COOPERATIVE RESEARCH CENTRE FOR **CATCHMENT HYDROLOGY**

# THE DEVELOPMENT OF WATER REFORM IN AUSTRALIA

**TECHNICAL REPORT**
**Report 02/5**
May 2002

**John Tisdell / John Ward / Tony Grudzinski**

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**John Tisdell, John Ward and Tony Grudzinski**

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## Foreword

Australia is one of the most arid countries in the world. Like many countries, it has been reforming water management practices and policies in order to meet the needs of a maturing water economy. This phase has brought with it significant national and state government changes to water pricing, the definition of water entitlements and the nature of water as a tradeable chattel.

This report is extremely timely in providing a sound review of the nature of water, of where we have been in water management in Australia and of current water reform debate.

John Tisdell
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Program Leader
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## Executive Summary

The first phase of the Cooperative Research Centre for Catchment Hydrology Project 3.2 'Enhancement of the Water Market Reform Process' is to gather background information on water management in Australia, and water reform and water trading in particular. Part of this important process is to gain an overview of the nature of water, a history of water management in Australia, and compile the current literature on water reform. This report is a summary of that overview and contributes to a greater understanding of water management in Australia and its future.

Water management in Australia has changed considerably with time, and particularly over the last twenty to thirty years. When making decisions concerning water supply, water authorities now need to consider not just hydrological and system constraints, but also the social, environmental and regional economic consequences of their decisions. COAG reforms have brought with them questions of economic efficiency and equity in managing a public good, not just better management of water supply systems. Project 3.2 aims to assist in the development of new water policies and in particular the development of trading rules and procedures for water trading.

To understand and develop sound policy it is first necessary to understand the background to water management in Australia. For most of the first two hundred years of European settlement, water resource policies, like those relating to other resources, were focused on exploitation to promote economic and demographic growth, and employment generation. The role of the water authority was to engineer dams and supply systems to capture and promote the use of available water, rather than plan or implement national or state economic or social policies.

The relevant legislative arrangements in Australia date from 1886 and established the principle that streams were State property administered by State controlled water agencies. A system of administrative allocation of rights to water was also instituted, managed by public water authorities in each State.

On the basis of these institutional arrangements, State governments became developers of water supply infrastructure such as dams, and developers and owners of large-scale urban and rural supply schemes (including irrigation).

In the 1980s water management in Australia began to consider broader objectives. No longer do water authorities look solely to the construction of bigger dams to solve water issues; rather, they examine options of improving the allocation of existing water entitlements in conjunction with environmental and social policy objectives. Their objective is seen as promoting efficiency and equity of water allocation while protecting the environment.

By 1990, water authorities were compelled to address issues and policies related to the management of water resources in a mature water economy. The incremental cost of water supply was sharply increasing. As most of the available and economic water resources had been exploited, and the cheap dam sites used, the opportunity cost of capital for water resource development had risen to historically high levels; an ageing infrastructure was contributing to increased operation and maintenance costs, and increased pressure for expenditure on replacement was increasing. Further, the demand for water resources was increasing in scale and diversity, particularly demand for environmental objectives, and concern for improved quality of supply. Conflict was growing, both between potential uses, and between the old developmental objectives and the newer economic and environmental objectives, but being played out within institutional settings geared to resource expansion rather than the optimal allocation of a scarce resource. Finally, awareness was growing of the severity of environmental degradation, its irreversibility in some cases, and the consequences including declining quality of the resource.

The water authorities are now involved in managing these conflicting demands on the use and distribution of water within a period of institutional reform - be they economic, environmental or social. Meeting the broadening and changing role of water management in Australia will be among the greatest challenge facing water authorities in the future.

Chapter 1 begins by outlining the nature or water resources, especially the relative volumes of useable water at a global and national level, and the increasing relative scarcity of water. In the backdrop of the

physical characteristics of Australia's climatic characteristics and water resources, Chapter 2 outlines the debate on the historical development of water management in Australia from early British common law to current national water reform agendas and international agreements.

Chapter 3 begins by pointing out the place of water reform within Australia's macroeconomic reform agenda. Following an outline of the history of microeconomic reform in Australia and its agenda to foster greater competition with the Australian economy, the chapter explores the macroeconomic concerns leading to reform and the eventual establishment of the Council of Australian Governments (COAG) from which Australia's water reform agenda came. In doing so it outlines National Competition Policy and the Hilmer report and their links to the water reform agenda. The chapter concisely outlines the National Competition Policy on competition issues including regulatory restrictions on competition, structural reform, monopoly pricing, competitive neutrality and the public interest test. The chapter also explores the links between COAG reform and associated tranche payments by the National Competition Council. The chapter brings these together in an outline of the possible gains arising from the National Competition Policy. The chapter concludes by briefly outlining the benefits and criticisms of the microeconomic reform agenda.

In greater detail, Chapter 4 explores the implementation of the COAG reforms, National Competition Policy and National Competition Council tranche payments. It overviews progress of implementation of the water reform agenda, specifically in water allocation and establishing water trading. The chapter decomposes and evaluates the implementation of water reform at a national, Murray-Darling and State level (New South Wales, Queensland and Victoria), outlining the institutional and legal structures each have adopted in implementing the water reform agenda.

Finally, Chapter 5 summarises current debate on the nature of water and the direction of water management on the basis of water being seen as an economic good. It begins by explaining the underlying theoretical economic assumptions of the water reform agenda and the axiomatic requirements for a functional, competitive market. A property rights approach has dominated the water reform agenda both nationally and internationally. It reviews the current opinion on the validity and potential application of that approach to water management at both levels.

The Council of Australian Governments, realising the need to address complex economic, social and environmental demands on water management, has implemented a water reform agenda which will require well defined property rights to water and the evolution of water markets. The task ahead is to develop and operationalise such rights and encourage immature water markets to evolve.

# List of Figures

# List of Tables

# 1. The New Water Agenda

## 1.1 Introduction

*"Life is animated water"* (Vernadsky 1986)

The increasing relative scarcity of water is driven by escalating demands, both in terms of diversity and scale and rapidly increasing marginal costs of infrastructure and supply. The regional availability of fresh potable water is often stated as the resource that will ultimately limit economic development and growth (Easter *et al.* 1998a). As the physical attributes and properties of water are ostensibly immutable, remedial action and change must be facilitated and accommodated within the social dimension. Strategies to offset the expected reduction in economic growth, imposed by resource limits, include a more technically efficient application of existing supplies (in the context of current use) in conjunction with the transfer of low value uses to higher value uses. Constrained by physical, ecological, environmental and social thresholds, ensuring the mobility of water to facilitate higher valued uses is fundamental to the water allocation decision-making process. Managing agencies have embraced market structures and processes as the most effective means to facilitate structural change to higher valued uses, without increasing available supplies.

Water reform is often embedded within a larger, systemic natural resource reform agenda. Within current compliance initiatives, that agenda is consistently associated with a tendency to modify existing institutions and utilities, an approach to foster full cost recovery, the removal of direct and cross subsidies and the promotion of joint agency efforts.

At most constituencies and jurisdictions, there is a growing impetus to rely on markets in natural resources to provide a means of allocation, including tradeable water entitlements. Markets are contingent, *inter alia*, on a suite of enforceable property rights in achieving an economically efficient allocation of water resources (Bromley 1991, Randall 1981).

The identification and definition of property rights, and the procedures of exchange are part of the evolution of water as an economic resource. The vital and cardinal nature of water makes its characterisation as an economic good enigmatic. The multiple and heterogeneous production outputs of water are jointly produced and physically interdependent, complicating the partial determination of benefits and costs. They include both consumptive and non-consumptive uses, are inter-sectoral, constitute market and non-market values, include extensive public good values and are characterised by a high likelihood of external effects. The interdependencies of outputs and uses preclude the unequivocal application of property rights common to most factors of production. The perceived inability of markets to account for the ubiquity and magnitude of externalities and non-market factors has resulted in the proposed augmentation of market structures. The blend of regulatory, economic and suasive instruments remains iterative and unresolved.

There are specific predicates to ensure effective, natural resource markets (including water). These include the determination and imputation of the finite; physical thresholds of water in concert with a willing and competent regulatory framework to ensure the specification and enforcement of property and contractual regimes. As a consequence there have been widespread changes to institutional settings, including the statutory and organisational frameworks to accommodate the operation of water transfers. The degree of observed global institutional change appears to be correlated with the relative scarcity of water (conditioned by the full suite of economic values and prevailing social preferences and values).

There is a concurrent and systemic attempt by managing agencies responsible for natural resources to rely on economic instruments in general, and markets in particular, to achieve increasingly stringent environmental guidelines and objectives. The synchronized development and correlative nature of these two focal points of current resource management has confused the distinction between the determination of causal agents and concordance. As economics is founded on the concept of relative scarcity, and environmental parameters and attributes have become increasingly so, the symmetry is not surprising. Regardless of process, the mutual buttressing of environmental objectives and economic principles has been shaped and directed by a number of international treaties, agreements and conventions. Water reform initiatives are benchmarked by the sometimes divergent metrics of economic efficiency and ecologically sustainable use.

The scope and purpose of this review is: to synthesise existing knowledge on trading in water entitlements, explore synergies between water markets across Australia and evaluate current water market activity and trading rules and procedures.

This chapter provides a summary of the spatial and temporal characteristics of the hydrological cycle in Australia and how that has influenced the institutional setting and operational management of water. The nation-wide availability and consumption of water is discussed, categorised by industry and institutional sectors and evaluated spatially and temporally. The report traces the heritage of Australian diverted water management, with particular emphasis on the evolution of water property rights in terms of specification, scope and the framework of enforceability.

### 1.2 Global Demand and Supply.

Economics is a discipline premised on the anthropocentric perception of scarcity. Despite being the aqueous planet (74.35 per cent of the earth's surface is covered by water), more than 97 per cent of the world's water is toxic to terrestrial organisms. Fresh water lakes, rivers and water vapour in the atmosphere constitute only 0.5 per cent of the total world's fresh water supplies. With those dimensions and scales, in concert with the cardinal role water assumes in the existence of terrestrial biology and an escalating human population, water is a scarce resource in both absolute and relative terms. Figure 1 represents the major categories and sub-divisions of the world's water.

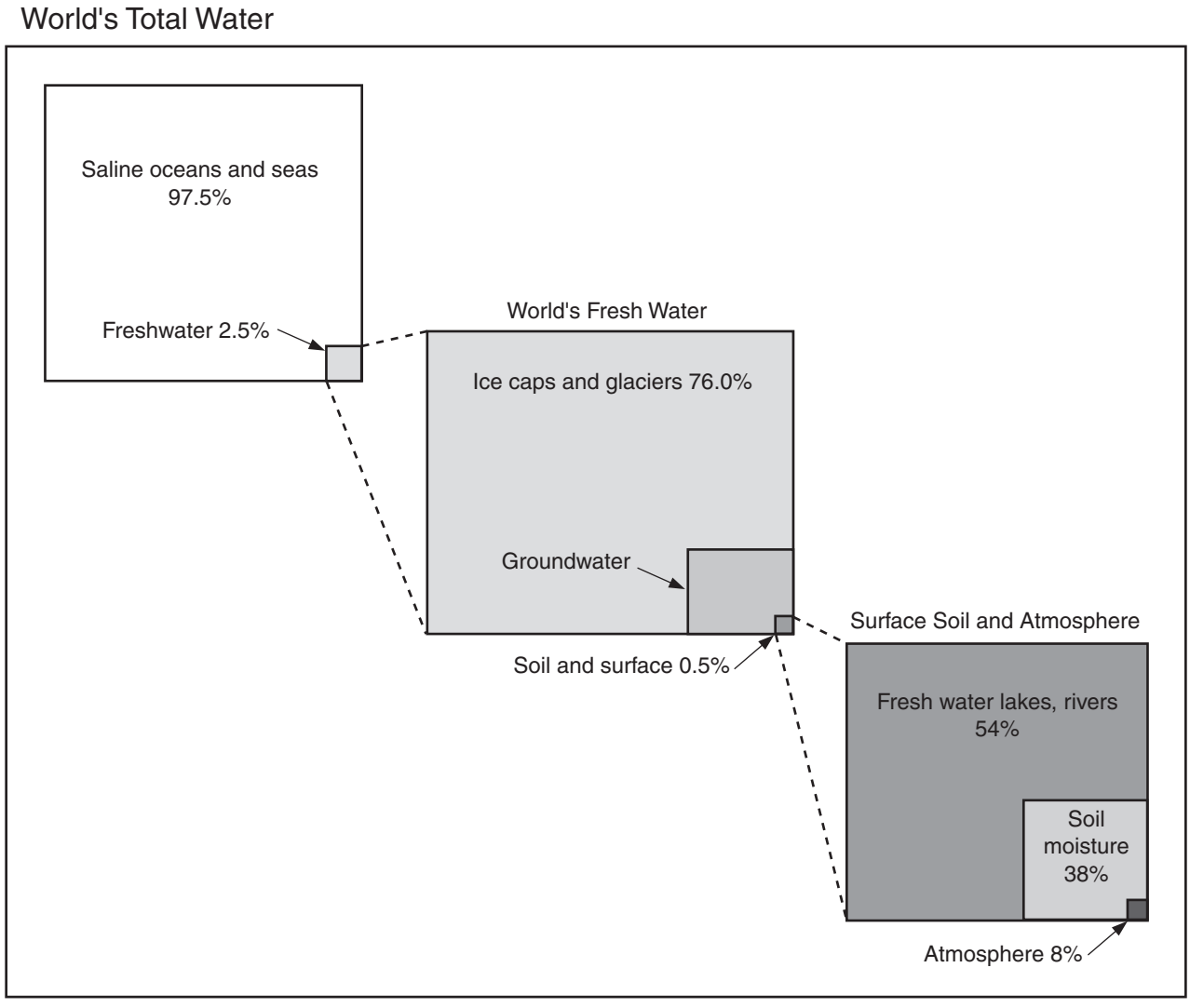
Fresh water has historically been considered an abundant resource, freely or at least cheaply available. The relative scarcity of usable fresh water has increased dramatically over the past few decades, due to increased consumption from a rapidly expanding global population, the increasing scale and diversity of use per capita and a diminution of available supplies as a result of chemical pollution, increased nutrient loads, eutraphication, contamination and degraded catchments. Postel *et al.* (1996) estimate current human consumption appropriates 25 per cent of the total fresh water in the hydrological cycle and 50 per cent of the accessible runoff.

Projections by Rosegrant (1997) indicate a 35 per cent increase in future water withdrawals and consumption to the year 2020, with total withdrawals approximating 5060 billion cubic metres ($bm^3$). The modelled scenarios and projections are an aggregate of industrial, domestic and agricultural uses, representing functions of GDP and intensity per unit of GDP, population and per capita income growth, the income elasticity of water demand, and the irrigated area and water use intensity respectively. Water demand in developed countries is projected to increase by 22 per cent, 80 per cent or more of that increase assigned to industrial uses (Easter *et al.* 1998a). A 43 per cent total increase in water demand is expected in developing countries, where it is predicted the absolute increase in domestic and industrial water demand will be greater than the increase in agricultural water demand in 2020 (Easter *et al.* 1998a, Rosegrant 1997). The aggregate figure of water use from industrial and domestic purposes in developing countries is predicted to increase from 13 per cent to 27 per cent, representing a major structural change in sectoral water demand (Rosegrant 1997).

Given an estimated 10 per cent increase in harvesting fresh water runoff, coupled with a projected 45 per cent increase in population, Postel *et al.* (1996) argue that a substantial shortfall exists in meeting projected global water needs. Coupled with an escalating increase in the cost of infrastructure development (Easter *et al.* 1998a), a shortage of new cost-effective water storage sites, and the predicted shortfalls of non-traditional water supplies[1] it is difficult to visualise a supply strategy that could keep pace with the predicted increases in demand. International examples cited in Easter *et al.* (1998a,b) and Rosegrant (1997) indicate a global trend of increasing capital costs of water-based infrastructure and the operational costs of delivery and transmission. The magnitude of the cost increases is in the order of 50 per cent to 300 per cent, depending on site conditions and location, and considered a prime constraint on the development of further major water supplies. Moreover, the reported costs only represent the capital and

[1]Easter *et al.* (1998a) note some non-traditional water supply sources as desalination, reuse of wastewater and water harvesting (the diversion and capture of land runoff). The authors consider the excessive cost of supply, or unreliability will preclude their adaptation as significant alternate supplies of fresh water.

operational costs accruing to agencies. The accounting conventions do not impute the additional economic costs of environmental degradation of dependent riverine ecosystems and wetlands, social and community upheaval and the diminished value of alternate non-consumptive values occurring as a result of development programmes. The development of water capture, diversion and storage infrastructure has been associated with environmental degradation (Smith 1998, State of the Environment Advisory Council (SOEAC) 1996). Environmental losses attributable to USA diversion projects include a 60 per cent reduction in the pre-European settlement area of inland wetlands and 50 per cent of stream miles affected by pollution (Gleick 1998). Gleick (1998) reports similar levels of environmental degradation for other countries, including Australia (Smith 1998).




(source; Smith 1998 p. 2)

Figure 1.1 Global stores of water

Mindful of the noted caveats and forecast thresholds on expanding the global water supply, the rapidly escalating demands for industrial, municipal and domestic water in developing countries will need to be met by diversions from existing irrigation supplies (Easter *et al.* 1998a). As the authors note;

> *A particularly difficult challenge will be to improve the efficiency of agricultural water use to maintain crop yields and output growth while at the same time allowing reallocation of water from agriculture to rapidly growing urban and industrial uses. How this will be managed could determine the world's ability to feed itself (Easter et al. 1998a p. 2).*

The endorsement and application of global trends to the management of Australian water resources is conditioned, *inter alia*, on the bio-physical parameters that ultimately determine the capacity to capture and divert water resources and the environmental-economic interaction that is entrained in the specific framework of public ownership and distribution. The following sections discuss the physical and biological constraints specific to Australian water management and the heritage of the current Australian institutional setting of water allocation in both the public and private domains.

### 1.3 The Physical Constraints of a Dry Continent

Water resources are usually classified and presented according to various composites of the natural geographic, landscape and planning units of river catchments. The taxonomy of Australian fresh water resources includes 13 drainage divisions, subdivided into 245 river basins, which are used to report rainfall and runoff data (Smith 1998). Groundwater is not always congruent or contiguous with surface water and is separately assessed for 61 groundwater provinces. A mean annual precipitation value of 455mm has been estimated when aggregating the 12 mainland drainage divisions (Department of Primary Industries and Energy (DPIE) 1987). Of the estimated 455mm mean annual precipitation, 399mm (88 per cent) is lost to evapo-transpiration, 52mm (11 per cent) to river runoff and 4mm (1 per cent) to groundwater recharge (DPIE 1987, reported in Smith 1998). According to the DPIE report, evapo-transpiration limits runoff to 5 per cent of rainfall for 75 per cent of the Australian land base. Importantly the variance associated with the 455mm mean annual rainfall is substantial, ranging from 150mm to 3000mm across drainage divisions (DPIE 1987).

In concert with a high degree of spatial variation, Australian rainfall is highly episodic and stochastic when compared to other continents from the same latitude or with similar climatic zones (McMahon *et al.* 1992). Australia is characterised by high seasonal variability across the continent and a high frequency of drought/flood oscillations (SOEAC 1996). Smith (1998) postulates the El Niño and La Nina perturbations as a favoured, though poorly understood explanation of observed rainfall variance. As part of a worldwide compilation of water data, the Australian data set shows that the coefficients of variation for annual runoff and precipitation related to mean annual precipitation was respectively two and four times that of countries of similar latitude and climate zones. The observed variability is greater than that of any other continental region and about twice that of Europe (McMahon *et al.* 1992, Smith 1998)[2].

Invariably Australia is characterised as the "driest inhabited continent"[3]. If the metric of continental dryness is the degree of river runoff with respect to area, then Australia can fairly assume that mantle. The temporal variance in rainfall is the largest observed from any continent, exacerbating the difficulty in Australian water management and planning[4].

The additional storage capacity required to achieve a given level of supply security is the corollary of high rainfall variability and consequent water management and diversion strategies. (Australian Academy of Technological Sciences and Engineering (AATSE) 1999, Smith 1998). According to Smith (1998) in

[2]CRC for Catchment Hydrology Program 5 is researching climate variability and impacts on water supply. The Program is headed by Professor McMahon.

[3]As Smith (1998) notes: 1) Antarctica is the driest continent, inhabited or uninhabited 2) the geographic definition of the Australian continent includes New Zealand, Papua New Guinea and other less well defined island nations.

[4]As noted by Smith (1998), "This facet of comparative hydrology is undoubtedly a key factor in explaining why European immigrants to Australia had so much trouble adjusting their farming practices to local conditions" (Smith 1998 p. 14)

relating river runoff and temporal variance, Australian dam storage capacities need to be twice that of the world mean and six times that of Europe to achieve a similar level of supply security. Until recently, the perceived need for the drought-proofing of the continent and the ideology of national development provided the impetus for broad public encouragement and government approval for a rapid and substantive increase in water harvesting development (Paterson 1987a). The zenith of surface water development occurred during the period 1960-80.

Partly as a risk management response to observed rainfall fluctuations, Sydney stores 932 kilolitres (kL) of water for every inhabitant compared to 250 kL for New York and 182 kL for London.

The storage capacity for NSW irrigation water is 1580 kL $km^{-2}$ of irrigated land compared to 760 kL $km^{-2}$ for the USA and 380 kL $km^{-2}$ for Egypt and 150 kL $km^{-2}$ for India (Gleick 1998, Commonwealth of Australia 1996 p. 7-8). Estimates of the total Australian water storage capacity[5] in 1990 vary from 81,000 GL (SOEAC 1996) to 87,000 GL (Smith 1998). The rate of storage construction peaked in 1980, diminishing rapidly from that point on (ABS 2000, SOEAC 1996).

### 1.4 Australian Water: Diversions, Storage, Supply and Demand

Water is potentially a limiting factor of production and its use is conditioned, amongst other factors, by the constraints of the bio-physical dimensions of the resource. The formulation of sustainable management plans is dependent on the determination of actual and potential supply and demand levels. Prior to the recent assessment of water resources as part of the environmental accounts programme of the Australian Bureau of Statistics (ABS 2000), the most reliable and comprehensive assessment of Australian water resources was carried out in 1983-84 (DPIE 1987). The report provided baseline data inclusive of definitive catchment boundaries and scale, water quality and the diversity and level of use.

Water use is dependent on prevailing rainfall and climatic conditions, and subject to variability. The observed level of water use for 1983-84 is less than a statistically average year and needs to be adjusted according to catchment specific correction factors (DPIE 1987). An increase of 12.3 per cent to the aggregated gross water statistics of the 12 Australian drainage divisions corrects for the climate variation (AATSE 1999, Table 4.1). A correction factor of +17.1 per cent adjusts for catchment specific climate variation in the Murray-Darling basin, which accounts for approximately 60 per cent of total Australian water use (Murray-Darling Basin Ministerial Council (MDBC) 1995).

In a joint report by the Australian Water Resources Council and Department of Primary Industries and Energy (DPIE 1987 vol. 1), a divertible water resource is defined "as the average volume of water which, using current technology, could be removed from developed or potential surface or groundwater sources on a sustained basis, without causing adverse effects or long-term depletion of storages".

As noted by Smith (1998) the in-stream-allowances of 8 per cent of total river flow acknowledged in the 1987 review are at variance than those currently recommended for the maintenance of *sustained* riverine and wetland ecosystem health. A composite of suitable indicators of in-stream vitality and the estimation of the necessary, catchment specific environmental flows are the focus of ongoing research (for example, CRC for Freshwater Ecology).

The DPIE (1987 vol. 1) defines a developed water resource as "the portion of the divertible resource currently available for use, estimated for storages already existing or under construction, and including licensed withdrawals from streams."

