous groups, ownership of resources like water is often viewed communally. Integrating this worldview with individual property rights regimes can be complex and lead to inequities (see Trawick, 2003). Trawick (2003) proposes in the Andes that approaches to water allocations should reflect community values and interests, in this case he suggests a communal system of ownership that reflects traditions and self management- emphasising that approaches should be local in nature and affirmed by the people whose livelihood is at stake. Trawick (2003) confirms the work of Ostrom (1990) that rules for governing common property are only effective if they are specified by the users themselves. For Indigenous groups across northern Australia, the lessons from Trawick suggest an integration of Indigenous values in collaborative governance efforts- at the same time capacity building should be an inherent part of these collaborations. Capacity building includes training and education outcomes on water resource management, which can lead to increased knowledge dispersal and potentially changes in water management (Leendertse and Taylor, 2011).

6. Conclusions

This study highlights that water markets are at a formative stage across northern Australia. In southern Australia water markets have been effective in providing flexibility to irrigators and supporting productivity through reallocation during drought. But there are preconditions for a water market to be effective. Important is for there to be scarcity, competition for water and low to medium transactions costs. The potential for high and increased transactions costs is significant across northern Australia. There remains uncertainty over the resource and around Indigenous customary rights to water. This

suggests that there must be greater certainty around Indigenous involvement in water markets to minimise the potential for increased transaction costs.

There are environmental costs associated with water markets. These impacts include increased water use (from the activation of sleeper and dozer entitlements), higher levels of salinity, and consequences from moving water from one area to another. There is the potential in northern Australia for environmental impacts from trade. Increased salinity in-stream; water logging from more on-farm use; saltwater intrusion because of reduced flows; and during the dry increased nutrient loads could threaten the health of rivers. These issues can be addressed through management efforts.

Efficiency is key aim of water markets. Economic efficiency arises when all the gains from trade have been exhausted and the costs imposed on others from water use have been fully accounted for in the decision making of water users. Any assessment of efficiency of water markets in the north must seek to integrate customary or ecological values, but it is acknowledged that this is complex as these values are intangible and difficult to quantify.

Issues of equity are important in the transition to water access rights. In the north, the movement to water markets will require considerable Indigenous involvement to ensure principles of equity are upheld. Water trading should be guided by rules that protect Indigenous customary values and interests. Importantly, there will need to be consideration of surface and groundwater connectivity, and the effect of extraction on groundwater dependent ecosystems, which are of high importance to Indigenous people in the region.

Political opposition to water markets is an important consideration. There was slender support for water markets. Support for water markets was found to be strongest among Indigenous respondents. But it was emphasised that there should be important conditions on how markets should operate in the north, including the protection of ecological assets

and customary values. Greater community awareness on the purpose of water markets is important, to building understanding and support.

Non market approaches to allocation may be more suitable than market based approaches across the north. Determining which approach is most appropriate will be dependent on local conditions. A blend of approaches to allocating water may be more suitable. Markets combined with collaborative governance may support the achievement of ecological and equity outcomes. Collaborative approaches provide a formal structure for stakeholders to develop rules over allocation and management of water, as well rules for enforcement and compliance. Straton et al. (2009) suggested that such an approach is important in Katherine in the NT to encourage sustainable use of groundwater resources. It is important to foster inclusivity in collaborative approaches, and uncertainty over customary rights can be a significant constraint to the efficacy of a collaborative approach. Resolving uncertainty for Indigenous rights to water could occur through the creation of a property right specific to Indigenous interests.

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