Minor divertible surface resources refer to those water bodies yielding less than 500 ML $yr^{-1}$. Smith (1998) categorises farm dams, roof runoff and desalination plants as minor resources. The total cumulative volume is only relatively small compared to the major divertible resources (Smith 1998), although they can assume a more important dimension at the local scale. The Victorian State of the Environment (1988) estimated 300,000 farm dams in Victoria in 1988. The same report estimates farm dams in the Lal Lal reservoir catchment reduced average annual stream flows from a predicted

[5] The estimates are limited to dams with a capacity greater than 100GL.

7 per cent in years of average flow to 50 per cent during drought periods.

Brennan and Scoccimarro (1999) report an increase in on-farm storage and high-flow water harvesting. On-farm-storage in the Murray-Darling Basin has increased by more than 100 per cent in the five years to 1999, impacting on instream flows, and the allocation rights of current entitlement holders. Brennan and Scoccimarro (1999) propose that the establishment of transferable property rights to unregulated diversions, farm-storage and water harvesting, as a means of effectively maintaining current allocations and allowing water to transfer to higher use values. Greig (1998) notes that the cap on off-allocation diversions and the proposed volumetric allocations for users of unregulated rivers, and the licencing of dams with less than 7 ML storage will ameliorate some of the impacts (Brennan and Scoccimarro 1999).

### 1.4.1 Groundwater

According to Lyons (1995) and Smith (1998) the recharge rates in both minor (yielding less than 500 ML $yr^{-1}$) and major groundwater aquifers are poorly understood and the determination of the coefficients of variance unreliable, a product of widely diverse storage and transmission capacities. The levels of vegetative and forest cover and the extent of irrigated agriculture can similarly affect the rate of aquifer recharge (SOEAC 1996). Sustainable groundwater use equates to an extraction or abstraction rate no greater than the rate of recharge. The mean annual rate of recharge for 12 major Australian groundwater aquifers is 4 mm $yr^{-1}$ (reported variance of 1-12 mm $yr^{-1}$) (DPIE 1987). Subsequent estimates of abstraction levels calibrated to recharge rates are similarly difficult to predict and can differ markedly.

The estimates for total annual divertible groundwater range from 30,000 GL (DPIE 1987), to 70,000 GL (Brown *et al.* 1983). The State of the Environment reports a figure of 15,000 GL (SOEAC 1996). Of the combined major and minor groundwater resources, 29 per cent are categorised as fresh and 11 per cent as saline[6]. The DPIE report estimated 9,800 GL of fresh groundwater reserves.

The last evaluation of groundwater on a national scale occurred in 1983-84 (DPIE 1987). Victorian groundwater stocks have been assessed more recently by the Australian Bureau of Statistics (2000). The development of Australian groundwater resources is temporally and spatially erratic, with several reserves and provinces not being utilised at the time of the DPIE national evaluation. As groundwater appraisal is pragmatically a function of water demand and needs, the assessment process for many of the remote provinces was characterised as ad hoc or lacking. Several groundwater reserves were listed where abstraction rates, predominately due to irrigation activity, exceeded natural recharge estimates (SOEAC 1996, DPIE 1987). Both surficial and sedimentary aquifers are subject to either substantial seawater intrusion (when proximate to coastal zones such as the Burdekin Delta) or salt intrusion. The State of the Environment (SOEAC 1996 p. 7-9) reports that while some remedial action has been initiated, several of these and other more recently tapped aquifers are still substantially over-utilised. Groundwater pressures have appreciably diminished in the Great Artesian Basin, resulting in reduced bore flows and an increase in the number of failed bores[7]. Current daily discharges have diminished to approximately 33 per cent of the peak abstractions of the early 1900's, despite a 300 per cent increase in the number of drilled bores (SOEAC 1996 p. 7-25).

Australia is endowed with extensive reserves of groundwater. Untapped groundwater resources are susceptible to contamination from several sources, necessitating a cross-agency management strategy. Potential contaminates include microbial pathogens, acidification, high nutrient loads, salinity, heavy metals, and toxins (herbicides and pesticides). Smith (1998) notes the hydrology and fluid dynamics of groundwater levels and contamination are poorly understood, as are the incremental and confounding affects of contaminate residues and metabolites. The unknown extent and rates of pollutant transport and diffusion in groundwater aquifers make the determination of remedial efficacy highly problematic. The potential cost of amelioration and ongoing monitoring may render some aquifer pollutants economically intractable.

[6]Fresh groundwater is defined as a soluble salt content of less than 500 $mgl^{-1}$, saline is defined as a soluble salt content greater than 5000 $mgl^{-1}$ and less than 15000 $mgl^{-1}$ (Smith 1998).

[7]Yencken and Wilkinson (2000) cite reduced flows in the Great Artesian basin from an original 10 ML per day to between 0.01 to 6 ML per day.

There exists substantial links and interdependencies of surface water and groundwater systems, in both volumetric and qualitative terms. Groundwater is fundamental to the base flows of river systems. Within the study focus catchments, groundwater is generally not considered as a major supply of water and viewed as a self-extracted, complementary source to surface water. Groundwater use accounted for approximately 7.4 per cent of total water consumption in the Murray-Darling Basin (MDBC 1995 p. 7). The relatively low proportion of groundwater utilisation in the Murray-Darling Basin and anticipated legislation regarding conjunctive surface and groundwater property rights makes the forecasting of water market impacts unreliable (Marsden Jacob and Associates 1999, Fisher 2000). It is possible that as a function of availability, extant quality and the cost of groundwater extraction, groundwater may exert some influence on market prices.

### 1.4.2 Total and divertible resources

The total average annual divertible water resource in Australia is estimated at 130,300 GL, comprised of 100,000 GL of surface water and 30,300 GL of groundwater (ABS 2000). The AATSE (1999) estimates for the total divertible resources for 1995-96, based on corrected 1983-84 figures, are 102,360 GL (92,470 GL of surface water and 9,800 GL fresh groundwater). The AATSE estimates do not incorporate the approximately 21,000 GL of saline groundwater as a divertible resource. At a national scale, this represents a 25 per cent capture of the total mean annual runoff and groundwater recharge (DPIE 1987), a figure in general accord with the global estimates of Gleick (1998) and Postel *et al.* (1996).

Smith (1998) estimates that Australia has developed approximately 25 per cent of divertible surface water and 9 per cent of groundwater, a combined figure of 19 per cent, or approximately 24,000 GL. Whilst there is some difference in commentators interpretation and estimates of developed water and usage[8], approximately 20,000 GL of water diverted per annum is a concordant figure. The AATSE (1999) estimate of 19,950 GL for the 1995-96 financial year corresponds to a mean 20 per cent utilisation of total divertible fresh water resources.

There is considerable variation in the level of developed water as a proportion of divertible resources across catchments. Table 1.1 summarises the divertible, developed and utilised proportion of fresh water resources across 18 designated drainage/catchment divisions. The percentage of resource utilisation is calculated as total estimated use divided by total divertible resource. The calculated values across catchments range from 1 to 2500 per cent[9]. The mean value of the percentage of water utilised is 20 per cent of the total divertible resource. The figures indicate that the level of current water use is approaching prescribed maxima for the Murray-Darling Basin, South Australia, the south-west of Western Australia and the Gasgoyne and Pilbara (AATSE 1999, Smith 1998). Further allocations of water for these divisions are limited and unlikely given present and proposed statutes and initiatives (Fisher 2000).

According to the AATSE (1999), there is greater scope for additional water allocation along the eastern seaboard, although a combination of sufficient rainfall for dryland farming, environmental constraints and a reduced urban demand[10] may limit the incentive for further infrastructure expansion. The surplus of divertible water that currently exists in the North and the Kimberley is likely to remain. The viability and development of major water uses in those regions are constrained by market accessibility, native title claims, unsuitable soils and an obligation to maintain environmental and non-consumptive flows (AATSE 1999, Johnson and Rix 1993). The drainage division boundaries used by the DPIE (1988) vary, although the general levels of use as a proportion of potential diversions are in accord with the AATSE estimates (Smith 1998).

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[8]The ABS estimates 21,500 GL water available in 1992 (ABS 1992, Johnston and Rix 1993), the extrapolation from the State of the Environment estimates is 21,400 GL for 1992-93, AATSE (1999) estimate 16,240 GL of gross water supplied in 1983-84 (which equates to 18,245 climate adjusted) and 19,950 GL gross water supplied for the 1995-96 financial year.

[9]Represents the level of diversion for the South Australian region of the Murray-Darling Basin. The high diversion figure is a function of water imported into the region. The figure is considered a management artefact and treated as a statistical outlier (AATSE 1999, Table 2.1). The NSW figure of 115% is similarly a function of water imports.

[10]Water infrastructure investment deferments of 30 years have been noted for Melbourne, Sydney and the Hunter region (AATSE 1999).

The Murray-Darling Basin Ministerial Council (MDBC) (1998) reported data for the Murray-Darling basin that indicates a high degree of variance in the level of diversions specific to state regions and river catchments. The basin-wide level of water use as a percentage of prescribed allocations is 76 per cent for the year 1997-98. The majority of water use occurred in New South Wales (NSW) and Victoria. The mean actual water use as a percentage of allocations in New South Wales was 88 per cent and 92 per cent in Victoria.

Figures for specific river catchments vary from 67 per cent to 100 per cent for New South Wales and from 69 per cent to 95 per cent for Victoria (ABS 2000, MDBC 1998).

Table1.1 Estimated divertable and developed water resources in 1995-96

| **Drainage unit** | **Divertible fresh surface water (GL)** | **Divertible fresh ground water (GL)** | **Total divertible fresh water (GL)** | **Total estimated use in 1995-96 (GL)** | **(%) [a] utilisation** |
|---|---|---|---|---|---|
| 1. Queensland coast | 6,000 | 1,220 | 7,220 | 2,740 | 38 |
| 2. Queensland: Lake Eyre drainage basin | 160 | 170 | 330 | 80 | 24 |
| 3. Queensland Carpentaria and Cape York | 20,130 | 620 | 20,750 | 400 | 2 |
| 4. New South Wales coast | 11,160 | 820 | 11,980 | 1,460 | 12 |
| 5. Victorian coast | 3,380 | 380 | 4,210 | 1,030 | 24 |
| 6. Tasmania | 10,860 | 180 | 11,040 | 560 | 5 |
| 7. Murray-Darling Basin | | | | | |
| *New South Wales* | 5,140 | 710 | 5,850 | 6,750 | 115[b] |
| *Victoria* | 6,530 | 60 | 6,590 | 3,790 | 57 |
| *Queensland* | 720 | 230 | 950 | 370 | 39 |
| *South Australia* | 20 | 0 | 20 | 500 | 2500[b] |
| 8. South east coast of South Australia | 80 | 1,090 | 1,170 | 490 | 42 |
| 9. Adelaide and hinterland | 150 | 230 | 380 | 290 | 76 |
| 10. South Australia: Eyre Peninsula and North | 10 | 320 | 330 | 80 | 24 |
| 11. South west of Western Australia | 1,390 | 730 | 2,120 | 980 | 46 |
| 12. Goldfields and Esperance | 10 | 50 | 60 | 30 | 50 |
| 13. Gasgoyne and Pilbara | 300 | 90 | 390 | 150 | 38 |
| 14. Kimberley | 8,660 | 490 | 9,150 | 130 | 1 |
| 15. Northern Territory | 17,320 | 2,420 | 19,740 | 120 | 1 |
| **Total** | **92,470** | **9,800** | **102,360** | **19,950** | **20** |

(Source: AATSE 1999, Table 2.1)

[a] calculated as total estimated use divided by total divertible resource

[b] see Footnote 8, previous page

At the national scale, 20 per cent of divertible water has been developed. The scope for potential future utilisation and capture is limited by increasing costs, less viable sites, and more rigorous economic and environmental assessment. At a regional scale, specifically the Murray-Darling Basin (the major user of water in Australia) water resources in key catchments are either over allocated or approaching upper thresholds of development. The volume of divertible water may not be the primary constraint of future water development. The general shortcomings observed for a range of technical and economic efficiency measures are more likely to constrain increased water use (Johnson and Rix 1993, Smith 1998). They are inclusive of increased soil salination and degradation, degeneration of water quality, (measured by a number of contaminate-specific metrics), loss of wetlands and riverine ecosystems, continuing partial recovery of supply costs and poor economic returns for both agencies and farmers. High levels of disturbance and intervention in upper catchments may also impose volumetric and quality constraints to future water use (SOEAC 1996).

The magnitude of divertible water resources in Australia is greater than in most other countries. As Smith (1998) states;

> *As a nation, Australia has per capita resources that exceed those of most other continents. Perversely, much of the water is in the wrong place, and sometimes it arrives at the wrong time-but it is, of course, better to have some water than none at all (Smith 1998 p. 135).*

### 1.4.3 Water use by industry and institutional sectors

The majority of water consumption occurs in NSW (39 per cent), Victoria (30 per cent) and Queensland (17 per cent). The aggregate net consumption of South Australia, Western Australia, Tasmania and Northern Territory represents 14 per cent of the Australian total. There is a wide disparity across sectors, summarised in Table 1.2. The figures indicate that water consumption is dominated by the agricultural sector. Total water consumption has risen from 18,575 GL in 1993-94 to 22,186 GL in 1996-97, an increase of 3611 GL or 19 per cent (ABS 2000).

Table 1.2 Net consumption of water by sectors in Australia - 1996-97

| Sector | Self-extracted use (ML) | Mains supply (ML) | Mains use (ML) | In-stream discharge (ML) | Net water consumption (ML) [d] |
|---|---|---|---|---|---|
| Agriculture [a] | 7 156 488 | - | 8 346 485 | - | 15 502 973 (70%) |
| Mining | 544 746 | - | 14 240 | 8 589 | 18 815 (3%) |
| Manufacturing | 216 666 | - | 511 071 | - | 727 737 (3%) |
| Electricity and Gas | 47 771 365 | 12 869 | 58 387 | 46 509 049 | 1 307 834 (6%) |
| Water supply [b] | 12 864 431 | 11 507 477 | 349 691 | - | 1 706 645 (8%) |
| Other [c] | 103 588 | 252 | 419 207 | - | 522 513 (2%) |
| Household | 32 923 | - | 1 796 076 | - | 1 828 999 (8%) |
| **Total** | **68 703 371** | **11 525 533** | **11 525 533** | **46 517 638** | **22 185 733** |

[a] Includes services to agriculture, hunting, and trapping; forestry and fishing

[b] Includes sewerage and drainage services

[c] Includes construction, retail, accommodation, restaurants, education, finance, health and community services (ABS 2000 table 1.18)

[d] Net water consumption = self extracted use + mains use - mains supply - in-stream discharge. The (per cent) figure represents the proportion of total water consumption used by the sector.

(Source: ABS 2000)

The high degree of inherent unreliability in Australian weather patterns imposes caveats on the extrapolation of trends from water data analysed without reference to climate-based data sets. The perturbations to weather patterns at a national and regional scale are subject to the cycle of the El Niño-La Nina Southern Oscillation effect. The Southern Oscillation Index is calculated as the difference in oceanic air pressure from Tahiti to Darwin and North to Micronesia. Negative Southern Oscillation Index values indicate an El Niño effect, manifesting as an increased probability of drier conditions in Eastern Australia. Conversely, positive values indicate a La Nina effect, associated with a higher probability of increased rainfall (Allan *et al.* 1996, Bureau of Meteorology 1998). The stochastic fluctuations in the frequency of the El Niño-La Nina cycle vary in length from two to seven years.

### 1.4.4 Sectoral contributions to Water Authority revenues

In providing essential water supply services to all sectors of the Australian economy, the water industry had a gross turnover of approximately $6 billion in 1996-97, $2.4 billion for supply, the balance for sewerage and drainage (AATSE 1999). At the time of writing, the latest input-output tables for the Australian economy were for 1992-93. According to the ABS (1994) the final consumptive demand from households amounted to 50 per cent of water revenue (consumption equates to 8 per cent of total water use). Water supply to the service sector accounted for 40 per cent of revenue (consumption equates to 2 per cent of total water use) and receipts from mining and manufacturing amounted to 10 per cent of total revenue. Generally, charges for urban based final consumptive and intermediate demand include the operational costs of delivery, returns on fixed capital assets and shareholder dividends.

Receipts from supplies to agricultural and rural users amounted to 5 per cent of total revenue (consumption equates to 80 per cent of total water use). Generally the low recovery of rural costs reflects a persistent tradition of below-cost rural delivery, reflecting transmission costs only and ignoring the capital and operating costs of headworks. Governments have generally borne the capital costs of water diversion infrastructure and current accounting conventions typically treat the costs of existing infrastructure as sunk costs. The factors that condition agricultural below-cost water pricing and the historical precursors are discussed in Section 5.6.

Rural systems accounted for 20 per cent of total supply costs, urban systems accounted for 80 per cent (AATSE 1999). The low unit cost for irrigation systems are thought to be due to (AATSE 1999):

- Most irrigation water is delivered by gravity flow in rivers and streams or channels.
- There is no treatment to improve water quality
- Irrigation return flows are discharged through simple drains without treatment
- Groundwater extraction is generally at the point of use.

### 1.4.5 Agricultural and rural water consumption

Agriculture accounted for 3,434 GL (95 per cent) of the observed increase in water consumption of 3611 GL from 1993-94 to 1996-97 (ABS 2000). The proportion of the water consumption increase attributed to increased livestock, pasture and grains production is approximately 2,271 GL or 63 per cent. Irrigated pasture increased in area from 850,000 hectares to 935,000 hectares, a major component of the livestock, pasture and grain classification. Total water use for irrigated pasture in 1996-97 is estimated at 3,273 GL (SOEAC 1996). Less substantial increases were noted for cotton and rice, accounting for 13 per cent and 8 per cent of the total increase respectively. Table 1.3 summarises the gross value and water use of the major categories of irrigated agriculture for 1996-97.

### 1.4.6 Irrigation: technical efficiency in transmission and on-farm technology.

According to Postel *et al.* (1996), the technical efficiency of irrigation is finally measured as the proportion of diverted and transmitted water that actually reaches the plant root zone and is therefore utilised by plants. The global estimates determined by Postel *et al.* (1996) are in the order of less than 40 per cent, those in Australia are approximately 33-40 per cent (Watson and Johnson 1993).

The majority of irrigation water transmission occurs via natural channels and ditches. Smith (1998) estimates natural channel transmission accounts for 85 per cent of Australian irrigation water distribution and Hawken *et al.* (1999) estimate global figures at 93 per cent. Although difficult to quantify, Smith (1998) estimates transmission losses in the order of 20-25 per cent, a function of evapotranspiration, and variable channel seepage loss. Although there are dramatic improvements

in the reduction of transmission losses reported[11], Smith (1998) states there are unlikely to be substantial efficiency gains from transmission improvements.

Variable on-farm efficiency gains are reported. Smith (1998) reports yield gains per ML of water applied for trickle and drip irrigation systems of 15 per cent to 65 per cent. Hawken *et al.* (1999) report similar gains in the United States. Both Smith (1998) and Hawken *et al.* (1999) report water loss reduction approximating 65 per cent for sub-surface drip irrigation similar to that used in Israel.

Wall and Marshall (1995) estimate that on-farm water availability could be increased by 15 per cent by water recycling, although the adoption rates and applicability of recycling technology are a function of water table depth (Brennan and Scoccimarro 1999). Brennan and Scoccimarro (1999) note that the widespread adoption of technology to increase rates of on-farm water retention may have negative impacts on instream flows by increasing total consumptive use. The authors state that an empirically based adoption rate of 50 per cent in NSW and Victoria would result in a 700 GL increase in consumptive use, representing a substantial loss to residual environmental flows. That is, the

Table 1.3 Australian irrigated agriculture 1996-97

| Crop | Gross value ($m) | Net water use (ML) | Irrigated area (ha) | Gross value [d] ($ ML$^{-1}$) | Water use [e] (ML ha$^{-1}$) | Gross value [f] ($ hectare$^{-1}$) |
|---|---|---|---|---|---|---|
| Livestock, grains, pasture | [a] 2 540 (35%) | 8 795 428 [b] (56.7%) | 1 174 687 | 288 | 7.5 | 2162 |
| Vegetables | 1 119 (15.4%) | 634 913 (4.1%) | 88 782 | 1760 | 7.2 | 12615 |
| Sugar | 517 (7.1%) | 1 236 250 (8%) | [g] 173 225 | 418 | 7.1 | 2988 |
| Fruit | 1 027 (14.1%) | 703 878 (4.5%) | 82 316 | 1460 | 8.6 | 1459 |
| Grapes | 613 (8.5%) | 648 574 (4.2%) | 70 248 | 945 | 9.3 | 8726 |
| Cotton | 1 128 (15.6%) | 1 840 624 (11.9%) | [h] 314 957 | 613 | 5.9 | 3580 |
| Rice | 310 (4.3%) | 1 643 306 (10.6%) | 152 367 | 189 | 10.8 | 2035 |
| **Total** | **[c] 7 254 (100%)** | **15 502 973 (100%)** | **2 056 580** | | | |

[a] comprises the gross production value of stock products (excluding milk) of $148 million, milk products of $1,259 million, and crops (mostly cereals) of $1,133 million. Percentage value equals gross value as proportion of total irrigated gross value

[b] Proportion of water allocated to irrigation used by crop or production

[c] The gross value of agricultural production is $28,156 million, representing an aggregate of dryland and irrigated production. The gross value of irrigated production is 26% of the total agricultural gross value

[d] calculated as gross value divided by net water use

[e] calculated as net water use divided by irrigated area

[f] calculated as gross value divided by irrigated area

[g] Rudwick and Dantzi (1997) estimated the area of sugar under irrigation was greater than 200,000 hectares

[h] AATSE (1999) states that the area assigned to cotton production was approximately 400,00 hectares in 1996- 97

(Source: ABS 2000, SOEAC 1996)

[11]MDBC (1995) reports 22 farmers capped the Milroy groundwater bore, constructing pipelines capable of handling the 51$^{0}$C water temperatures. The efficiency of water use improved from 4% to 94% (MDBC 2000). Smith reports water loss savings of a similar magnitude in the northern mallee region of Victoria as a result of pipeline installation.

private benefits accrued by increased on-farm water availability may be offset by the social costs of reduced environmental flows. Hawken *et al.* (1999) note that buy back schemes of saved water, sponsored by Californian water agencies, represent a price incentive for the uptake of conservation strategies and maintain instream flows. The maintenance of environmental flows is contingent on the volume of saved water not being diverted to other consumptive uses, an issue flagged by Brennan and Scoccimarro (1999).

### 1.4.7 Urban and industrial water use

Twenty one per cent (4,783 GL) of the total 1996-97 water usage is attributable to aggregated residential, commercial, manufacturing and municipal consumption, including sewage and drainage (ABS 2000). The household sector consumed 1829 GL for the period, the water supply, sewerage and drainage sector consumed 1707 GL, manufacturing 727 GL and service industries 522 GL for the 1997-98 period (ABS 2000).

#### *Mining*

The mining industry used about 570 GL or 3 per cent of the total national water use. As a function of remoteness and general site aridity, the industry is not reliant on the reticulated supply and is predominately independent in obtaining water. The reticulated mains infrastructure supplied 5 per cent of total mining water requirements. The majority of mining water is obtained as self-extracted groundwater, effluent reuse, recycled site runoff or water pumped from mine shafts (ABS 2000, AATSE 1999, Smith 1998). Principal water uses include dust suppression, ore washing, mine rehabilitation and fire-fighting. The mining sector reduced water consumption by 3.5 per cent over the period 1993-94 to 1996-97 (ABS 2000).

#### *Urban Use*

As expected, the majority of urban and industrial water usage is attributed to the eastern seaboard drainage divisions inclusive of Brisbane, Melbourne and Sydney. The combined household consumption of the three capital cities accounted for 78 per cent of the nation wide total. The majority of water is provided via a reticulated system, obtained primarily from surface water[12]. The mean household water use for Australia was 294 kL year$^{-1}$ for the 1997-98 period, an increase from the previous year of 12 kL year$^{-1}$ (ABS 2000). The values for New South Wales, Victoria and South Australia were between 218 kL and 237 kL year$^{-1}$, Queensland households consumed 340 kL year$^{-1}$, Western Australia 320 kL year$^{-1}$. Households in the Northern Territory consumed 500 kL year$^{-1}$ and Tasmania 176 kL year$^{-1}$.

### 1.4.8 Urban water conservation

Substantive increases in the marginal cost of infrastructure provision and maintenance for potable water supply, metropolitan waste-water treatment and storm runoff have occurred in recent years. For most water jurisdictions, the opportunity cost of capital for water resource development and the incremental cost of water supply has risen to historically high levels. Most of the low-cost, accessible dam sites and water resources have been exploited, and an aging infrastructure contributed to increased operational and maintenance costs (Dudley and Musgrave 1991, Pigram 1993).

The escalating storage and delivery costs, in concert with competing land-uses and enforced compliance with increasingly stringent environmental standards, have led to a raft of agency initiatives. These include, *inter alia*, improved water use efficiency[13] (minimising transmission losses and maximising onsite utility), improved water reuse, reduced domestic use in relative and absolute terms and cost-savings in the provision of services. The initiatives and strategies have included a composite of regulatory, market-based and educational instruments.

Smith (1998) and AATSE (1999) discuss several city specific initiatives, highlighting water pricing tiers and structures, water conserving innovations and usage-based educational programmes to reduce per

[12]Groundwater provides domestic water for over 600 communities, consisting of more than a million people. Self extracted groundwater is important in Perth and Western Australia as a whole (SOEAC 1996).

[13]Efficiency is used in the physical or technical context rather than the socio-economic context of market or Pareto equilibrium. The latter is discussed in greater detail in Chapter 5.

capita domestic water consumption in Australia. Hawken *et al.* (2000) provides a global perspective on similar initiatives and water saving innovations and programmes. The introduction of this coalescence of incentives to conserve water has resulted in reduced or stabilised per capita consumption in the majority of Australian cities (ABS 2000). Whilst the prescription and mix of successful incentive mechanisms varies and appear to be site specific (AATSE 1999), municipal water agencies are striving to attain future reductions. Sydney Water has prescribed a 35 per cent reduction in per capita consumption by the year 2010 and Canberra aims for 25 per cent reductions for the same year (Sydney Water 1995, Smith 1998).

Solley *et al.* (1998) have determined a reduction of approximately 10 per cent in urban per capita consumption in the United States in the period 1980 to 1995. Across all sectors, the authors estimate a 21 per cent reduction of total water withdrawals in the same period.

Data from the ABS (2000) indicate that industrial, manufacturing and commercial use is following a similar downward or static trajectory as that of domestic and mining water consumption. Water use by the manufacturing sector was approximately 730 GL in 1993-94 and approximately 718 GL in 1996-97, a reduced consumption of 1.6 per cent (ABS 2000). Water used in the manufacturing sector 1996-97 was comprised of 69.8 per cent mains supplied, 29.6 per cent self-extracted and 0.6 per cent effluent recycling. The main manufacturing water users in 1996-97 were basic metals and products (21 per cent), paper processing and manufacture (17 per cent) and food processing (9 per cent). All three sectoral categories are characterised by reduced water consumption over the 1993-94 and 1996-97 period (ABS 2000).

## 1.5 Summary

Australia is relatively well endowed with accessible freshwater resources, despite being characterised by substantial temporal and spatial variance of rainfall and groundwater stores. The magnitude of divertible and developed water resources is greater than in most countries. Further development is unlikely in high use catchments such as the Murray-Darling Basin; a function of previous over-allocation and interdependent environmental constraints. The irrigation sector uses approximately 70 per cent of the total water consumed, and accounts for 95 per cent of the observed increase in consumption. 63 per cent of that increase is attributed to irrigated pasture. Water use for the urban, mining, manufacturing, energy and service sectors accounts for 22 per cent of total water use and per capita use is relatively stable or declining. Declining per capita and absolute consumption by households has been observed for major capital cities. The balance of total water consumption is attributed to the sewerage and drainage sector. The urban and service sector contributed 90 per cent of total water revenue. The combined rural and irrigated agricultural sectors contributed 5 per cent of water revenues and consumed 80 per cent of total water supplies (AATSE 1999, ABS 2000, SOEAC 1996)[14].

[14]Australian Academy of Technological Sciences and Engineering, Australian Bureau of Statistics and the State of the Environment Advisory Council respectively.

## 2. The Evolution of Water Management in Australia

A historical perspective to water management[15] provides an insight into the reasoning that underpinned the rationale and eventual decisions of past agencies and legislators and provides an understanding of the evolution of contemporary management initiatives. The line of historical examination flags the inherent and prevalent difficulty in determining a judicious balance between water utilisation and conservation and in establishing a comprehensive, integrated framework of management that accounts for the terrestrial hydrological cycle.

### 2.1 British Common Law, Riparian Rights and Alfred Deakin

The colonies of Australia inherited the riparian doctrine, entrained in British common law, that gave landholders conditional rights to the access and rights to water contiguous with and adjoining their land. Although modified to suit the attributes of Australia[16], the rules of common law still represent the foundation of the legal system relating to water in Australia (Fisher 2000). The doctrine of common law impeded the colonial development of mining, agriculture and particularly the urbanisation of Victoria (Paterson 1987). Commentators have identified an amalgam of factors which prompted legislative changes in the late 1800's, relevant to the control of water and its allocation. The three main points are summarised as follows.

Firstly, in the mid 19th century, a high proportion of the Australian population resided in urban communities, a characteristic of current Australian demographic distributions. Smith (1998) estimates 40 per cent of the European population was urban in 1861, rising to 50 per cent in 1881. The dictates of urban water services are reticulated supply and disposal; at the time these were not being satisfied in any of the major urban communities. The existing rules of common law were inadequate to accommodate the required appropriation of land titles for catchment and storage, transmission canals, community resettlement and land resumption (Paterson 1987b, Powell 1976). The required scale of urban water development necessitated obtaining capital, a process predicated on the existence of secure legal water rights (Paterson 1987b).

Secondly, the original ideal of a bucolic clone of English cottage farms supplanted in the rural districts of Victoria was facilitated by the land selection Acts of the 1860's. The process of intensification of land-use and population was termed "closer settlement", a process that demanded an increased and more reliable water supply (Powell 1976, Smith 1998). The legal settlers were soon in conflict with the growing number of squatters occupying large tracts of grazing land which, as an acquisition priority, were associated with water or river frontages. The squatters' implicit assumption that rights to the land automatically bestowed rights to water reflected the notion of the prior appropriation of water, the prevailing doctrine of water rights of the Western United States. The doctrine of prior appropriation applies formal property rights to water, accrued to the user on a "first in time, first in right" basis (Colby 1995).

Lastly, as noted by Fisher (2000) and Powell (1976), during the 1850's the control of many rural water resources were commandeered by the mining industry during the Victorian gold-rush to the extent that:

> *Mining did eventually highlight the vital significance of water as a resource and distinguished some of the major legal, political and administrative implications inherent in its management in a dry continent. In several districts during the fifties, race holders spurned the toils of mining itself and made a good living from the sale of water rights, contrary to the spirit of the vague legislation which had been developed too casually to link the specified rights of using the water to directly productive activities" (Powell 1976 p. 39).*

[15]J.M. Powell provides an account of the history of water development in Australia. In particular Environmental Management in Australia 1788-1914 (Powell 1976), Plains of Promise, Rivers of Destiny; Water Management and the Development of Queensland 1824-1990 (Powell 1991), Watering the Garden State; Water Land and Community in Victoria 1834-1988 (Powell 1989).

[16]See Mabo v Queensland 1992 (Fisher 2000).

According to Fisher (2000), the initial legislative attempts by the Crown to resolve these issues were both cumbersome and confusing. The Crown failed in its attempt to "enforce its rights of ownership of land and secure associated water rights as a basis for providing a supply of water for the community" (Fisher 2000 p. 4).

Powell (1976) notes that the importance of these early institutional developments in defining water rights, is the recognition that the rights to water were increasingly reliant on public administration. According to Fisher (2000) these were the precursors of the current centralised public systems of water management.

Smith (1998 p.151) describes the political and institutional outcomes in response to the drought of 1877-81 as *"climatic determinism"*. Galvanised with the water needs of mining, agriculture and escalating urbanization, the drought catalysed legislative change culminating in the *Water and Conservation Act* of 1880 (and its later amendments). The subsequent irrigation trusts formed to supply metropolitan water and later irrigation were the one brief episode in the history of Australian water administration where privately administered and owned corporations constructed, controlled and financed waterworks (Smith 1998). The private irrigation trusts were poorly designed and constructed, and administered by commissioners with little practical experience. Powell (1976) notes the incentive for a more conservative use of water by farmers was diminished by the imposition of below-cost supply costs, exacerbated by inadequately defined riparian rights. The subsequent financial losses incurred by the trusts were subsidised by government funds obtained from urban taxpayers, constituting early variants of cross-subsidies and economic rent-seeking by water users.

The relevant legislative arrangements in Australian states, including the definition of ownership of water and rights to water use, eventually followed the model established by Alfred Deakin's Victorian *Irrigation Act* of 1886. The seminal legislation:

- exclusively vested the right to the use, flow and the control of water in any watercourse in the state
- subordinated the rights of the individual in that private riparian rights could not compromise the cardinal rights of the state
- highlighted the need for the rights of the individual and the state be fully defined.

(Mulligan and Pigram 1989, Smith 1998).

The legislation superseded the traditional English doctrine of "riparian rights" whereby ownership of water went with the ownership of land abutting waterways, and entailed an explicit rejection of the western United States doctrine of "prior appropriation".

The *Irrigation Act* of 1886 instituted a system of centralised administrative allocation of water rights, managed by a public water authority. Paterson (1987b) postulates that the consequent nationalised *rights* to water were not the direct causal agent of the current public *ownership* of water resources. The *Irrigation Act* did not prohibit the private irrigation or water supply schemes (Smith 1998). The *Act* is premised on the assignment of water allocations to private, co-operative and municipal water supply corporations (Paterson 1987). Deakin specifies in his original recommendations that:

> *local 'water masters' should be appointed to supervise distributions and settle disputes; the duties of these officials should be organised by a central office so as to guarantee the preservation of watercourses and other sources of supply (Deakin 1885 p. 55).*

The failure of the private trusts and water trading entities, ratified by legislation in 1905 (Powell 1976), in concert with the need for secure urban water supplies, culminated in the almost exclusive provision of public water by government authorities (Paterson 1987b). The primary role of government agencies, initially defined and codified in Victoria in the 1890's, remains as the principal *modus operandi* of Australian water authorities. As Smith notes (1998), it is Deakin's legacy that marks the period, through the formulation of statutory and administrative arrangements, rather than the impact of urban and rural water development on the physical landscape.

Powell (1976) argues that under the aegis of the 1886 legislation and the determining factors culminating in the public management of water, irrigation removed the

element of climatic risk and was viewed as the means to "establish man's final and complete dominion over a hostile environment, or fulfil his sacred commission to improve on nature" (Powell 1976 p. 132).

According to Kirkpatrick (1995), the perceived key to colonial wealth, the soil, manifested through agricultural pursuit in concert with ample water, was encapsulated in and administered by a public bureaucracy dominated by an engineering ethos (Paterson 1987a, and Smith 1998).

The provision of water supply infrastructure has been considered by Australian governments of all persuasions as an unequivocal public good and intrinsically coupled to the strategic social objective of national and regional development. The primacy of economic development and regional employment, resulted in the provision of water diversion and reticulation schemes regardless of cost (Crase *et al.* 2000, Musgrave 1996, Paterson 1987b). The comment provided in the first Victorian progress report on irrigation and water supply epitomizes the historical and prevailing enthusiasm for irrigation.

> *If Victoria is to continue to progress in the settlement of her people upon the lands and multiplication of her resources by the conquest of those areas hitherto regarded as worthless; if she is to utilise her abundant natural advantages, bring her productiveness to the highest point and secure to the agricultural population of her arid districts a permanent prosperity, it must be by means of irrigation. No price, it may be said is too high, indeed, it implies the sapping of the spirit of independence and that of self-reliant energy and enterprise which have one her present position; for by these, and these alone, can she maintain it. (First progress report 1885 p. 113; cited in Powell 1976 p. 133).*

## 2.2 The Role of State Governments as Water Developers

On the basis of these institutional and policy dictates, State governments became extensively involved in the water industry as developers of water supply infrastructure such as dams, and developers and owners of large-scale urban and rural supply schemes (including irrigation).

The deployment of this grand scheme received broad political and commensurate financial support, and was facilitated by a well-established engineering hierarchy, responsible for the conceptualization, planning and construction of dams, and reticulated supply, drainage and sewerage systems. Additionally, the statutory authorities responsible for supplying rural irrigation water[17] progressively controlled the pattern of rural settlement, inclusive of farm size and crop types (Smith 1998). The agency objectives and tasks, whilst large in magnitude and scale, were narrow in scope and comprehensively specified. With minimal political distraction, the achievement of specific hydraulic and engineering objectives was vigorously executed with high levels of technical expertise and utility. According to Paterson (1987b and Powell (1976) there was no legislated obligation to consider external consequences, and the subsequent metric of rural water development success was couched in engineering terms and measured accordingly. Although punctuated by the Depression and two World Wars, the pace of water development, particularly rural irrigation schemes, has continued unabated over the 100-year period initiated by Deakin's *Irrigation Act* of 1886.

The period prior to the early 1990's is characterised by optimistic national development, a regime dedicated to drought-proofing extant and proposed agricultural endeavor and a policy of intensive and extensive rural settlement (reinforced in later years by the motivation of national defence). According to Paterson (1987a), Pigram (1993) and Randall (1981), the confluence of factors introduced predictable distortions to water use and the operations of managing agencies. The result was the over-allocation of water supplied at below-cost and a lack of adequate signals or incentives to conserve water (Greig 1998, Mulligan and Pigram 1990).

Several commentators suggest that partly as a corollary of the engineering hegemony, the diversion and construction costs of water supply schemes were rarely

[17]The Water Conservation and Irrigation Board in NSW and the State Rivers and Water Supply Commission in Victoria (Smith 1998).

subjected to the scrutiny of basic cost accounting conventions and certainly not to the rigour of benefit-cost analysis (Davidson 1969, Mulligan and Pigram 1989, Musgrave 1986, Paterson 1987a, Powell 1976 1989, Watson 1990). Davidson (1969) argues that proponents, when questioning the justification and costs for water development proposals, were generally dismissed as naïve or lacking foresight. The opinion has some historical precedence. Powell (1976) notes the recommendation of restraint and recognition of caveats on the benefits of irrigation being extolled prior to the *Irrigation Act* of 1886.

> *We believe that too sanguine views of its profitableness are often entertained from an underestimate of the cost and over estimate of the results, arising from a want of information or due consideration of the conditions essential to success (Irrigation Committee Report 1882, 10-11 cited in Powell 1976 p. 128).*

Davidson (1969) has criticised the level of government expenditures on irrigation schemes, based on a thesis that the drought proofing and the irrigation solution were fundamentally ill-founded and misconceived. The extant competitive advantage for Australian agricultural is founded on a high ratio of naturally well watered land per capita. Successful agricultural enterprise was predicated on the utilisation of large tracts of cheap land, the use of low levels of labour and the production of a relatively durable export commodity (Paterson 1987b). Irrigation, as posited by Davidson (1969), was the antithesis of a successful Australian farming system predicated on that natural advantage. Irrigation required smaller parcels of land and was labour intensive. Davidson's examination of the accounting detail of irrigated farming budgets indicated a bleak picture for individual operators and that extensive irrigation development was economically irresponsible. Paterson (1987b) estimates that based on economic criteria, *ex ante*, only 12 per cent of the land in irrigation production in 1987 would have been developed. Paterson (1987b) continues that if the inertia and motivation for agricultural production had been calibrated to economic measures rather than the fervor of national development, the infrastructure that provides 70 per cent of Australia's water use would not have been constructed.

The increase in the area of irrigated land dedicated to pasture from 1987 to 1996-97 (ABS 2000) highlights the entrenched nature of the development doctrine.

Davidson (1969) argues that the corollary of the deployment of scarce capital into the development of irrigation rather than the improvement of dryland techniques, is the inability of irrigation farmers to pay for full cost water provision. A more recent appraisal by Watson (1996) comes to similar conclusions.

The partial recovery of supply costs has been inherited by contemporary water institutions managing predominately irrigation water (Hall *et al.* 1993, Grey 1998, Watson 1996). Of the total receipts of $181 million collected for the 1995-96 financial period by the New South Wales Department of Land and Water Conservation, $22 million (12.2 per cent) stemmed from user charges. The balance of $159 million came from government subsidies and miscellaneous sources (AATSE 1999). Grey (1998) states the magnitude of the irrigation subsidy figure for New South Wales is approximately $400 million per annum, reflecting expenditure on capital items, management costs and environmental amelioration. There is significant divergence amongst authors in estimating the magnitude and the proportion of revenues from water users. Sturgess and Wright (1993) state that of a total estimate of $8.2 million needed to manage the rivers in NSW water users contributed $5.7 million (70 per cent).

The aggregate 1996-97 revenue for the four Victorian rural authorities; Southern Rural Water, Goulburn-Murray Water, Wimmera-Mallee Water and Sunraysia Rural Water was $141.5 million (AATSE 1999). The $96.2 million or 68 per cent attributed to user charges, is sufficient to cover operating charges but does not contribute to capital depreciation or a sufficient return on investment. Walker (1993) contends some of these assessments may undervalue the performance of water authorities, and subsequently reflect an artifact of accounting conventions and procedures. Although the empirical appraisal of Walker (1993) deals predominately with urban water agencies, the article concludes that rural water agencies are endowed with substantial subsidies and are supplying below-cost irrigation water. Alaouze and Whelan (1996), Grieg (1998), Musgrave (2000), Paterson (1987b), Pigram

(1993, 1999), Randall (1981) and Watson (1996) for example, reach similar conclusions regarding irrigation subsidies and/or below cost pricing of water supplies.

Institutional accounting conventions have assumed that as a natural monopoly, formulated in response to the necessary economies of scale, the costs of water institutions would be compensated by the accrued national benefits of economic development, additional external benefits of regional activity and marginally decreasing operating costs (Watson and Johnson 1993). The notion that the sale of land associated with irrigation improvements, developed with government funds, would provide a partial recovery of costs has persisted, despite the lack of any historical precedent, a body of contrary evidence and the commercial failure of institutional land development enterprises (Smith 1998).

By the 1980's economists and environmental groups had come to question the wisdom of continued dam building and public subsidisation of rural water use (Hartman and Seastone 1970, Randall 1981, Watson and Rose 1980). Greig (1998) argues that the expectation of continuing public subsidy of rural water and the desire of politicians to appeal to this sentiment had created a situation conducive to management reform. The factors of the over-allocation of water diversions, severe environmental degradation, a lack of adequate signals to conserve water, unrelated agency revenues and operational costs and extensive subsidisation were also predicates of the reform process (Greig 1998).

Ideally, the development of natural resource administration and legislation in Australia would reflect the extant constraints of biophysical parameters in concert with the environment-economic interface, shaped by the prevailing social preferences and values. Paterson (1987a) and Powell (1976) argue that more often, management represents the legacy of past statutory decisions and their precursors, embedded to varying degrees in natural resource law and operations across all constituencies. Paterson (1987a) argues that current institutional arrangements to manage water are the accretion of policy, both appropriate and inapt, and often the corollary of political expediency, institutional capture and vested interest lobbying.

According to Greig (1998), Mulligan and Pigram (1989) and Musgrave (2000) the heritage of Australian water allocation is no exception, particularly in the exploration of the initial doctrine of exploitation and development and the transition to an ideology of systemic water management.

## 2.3 The Push to Water Reform

Prior to the 1980s water authorities had been preoccupied with the development and delivery of water services and supply. By the end of the decade they were compelled to address issues and policies related to the management of water resources in a mature water economy. Randall (1981) and Watson and Rose (1980) characterise a mature water phase by rising marginal supply costs, intensified competition between disparate users, increasing relative scarcity and increased interdependencies amongst water users.

The incremental cost of water diversion and transmission was sharply increasing and an aging and deteriorating reticulation system was contributing to increased operation and maintenance costs and pressure for replacement expenditure (Randall 1981). The opportunity cost of capital for water resource development had risen to historically high levels. The majority of accessible dam sites and water resources, characterized by marginally lower diversion costs, had been exploited. Marginally increasing costs of supply were exacerbated by an increasing demand for water resources, both in scale and diversity, particularly community demand for in-stream environmental objectives and consumer concern for improved quality of supply.

Conflict was growing between the old developmental objectives and the newer coalescence of economic and environmental objectives. Tension between potential uses was being played out within institutional settings geared to resource expansion rather than an optimal allocation of a scarce resource. Finally, awareness was growing of the severity of environmental degradation, its irreversibility in some cases, and the consequences including declining quality of the resource.

Watson (1990) identified two interrelating issues associated with these changes. Firstly, those concerning the increasing relative scarcity of water resources and the efficiency and equity of their allocation. Secondly, those concerned with increasing environmental impacts,

degradation and the sustainability of water use. Watson (1990) states these two sets of issues required a fundamental shift away from an axiom of single resource development, to the systemic management of resources as an ecological, economic and social system. (Watson 1990 p. 13)

Watson's identification of economic efficiency and ecological sustainability as the twin focal points of contemporary water policy reflected emerging international trends in resource management and anticipated a recurring theme in water reform initiatives of governments, water authorities and analysts in the subsequent decade. This appraisal, articulated by early analysts and commentators such as Ciriacy-Wantrup (1952, 1955), Krutilla and Eckstein (1958) and Polanyi (1944), reflected the concerns of the external effects of poorly specified property rights of jointly produced, multiple-purpose resources (inclusive of water). Hartman and Seastone (1970), Hayek (1965), and Randall (1981) *inter alia*, proposed various resolutions, arrangements and caveats for market-based water right transfers.

### 2.4 Sustainable Water Management

The World Conservation Strategy (IUCN 1980) is arguably the first global statement on sustainable development, although it is less well recognised than the World Commission of Environment and Development meeting of 1987. In that year, the United Nations published the pivotal Brundtland report on the environment, the first official international platform for sustainable development (WCED 1987). Concurrently, Opschoor and Vos (1989) reviewed the extent of the Organisation for Economic Co-operation and Development (OECD) application of economic instruments as a tool for environmental management. The timing of the two reports is significant in that one of the major strategic imperatives of the Brundtland report is the mutual reinforcement of economic and environmental policy in decision making. It is described as the common theme to all other elements (WCED 1987 p 62.) and meant to induce changes in institutional attitudes, objectives and initiative (Turner and Opschoor 1994).

The synthesis of environmental and economic imperatives and the proposed means of compliance and application formed the substratum of the next wave of international conventions, and continue to influence their evolution and implementation.

Evidence presented to the commission pointed to a critical disparity between population growth and unrestrained consumption patterns, natural resource availability and the environments ability to assimilate waste. The report signalled the need to adapt unrestrained economic growth, by incorporating a sustainable development ethic. The report defines sustainable development as:

> *… development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED 1987, p. 43)*

According to the Brundtland report (WCED 1987 p 65) sustainable development requires:

1. A political system that secures effective citizen participation in decision making.
2. An economic system that is able to generate surpluses and technical knowledge on a self reliant and self sustained basis.
3. A social system that provides for solutions for the tensions arising from disharmonious development.
4. A production system that respects the obligation to preserve the ecological basis for development.
5. A technological system that can search continuously for new solutions.
6. An international system that fosters sustainable patterns of trade and finance.
7. An administrative system that is flexible and has the capacity for self-correction.

The Brundtland report managed to distill the rhetoric and vagaries of the then debate, and presented the results as a concise and persuasive argument, compelling enough to catalyse future commissions and committed debate. The concerns of inequality in wealth distribution, population growth and consumption patterns, formed the framework for Agenda 21. Most of the conventions post 1992 and recent amendments to the earlier forums and conventions are underpinned by Agenda 21, the working plan for action developed and ratified in Rio (UNCED 1992).

As a signatory, the Commonwealth of Australia agreed to comply with the principles of ecologically sustainable development as set out in the Rio declaration. In so doing, the Commonwealth committed the States to adhere to those principles—one of the tenets of current management, planning and policy for water management in Australia.

Entrained in the fora of conventions, treaties and the ensuing literature, the terms sustainable management and sustainable development are applied extensively and broadly. The foundations and intent of sustainability are cogent, intuitive and compelling. The current needs of society are met by the utilization of the outputs and services of water, and with benign intervention, future generations inherit water resources with the same potential.

Given the almost universal usage of the term "sustainability" one could assume that a concise definition has been broadly accepted and implemented. Throughout the substantial literature, there exists an overall consensus of the fundamental characteristics of sustainability as originally formulated and espoused in the World Conservation Strategy (IUCN 1980) and the Brundtland report (WCED 1987). However many specific definitions abound (Pearce *et al.* 1989, Pezzey 1992, 1992b). The term has a permanent place in the political and economic discourse of all jurisdictions, is a central tenet of Federal, State and Local Government policy, and is widely disseminated in the media and industry.

However, rather than becoming codified and institutionalised as suggested by this ubiquitous usage, the term can be seen as vague, malleable and generic. The process has been defined by promises, goals and intentions, shaped into national action by political and institutional persuasion rather than by enforceable legislation. The widespread inertia and current concern is considered by some critics to be founded on "moral guilt and pragmatic fear" (O'Riordan 1993 p. 39) rather than the implied concern for intergenerational equity that sustainability engenders.

The operational context and dimension seems to have been lost in the generality of application, and subsumed in the definition debate. This ambiguity has made pragmatic applications difficult for individuals, industry and government alike, and has significantly contributed to the misunderstanding and limited administration of sustainable principles.

The implementation of sustainable development principles in the early 1990's, which postulated an adaptive management approach to stochastic riverine environs and was based on an imprecise knowledge of environmental perturbations, contrasted with the singular engineering and hydraulic objectives that had informed and dominated water management up to that time. There is no blueprint for ecological sustainability (Common 1995) and the subordination of the extant expansionary doctrine meant water institutions faced an array of problems, many of which were at odds or unrelated to the initial reasons for their establishment (Pigram 1993).

While this is seemingly cosmetic, there are signs of a political force and impetus in the management of water. Having transcribed the rhetoric to at least raise the awareness of, and sensitise water institutions and decision-makers to the principles of sustainable water management, there was a pressing need to design and implement relevant, practical outcomes and assessable methodologies. The National Strategy for Ecologically Sustainable Development was the Council of Australian Governments (COAG) initiative to provide a structured framework of guidelines for natural resource management (COAG 1992).

## 2.5 National Strategy for Ecologically Sustainable Development

After consultation with the states and industry, the National Strategy for Ecologically Sustainable Development (NSESD) (COAG 1992) was the Federal Government's compliance initiative to the Brundtland report and preparatory statement for Agenda 21, resulting in policy statements and strategies for nine key sectors. The document was ratified in 1992 by the Federal Government and all States and represents a non-legally binding set of policy guidelines for the States, the Commonwealth and the respective agencies in their control.

Sustainable development of resources was defined as:

> *Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the quality of life now*

*and in the future can be increased. (Commonwealth of Australia 1990, p(i)).*

The guiding principles and objectives (summarised in Table 4) are similar in intent to the recommendations of the World Conservation Strategy and reflect the prescience of that meeting. The recognition and inclusion of social costs and the interface between economy and environment in the National Strategy for Ecologically Sustainable Development document goes some way to answering Adams (1990) criticism of the World Conservation Strategy statement, as "pious, liberal and benign, inevitably ideological and disastrously naïve".

The policy changes highlight the institutional recognition of a broader suite of water resource issues than that associated with past water management regimes. A number of policy instruments, from all political jurisdictions, have been deployed in an attempt to ameliorate those deficiencies (COAG 1994, 1995, Fisher 2000).

The water reform process is articulated in the Council of Australian Governments reform initiatives, directed by the enforced compliance with the National Competition Council's recommendations and shaped by the in principle agreements of the National Strategy of Ecologically Sustainable Development (COAG 1992, 1994). The report and proposals on national competition policy of the Hilmer Committee (Hilmer 1993) conditioned later recommendations of the National Competition Council. The development, implementation and jurisdictional compliance of the triad of water reform initiatives are discussed extensively in Chapters 3 and 4.

Table 2.1 The guiding principles and core objectives of the National Strategy for Ecologically Sustainable Development (ESD)

| **The National Strategy for Ecologically Sustainable Development** |
|---|
| **Core Objectives**<br>• To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations<br>• To provide for equity within and between generations<br>• To protect biological diversity and maintain essential ecological processes and life-support systems |
| **Guiding Principles**<br>• Decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations.<br>• Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>• The global dimension of environmental impacts of actions and policies should be recognised and considered.<br>• The need to develop a strong, growing and diversified economy, which can enhance the capacity for environmental protection should be recognised.<br>• The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised.<br>• Cost-effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentives mechanisms.<br>• Decisions and actions should provide for broad community involvement on issues that affect them. |

Source: COAG (1992)

The chronology of the reform agenda has been:

- December 1992: National Strategy for Ecologically Sustainable Development (COAG 1992)
- August 1993: Hilmer Committee report on national competition policy (Hilmer 1993)
- February 1993: COAG strategic water resources policy framework (COAG 1994, 1995)
- March 1995: COAG adopts the national competition policy package.

In particular, the singular construct of water capture and reticulation, which traditionally reflected the primacy of national development, was increasingly seen as failing to capture the multiplicity of water outputs, ecosystem functions and the changing societal objectives of maintaining instream values and water quality.

The adopted system of natural resource management depends on the prescribed objectives of the prevailing managing agency or government instrumentality. The ratification of the NSESD added a complicating dimension to the previously narrow, well-defined and enthusiastically implemented functions and mission statements of the water authorities. The policy addenda, presciently noted by Paterson (1987b) and Watson (1990), forced the agencies to comply with a more extensive, fluid and stochastic set of parameters measured by diverse environmental metrics rather than the extant engineering specifications.

The entrenched bureaucracy, accustomed to public support, widespread financial endorsement and independent decision-making, were corralled into an environment of inter-agency cooperative planning[18], committee administration and systemic water management. The diminution of independent decision making resulted in a dissipation of purpose. According to Paterson (1987b), the compliance with a management protocol that recognised the multiple functions of water complicated the specification of jurisdictional boundaries and the assignment of functional separability. Fisher (2000) flags the ongoing difficulty in accurately specifying the interdependency of the catchment/water-use environs and translating that into an operational, binding set of constituent specific statutes.

The complexity of institutional transformation by water agencies was further exacerbated by the introduction of another set of alien metrics, those of economic efficiency.

The Industry Commission (1992) bunched the salient issues in water reform under the headings of:

- efficiency of service provision and water management, primarily pricing of water services, institutional arrangements and better systems for allocating water between competing uses; and
- sustainability of water use, identifying increasing eutrophication of waterways, salination and waterlogging in irrigation districts, sewage pollution in rivers and oceans, and degradation of groundwater systems as major issues.

The political context of the changing water policy agenda is summarised by the Industry Commission thus:

> *Worthwhile changes continue to be thwarted by the outcomes of past policies and the attitudes that those policies have engendered in both water users and government . . . there are major challenges for policy makers in reconciling the often competing interests of the environment and those using and disposing of water (Industry Commission 1992 p. 21).*

## 2.6 Summary

Several commentators broadly classify the history of European initiated water resource development into at least two phases (for example Mulligan & Pigram 1989, Musgrave 1996, Smith 1998, Watson 1990 among others). The first one hundred years of European settlement was typified by the ad hoc and opportunistic development of water resources. Survival, food and shelter took precedence over any long-term national planning and development strategy and precluded any pioneering environmental consciousness.

Water resource policies since the Victorian *Irrigation Act* of 1886 (initiated by Deakin) to the late 1980's, like

[18]Paterson (1987b p. 5) notes this was more likely a case of "pervasive territorial conflict with their peers in the fields of land protection".

those relating to other natural resources, were focussed on exploitation to promote economic and demographic growth and employment generation. Specific to water, the drought proofing of the nation was entrained in an ethos of national development, vigorously pursued and enacted. Private riparian rights were subordinate to those of the State, and administered according to a doctrine of "non-priority riparian rights". On the basis of these institutional and policy dictates, State governments became extensively involved in the water industry as developers of water supply infrastructure such as dams, and developers and owners of large-scale urban and rural supply schemes. The period of extensive and prolonged water diversion came to a relatively abrupt halt in the 1980s.

The following quotation by Mulligan and Pigram (1989) succinctly portrays the prevailing attitudes during the transition phase.

> *Decades of steady growth, both economic and demographic, have, in a relatively short time, come to an end. The former emphasis on developing new sources of water supply has given way to encouraging more efficient management of existing supplies …unquestioned endorsement of water development programs can no longer be assumed.… In the harsher economic climate of the 1980s are the financial constraints resulting from intensified competition for funds between water resources development and other priorities for public works and services. These factors, in turn, make more urgent the adoption of more appropriate financing and pricing policies, and more efficient management practices by water administrative bodies. Community attitudes to water are also changing. Environmental constraints are becoming increasingly effective in inhibiting water resources development and an active and vocal segment of public opinion…wants to participate in decisions affecting the physical and social environment (Mulligan and Pigram 1990 p. 1-2).*

The confluence of the over-allocation of water, the spread of irrigation-based agriculture and a lack of financial conservation incentives culminated in a situation of severe environmental degradation, unrelated institutional revenues and costs and an agricultural sector supported by extensive subsidisation. The combination of events galvanised forces to provide the necessary impetus for the substantial reform of water management.

The national goals of water management have been shaped and conditioned by a number of policy agreements, ratified by the Federal and State Governments. These in turn have been directed by a number of international conventions and treaties. Much of the impetus for water reform has come from the twin focal points of ecologically sustainable development and a national agenda of microeconomic reform and prescribed economic efficiency. Both are viewed as cardinal objectives and often couched in at times conflicting ideological terms.

The extent to which economic and environmental objectives dovetail (as asserted in current Federal and State government policies), or whether there remain tensions between them, is a recurring theme.

# 3. Overview of National Competition Policy

The purpose of this chapter is to provide an overview of contemporary microeconomic reform. This provides the context in which the COAG water reform agenda is embedded. Discussion begins with the historical evolution of current microeconomic reform. National Competition Policy (NCP) is then outlined followed by a discussion of the rationale or need for such reform. Discussion concludes with consideration of some criticisms of microeconomic reform.

## 3.1 Historical Development of Microeconomic Reform in Australia

The current reforms in the water industry, including the development of water markets are a part of a broader microeconomic reform agenda in Australia. This microeconomic reform agenda includes a broad suite of measures taken at the microeconomic (grass roots) level aimed at improving the performance of the Australian economy. As Forsyth notes:

> *Microeconomic reform is about raising standards of living by raising real incomes available for consumption…it includes measures to make individual firms produce their outputs more efficiently, better to provide the goods and services that consumers want, and measures to make markets more effective conduits between consumers and producers…it is primarily concerned with the efficiency of production and allocation of goods and services (Forsyth 1992, p. 5).*

The basic tool of the microeconomic reform process is fostering greater competition within both the private and public sectors of the economy. This involves governments changing and adapting regulations and other measures to promote competition, efficiency and a more dynamic economy (Bureau of Industry Economics (BIE) 1996).

Australia's economic policy and regulatory structure of the economy was reasonably static for the first three decades since World War II. During this time some microeconomic reforms did occur, however, they were limited and adhoc, and were not part of a coordinated economic reform agenda. During these post-war decades, macroeconomic policies, such as controlled exchange rates were the dominant instruments used by government to deliver economic policy outcomes (Forsyth 1992).

During the 1960s and early 1970s Australia enjoyed favorable economic conditions with high employment and low inflation. However, this economic prosperity began to decline in the early 1970s with rising unemployment and high inflation. The industrial and regulatory environment at that time compounded the problems of declining economic growth and rising levels of public sector debt and facilitated further declines in employment and general economic prosperity (BIE 1996).

By the late 1970s, these problems had led government to realise that many of its macroeconomic policies were inadequate for improving economic prosperity. The initial focus for change was tariff protection and improving the competitiveness of the manufacturing industry. Although government recognised that macroeconomic policies such as tariff protection were impeding desired microeconomic improvements (mainly increased competitiveness of manufacturing) government maintained a focus on macroeconomic policy (BIE 1996).

Macroeconomic concerns, such as high inflation and large budget deficits also drove the government to examine deregulation of the financial system. In 1983 the government acted on advice from various review committees and floated the Australian dollar, deregulated the financial market and abolished most foreign exchange controls. This meant greater exposure to international pressures for the Australian economy than was the case with previous macroeconomic policy regimes.

The impetus for these changes was firmly based on macroeconomic concerns; however, it provided policy makers with experience and confidence of industry reforms and was the watershed of current microeconomic reform. The development of private interest theory also made governments more aware of the costs of regulation and more critical of regulation in general. In addition, the focus overseas was increasingly moving towards microeconomic reform instruments (Forsyth 1992). By 1984, the government considered that macroeconomic instruments were not

capable of transforming a non-competitive, inflexible and sluggish economy into one that can generate strong economic growth (BIE 1996).

From the mid 1980s the government was still faced with deteriorating macroeconomic circumstances such as rising external debt and high current account deficits. These problems were exacerbated by falling commodity prices, which deflated the value of the now floated dollar with subsequent increases in import prices (BIE 1996).

The government increasingly saw that these macroeconomic problems were caused by underlying microeconomic problems and proposed microeconomic based solutions essentially aimed at improving the competitiveness of Australian exports. This involved examining the cost of inputs to these industries and included agricultural pricing and marketing arrangements (BIE 1996).

In 1988, the government broadened its microeconomic reform focus from manufacturing and agriculture to considering impediments to improved efficiency and international competitiveness across all industry sectors. There was also a growing awareness of the need to reform Government Business Enterprises[19] (GBEs) and expose them to competition (BIE 1996). The initiatives outlined in the government's 1988 Economic Statement signaled that they "recognised the importance of removing or modifying regulations that impeded efficiency as well as the importance of promoting competition for improving performance" (Keating 1988, p. 120).

This broader and more systematic approach to microeconomic reform was reflected in the establishment of the Industry Commission (IC) in 1990. The establishment of the IC was significant in that its role encompassed economy wide aspects of productivity and competitiveness and in that the IC embodied a cooperative approach with the states and territories in implementing microeconomic reforms (BIE 1996). About this time, international performance benchmarking of infrastructure services began. The benchmark was designed as a competitive stimulus to drive efficiency gains and lower the cost of infrastructure services used as business inputs.

Thus, by the early 80s, the reform agenda had incorporated, *inter alia*, a focus on GBEs and infrastructure services and identified the need for cooperation with the states and territories to implement microeconomic reform. In May 1992, the Council of Australian Governments (COAG) was established to facilitate such a cooperative approach. COAG comprises ministerial representatives from all states and territories and plays an important role in the negotiation and implementation of microeconomic reform (amongst many other policy issues) (BIE 1996). In addition to COAG, governments utilised Leaders' Forum and Heads of Government meetings to facilitate the adoption of a nationally coordinated approach to various reform issues (National Competition Council (NCC) 1998).

In October 1992, after agreement with the various tiers of government, the federal government established an independent inquiry into a national competition policy headed by Professor Fred Hilmer. The Hilmer review was released in late 1993 and recommended that competition policy should be pursued on a national basis. The review also recommended a suite of new policy principles to regulate markets traditionally supplied by governments, particularly where there are natural or mandated monopolies. It was also recommended to establish a National Competition Council to assist cooperative implementation of the reforms (BIE 1996).

In 1994, the Federal and State/Territory governments agreed, in principle, to implement the competition policy principles of the Hilmer review. The governments also agreed the revenue benefits flowing from the reforms should be shared amongst all governments (BIE 1996). The then Prime Minister commented that:

> *Competition policy will be introduced to large parts of the economy that until now have been sheltered from it, including utilities owned by Commonwealth*

[19]Government Business Enterprises are businesses owned by Government. Many previously nationalised enterprises such as Telecom (now Telstra) are GBEs. GBEs may or may not be wholly government owned. In the case of Telecom, it was corporatised to Telstra with partial privatisation whereby the Federal Government currently retains 51% ownership. The water industry has seen the creation of many GBEs when water authorities have been corporatised. Privatisation is the process of selling a publicly owned corporation or GBE to private shareholders and corporatisation is the process of creating a separate government owned business enterprise.

*and State governments…including ports, water, gas, electricity and rail (Keating 1994, p. 23).*

In 1994, COAG endorsed a framework of initiatives for the water industry to run over a seven year period. The framework covered water pricing reform based on the principles of consumption based pricing and full cost recovery, elimination of cross subsidies and making subsidies transparent. Also covered were issues on water allocation and entitlement, reform of irrigation systems, allocating water for environmental purposes and institutional reform (IC 1998).

The COAG water reform framework required the development of a comprehensive system of water allocations and entitlements. In October 1995, the Standing Committee on Agriculture and Resource Management (SCARM) developed the National Framework for the Implementation of Property Rights in Water.

The COAG water reform framework later became linked with the NCP reform package agreed to by COAG in 1995 (discussed below). The COAG water reform framework and its implementation is discussed in the following chapter.

In April 1995, a National Competition Policy (NCP) reform package was agreed amongst the federal and state/territory governments. The NCP reform package contained three intergovernmental agreements. They are the:

- Conduct Code Agreement
- Competition Principles Agreement
- Agreement to Implement the National Competition Policy and Related Reforms.

The Conduct Code Agreement operates in conjunction with the *Competition Policy Reform Act 1995*, and sets out processes for amending the competition laws of the Commonwealth, States and Territories to extend the coverage of Part IV of the *Trade Practices Act 1974* to all businesses in Australia, irrespective of their ownership (NCC 1999b).

The Competition Principles Agreement, establishes reform principles in relation to access to essential infrastructure facilities; prices oversight of government businesses; structural reform of public monopolies; fair competition between government businesses and private sector businesses; reviewing the merits of anti-competitive legislation and regulation; and the application of competition principles to local government. A public interest test to enable governments to assess the merits of proceeding with particular reforms is also included (NCC 1999b).

The agreement to implement the National Competition Policy and related reforms incorporates COAG reform agendas for the electricity, gas, water and road transport industries into the NCP framework and includes implementation timetables and details of Commonwealth NCP payments to the states/territories (NCC 1999b).

These three competition policy agreements "committed governments to reforms broadly in line with the Hilmer recommendations, and to changes in the electricity, gas, water, and road transport industries which had been previously agreed by governments" (NCC 1998, p. 5). The competition policy agreements also established the National Competition Council (NCC) with the role of NCP oversight, advising Ministers and assisting governments with NCP implementation (BIE 1996). Governments were also required to report their NCP implementation progress annually to the NCC.

Governments had previously agreed, in principle, that the benefits of microeconomic reform should be shared. Consequently, under the Implementation Agreement, the Commonwealth Government undertook to make NCP payments to each state and territory. Three tranches of NCP payments were agreed for July 1997, July 1999 and July 2001. These payments comprised an indexed competition payment and an agreement to maintain the real per capita value of the Financial Assistance Grants available to each state/territory. These payments were however contingent upon NCC recommendation for payment approval to the Federal Treasurer based on the NCC's assessment of state/territory implementation against agreed implementation requirements (NCC 1999b).

The first tranche of NCP payments were made without water reform obligations. The second tranche payments were dependant on states and territories effectively implementing the strategic framework for the efficient and sustainable reform of the Australian water industry. The third tranche payments require the states and territories to give full effect to, and continue to fully observe, all COAG agreements on water (NCC 1998).

The NCP reform package agreed to by the Federal and State/Territory governments effectively linked the strategic water reform framework adopted by COAG in 1994, to the NCP tranche payments. As mentioned above, the implementation of the COAG water reform framework as part of the NCP reform process is the subject considered in the following chapter.

### 3.2 National Competition Policy Outlined

All Australian governments agreed with the need for a national competition policy and that it should give effect to the following principles:

- no participant in the market should be able to engage in anti-competitive conduct against the public interest;
- as far as possible, universal and uniformly applied rules of market conduct should apply to all market participants regardless of the form of business ownership;
- conduct with anti-competitive potential said to be in the public interest should be assessed by an appropriate transparent assessment process, with provision for review, to demonstrate the nature and incidence of the public costs and benefits claimed; and
- any changes in the coverage or nature of competition policy should be consistent with, and support, the general thrust of reforms:
  - to develop an open, integrated domestic market for goods and services by removing unnecessary barriers to trade and competition; and
  - in recognition of the increasingly national operation of markets, to reduce complexity and administrative duplication (Hilmer 1993).

Competition policy encompasses all policy dealing with the extent and nature of competition in the economy. The Hilmer report noted that competition policy "seeks to facilitate effective competition to promote efficiency and economic growth while accommodating situations where competition does not achieve efficiency or conflicts with other social objectives…these accommodations are reflected in the content and breadth of application pro-competitive policies, as well as the sanctioning of anti-competitive arrangements on public benefit grounds" (Hilmer 1993, p. 6).

While the Trade Practices Act is an aspect of competition policy, the relevant field of policy interest is much wider. Competition policy "permeates a large body of legislation and government action that influences permissible competitive behavior by firms, the capacity of firms to contest particular economic activities and differences in regulatory regimes faced by different firms competing in the one market" (Hilmer 1993, p. xvi).

Hilmer regarded regulation by all levels of government as the greatest impediment to competition. Consequently, it was considered that regulatory restrictions on competition should be removed, unless it can be clearly demonstrated that this would not be in the public interest (BIE 1996).

The Hilmer inquiry considered the principles of competition policy agreed to by governments in terms of six specific elements:

- limiting anti-competitive conduct;
- reforming regulation which unjustifiably restricts competition;
- reforming the structure of public monopolies to facilitate competition;
- providing third party access to facilities that are essential to competition;
- restraining monopoly pricing behavior; and
- fostering 'competitive neutrality' between government and private businesses when they compete (Hilmer 1993).

The focus of NCP outlined in the Hilmer report covered three main areas; extending both the content and coverage of the competitive conduct rules of the *Trade Practices Act 1974 (Cth)*, reviewing and reducing regulatory restrictions on competition and increasing the competitive forces on public sector monopolies.

***Competitive conduct rules***

It is possible for firms to engage in anti-competitive behavior, either individually or collusively. In Australia the rules contained in Part IV of *Trade Practices Act 1974 (Cth)* (TPA) are designed to prevent this erosion of the competitive process. Essentially these rules prohibit firms making arrangements that increase market power or using market power in an anti-competitive way (Hilmer 1993).

The Hilmer inquiry recognised the need to strengthen the prohibition on price fixing, by removing the distinction between goods and services and relaxing prohibitions on certain forms of exclusive dealing and resale price maintenance where they can be demonstrated to offer net public benefits.

The Hilmer inquiry also recognised the need to extend the coverage of Part IV of the TPA to previously exempt areas, such as unincorporated businesses, statutory marketing authorities and government business enterprises. It was also recognised that process of gaining exemption from coverage should be made more rigorous and transparent.

It remains to be seen what the significance of these changes will be for the water industry, however, many water authorities are being corporatised thus existing as wholly owned GBEs. Consequently, unless exemption is granted, this allows possible anticompetitive behaviour of water authorities to be scrutinised under the NCP reforms.

***Regulatory restrictions on competition***

Hilmer considered that "the greatest impediment to enhanced competition in many key sectors of the economy are the restrictions imposed through government regulation - whether in the form of statutes or subordinate legislation - or government ownership" (Hilmer 1993, p. xxix). Hilmer also noted that the TPA does not prohibit businesses (private or public) from complying with various regulations, no matter how anti-competitive the outcome. Similarly, imposition of the anti-competitive regulation is also not prohibited by the TPA. Examples include legislated monopolies for public utilities and statutory marketing arrangements for agricultural products.

The Hilmer committee recommended that all Australian governments remove these regulatory restrictions to competition unless it is clearly in the public interest to retain them, in which case further systematic public reviews should occur within five years.

***Competitive forces on public sector monopolies***

The relatively small size and geographical fragmentation of Australia's largely city based markets has often meant that monopoly provision of utility services has been the only method, and possibly the least cost method, of developing this infrastructure. Australia's federal system has also meant that these monopolies have developed a strong state focus with the development of national markets and interstate trade in industries such as electricity, gas, water, rail and ports being severely hampered (Department of Parliamentary Library 1997). For example, the rural water industry in Australia has been characterised by substantial public investment, essentially aimed at providing accessible and inexpensive water to underpin regional economic development. Even though, some user charges are levied on rural water users, these charges usually only collect part of variable costs with no return of capital investment. As a result, the capital costs of irrigation supply have usually been funded from governments out of consolidated revenue (AATSE 1999).

The Hilmer committee considered that simply removing regulatory restrictions to competition may not be sufficient and that other competitive forces will have to be considered for public sector monopolies. These include reforming the structure of public sector monopolies, ensuring private sector access to the infrastructure facilities of public monopolies, restraining monopoly pricing behaviour and ensuring 'competitive neutrality' when public enterprises compete with the private sector.

In the irrigation sector, there has been widespread privatisation of infrastructure at the district level. Competitive pressures are brought to bear through various mechanisms such as competitive tendering and subcontracting, in addition to regulatory oversight by state authorities regarding pricing arrangements and other competition issues (AATSE 1999).

***Structural reform***

The committee recommended that as part of reforms to introduce competition to a market traditionally dominated by a public monopoly, the public monopoly be subject to appropriate restructuring to ensure:

- the separation of regulatory and commercial functions of public monopolies;
- the separation of natural monopoly and potentially competitive activities; and
- the separation of potentially competitive activities into a number of smaller, independent business units.

It is essential for the operation and entry to markets that regulatory and commercial functions be separated

in addition to the establishment of an independent regulator. The separation of natural monopoly and potentially competitive activities quarantines those activities, reduces the opportunity for cross-subsidisation and increases the opportunity for market entry by competitors. Opportunities for cross-subsidisation and potential conflicts of interest are both reduced by the separation of potentially competitive activities into independent business units (BIE 1995).

For example, a key aspect of the water industry reforms has been the separation of water resource management, standard setting/regulatory enforcement and water supply. This has meant that many water authorities have been corporatised and separated from the previous water resource managing agency. Various administrative reforms have been implemented which are aimed at improving the efficiency of authorities delivering bulk water to irrigators.

***Access to Essential Facilities***

For effective competition to occur in some markets, competitors need access to certain 'essential facilities' that cannot be produced economically, such as electricity transmission grids and rail track networks. Hilmer recommended a new legal regime be established under which firms could in certain circumstances be given a right of access to specified 'essential facilities' on fair and reasonable terms.

***Monopoly Pricing***

Monopoly pricing occurs when legislated or natural monopolies charge above their long-run average cost, over a sustained period, and is considered detrimental to both consumers and society. Such over-charging is generally not possible in contestable markets with effective competition as the above-commercial returns attract new entrants to the market and allow consumers to choose a rival supplier. This competition drives prices down and returns industry profits to normal commercial levels.

The Hilmer committee considered that increasing competitive pressures through the removal of regulatory restrictions, restructuring public monopolies and if needed, providing third party access rights, should be the primary response of competition policy to monopoly pricing issues.

***Competitive Neutrality***

Increasing the efficiency of GBEs, primarily associated with infrastructure provision, through commercialisation and allowing competition has created the need to ensure GBEs do not enjoy an unfair advantage over their new competitors. Historically, private businesses and GBEs operate under quite different rules. For example, GBEs have been exempt from taxation, enjoyed immunity from bankruptcy, and received explicit or implicit government guarantees on debt and thus enjoyed quite favourable investment conditions relative to private firms. However, a significant constraint on investment decisions for GBEs has been various community service obligations (CSOs) which compel the provision of certain services which private companies may find unprofitable to provide. Private companies are not legislatively compelled to provide such CSOs although moral persuasion is sometimes applied to firms such as banks.

The requirement for competitive neutrality is designed to ensure these differences are eliminated as far as possible, so that GBEs do not enjoy an unfair competitive advantage. It is suggested that this could be achieved through corporatisation and/or the application of effective pricing mechanisms (BIE 1995).

***The Public Interest Test***

The NCP covers a broad range of economic and social policy issues. Many issues are complex and involve competing policy outcomes, which will need to be traded off in order to maximise benefits to the community (NCC 1999b). It is for these reasons that an important aspect of the NCP implementation involves a 'public interest test' by respective governments during implementation. The NCC stated that:

> *The public interest test covers a wide range of factors, including the environment, employment, social welfare and consumer interests as well as business competitiveness and economic efficiency. The assessment of these factors gives equal weight to economic and social considerations. In this sense, the NCP package seeks to balance economic accountability with social responsibility (NCC 1999b, p. 5).*

The public interest test is outlined under clause 1(3) of the Competition Policy Agreement and says that

governments should take the following factors into consideration when assessing the merits of reforms in relation to competitive neutrality, anti-competitive legislation and the structure of public monopolies:

- government legislation and policies relating to ecologically sustainable development;
- social welfare and equity considerations, including community service obligations;
- government legislation and policies relating to matters such as occupational health and safety, industrial relations and access and equity;
- economic and regional development, including employment and investment growth;
- the interests of consumers generally or of a class of consumers;
- the competitiveness of Australian business; and
- the efficient allocation of resources (NCC 1999b, p. 6).

The NCC (1999b, p. 20) noted that, in terms of implementing the public interest test, "a challenge for review bodies and for governments is to focus on outcomes that benefit the community as a whole, rather than providing special treatment for certain groups at the expense of others". The NCC also recognised that tradeoffs will sometimes have to be made, both between interest groups and between policy outcomes, consequently, the NCC has "consistently stressed the importance of independent, transparent and rigorous processes by governments in considering public interest matters" (NCC 1999b, p. 20).

In terms of the rural water industry, the public interest test is an important mechanism for balancing the social, economic and environmental effects of proposed NCP reforms on rural communities.

### 3.3 The Need for Microeconomic Reform

Previous discussion of the historical evolution of the current microeconomic reform agenda highlighted that Australia's declining economic performance was the principle driver of reform. Australia's economy has been faced with a number of problems over the last few decades including inflation, unemployment and large current account deficits (Forysth 1992). The Australian economy has performed badly in terms of full-time job creation and growth in real wages. As Gregory notes "unemployment levels are greater than those that prevailed in the 1960s by a factor of about five" (Gregory 1992, p. 309). Thus, Australia's declining community welfare (illustrated through these economic indicators), relative to our recent past, illustrates the need for microeconomic reform.

It is commonly argued that Australia should pursue microeconomic reform because our economic performance relative to other countries is declining significantly (Quiggin 1996). Clark (1995) considers that Australia's extremely high labour productivity late last century, relative to our competitors (US and UK) resulted in our living standards being one of the highest in the world at that time. However, Clark considers that since then, we have fallen further and further behind in the international economic race, largely because of insufficient structural change and productivity growth below that of most other western economies. Similarly, the Productivity Commission (PC) (1996) notes that Australia's overall productivity performance, over the last 25 years, has been significantly below that for countries of the Organisation for Economic Cooperation and Development and that they are below an increasing number of dynamic Asian economies. Consequently, because of Australia's slower productivity growth, our place in the international 'league table' of per capita incomes has dropped from tenth to twentieth over that same twenty five year period.

The central tenant of most arguments for microeconomic reform is that microeconomic reform is the key to achieving better productivity which is the key determinant of living standards and community welfare. Krugman explains this link:

> *Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker. World War II veterans came home to an economy that doubled its productivity over the next 25 years; as a result, they found themselves achieving living standards their parents had never imagined. Vietnam veterans came home to an economy that raised its productivity less than 10 per cent in 15 years; as a result, they found themselves living no better- and in many cases worse- than their parents (Krugman 1992, p. 9).*

Thus, the underlying need for microeconomic reform rests with a desire to maintain and improve the living standards and community welfare of Australians. The then federal Treasurer, Paul Keating, in delivering the governments 1988 economic statement, commented that:

> *The way forward for Australia is not to be closeted and sheltered, but to be open and dynamic, trading aggressively in the world. Only this kind of economy can provide the employment and rising living standards that Australians aspire to (Keating 1988, p. 16).*

In commenting on the need to develop a NCP, the Hilmer committee stated that:

> *If Australia is to prosper as a nation, and maintain and improve living standards and opportunities for its people, it has no choice but to improve the productivity and international competitiveness of its firms and institutions…Australian organisations, irrespective of their size, location or ownership, must become more efficient, more innovative and more flexible (Hilmer 1993, p. 1).*

The major focus of microeconomic reform has been competition policy as this is seen as the most effective mechanism to increase productivity growth and improve economic efficiency. Furthermore, "efficiency is a fundamental objective of competition policy because of the role it plays in enhancing community welfare" (Hilmer 1993, p. 3). The Hilmer committee justified the focus on competition policy by stating that:

> *Competition provides the spur for businesses to improve their performance, develop new products and respond to changing circumstances… competition offers the promise of lower prices and improved choice for consumers and greater efficiency, higher economic growth and increased employment opportunities for the economy as a whole (Hilmer 1993, p. 1).*

Thus, microeconomic reform and competition policy is primarily concerned with the efficiency of production and the allocation of goods and services and includes:

> *those measures taken at the microeconomic level to make the economy perform better in terms of creating real income from the available inputs… raising living standards by raising real incomes available for consumption…measures to make individual firms produce their outputs more efficiently, better to provide the goods and services that consumers want, and measures to make markets more effective conduits between consumers and producers (Forsyth 1992, p. 5).*

At this point it is important to note the distinction between technical efficiency and economic efficiency. Technical efficiency occurs when it is not possible to increase output without increasing inputs. Through the substitution of production inputs, it is possible to have many different technically efficient input mixes. Technical efficiency has nothing to do with the price of inputs or final goods, rather the quantities. Economic efficiency goes beyond pure technical or engineering efficiency, which involves maximising the quantity of output for a quantity of inputs, and involves minimising the economic cost of producing a given output.

In the context of microeconomic reform, economic efficiency is comprised of three distinct components. They are productive, allocative and dynamic efficiency.

Productive efficiency involves the production of goods and services for consumers at least cost. For example, increased price competition may induce firms to seek changes to production methods or material inputs etc, which result in reduced prices for the same good or service.

Allocative efficiency is achieved where goods and services used as business inputs are allowed to flow to their most productive or profitable use. Competition and less regulation tends to increase allocative efficiency, because firms that can use a particular resource more productively can afford (or be permitted) to purchase that resource from businesses that are not ustilising it as profitably.

Dynamic efficiency involves firms being responsive, resilient and robust. It incorporates the capacity of firms to competitively respond to changing market circumstances. Competition in markets for goods and services provides incentives to undertake research and development, effect innovation in product design, reform management structures and strategies, and create new products and production processes.

As discussed above, the current microeconomic reform agenda emerged from a macroeconomic policy context, however, microeconomic reform is not directly about achieving macroeconomic policy objectives such as lower inflation, unemployment, and current account deficit. Microeconomic reform may help achieve these objectives, but it is primarily concerned with getting the most efficient and productive use out of Australia's human and capital resources utilised in the economy (Forsyth 1992).

Another important need for microeconomic reform stems from the budgetary pressures put on government. The government's tax base has been eroded through low employment and wages growth while at the same time increased demands have been made on revenue through social welfare, health and education. The government has responded through a combination of attempts to increase revenue and reduce expenditure. These pressures have also been exacerbated by tax payer expectations of reductions in income taxes and governments pursing such policies. Consequently, a considerable amount of microeconomic reform is directed at government service delivery and GBEs in particular which have been attempting to increase profitability and decrease employment levels.

In addition to the above mentioned rationale for microeconomic reform there are also three imperatives for Australia developing a National Competition Policy. First, there is increasing acknowledgement and often impatience by business and the community, that Australia should move towards a single integrated market. Second, although trade policy has exposed some sectors to increased competition, many other sectors remain sheltered from competitive pressures. Third, there is recognition that microeconomic reform should be advanced in a cooperative, systematic and integrated manner within a broad policy framework or process (Hilmer 1993).

### 3.4 Estimating the Gains from Microeconomic Reform

Previous discussion explained that the overall rationale for microeconomic reform lies in improving social and economic welfare through competition policy which drives economic efficiency gains throughout the economy. It was also discussed that economic efficiency gains can stem from productive, allocative and dynamic efficiency improvements.

The benefits of microeconomic reform can either be assessed on a case by case basis (for a particular reform or a particular industry) or the economy wide gains for a package may be estimated.

There have been a significant number of studies, which have modelled the potential impacts of various aspects of microeconomic reform. The Industry Commission (1989, 1995) has produced a number of model-based estimates, as has the Business Council of Australia (1994), Bureau of Industry Economics (1990), Filmer and Doa (1994), and Dao and Jowett (1994). These studies produced estimates of long term gains to Australia's Gross Domestic Product (GDP) growth of between 5 to 20 per cent, irregardless of the type of model used (PC 1996). The Economic Advisory and Planning Council/Commission (EPAC) considered that all of these studies illustrate that the benefits of microeconomic reform are significant, widespread and ongoing (EPAC 1994).

In August 1994, COAG requested the IC to assess the benefits to economic growth and revenue from implementing the Hilmer and related reforms. The IC considered that:

- Hilmer and related reforms are overwhelmingly good for the Australian economy and would lead to Australia's GDP increasing by 5.5 per cent or $23 billion a year (in 1993-94 dollars). Consumers would also benefit with an additional $1500 spending per year for each household, totaling $9 billion. These gains are also compatible with a 3 per cent increase in real wages and 30,000 extra jobs.
- The benefits of reforms are expected to be widely distributed with very few industries losing. The gains from some reforms tend to offset the losses from others with small individual net gains accumulating to widespread substantial gains across the economy.
- Both state and federal governments were projected to obtain large revenue gains. It was estimated that Commonwealth revenue would increase, in real terms, by $5.9 billion and States/Territories/ local government revenue by $3 billion. This equates to an additional 6 per cent revenue for

the Commonwealth and 4.5 per cent for the states/territories/local governments.
- Of the total expected 5.5 per cent increase to GDP growth, 1 per cent is expected to come from commonwealth reforms with the remaining 4.5 per cent stemming from state/territory/local government reforms. It was also noted that reforms to GBEs contributed about 45 per cent of the total increase to GDP, or almost $11 billion per year extra GDP (IC 1995).

The NCC noted the following industry specific outcomes from competition reform:

- Following the introduction of competition, electricity bills fell by about 23 to 30 per cent on average, for those NSW and Victorian businesses covered by the national competitive market; while wholesale prices in Queensland fell by around 23 per cent after its internal competitive electricity market commenced.
- Gas prices for major industrial users fell 50 per cent after deregulation of the Pilbara market in 1995, while gas distribution tariffs are set to fall 60 per cent by the year 2000 in NSW.
- Rail freight rates in Western Australia have fallen by 42 per cent in real terms since 1991-92, while rail freight rates for the Perth-Melbourne route fell 40 per cent, and service quality and transit times improved, following the introduction of competition in 1995.
- Conveyancing fees in NSW fell 17 per cent between 1994 and 1996, after the abolition of the legal profession's monopoly and the removal of price scheduling and advertising restrictions, leading to an annual saving to consumers of a least $86 million.
- Prices for the outputs of government trading enterprises fell substantially between 1991-92 and 1995-96, and payments to governments doubled, due partly to competition policy reforms. In the five years to 1996-97, the sharpest price reductions occurred in electricity (24 per cent), port services (23 per cent), telecommunications (23 per cent) and air traffic services (40 per cent).
- In Queensland, ten of the seventeen largest local councils have implemented two part tariffs for water, resulting in an average saving in water usage of 20 per cent in the first year.
- Following a review of business licensing in NSW that found significant duplication and overlap, some 72 licenses have been repealed and 44 categories collapsed into just three (NCC 1999a, p. 9).

***Water industry specific estimates***

Barker *et al* (1997) conducted a cost-benefit analysis of water industry reforms in Victoria. Specifically the allocative efficiency gains from water trading in the agricultural irrigation sector were estimated using the cost-benefit analytical framework and the water policy model developed by the Performance Evaluation Division of Natural Resources and Environment (Victoria).

The study estimated the allocative efficiency gains as the change in economic surplus associated with increased water trading because of the reformed water market arrangements. The basis of the allocative efficiency gains and economic benefits from increased water trade is that water is reallocated from low returning activities such as irrigated grazing, to higher returning activities, such as horticulture or dairy.

The Water Policy Model is a spatial equilibrium model, comprising various regions, that characterises the trading environment of agricultural irrigators. The demand curves for water were estimated using linear programming models and were based on the specific demand characteristics of each region such as crop, climate and soil type. In modelling trade, the Water Policy Model incorporated a range of constraints including channel capacity and transport losses. The Water Policy Model employed a comparative static approach where inter-temporal effects were not explicitly considered and assumes that resources adjust to a new and stable equilibrium.

The study estimated the net present value of benefits from water market reforms in the agricultural irrigation sector to be $34.2 million. This figures comprises a present value of potential benefits of $42.7 million and a present value of costs of $8.5 million. The study also calculated that every dollar invested by the Victorian government, in the reform of water markets, would generate an extra $5 of economic benefits for Victoria. The authors considered that:

*This evaluation reveals that microeconomic reform can improve economic welfare…this return arises from the increased ability of irrigation farmers to allocate water to its highest value use (Barker et al 1997, p. 19).*

While not conducting a cost-benefit analysis, Marsden Jacob Associates (1999) estimated the allocative efficiency gains from water trading in New South Wales. As mentioned above, the basis of these allocative efficiency gains is water moving to higher economic value use. Table 3.1 presents some examples of gross margins for various uses to illustrate the range of economic value uses involved. It is worth noting that for temporary trade, these gross margins are a reasonable indicator of gains from trade, however, for permanent trades, net margins would be appropriate as significant other investment would be required to realise these gross margins.

Table 3.1 Example water use gross margins

| **Water Usage** | **Gross Margin ($/ML)** |
|---|---|
| Pasture in the Lachlan | 10 |
| Rice in the Murray | 65 |
| Barley LF | 339 |
| Citrus in the Murray | 460 |
| Garlic | 866 |
| Clementine Navels | 1 642 |
| Vines in the Hunter | 2 600 |
| Mining in Central West NSW | 4 000 |

Source: adapted from Marsden Jacob Associates (1999)

Marsden Jacob Associates (1999) estimated that water trading in New South Wales in the 1997/98 season increased the value of irrigated agriculture by around $30 million for temporary trade and $35 million for permanent trades. The authors noted that these estimates account for direct effects only, with second round or 'multiplier' effects possibly increasing direct effects by up to four times.

In terms of gains from interstate water trading, Marsden Jacob Associates (1999) considered that there is strong evidence that permanent trade in water is allowing irrigation activities within the Murray-Darling Basin to move to:

- higher value enterprises;
- areas with better soil and drainage and lower salinity; and
- more efficient irrigation techniques (Marsden Jacob Associates 1999, p. 3.17).

In considering permanent interstate water trades between South Australia and Victoria for the 1994-96 period, Marsden Jacob Associates noted that "almost half the water sold had been used in lucerne and grain with 81 per cent of water purchased being applied to the higher value enterprises of vines, horticulture and vegetables" (Marsden Jacob Associates 1999, p. 3.17). Furthermore, the authors estimated that the average gross margin of this permanently transferred water in its final use to be $480-900 per ML compared to $80-100 per ML in its original use.

### 3.5 Criticism of Microeconomic Reform

The majority of authors in the area of public policy and economics, government policy and economic research bodies, and the major political parties all agree, in overall terms, with the need and the significant benefits of implementing microeconomic reform in Australia. There is however, much debate concerning the detail, speed and method of implementation of microeconomic reforms. These specific details will not be considered here, rather a brief overview of the key criticisms of the overall microeconomic reform agenda will be discussed.

Criticism or problems associated with microeconomic reform stem from the rationale of reforms, specific realities concerning implementation or criticisms of the quantitative estimates of the benefits.

Maddock (1994, p. 37) considers that the NCP rationale "goes far beyond the normal arguments supported by microeconomic theory". The NCP purports to use the standard criteria of economic efficiency but rather the

undefined and wider 'public interest' test is the actual criteria for specific sectoral reforms. Maddock (1994, p. 37) concludes that "since the 'public interest' is going to have to be interpreted by a number of different agencies this will lead to inconsistent interpretations of the reform agenda" and that "the reform process is likely to stall in the face of strong sectional interests".

The Hilmer report also lacks consistency, in terms of the criteria for determining the nature of the competitive reforms. For example, the rationale underpinning the splitting up of public monopolies is to facilitate the entry of competitors to the market and also rests on the separation of powers arguments. However, Maddock (1994, p. 34) contends that "if the situation had been considered using the efficiency criterion we would have realised that there is no necessary presumption in favour of splitting conglomerates, even of splitting conglomerate monopolies" and that "there is no recognition in the report of the potential importance of economies of scale and of scope".

An important criticism of the Hilmer report and the NCP reform agenda stems from the theory of second best. Lipsey and Lancaster (1956-57) originally developed this theory, and basically demonstrated that the perfect competition model and assumptions about economic efficiency are not valid and do not provide a useful model in an applied policy context, due to major real world differences to the over simplified perfect competition model.

The practical meaning of the theory of second best is that if the desired policy outcome is to improve efficiency and welfare through increasing competition then either all firms/markets need to be made perfectly competitive or the actual market structures of each firm or sector (such as monopoly or duopoly) need to be considered as a constraint. Furthermore, it cannot be assumed that increasing competition will necessarily lead to efficiency gains. Thus, in an applied policy context, competition policy must determine whether an increase or a decrease in competition, in that particular market/sector, would lead to efficiency/welfare gains (Kolsen 1996).

The basic rationale of the NCP is that increasing competition and reducing regulatory restrictions will automatically lead to efficiency gains and subsequently to social/economic welfare gains. However, the theory of second best suggests that chain of logic will only hold true under special circumstances (Maddock 1994). Suboptimal outcomes will eventuate when competition is introduced to one market where it cannot be introduced in others. For example, it may be optimal to have a marketing monopoly when dealing with foreign monopolies and imperfectly competitive market structures. Furthermore, open access regimes may produce inefficiencies and the imposition of user access charges beyond the economically efficient point of the marginal cost of supply (Larkin and Dywer (BCA) 1995).

The corollary of the second best theory based criticism, is that an industry specific approach is needed to ensure that efficiency gains are realised in the context of each particular market. However, the basic approach of implementing the NCP is not to adopt an industry specific approach, but rather to generically apply a homogeneous set of 'competition principles' by a single regulatory body (the NCC). Consequently, these principles will "sometimes be applied in circumstances where less competition would produce higher levels of economic efficiency" (Kolsen 1996, p. 85)

Concerns about the underlying assumptions of the NCP were also criticised by Senator Boswell who commented (in considering NCP related legislation) that:

> *The Hilmer report and the subsequent Industry Commission report used the fundamentally flawed assumption of pure competition…A newsagent's submission said, "Our significant concern is that the unintended consequences of the legislation designed to foster competition may produce the opposite result." In many Australian industries… there are few players who are so large that they do exert considerable influence on price and raise the barriers to entry…This bill does nothing to foster competition in those very imperfect markets (Boswell (Senator) 1995, p. 1703).*

There are also contradictory criticisms, concerning GBEs and the NCP reforms. Some authors such as Kolsen (1996, p. 87) who suggests that "while effective implementation [of NCP reforms] would, so far as state GBEs are concerned, result in greater economic efficiency, the constraints imposed by social and income distribution considerations will prevent such

an outcome". In contrast, other authors such as Butler (1996) who consider that community service obligations (CSOs) are considered as "nasties- obligations put on organisations that hinder their basic purpose" and further considers that pressures for cost reductions would erode workplace health and safety standards and environmental performance and work against the maintenance of CSOs. Consequently, some authors consider that CSOs would prevent efficiency gains form the NCP process while others consider that such reforms to GBEs would put serious pressure on the maintenance of CSOs.

In terms of the quantitative estimates of NCP gains, criticisms are based on the meaning or relevance of GDP based figures and also the accuracy of the size of the GDP estimate (through problematical modelling).

Quiggin (1998, 1996) and Forsyth (1992), among others, pointed out that all the modelled estimates of benefits of microeconomic reform, including the Growth and Revenue Implications of Hilmer and Related Reforms (IC 1995), have all been based on increases to GDP growth. However, GDP is a financial indicator of economic activity and is not based on welfare theory. Consequently, the social welfare gains from improvements to GDP (or other economic indicators such as labour and capital productivity) are assumed rather than directly assessed.

In addition to this general concern that GDP is not a measure of social welfare gains, Forsyth (1992, p. 16) notes that "it is important not to confuse changes in GDP with changes in net benefits: this is because additional resources are needed to produce the extra GDP". Welfare theory says that net benefits are comprised of increases to producer and consumer surplus, however, to measure this requires substantial market supply and demand information of the market in question and related markets which, in reality, is often not obtainable. In commenting on an IC (1990) estimate of 6.5 per cent additional GDP growth from a certain package of microeconomic reforms, Forsyth (1992) pointed out, that to attain this extra GDP an increase of 0.6 per cent in the labour force and 7.2 per cent in the capital stock (i.e. over $70 billion) would be required and when these requirements are costed out, the GDP estimate falls from 6.5 to 4.7 per cent. Furthermore, when capital stocks are variable, such GDP estimates do not provide an appropriate basis for considering the effects of microeconomic reform on social welfare (Forsyth 1992).

In addition to GDP gains being confused with net benefits or improvements to social welfare, the most significant criticism to these GDP estimates of gains from microeconomic reform is that they "have adopted procedures leading to a systematic upward bias in estimates of benefits" (Quiggin 1996, p. 201). Quiggin (1996) reexamined the IC's (1995) growth estimates of the NCP, and suggested that the total (for all industries/ reforms) direct GDP figure of 2.29 per cent and the final GDP figure (with general equilibrium/flow on effects) of 5.46 per cent should be 0.71 per cent and 0.48 per cent, respectively. For the electricity, gas and water industries the IC's direct GDP increase of 0.6 per cent and final GDP figure of 1.5 per cent compares to Quiggin's estimate of 0.1 per cent and 0.08 per cent respectively.

Even though Quiggin (1996) believes these estimates are substantially over-inflated, he nonetheless contends they remain significant and that microeconomic reform should not be halted. The central conclusion of Quiggin's critique is that:

> *…a reform policy formulated on the basis of a dogmatic commitment to competition and the private sector amounts to little more than the substitution of one set of prejudices for another. What is needed in microeconomic reform is a willingness to analyse each problem on its merits, bringing the relevant economic theory to bear. In some cases, such an analysis will support deregulation; in other cases, an increase in regulation; in others, the status quo (Quiggin 1996, p. 222).*

The main significance of the possibility that the benefits of microeconomic reform have been significantly over-estimated, is that it has possibly distorted Australia's economic policy agenda and contributed to the uncritical acceptance of such policies in general and particularly any policy initiatives which appear to increase competition (Quiggin 1998).

Another criticism of microeconomic reform in general, is that the distributional or equity consequences have been ignored in estimating the benefits of reforms. Quiggin (1996, p. 221) notes that "most analysis of the

benefits of microeconomic reform has been conducted in terms of the efficiency assumption that the concern of policy should be to maximise aggregate income regardless of distribution". It is beyond the purpose of this discussion to consider this issue in detail, however, it is worth noting that even though the above statement is true, the NCP, at least in terms of stated policy, attempts to maximise efficiency in the context of other social and environmental policy outcomes and that CSOs, the 'public interest' test and making explicit cross-subsidies are some of the mechanisms to achieve this. It is also worth noting that attempts to assess some distributional issues have been made, such as the Productivity Commission's (1999) assessment of the impact of NCP on rural and regional Australia.

The Business Council of Australia advance an argument that :

> *Perhaps the most serious criticism of the competition policy reforms is not so much of the principle of the Hilmer reforms themselves but of the likelihood that the Hilmer reform process is hijacked by Governments to serve their own interests. Business is interested in microeconomic reform to cut costs and improve Australia's competitiveness. Governments and Treasuries have their own agendas, which seem to be as much about seizing productivity gains as revenue (Larkin and Dwyer 1995, p. 59).*

The thrust of the BCA's (Larkin and Dwyer 1995) argument is that the NCP reforms (particularly with respect to public monopoly service and infrastructure provision of which the rural irrigation water industry is a good example) may not be based on economic efficiency principles of marginal cost pricing and treating past excessive and uneconomic capital expenditure as sunk but rather based on a forced rate of return on assets. Such an approach has more to do with accounting cost recovery than sound economic principles of efficiency and maximising net benefits and welfare. Furthermore, forcing positive rates of return on possibly inflated asset values may simply legitimate the extortion of monopoly rents from both consumers and businesses (Larkin and Dwyer 1995).

While it is beyond the scope of this discussion to consider pricing and asset valuation issues it is worth noting that standard economic principles suggest that pricing (rural irrigation water for example) at anything other than marginal cost of supply will lead to an economically inefficient outcome. Such a suboptimal outcome is possible, in overall terms, even though allocative efficiency gains may occur (through water trading for example).

A related criticism is that the above-mentioned trend of government requiring GBEs providing non-priced or underpriced services/infrastructure to provide such returns on assets through 'dividends' and 'user charges' has created a "recent meteoric rise in indirect taxation in Australia disguised as user charges…this form of revenue has increased in revenue terms by 650 per cent since 1987-88 from $400 million to $3 billion" (Larkin and Dwyer 1995, p. 59). It is also noted that such revenue raising through 'user charges' for infrastructure etc undermines Australian export competitiveness. This is because such indirect taxation cannot be rebated back to exporters (under the General Agreement on Tariffs and Trade) unlike in many of our international competitor countries who apply an explicit indirect tax such as the Value Added Tax, which can be rebated back to their export industries (Larkin and Dwyer 1995). In terms of the irrigation sector, reforms essentially advocate full cost recovery plus, in some instances a rate of return on existing capital. The effect of this is to greatly increase the prices of irrigation water (AATSE 1999).

Larkin and Dywer (1995) summarise their criticism of some aspects of the NCP by stating that:

> *The danger is that the benefits of the Hilmer approach may be hijacked. Productivity could be up, efficiency improved and infrastructure financed without taxes [direct taxation]. The catch could be that business and consumers will see little or no benefits from the productivity gains or, even worse, that costs will rise and taxes fail to fall in lieu. If businesses see that their infrastructure costs do not fall as much as they should and that they are being charged more than marginal costs for their use of network infrastructure, they may invest offshore, especially if higher utility costs lead to wage pressures (Larkin and Dwyer (BCA) 1995, p. 61).*

### 3.6 Conclusion

The purpose of this chapter was to provide an overview of the microeconomic reform agenda in which the COAG water reform framework is embedded. Discussion began with the historical evolution of microeconomic reform from its macroeconomic policy origins through to the recent development of the NCP which incorporated the COAG water reform framework. The NCP was then outlined in some detail, followed by a discussion of the rationale or need for microeconomic reform. This discussion also considered the benefits of microeconomic reform in general and also the benefits specific to water trading reforms. Discussion then finished with a brief consideration of some of the criticisms of the microeconomic reform agenda. Discussion in the next chapter now turns to the implementation of the water allocation and trading aspects of the NCP reform package.

# 4. Water Reform Implementation Progress, Water Rights and Trading

The purpose of this chapter is to provide a summary of water reform implementation progress, in terms of permanent and temporary water trading (including interstate trading) and water rights regimes, for the Murray-Darling Basin Commission, New South Wales, Queensland and Victoria. Where available, information will be included for the Fitzroy, Murray-Goulburn and Murrumbidgee catchments. Discussion begins with an overview of the Coalition of Australian Governments (COAG) and National Competition Policy (NCP) water reform commitments, in terms of water allocations and trading, and also considers the National Competition Council (NCC) competition tranche payment system to the states/territories and the process of assessing water reform commitments. Discussion then proceeds with the implementation progress for the above mentioned jurisdictions.

## 4.1 Overview of COAG and NCP Water Reforms-Allocations and Trading

In 1994, COAG endorsed a framework of initiatives for the water industry to run over a seven year period. The framework covered water pricing reform based on the principles of consumption based pricing and full cost recovery, elimination of cross subsidies and making subsidies transparent. Also covered were issues on water allocation and entitlement, reform of irrigation systems, allocating water for environmental purposes and institutional reform (Industry Commission (IC) 1998).

The COAG water reform framework is being implemented by the State and Territory Governments because they are responsible for the management of natural resources. However, given the national importance of the reforms, the Commonwealth Government is also contributing to the process through the Natural Heritage Trust and associated programs like Murray-Darling 2001, Rivercare and the National Land and Water Resources Audit (Agriculuture Fisheries and Forestry Australia (AFFA) 2000).

While the States and Territories have a leading role, the Commonwealth is assisting through the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), the Australia and New Zealand Environment Conservation Council (ANZECC) and the Murray-Darling Basin Ministerial Council (MDBC). To ensure the full benefits of reform and a consistent approach by the States and Territories, ARMCANZ established a High Level Steering Group on Water (HLSGOW). The Steering Group provides advice on strategic water policy issues and monitors the effectiveness of implementation of the water reforms. ARMCANZ, ANZECC and where appropriate MDBC are responsible for monitoring and reporting progress on the framework implementation to COAG (AFFA 2000).

In relation to water allocation and entitlements, the COAG water reform framework included agreement that (NCC 1998):

- water be used to maximise its contribution to national income and welfare, within the social, physical and ecological constraints of catchments;
- comprehensive systems of water allocations or entitlements backed by separation of water property rights from land title and clear specification in terms of ownership, volume, reliability, transferability and, if appropriate, quality;
- cross-border trading be facilitated and arrangements be consistent, where this is socially, physically and ecologically sustainable;
- allocations for the environment be a legitimate user of water; and
- environmental allocations be determined on the best scientific information available.

The COAG water reform framework required the development of a comprehensive system of water allocations and entitlements. In October 1995, the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ)[20] developed the National Framework for the Implementation of Property Rights in Water.

The principles establishing a strategic framework for the implementation of property rights in water are:

[20]Standing Committee on Agriculture and Resource Management- Task Force on COAG Water Reform.

1. That all consumptive and non-consumptive water entitlements be allocated and managed in accordance with comprehensive planning systems and based on full basin-wide hydrologic assessment of the resource.
2. That water entitlements and institutional arrangements be structured so as not to impede the effective operation of water markets and such that, as far as practicable, trading options associated with property rights in water reside with the individual end users of water.
3. That water entitlements be clearly specified in terms of:
   - rights and conditions of ownership tenure;
   - share of natural resource being allocated (including probability of occurrence);
   - details of agreed standards of any commercial services to be delivered;
   - constraints to and rules on transferability; and
   - constraints to resource use of access.
4. That acceptable rules on the holding and trading of environmental flow entitlements be resolved by jurisdictions at the same time as determining the appropriate balance between consumptive and non-consumptive uses of water.
5. That, where interstate trading of water entitlements is possible, jurisdictions cooperatively develop on a catchment-by-catchment basis cooperative approaches for (or at least clear conversion mechanisms between):
   - planning systems and basin-wide hydrologic assessment methods;
   - water entitlement specifications;
   - pricing and asset valuation arrangements;
   - water entitlement trading arrangements; and
   - provisions for environmental and other instream values.
6. That, in implementing and initialising property rights in water, jurisdictions call on water users, interest groups and the general community to be involved as partners in catchment planning processes that affect the future allocation and management of water entitlements.
7. That governments give urgent priority to establishing the administrative and regulatory arrangements that are necessary to implement and support the strategic framework (ARMCANZ 1995, pii).

A number of key issues in the application of these principles were also identified:

- property rights regimes should not be implemented in a catchment until a comprehensive planning system is in place which fully describes the resource and establishes a framework of consumptive and environmental uses;
- rights regimes should be structured to recognise the difference between shares in the natural resource and commercial service agreements which emanate from the development of infrastructure to regulate or distribute the natural resource;
- as far as practical, rights to a share of the natural resource should reside with the individual end users although commercial infrastructure managers will need diversion rights. This is considered vital so that the incentives to make effective use of the resource are with the users and also that the accountability for risk taking is, as far as practical, with those investing in the risk. However, the rights of water supply and distribution institutions should be protected in commercial service agreements;
- rights will not be to any absolute volume but to a capped share of the resource as it becomes available in the variable climatic cycles;
- constraints to trading should be as few as possible, predominantly associated with ecological sustainability and preservation of the property rights of others;
- with the exception of minimum passing flow provisions, surface water environmental entitlements should be tradeable where possible within clear constraints and jurisdictions should ensure that the holders of such rights are properly accountable to the community for their management of them; and
- administrative systems should facilitate interstate trade, but state policies should be established to minimise distortions of effective resource use (ARMCANZ 1995, p. iii).

In 1999, the High Level Steering Group on Water (HLSGOW) released a report to COAG on the progress of implementation of the COAG Water Reform Framework (HLSGOW 1999).

As discussed in the previous chapter, the COAG water reform is also a requirement of National Competition Policy. On the basis of progress in implementing water

reform the States and Territories will be entitled to share in the competition transfer payments from the Commonwealth based on the advice of the NCC to the Federal Treasurer.

***NCC Assessment and NCP tranche payments***

The Commonwealth makes payments to the States and Territories for implementing the NCP reform package. Under the Agreement to Implement the National Competition Policy and Related Reforms (Implementation Agreement), the NCC is required to assesses progress in three tranches (prior to July 1997, July 1999 and July 2001) and makes recommendations on payments to the Federal Treasurer. Approximately $1.106 billion in NCP payments are available in the second tranche period (1999-2000 and 2000-01). Satisfactory progress against the obligations in the NCP Agreements is a pre-requisite for States and Territories to receive these payments. In addition to the three tranches of assessments, the NCC also conducts supplementary assessments. Supplementary assessments are undertaken where governments had achieved progress against reform objectives but had not implemented the objectives in full at the time of the tranche assessments (NCC 2000a).

For the first three financial years (up to and including 1999-00), NCP payments comprised two elements: maintenance of the real per capita value of the Financial Assistance Grants and NCP payments. However, from 2000-01, as a result of the change in Commonwealth/ State financial arrangements whereby States and Territories are to receive revenue raised through the GST (Goods and Services Tax), only the Competition Payment element will apply. Nonetheless, the States and Territories, as direct recipients of GST revenue, will continue to receive dividends from implementing NCP, through increased GST revenues arising from economic growth (NCC 2000a).

Maximum NCP payments across all States and Territories under the second tranche are $1.106 billion. The maximum amounts which each jurisdiction could receive, assuming satisfactory reform progress, are set out in Table 4.1 below. Each State and Territory received maximum NCP payments in 1999-2000.

Table 4.1 Estimated maximum NCP payments under the second tranche

| **State/Territory** | **1999-2000 ($m)** | **2000-2001 ($m)** |
|---|---|---|
| New South Wales | 210.9 | 155.9 |
| Victoria | 153.2 | 114.7 |
| Queensland | 119.9 | 86.0 |
| Western Australia | 62.3 | 45.6 |
| South Australia | 53.9 | 36.0 |
| Tasmania | 19.0 | 11.2 |
| ACT | 10.9 | 7.5 |
| Northern Territory | 14.6 | 4.7 |
| **Total for year** | **644.7** | **461.6** |

Source: NCC 2000

***NCC process of assessing water reforms***

In February 1994, COAG adopted the water reform strategic framework and in 1995 the NCC was charged with assessing its implementation (along with other NCP reforms). Since that time, the NCC considers that it has "worked with jurisdictions to increase understanding of the water reform commitments and develop an assessment process that is co-operative, sensible and fair…The Council has engaged in bilateral discussions with every State and Territory in completing this assessment" (NCC 1999b, p. 271).

Overall, the second tranche assessment has focussed on looking at the systems and structures States and Territories have in place and assessing whether they will deliver real benefits to the water industry in the future. In the third tranche assessment the NCC will also be looking for further evidence to demonstrate that these benefits have been realised (NCC 1999b).

***NCP second tranche water reform commitment: allocations and trading***

In line with the COAG water reform agenda, the States and Territories have agreed to implement a number of water industry reforms as part of the NCP agreements. These reform commitments regarding water allocations and trading are the assessment framework used by the NCC to evaluate implementation progress by the states and territories. The NCC lists these reform commitments:

- There must be comprehensive systems of water entitlements backed by separation of water property rights from land title and clear specification of entitlements in terms of ownership, volume, reliability, transferability and, if appropriate, quality.
- A 'comprehensive' system requires that a system of establishing water allocations which recognises both consumptive and environmental needs should be in place. The system must be applicable to both surface and groundwater.
- The legislative and institutional framework to enable the determination of water entitlements and trading of those entitlements should be in place. The framework should also provide a better balance in water resource use including appropriate allocations to the environment as a legitimate user of water in order to enhance/restore the health of rivers. If legislation has not achieved final parliamentary passage, the Council will recognise the progress towards achieving legislative change during its assessment of compliance.
- Jurisdictions must develop allocations for the environment in determining allocations of water and should have regard to the relevant work of ARMCANZ and ANZECC. Best available scientific information should be used and regard had to the inter-temporal and inter-spatial water needs of river systems and groundwater systems. Where river systems are over allocated or deemed stressed, there must be substantial progress by 1998 towards the development of arrangements to provide a better balance in usage and allocations for the environment. Jurisdictions are to consider environmental contingency allocations, with a review of allocations 5 years after they have been initially determined.
- Jurisdictions must demonstrate the establishment of a sustainable balance between the environment and other uses. There must be formal water provisions for surface and groundwater consistent with ARMCANZ/ANZECC "National Principles for the Provision of Water for Ecosystems".
- Rights to water must be determined and clearly specified. Dormant rights must be reviewed as part of this process. When issuing new entitlements, jurisdictions must clarify environmental provisions and ensure there is provision for environmental allocations.
- For the second tranche, jurisdictions should submit individual implementation programs, outlining a priority list of river systems and groundwater resources, including all river systems which have been over-allocated, or are deemed to be stressed and detailed implementation actions and dates for allocations and trading to the Council for agreement, and to senior officials for endorsement. This list is to be publicly available.
- It is noted that for the third tranche, States and Territories will have to demonstrate substantial progress in implementing their agreed and endorsed implementation programs. Progress must include at least allocations to the environment in all river systems which have been over-allocated, or are deemed to be stressed. By the year 2005, allocations and trading must be substantially

completed for all river systems and groundwater resources identified in the agreed and endorsed individual implementation programs.

- Arrangements for trading in water entitlements must be in place by 1998. Water should be used to maximise its contribution to national income and welfare.
- Where cross border trade is possible, trading arrangements must be consistent between jurisdictions and facilitate trade. Where trading across State borders could occur, relevant jurisdictions must jointly review pricing and asset valuation policies to determine whether there is any substantial distortion to interstate trade.
- Jurisdictions must establish a framework of trading rules, including developing necessary institutional arrangements from a natural resource management perspective to eliminate conflicts of interest, and remove impediments to trade. The Council will assess the adequacy of trading rules to ensure no impediments. If legislation has not achieved final parliamentary passage, the Council will recognise the progress towards achieving legislative change during its assessment of compliance.
- As noted above, for the second tranche, jurisdictions should submit individual implementation programs, outlining a priority list of river systems and groundwater resources and detailed implementation actions and dates for allocations and trading to the Council for agreement, and to senior officials for endorsement. This list is to be publicly available.
- Cross border trading should be as widespread as possible. Jurisdictions are to develop proposals to further extend interstate trading in water (NCC 2000, p. 144).

## 4.2 Reform Implementation Progress, Allocations and Trading.

The purpose of this section is to examine the implementation progress of the NCP water reforms, in terms of water rights and water trading. Discussion will consider the definition of water rights and extent and nature of water trading (including interstate trading) for the MDBC, New South Wales, Queensland and Victoria and where available, include information on the Fitzroy, Murray-Goulburn and the Murrumbidgee catchments.

### 4.2.1 Murray-Darling Basin Commission (MDBC)

This section examines the contribution of the MDBC, in terms of allocations and trading, towards implementing the NCP water reforms.

The Murray-Darling supports approximately seventy five per cent of Australia's irrigation agriculture. The Murray-Darling Basin Initiative was introduced in 1987 and is a partnership between the Commonwealth, New South Wales, Victorian, South Australian, Queensland and Australian Capital Territory Governments. The objectives of the Initiative are to promote and coordinate effective planning and management for the equitable, efficient and sustainable use of the water, land and other environmental resources of the Murray-Darling Basin. The Murray-Darling Basin Ministerial Council is the policy making body for the Initiative with policy being implemented and managed by the Murray-Darling Basin Commission (MDBC). As mentioned previously, responsibility for implementing the water reform framework lies with the States/Territories, however, the framework identifies a role for the MDBC relating to water trading, institutional reform and bulk water charges (HLSGOW 1999).

#### *Allocations*

In 1997, the Murray-Darling Basin Ministerial Council agreed to a cap on diversions from the Basin. This was in response to increasing diversions and declining river health within the Basin. The volume of diversions for the year 1993/4 was set as the CAP. For unregulated rivers, the CAP may be defined as an end-of-valley flow regime. The primary objectives of the CAP are to maintain and where appropriate improve existing flow regimes, to protect and enhance the riverine environment and to achieve sustainable consumptive use by developing and managing Basin water resources to meet ecological, commercial and social needs (HLSGOW 1999).

The NCC (1999b) noted that two reviews of CAP implementation have been completed and that both of these noted the commitment of South Australia, Victoria and New South Wales in implementing the CAP. It was also noted that:

- South Australian diversions were within the CAP for both reviews;

- Victorian diversions in 1996-1997 may have exceeded the CAP and 1997-1998 diversions were below climate adjusted CAP targets; and
- New South Wales diversions for the Lachlan and Murrumbidgee Rivers exceeded the CAP on both reviews. 1997-1998 diversions for the Barwon-Darling and Border regions appeared to have exceeded the CAP although environmental flow policies on all but the Barwon-Darling River should ensure CAP compliance.
- Queensland will determine end-of-river flows as part of the Water Allocation and Management Plans and Water Management Plans processes (DNRQ 1999b, p. 754).

***Trading***

The Australian Bureau of Agricultural and Resource Economics (Samaranayaka et al 1998) surveyed various irrigation areas in the Murray-Darling Basin and found that there are varying degrees of water trading occurring throughout the Basin. It was also found that there is a wide range of institutional arrangements, which reflects distinctive demand and supply characteristics of water across the Basin.

In March 1994, the Murray-Darling Basin Ministerial Council approved a water market reform timetable in line with the COAG water reform framework. In June 1996, approval was granted for the establishment (after finalisation of the CAP) of a pilot project to introduce permanent interstate water property rights trade in the Mallee region (HLSGOW 1999).

A set of trading rules and administrative procedures were developed for the trial interstate permanent water trading. In developing these rules and procedures, consideration was given to salinity and drainage issues; financial contributions to the Commission's Water Business; exchange rates applying to the transfer of water; and environmental matters (HLSGOW 1999).

Only private diverters (individual irrigators who pump water directly from the river) with high security water entitlements may participate in the pilot permanent interstate trading project. The MDBC (2000) notes that broadening the project beyond high security entitlements would significantly complicate the project. High security licenses in each of the States are described as:

- New South Wales: private security licenses;
- South Australia: water licences granted under the *Water Resources Act 1997*; and
- Victoria: private diversion licences.

The pilot project began in January 1998 and was extended, in May 1999, to include high security water entitlements within the pumped irrigation districts below Nyah (MDBC 2000). From inception to February 1999, a total of 3431 ML of water have been traded across State borders. This comprises 248 ML from NSW to Victoria, 600 ML from Victoria to South Australia, and 2583 ML from NSW to South Australia (HLSGOW 1999).

The respective State authorities must also approve the trades. In order to limit the impact on entitlement security, trades involve exchange rates. Environmental clearances are integral to the pilot project. These clearances concern salinity, environmental flows and, in general terms, the avoidance of environmental degradation resulting from the trade (MDBC 2000).

The steps involved in the permanent interstate trade of high security water involve the following steps:

1. A private diverter located in the pilot project area considers the option to buy or sell a high security water entitlement.
2. A potential seller or buyer is sought, either through personal contacts or through an intermediary, such as an estate agent. The seller and especially the buyer must satisfy the particular requirements of the States and agencies involved.
3. A contract is agreed between the buyer and the seller, subject to the approval of the relevant licensing authorities.
4. The buyer and seller simultaneously lodge applications to transfer water with the licensing authority in the State of destination.
5. The State of destination and the State of origin licensing authorities assess the applications based on their requirements with particular reference to:
   - the transfer of water entitlements within the State;
   - environmental clearances and development standards;
   - the Murray-Darling Basin Commission Salinity and Drainage Strategy; and

- MDBC policies on environmental flow management.

6. The licensing authority in the State of destination also sends copies of both applications to the MDBC for:
   - an assessment of the Commission's ability to deliver the water to the buyer; and
   - a determination of the exchange rates to be applied to the transfer and any consequent adjustment to the transferred water entitlement.
7. The MDBC advises each State whether the water can be delivered and the exchange rates to apply to the transfer.
8. On the basis of the States' requirements and the MDBC advice, the application is either approved or rejected. The State of destination will determine what conditions, if any, will apply to the transfer in order to satisfy State and MDBC requirements.
9. If the application is approved, the State of origin cancels or reduces the licence of the transferred water allocation of the seller. On confirmation of the cancellation or reduction in the State of origin, the State of destination finalises the approval of the application and issues a new licence to the buyer. In the case of a sale of part of an entitlement, a revised licence is issued to the seller. The buyer and seller are notified accordingly and the transfer is finalised.
10. The State of destination advises the MDBC once the transfer has been approved.
11. The MDBC records the transfer of the water allocation in the MDBC Trade Register and makes the necessary adjustments to the delivery of the States' water entitlements, the States' CAPS, and the States' financial contributions to the Commission's water businesses (MDBC 2000, p. 3).

The second tranche report (NCC 1999b) noted the work of the Murray-Darling Commission and Ministerial Council in progressing interstate trade through the pilot project and its careful and thorough development, extensive education programs and extension of the project. The NCC was satisfied that the MDBC had met its second tranche water reform commitments regarding allocations and trading.

***Conclusion***

The NCC (1999b) considered the work of the MDBC, in terms of allocations and trading reform framework and noted:

- the considerable contribution of the CAP on diversions to ensuring environmental flows; and
- the work of the Murray-Darling Commission and Ministerial Council in progressing the pilot interstate water trade project and the recent extension of the project.

### 4.2.2 New South Wales

This section examines the implementation progress of the NCP water reforms, in terms of water rights and water trading for New South Wales. Discussion considers the legislative definition of water rights and the extent and nature of water trading (including interstate trading).

***Water Rights***

*The Water Management Bill 2000* was introduced to the New South Wales Parliament on Thursday 22 June 2000. At the time of the September 2000 supplementary assessment of water reforms, the NCC had not assessed this proposed legislation. The NCC (1999b) assessed the current framework in June 1999 and found that:

> *The Water Act 1912 provides the main regulatory framework for New South Wales water rights. For example, it permits occupiers of land adjacent to rivers or lakes to exercise riparian rights and provides for farm dams (section 7). It provides for occupiers to apply for water licences (including terms, limitations and conditions as approved by the Ministerial Corporation (section 12)) to extract water for irrigation and other purposes (section 10). Part 2, Division 4C of the Water Act provides for the temporary or unlimited transfer of water allocations where these are measured volumetrically. The applications for transfer are subject to approval by the Ministerial Corporation which must be satisfied that the transfer 'would not result in the transferee's scheme being subjected to an unacceptable commitment'; section 20AH. For transfers exceeding in total three years a farm water management plan outlining information such as previous water consumption, groundwater levels,*

*soil type, existing and proposed irrigation must be approved by the Ministerial Corporation. The farm water management plan then becomes a condition on the licence permitting the transferee to take the traded water (NCC 1999b, p. 314).*

The following water rights currently exist in NSW (New South Wales Department of Land and Water Conservation (DLWC) 1998):

- non-specific, diffuse, unlicensed and non-tradeable water values such as recreational water rights;
- permissions which are specific, non-licensed and non-tradeable, such as access to off-allocation 90 flows;
- diffuse, specific and legislated (although unlicensed) rights that are non-tradeable and without a fixed term, combining concepts of access to and use of water, such as riparian water rights and farm dams;
- licensed, fixed term, specific rights closely linked to land title and combining concepts of access and use, such as area-based unregulated river water licences;
- licensed, specific, fixed term rights which are volumetric, tradeable and combine concepts of access and use, such as regulated water licences and some high yield bore licences;
- licensed, specific, fixed term rights which are volumetric, tradeable and separate concepts of access and use, such as water licences held by mining companies and corporate water licences; and
- licensed, specific, fixed term rights which have controls on access and use regulatory structures, such as SWC and HWC licences and licences of irrigation trusts and corporations.

In December 1999, the New South Wales Department of Land and Water Conservation (NSW DLWC) issued a White Paper (NSW DLWC 1999). The White Paper suggested the problems of the current legislation included:

- no explicit head of power for environmental needs;
- no explicit mechanism for broad community involvement;
- no community based planning provisions;
- licenses tie water entitlements to land;
- water access entitlements need definition;
- licenses tie water entitlements to works and specified land;
- access to water is not secure;
- water use approvals need streamlining;
- special entitlements are loosely or poorly specified;
- riparian rights in rural residential development; and
- difficult to integrate water management across the water ecosystem.

The present trading regime under the Water Act restricts water purchases to those who own land. The NSW DLWC (undated) notes the proposal to replace the current water licenses with:

- a water access right, established under legislation and wholly or partly transferable, which is defined as a fixed percentage of the water available for extraction at any one time; and
- a water use right, established under legislation and defined as a right to apply and use water at a specific location. Because it is site-specific the licence would not be transferable.

Table 4.2 Features of water access entitlements in NSW

| | ACCESS ENTITLEMENTS | | WATER USE APPROVALS |
|---|---|---|---|
| | **Share Entitlement** *How Much* | **Extraction Entitlements** *Where and When* | *Why and How* |
| **Regulated Rivers** | • defines a basis for sharing regulated water components (eg inflows) declared available at any time.<br>• is set at the water management unit level (regulated river system).<br><br>Therefore, because it represents a share only:<br>• it could be set for a longer non-fixed term<br>• ownership can be independent of land ownership<br>• it can be freely tradeable | • defines where water can be extracted and may include daily extraction rates, rostering and other limits<br>• may be appropriate at times or places where there are delivery constraints<br>• is set at the zone level and can have site specific conditions<br><br>Therefore, because these may vary over time with ecosystem and other requirements:<br>• it would need to be set for a defined term and subject to periodic review<br>• ownership can be independent of land ownership - relationship to the delivery constraint is the critical factor<br>• trade is only beneficial around the delivery constraint | • defines the amount of water, application rates, drainage needs, etc for each enterprise<br>• is set at the property or enterprise level<br><br>Therefore, because these may vary with environmental concerns over impacts on other users:<br>• it would need to be set for a defined term and subject to periodic review<br>• ownership must be dependent on land ownership<br>• approval is site specific and no trade is allowed |
| **Unregulated Rivers** | • defines the annual water diversion limit as a basis for sharing the yearly access volume. This provides a basis for assessing a cumulative rolling average<br>• is set at the water management unit level (river subcatchment).<br><br>Therefore, because it represents a share only:<br>• it could be fixed for a longer non-fixed term<br>• ownership can be independent of land ownership<br>• it can be freely tradeable | • defines basis for sharing the daily or event flow components declared available<br>• defines daily extraction rates<br>• is set at the zone or subcatchment level and can have site-specific conditions<br><br>Therefore, because these may vary over time with ecosystem and other requirements:<br>• it would need to be set for a defined term and subject to periodic review<br>• ownership can be independent of land ownership - relationship to the zone is the critical factor<br>• trade is restricted to the zone or sub catchment | As above |

Source: Author and DLWC (1999)

*Overall Objective:* to provide for the sustainable and integrated management of water sources of the State for the benefit of both present and future generations

*Socio-Economic Objectives:*
To recognise and foster the significant social and economic benefits to the state that result from the sustainable and efficient use of water, including: (i) benefits to the environment; (ii) benefits to urban communities, agriculture, fisheries, industry and recreation; (iii) benefits to culture and heritage; (iv) benefits to the aboriginal people in relation to their spiritual, social and customary use of land
To recognise the role of the community, as a partner with government, in resolving issues relating to the management of water sources
To provide for the orderly, efficient and equitable sharing of water from water sources
To encourage the sharing of responsibility for the sustainable and efficient use of water between the Government and water users

**Water Management Plan:** ***Planning to achieve Sustainable and Integrated Management***

*All plans must provide:*
A vision statement
A set of water management objectives that are consistent with the vision statement
Strategies for achieving these objectives
A set of performance indicators by which success may be measured

**Implementation Plans:** ***Implementation of Water Management Plans***

*All plans must provide:*
Water transfer rules consistent with NSW water transfer principles
Operational rules (these may vary between regulated and unregulated rivers)
Water quality rules
Rules regarding activities that affect ecosystems

**Access Licences and Water Use Approvals:** ***Specification of Water Rights***

*Access licences consist of share entitlements (how much) and extraction entitlements (where and when)*

*In regulated rivers share entitlements specify:*
An individual's proportional share of the total supply available for allocation

*In regulated rivers extraction entitlements specify:*
Where and when water may be extracted from

*In unregulated rivers share entitlements specify:*
The annual water diversion limit as a basis for sharing the yearly access volume

*In unregulated rivers extraction entitlements specify:*
The basis for sharing the available flow
The daily extraction rate

*Water use approvals (why and how) are the same for regulated and unregulated areas*

*Water use approvals specify:*
The amount of water, application rates, drainage needs for individual enterprises

*Important Note:* There are several categories of access licences which provide licence holders with varying degrees of security during supply shortages.

*Plans will contain a statement of the current position including:*
Identified ecosystem requirements
The impacts of water extraction
Urban supply, sewerage and drainage arrangements
An inventory of water resources
Current share entitlements, extraction entitlements and use approvals and activities affecting ecosystems
Water use constraints
Equitable adjustment mechanisms

*Plans will contain details of future water management strategites including:*
Plans and priorities for river/groundwater rehabilitation
Current and future risks
Current and future water needs
Socio-economic analysis options
Water conservation strategies
Monitoring and reporting requirments
Criteria for the operational aspects of an implementation plan

*Ecological Objectives:*
Apply the principles of ecologically sustainable development
To protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality
To integrate the management of water sources with the management of other aspects of the environment, including the land its soil, its native vegetation and its native fauna
To encourage best practice in the management and use of water

Source: DLWC (1999)

Figure 4.1 Water allocation, management and planning under the NSW Water Management Bill 2000

It was also noted (DLWC, undated) that the splitting of water licences into access and use rights would:

- provide for better definition of rights in that trading in access rights would be independent of the use to which the water is put;
- greater homogeneity in the right being traded; and
- prior approval (via a usage right) would speed up the processing of transfers and third party objections.

The *Water Management Bill 2000* was introduced to the New South Wales Parliament on Thursday 22 June 2000. Table 4.2 presents some features of water access rights in NSW and Figure 4.1 outlines the proposed Act.

The White Paper considered the main elements of the proposed legislation to be:

- Protection of the water environment - The proposed Water Management Act will make provision for the sharing of water resources between consumptive users and natural systems. For environmental water, the proposed Act will provide for the determination of environmental flow strategies and water for groundwater dependent ecosystems. Environmental health water and targeted environmental water will not be available for trading. The Minister will be able to adjust water entitlement conditions to achieve agreed environmental and public health outcomes. Examples include allocating water for specific ecosystems (eg. Macquarie Marshes) and making emergency water releases (eg. for blue-green algal blooms). Rivers/aquifers will be classified to prioritise action according to their level of health/conservation value. The proposed Water Management Act will provide mechanisms for defining and managing extractable limits for water.
- Water management planning and the community- The Minister may appoint committees, in particular the Water Advisory Council, water management committees and customer service committees to advise on water management. Water management plans will be developed on a priority basis. The proposed Act will set out a process for developing, approving and implementing the plans that specifically involves the community. DLWC will implement the water management plans at a technical and operational level via the mechanism of implementation plans. These implementation plans will be reviewed annually. Water management plans will link with other resources management plans and strategies in NSW.
- Clarification of water rights and ecosystem activity approvals - An integrated approvals administration system is included in the proposed Act. The same system will apply to regulated and unregulated surface water and groundwater systems. Where appropriate for the water management unit, water rights will be split into a share entitlement that entitles the holder to a portion of the resource and an extraction entitlement that entitles the holder to extract water at a specified location subject to conditions.
- Water trading and transfers - The proposed Water Management Act will allow different components of water entitlements to be owned and traded separately. Trade will be by transfer of share entitlement from one extraction entitlement to another, i.e. from one physical location to another. Water transfer applications, will have regard to factors such as potential environmental impacts and impacts on other water users, consistent with other approvals. Interstate and intervalley trades and trading across different water sources within a water management unit will be possible. The government will also be able to own and trade water.
- Compliance - The proposed Water Management Act will contain a modern legal framework, with a range of compliance options developed by the DLWC. New compliance provisions will include stop work orders and notices to allow prompt action and will provide for a range of both civil and criminal remedies. Any person will be able to bring actions where there is a breach or threatened breach of the Act. The Land and Environment Court will have jurisdiction to hear these matters and will have expanded powers to impose appropriate penalties (NSW DLWC 1999, p. 6).

The proposed legislation will have provision for the development of statewide transfer principles/rules by the Minister. Water management plans and implementation plans will be the mechanisms by which such transfer rules are given local relevance (NSW DLWC 1999).

There will also be improved market information through a public register of water entitlement holders with details of volumes, security and third party interests. Non-identifying volume and price information will also be available for water trades (NSW DLWC 1999).

In summary, the proposed legislation contains provisions for water markets that will:

- separate water rights from land and split it into share and extraction entitlements that can be owned and traded separately;
- enable a principle form of trade to be the transfer of share entitlement from one extraction entitlement to another, i.e. from one physical location to another;
- streamline consideration of water transfer applications, while having regard to potential environmental impacts and impacts on other users;
- allow, in some circumstances, interstate and intervalley trades, and trading across different water sources;
- allow government to own and trade water; and
- provide market information (DLWC 1999).

***Trading***

Marsden Jacob and Associates were commissioned by the New South Wales Department of Land and Water Conservation to review water trading in New South Wales. Marsden Jacob and Associates (1999) considered that the current situation in NSW supports active trade, particularly in the regulated systems and major gains from trade producing significant economic benefits have already occurred. Table 4.3 characterises water trading for the 1997-98 irrigation season. The review also noted that:

- all trading was in regulated river systems;
- 95 per cent of traded water involved temporary trades;
- water trading has increased thirteen-fold since 1988-89 season; and
- the bulk of the trade is within the local region or valley- some 32 per cent of total trade in NSW is within the boundaries of the irrigation corporations with a further 53 per cent within the valley (Marsden Jacob and Associates 1999).

Table 4.3 Water trade in regulated systems, 1997-98

| | **Volume ('000 ML)** | **% of Total Entitlement** |
|---|---|---|
| Trading | 863,145 | 11.5 |
| Usage | 5,761,753 | 77 |
| Entitlement | 7,465,922 | 100 |
| | **Volume ('000 ML)** | **% of Total Trade** |
| Within River System | | |
| - within licences | 278,054 | 32.2 |
| - between licenses | 460,498 | 53.4 |
| Between River Systems | 93,597 | 10.8 |
| Interstate | 30,996 | 3.6 |
| **Total** | **863,145** | **100** |

Source: Marsden Jacob and Associates (1999)

Marsden Jacobs Associates (1999) considered the manner in which water trade occurs in NSW and noted the following:

- Water trading occurs through formal exchanges, stock and station agents and informal agreements. The majority of trade takes place bilaterally, directly between water users, often based on landholder to landholder handshakes.
- The efficiency and effectiveness of these bilateral, informal trades is critically dependent on the buyer and the seller - but particularly the seller - being reasonably informed about price movements in the water market. Primarily for this reason, irrigator committees and associations have instituted and facilitated the development of formal exchanges for temporary trade. The grower-run exchanges play a critical role in providing price signals to the wider market and in keeping commission rates low.
- Formal markets or exchanges have been established in the southern systems where the bulk of temporary trade occurs, for example, by the Southern Riverina Irrigators District Council (SRIDC). In the northern systems, there is greater reliance on brokers and agents, eg. Elders believe that they control some 30 per cent of the trade in the Macquarie. (Information on the method of trade does not appear to be reliable) (Marsden Jacob and Associates 1999, p. 3.14).

The NCC (1999b, p. 351) considered that a "comprehensive systems of water allocations and trade, including provision of water allocations for the environment, has been achieved for the regulated rivers in New South Wales, excluding the Murray and Border Rivers for which environmental flow provisions are subject to inter-State negotiations."

The NCC noted that regulated rivers account for about eighty per cent of water use in NSW and these rivers are mature systems that can be characterised by:

- long-term embargoes on the issue of any additional entitlements, thereby protecting existing rights;
- a sound technical information base for these rivers and a sophisticated model of river operations;
- a strong and long-term understanding by the water using community of water availability; system reliability, river operations, water management framework and cost implications;
- environmental flow rules, which have been in place since last year for all the regulated river systems and in some areas for much longer. For instance, environmental allocations for the Macquarie have been in place since 1986;
- water trading on the regulated river systems has been in place since the 1980s and a mature market exists; and
- water trading rules are now being revised to examine how greater flexibility can be provided (NCC 1999b, p. 351).

The trading rules which govern both temporary and permanent trades vary amongst the regulated systems. For example, temporary trades in the Murrumbidgee have no zone restrictions and in/out of districts requires the general manager's approval; permanent trades both within and in/out of districts requires the general manager's approval. Murrumbidgee trades also have a low to high security conversion factor of 0.8 applied. In the Barwon Darling there are no restrictions on temporary trades and interim rules for permanent trade. In the Macquarie, no temporary or permanent trades are allowed into Crooked Creek and volumetric constraints apply to entitlements on Duck and Gunningbar Creeks and Cudgeong River, also, a conversion factor of 0.7 applies past Fairview Dam (NSW DLWC 1998b).

Trading in unregulated rivers cannot develop to its full extent until the development of river management plans,[21] completion of risk assessments and the volumetric conversions of water rights are in place (NSW DLWC 1998c). However, interim trade rules, applying to permanent trades only, have been developed. The NSW DLWC (1998c) noted that the interim rules:

- confine trades generally within subcatchments and provide that trades are available to active irrigator and industrial water users only;

[21]River Management Plans will clarify water access rights, conditions under which water can be taken from rivers and detailed trading rules.

- require a farm water management plan to be submitted with the application; and
- permit trading for licences on the basis of an equivalent area until volumetric conversion has taken place.

The NCC (1999b) considered that a comprehensive system of water allocations and trading for unregulated rivers is underway. However, "it must be recognised that water management of these rivers, and the understanding of water resource management issues and responses by the communities of these rivers, is at a much less mature phase" (NCC 1999b, p. 352). It was further noted that "the bulk of licenses are still on an area basis and little consideration has been given to environmental requirements" (NCC 1999b, p. 352).

The NCC (1999b) noted that unregulated rivers account for a small proportion of surface water extractions (5-10 per cent), however, it stated that:

> *Given the present state of water allocations for unregulated rivers, the Council is not satisfied that New South Wales has made sufficient progress to be regarded as having satisfactorily met this aspect*

Table 4.4 Murrumbidgee irrigation: growth in temporary trade

| |
|---|
| Temporary transfers were introduced in the early to mid eighties following the introduction of the volumetric allocation scheme in 1982-83. In Murrumbidgee, there is a history of underuse against 100% allocation and for the initial years following the introduction of the transfer scheme there was continuing substantial access to off-allocation flows to those who had a higher than 100% level of development. Additionally, the normal level of announced allocation was 120%. |
| The transfers have built up since 1991-92 and in the period up to and including 1993-94, allocation availability was 100% for high security and no less than 120% for normal security. Transfer rules in place in 1993-94 would have permitted up to 100,000 ML of inter-valley transfers but there was no buyer demand. |
| There was a spurt of demand in 1992-93 to inter-valley transfers of about 15,000 ML. 1994-95 was a critical resource constrained year where in-season demand management flow caps were put in place to share the available limited resource. Allocation was 100% for all users. A limited amount of off-allocation became available later in the season. |
| In 1995-96 the company customers had a net external transfer of 35,000 ML out of the company area. Allocation was 105% normal security and 100% high security. There was a lower than average off-allocation availability. |
| In 1996-97, there was a net 24,000 ML traded within the company and a net 84,000 ML out from the company area to other places. Allocation availability was 100% high security and 100% normal security. Off-allocation was available in reduced quantity compared to average as a 'history of dependence' access right was applied. |
| In 1997-98, there was a net 68,000 ML traded within the company and a net 95,000 ML from the company area to other places. There was no off-allocation availability in this year and water was tight. Allocation availability was 100% high security and 100% normal security. |
| In 1998-99 the volume traded to date is approximately 14,000 ML within the company and about 64,000 ML out from the company area to other places. There is plenty of water 'on the market' this year with not many buyers. Allocation has moved to 85% for normal security and 100% for high security. Off-allocation in reasonable quantities was available. |

Source: Marsden Jacobs (1999, p 3.4)

*of the strategic reform agenda. The Council is not therefore satisfied that there is a comprehensive system of water entitlements backed by separation of water property rights from land title and clear specification in terms of volume or transferability (NCC 1999b, p. 318).*

Marsden Jacob and Associates (1999) identified numerous deficiencies and impediments in current trading arrangements, which included:

- Permanent trades can typically take six to twelve months to complete and temporary trades, if interstate or inter-valley, up to seven weeks to approve. In part, these delays reflect the requirements placed on the Department under the Environmental Planning and Assessment Act, but they also reflect the lack of prior approval mechanisms and the cumbersome nature of current arrangements;
- Neither the current system of water rights nor approval processes for trades provide an easy process for prior approval;
- Although permanent trades require environmental approval (DLWC practice requires a case-by-case approval), temporary use of water up to a cumulative five years does not. While the enforceability of this arbitrary rule is unclear, it provides landholders an incentive to purchase water temporarily and prevents adequate scrutiny of the environmental impact of the dominant form of trade. A unified and seamless approach for effective prior approval of trades is required;
- Landholders on unregulated streams are disadvantaged by the prohibition on temporary transfers and by the Interim Trading Guidelines, introduced in July 1998, which require a case-by-case assessment of proposed permanent trades; and
- Permanent trade is constrained by the rapid evolution of water policy and concerns about the future security of the entitlement. Conversely, temporary trade is encouraged (Marsden Jacob and Associates 1999).

Marsden Jacob and Associates (1999) also considered the current situation in NSW, in terms of a set of optimal conditions for market efficiency. The optimal market condition followed by the findings are listed below:

- Physical delivery: Trade on regulated systems generally limited to the boundaries of the VAS.[22] Physical constraints are evident in many systems including the River Murray's Barmah choke. In the northern valleys the physical constraints such as the Macquarie Marshes define the boundaries of the VAS. Trade on unregulated and groundwater systems highly constrained, subject to active program to validate sustainable yield and trading rules.
- Clear, unencumbered title: Water right not fully specified in conditions, or to claimants, still legally linked to land ownership. Does not cover all sources of water.
- Homogeneous commodity: Heterogeneous and variable homogeneity, reflecting constraints imposed by physical delivery, environmental objectives, river regulation and river and aquifer management. Different levels of security and reliability. Water entitlement in unregulated systems still based on area rather than water volume.
- Economic prices (no tax/subsidy wedges): Reasonable transparency in government bulk charges, with independent oversight in NSW.
- Information costs minimised: Imperfect knowledge of opportunities for trade between individual licensees located in different systems and/or river sectors. Lower relative information costs for trade within districts/area, regions. Knowledge of market opportunities varies within reaches of the rivers, eg. on Macquarie.
- Transaction costs minimised: Transaction costs are highest where resource management plans and prior approval mechanisms are absent, eg. with river pumpers, especially in unregulated systems. Transaction costs are likely to be lower within the boundaries of the bulk licensees, since most of the checking and vetting requirements are met at the local level.

[22]All regulated rivers in NSW operate under what are known as Volumetric defined area below a specified storage or set of storages. The VAS is managed by DLWC to minimise losses and to maximise delivery capability and security. Any losses in the system are socialised amongst all licence holders supplied from that VAS.

- Third party impacts clearly identified: Plans and processes under development for river flow regimes and on-farm controls. However implementation and monitoring is variable and more effective in larger entities.
- Efficient market mechanisms: Market mechanisms vary in style between valleys and along reaches. Major exchanges in the southern systems and Macquarie. Heavy reliance on stock and station agents in northern valleys. The exchanges provide a higher level of price information than market transactions which occur through stock and station agents or bilateral trades between irrigators (Marsden Jacob and Associates 1999, p. 4.16).

The New South Wales Department of Land and Water Conservation (NSW DLWC) (1998b) examined water trading issues and considered that:

- Water trading offers substantial potential benefits to individual water users and the NSW economy but is currently operating less than optimally. Permanent trading, in particular, is sub-optimal. This may favour incumbent, annual crop growers and disadvantage potential new users
- Trading rules need to reflect environmental and river health objectives and a precautionary stance must be adopted at least until river flow regimes have been specified. Any delay in the specification of flow regimes will restrain responsible trading, particularly in unregulated rivers
- Links between flow management rules and trading are currently unspecified and individual permanent trades can take from 6 to 12 months to approve due to required environmental assessment. More efficient permanent trade requires the development of explicit trading rules, which are linked to flow management rules, and a prior approval mechanism, covering land use requirements. This could occur with the separation of access and use rights
- Effective separation of water access and water use rights would significantly improve the efficient operation of water markets, particularly permanent trades, and there appears to be reasonable support for the proposition amongst water users when the benefits of separation to trading are explained
- Licence holders and potential market participants need better information on the risk profile of future supply in order to efficiently value water transfers, particularly following the introduction of the MDB CAP, recent changes of usage within a region, the introduction of flow management rules and the implications of policy changes (such as farm dams). This issue should be addressed in the short term in systems where trading already occurs to develop an ongoing mechanism to service this need
- Transfer rules should reflect physical characteristics of water delivery (such as transmission losses) and explicitly state their objectives or interactions
- Rules that result in constraints to trade, particularly constraints to permanent trade out of regions, may be justifiable in terms of environmental impacts
- A charge on trade, in the form of an exit fee (which is effectively a reverse developer charge), may be appropriate where there will be demonstrated, uncompensated economic losses as a result of the trade, or contractual agreements are affected. Other types of constraints to trade would appear to contravene the Trade Practices Act and are contrary to the spirit of the COAG and National Competition Policy agreements on water reforms
- Attitudes to trade depend on whether the individual is in a growing or declining industry and/or whether the region may be impacted on. A majority of individual water users recognise the importance of efficient trading opportunities. An early statement on the issue of land valuation for rating purposes and the impact of trade on local government revenues is required, and
- DLWC's capacity to process trade efficiently has attracted adverse comment, albeit much of it sympathetic to the constraints imposed under current licensing arrangements. Greater flexibility in the resourcing and pricing of this essential function is required, and processes for dealing with transfer applications need to be standardised.

***Interstate water trading***

New South Wales is a participant in the pilot interstate water trading project in the Mallee border region of the Murray-Darling Basin. The project is limited to permanent transfer of high security water entitlements held by private diverters. Each trade must be approved by respective state authorities. The scheme provides for the registration of the trades and exchange rates to limit the impact of trades on the security of others' water entitlements and the environment. Environmental

clearances are integral to the pilot, as is the maintenance of the Salinity and Drainage strategy (MDBC 2000).

The NCC's second tranche report stated that:

> *The NCC was advised by the MDBC that the first water trade under the project occurred in September 1998 and that as at 15 February 1999, 248 ML had been transferred from New South Wales to Victoria, 600 ML from Victoria to South Australia and 528 ML from New South Wales to South Australia. The present price for trades is about $1,000 per ML. The MDBC is presently reviewing the project. New South Wales has advised that interstate trade between New South Wales and Queensland cannot occur until Queensland has completed 'capping' entitlements, and that there are at present no formal arrangements for trade (NCC 1999b, p. 335).*

The NCC considered that present trading arrangements do not meet the water reform commitments and that "considerable work in finalising new licensing regimes for water access, completing pilot trading projects and trading rule reviews and implementing recommendations to streamline present trading arrangements is required" (NCC 1999b).

***Conclusion***

The *Water Management Bill 2000* was introduced to the New South Wales Parliament on Thursday 22 June 2000. At the time of the September 2000 supplementary assessment of water reforms, the NCC had not assessed this proposed legislation. The NCC (1999b) assessed the current allocation and trading framework in June 1999 and found that:

- The present entitlement system in regulated[23] systems and groundwater meets the requirements of the COAG water reform framework. However, the NCC was not satisfied that this is the case for water licences on unregulated rivers and streams. In these systems the title to water is presently tied to the land area and use. The NCC was therefore not satisfied that New South Wales has in place a comprehensive system of water entitlements backed by separation of water property rights from land title and a clear specification of entitlements in terms of volume, reliability or transferability. However, NCC considered that the reform agenda outlined by New South Wales addresses many of the aspects of the framework.
- The achievement of New South Wales in developing Environmental Flow Rules on regulated rivers has advanced the process of balancing environmental and consumptive uses of water. However, the NCC was not satisfied that allocations have been developed for the environment in other systems. Progress in unregulated systems is somewhat dependent on reforms outlined by New South Wales.
- Significant trading in water is occurring in New South Wales, with some 200,000-700,000 ML traded annually and a significant net contribution to the New South Wales rural economy. The NCC was not satisfied, however, that present trading arrangements remove impediments to trade. In some cases approvals for trades can take several seasons. Many of the acknowledged deficiencies will be addressed by new water licensing arrangements. In addition, reviews underway will examine and make recommendations regarding trading rules. The NCC was not satisfied that New South Wales had met this reform commitment regarding water trading.

### 4.2.3 Queensland

This section examines the implementation progress of the NCP water reforms, in terms of water rights and water trading for Queensland. Discussion considers the legislative definition of water rights and the extent and nature of water trading (including interstate trading).

***Water Rights***

The *Water Act 2000* came into effect on 13th September 2000. Prior to this, the legislation relevant to allocations and trading was the *Water Resources Act 1989*. The second tranche report (NCC 1999b) noted that:

[23]Regulated rivers are those proclaimed under the Water Act as having their flows controlled by the major Government rural dams while unregulated rivers are all other rivers in the State.

*The Water Resources Act 1989 (WR Act) provides for the right to the use and flow of water[24] to vest in the Crown. The Act also vests beds and banks in the Crown. Riparian rights (water for domestic purposes and watering stock) are retained. The WR Act prohibits[25] actions such as construction of referable dams,[26] construction of levee banks, construction of artesian bores or the taking of water without a licence. Section 44 of the WR Act provides for licences that entitle the licencee to a nominal allocation of water.[27] Section 56 provides for limited application short term water permits to be issued. Part 5 of the Act provides for the sale of water licences 'to allow recovery of costs incurred by the State in providing works'. Part 4, Division 4 of the WR Act provides that licensees and permittees may be notified of the times during which water may be taken, the quantity of water that may be taken and the area of land/type of crop that may be irrigated (NCC 1999b, p. 487).*

The problems associated with the current WR Act include the following:

- no explicit head of power for environmental sustainable allocation;
- no statutory planning framework;
- licences tie allocation to land;
- lack of security of supply;
- licences tie water allocations to works; and
- riparian permits in rural residential developments (DNRQ 1998a, p. 17).

The Queensland Government is in the process of developing the necessary legislative and institutional arrangements to implement the COAG agenda for water reform. Part of this process is the new *Water Act 2000*, which came into effect on 13 September 2000.

Water allocation and trading in Queensland is closely tied to a comprehensive planning framework designed to ensure the most appropriate use of water and minimise the potential for adverse social, economic and environmental consequences. Some features of the proposed reforms are outlined in Table 4.5. There are two parts to the planning framework, Water Allocation and Management Plans and Resource Operations Plans.

Water allocation and management planning is the cornerstone of water reform in Queensland (DNRQ 1998a). A Water Allocation and Management Plan is an integrated plan for the allocation and management of water resources to determine the most appropriate balance between social, economic and environmental water needs on a catchment wide basis (DNRQ 1999a). Every Water Allocation and Management Plan must (a) identify a sustainable flow regime in order to protect environmental values; and (b) develop a catchment specific hydrologic model to be used to assess environmental flow scenarios, likely supply levels given existing allocations, and the availability of surplus water for future development. However, if there is an intention to establish a water market, the plan must also consider a range of other factors. This is due to the potential for significant social, economic and environmental externalities from water markets. Issues to be considered include, as a minimum:

- the environmental flow objectives within the plan area;
- water entitlement security objectives;
- performance indicators for environmental flow and entitlement security;
- water and aquatic ecosystem monitoring requirements;
- priorities for the development of Resource Operations Plans (DNRQ 1999a, p. 24).

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[24]Water in a watercourse that flows past, or a lake or spring within or abutting the land of, two or more owners, water conserved by a weir or dam on such a watercourse, lake or dam or groundwater. A watercourse is defined as including a river, creek or stream in which water flows permanently or intermittently: a natural channel; a natural channel artificially improved; and an artificial channel that has changed the course of the watercourse.

[25]Section 38

[26]Generally, works or proposed works that impound, divert or control water and: is more that 10m high with a storage capacity of 20,000 $m^3$ or 5 m high with a storage capacity of 50,000 $m^3$.

[27]For example, from a weir in a watercourse.

[28]Part 9 of the Act also provides for the allocation of a nominal allocation in respect of land in an irrigation district.

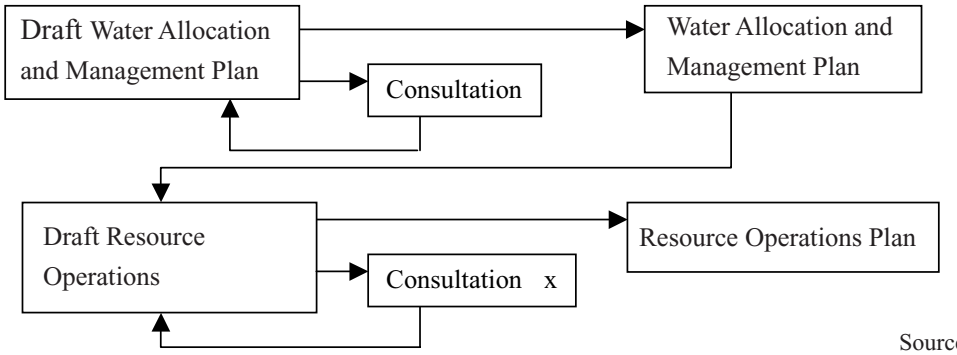
[29]There are some 83,000 licences or permits in force in Queensland.

The purpose of a Resource Operations Plan is to establish a strategy which contains all of the operational details for the implementation of a Water Allocation and Management Plan (see Figure 4.2). This includes all of all of the necessary arrangements for the establishment of a water market. A Resource Operations Plan must include details of:

- the purpose and focus area of the plan;
- how infrastructure in the area is to be operated by water service providers within that area;
- environmental management rules;
- water sharing rules;
- water allocation transfer rules, including any restrictions on transfers or interstate transfers;

Table 4.5 Features of water allocations in Queensland

| | **Water Allocations**<br>***How much, where, when, why and how*** |
|---|---|
| **Regulated Rivers** | • defines the annual volumetric limit of the allocation<br>• defines where water may be extracted from<br>• defines the purpose for which water may be used (urban, agricultural or industrial)<br>• specifies the resource operations licence (infrastructure operation) under which water is supplied<br>• specifies the priority group of the allocation with respect to supply<br>So,<br>• ownership is independent of land title<br>• allocations are freely tradeable within the rules specified by a resource operations plan |
| **Unregulated Rivers** | • defines the annual volumetric limit of the allocation<br>• defines where the water may be extracted from<br>• defines the purpose for which the water may be used (urban, agricultural or industrial)<br>• specifies the maximum extraction rate for the taking of water<br>• specifies the minimum flow conditions under which the water may be taken so, ownership is independent of land title<br>• allocations are freely tradeable within the rules specified by a resource operations plan |




Source: DNRQ (1999a)

Figure 4.2 Planning framework for water allocation and management in Queensland

- the details of interstate transfer agreements;
- arrangements for the conversion of existing licences and interim water allocations to transferable water allocations;
- monitoring practices and allocation of responsibility for monitoring.
- the operational responsibilities of the chief executive (DNRQ 1999a, p. 30).

Together, Water Allocation and Management Plans and Resource Operations Plans provide a framework for the allocation and management of water which addresses the limitations of the current piecemeal approach to the approval of water entitlements (see Figure 3.2).

Under the *Water Act 2000*, a Water Allocation is an authority to take water and (DNRQ 2000):

- is an entitlement to water that is separate from the title to land;
- is transferable within defined limits and rules;
- is securely specified by the Water Allocation and Management Plan; and
- may be described in terms of volume, location, purpose, priority group, extraction rate and flow conditions.

The way in which water allocations are specified varies according to whether supply is regulated and provided under a Resource Operations Licence or unregulated. In a regulated area, water allocations are defined in terms of the:

- annual volumetric limit that may be taken;
- location from which it may be taken;
- purpose for which it may be used (industrial, urban, agricultural);
- Resource Operations Licence under which it is supplied (There must be a supply contract between those who operate infrastructure and those who hold water allocations); and
- priority group of the allocation in relation to supply (different levels of entitlement security may be purchased) (DNRQ 1999a, p. 33).

When the allocation is taken from an unregulated stream, it is defined in terms of the:

- maximum extraction rate; and
- flow conditions under which the water may be taken (flow conditions will be publicly available information to ensure that compliance may be reasonable achieved) (DNRQ 1999a, p. 33).

Water allocations are to be registered on a public register showing the details of ownership and any encumbrances recorded against it and include:

- names of the holder of the Water Allocation and each holder's share of the Water Allocation;
- the volume of water for the Water Allocation;
- the purpose for which the Water Allocation may be used, for example, agricultural, industrial or urban (this is required to assist monitoring of any movement of water between sectors as trading occurs);
- for a regulated water supply, the priority group to which the Water Allocation belongs (this will be either medium or high priority based on security groups specified in the Water Allocation and Management Plan); and
- for unregulated water supplies, the maximum rate at which water may be taken and the flow conditions under which water may be taken (DNRQ 2000, p. 3).

If after the planning process is completed, additional water reserves have been identified, the Queensland Government has proposed a planning framework (Water Release Planning) for the allocation of these reserves. The primary objective of Water Release Planning is to ensure that any additional water supplies are allocated only after a comprehensive assessment of the potential for meeting demand through other means, such as markets and water use efficiency initiatives. A Water Release Plan will also offer a process for allocating additional water reserves which results in the highest value use to the community (DNRQ 1999b).

Because a Water Release Plan is prepared subsequently to a Water Allocation and Management Plan and a Resource Operations Plan for the same area, it must be consistent with both of these plans. This ensures that the environmental flow and water entitlement security objectives for the catchment are not compromised.

A Water Release Plan would include:

- projected water needs and/or priorities for urban, industrial, irrigation and environmental purposes;
- strategies for meeting water needs when there is a shortage; and

- strategies for the future allocation of water (DNRQ 1999a).

The allocation of additional water would be based on the outcomes of the Water Release Plan process. Water could be:

- reserved for future use;
- reserved for preferred future water storage sites;
- released permanently into the market;
- released for temporary use; and
- have conditions attached to its use to ensure that Water Allocation and Management Plan outcomes are met (DNRQ 1999a).

The September 2000 supplementary water reform assessment (NCC 2000b) noted that the following Water Allocation and Management Plans have been published:

- Fitzroy Basin Water Allocation and Management Plan;
- Cooper Creek Water Management Plan;
- Draft Moonie River Catchment Water Management Plan;
- Draft Boyne River Basin Water Management Plan; and
- Draft Condamine-Balonne Water Allocation and Management Plan.

The NCC (2000b) also noted that interested parties have raised a number of concerns as to the consistency of each of the plans or draft plans with COAG water reforms. Some of these relate to the transparency in the decision making processes, particularly as regards the amount of water that may be extracted or the matters to be included in the planning process. The NCC noted that these matters are crucial to both outcomes and the extension of the new tradeable water allocations system.

There are currently no Resource Operations Plans developed in Queensland. However, following the approval of the Fitzroy Basin Water Allocation and Management Plan in December 1999, a draft Resource Operations Plan for the Fitzroy is currently being developed. This will be the first Resource Operations Plan for Queensland (DNRQ 2000). The key components of this draft Resource Operations Plan include:

- how water will be managed sustainably;
- how Water Allocation and Management Plan outcomes will be addressed;
- how existing water supply infrastructure (such as Fairbairn Dam, the Fitzroy Barrage and the Dawson River weirs) is to be operated;
- how the proposed Nathan Dam on the Dawson River would be operated;
- how streamflows will be managed in unregulated systems (includes access conditions for waterharvesting);
- environmental flow management rules (such as specific rules about passing the first post-winter flow);
- water sharing rules (includes, for example, announced allocation rules and water access rules);
- conversion of existing water entitlements to tradeable water allocations (existing water entitlements includes existing licences, interim water allocations, agreements and certain Orders in Council. An interim water allocation is an entitlement to take water supplied by the operator of water infrastructure, such as SunWater, where a Resource Operations Plan has not been approved);
- details of any changes to be made to any existing water entitlement;
- adjustment measures for existing Dawson River waterharvesters, who would have less pumping opportunities as a result of the proposed Nathan Dam;
- water allocation transfer rules (i.e. rules about trading);
- seasonal water assignment rules (this is a new term for what is commonly known as temporary trading);
- processes for meeting future water requirements;
- processes for granting, reserving or otherwise dealing with unallocated water (includes, or example, public tenders and auctions);
- processes for dealing with licence applications (includes existing applications);
- an implementation schedule setting out arrangements for progressively implementing the requirements of the draft Resource Operation Plan over time; and
- water and natural ecosystem monitoring practices (DNRQ 2000, p. 2).

The NCC (2000b) considered that where there is a Water Release Plan, the new Bill provides for arrangements that can be consistent with reform commitments. In particular, a Water Release Plan:

- may provide for a comprehensive system of water entitlements backed by separation of water property rights from land title and clear specification of entitlements in terms of ownership, volume and transferability;
- will provide for environmental water provisions that have regard to relevant scientific information; and
- may provide for tradeable water entitlements, including any relevant trading rules.

The NCC (2000b) concluded that the Bill provides an opportunity for planning that has regard to the environment's needs, specifies clearly users' rights, has regard to intergovernmental agreements and downstream users and includes substantial community consultation. Furthermore, that it is a dramatic improvement on existing legislative arrangements.

However, the NCC (2000b) identified particular issues which include:

- that the legislation does not explicitly exclude water extraction that results in ecosystem degradation; and
- that the legislation or other arrangements provide no guidance as to:
  - when planning should be commenced;
  - what matters (other than those prescribed and overland and subartesian water) should be included in the planning process; and
- the matters that guide the Minister's decision to issue a moratorium notice including those factors that will inform the Minister's choice of water resources to be included in the notice.

Notwithstanding these issues, the NCC (2000) was satisfied that, with appropriate administrative arrangements, the *Water Bill 2000* provides a frame-work consistent with second tranche water reform commitments.

***Trading***

In preparing the Fitzroy Basin Resource Operations Plan, DNRQ will focus on developing tradeable water allocations in areas of the most intense water use (DNRQ, 2000). Existing water entitlements not converted to tradeable water allocations will continue under current terms and conditions. Initially, the draft Resource Operations Plan will focus on converting the following entitlements into tradeable Water Allocations:

- the Nogoa and Mackenzie rivers from the Fairbairn Dam storage to the Dawson River junction, including the Emerald channel system;
- the Comet River downstream of the Comet Weir;
- the Dawson River from the Utopia Downs gauging station, some 70 km upstream of Taroom, to the Mackenzie River junction, including the Dawson Valley channel system;
- the Fitzroy River from the Dawson River to the Fitzroy Barrage; and
- other locations directly benefited by flow or water pondage from the above sections of river (DNRQ 2000).

Water allocation transfer rules are integral to the Resource Operations Plan and will be developed as part of this process (DNRQ 2000). Under the *Water Act 2000*, transfer rules in Resource Operation Plans could include the application of volume exchange rates across geographic zones in addition to limiting the total volume of transfers amongst various zones (DNRQ 1999a).

Under the *Water Act 2000*, the following transactions are considered transfers and will therefore need approval:

- transfer to another person to be taken at the same location;
- transfer to another person to be taken at a different location (including outside Queensland) and therefore potentially re-specified in terms of volume and location;
- transfer by the same person to a different location (including outside Queensland) and therefore potentially re-specified in terms of volume and location;
- transfer to a different priority group or different flow conditions and/or different maximum rates of extraction; and
- transfer to a different purpose, namely urban, industrial or agriculture (DNRQ 1999a, p. 35).

The NCC's second tranche report notes that:

*Section 231 Water Resources Act 1989 has permitted temporary transfers for approximately ten years, this proving a useful tool in balancing annual fluctuations in water availability and demand. Section 231 permits the owner of land to which a water allocation has been granted to enter into an agreement allowing another land owner to use the water. Relevant approval is required and regard may be had to the capability of the system to supply the additional water or other matters (NCC 1999b, p. 498).*

Table 4.6 indicates that for 1997/98, 589 temporary trades involving 41,616 ML occurred and 177 trades involving 25,606 ML occurred 1998/99 (excluding groundwater).

The second tranche report (NCC 1999b) notes that interim permanent trading arrangements are progressively being implemented across larger irrigation districts. For example, in the Mareeba-Dimbulah Irrigation Area interim arrangements will facilitate structural adjustment from tobacco growing to higher-valued horticultural and sugar production. Table 4.6 illustrates that in 1997/98, no permanent trade occurred and that in 1998/99 13 trades occurred involving 208 ML (excluding groundwater).

The NCC (1999b) noted the Bundaberg irrigation area temporary transfer local rules:

- transfers apply within the water year;
- the seller can only sell their available announced allocation;
- transfers cannot be arranged in arrears to cover circumstances where customers are subject to excess water charges;
- transfers are not permitted between surface and groundwater supplies; and
- transfers between particular areas are not permitted.

Under the recent reforms, water allocations are owned independently of land title and may be traded within the bounds of the transfer rules established under the relevant Resource Operations Plan. If, however, two parties wish to effect a trade which is not covered by the transfer rules in the Resource Operations Plan, they may apply to do so. Any such application will be evaluated in the light of its likely impact on other water entitlement holders, resource operations licence holders and the environment. Parties who have an interest in the trade may submit their views to decision makers and have a right to appeal the decision (DNRQ 1999a).

Water released into the market would be auctioned to ensure that it went to the most highly valued use, unless demand is low relative to available water supply. If the decision was taken to release water into the market, it would have to take into account the:

- demand for water relative to current availability for trading purposes both in the short term and long term, and current water use efficiencies;
- reliability of supply required; and
- range of potential development scenarios in the catchment (DNRQ 1999a, p. 35).

Table 4.6 Water trading in Queensland (excluding trade in groundwater)

| **Permanent Transfers 1997/98** | | **Temporary Transfers 1997/98** | | **Permanent Transfers 1998/99** | | **Temporary Transfers 1998/99** | |
|---|---|---|---|---|---|---|---|
| **No.** | **Vol (ML)** | **No.** | **Vol (ML)** | **No.** | **Vol (ML)** | **No.** | **Vol (ML)** |
| nil | | 589 | 41,616 | 13 | 208 | 177 | 25,606 |

Source: adapted from DNRQ (1998b and 1999c)

***Interstate trade***

At present, there are no formal arrangements for interstate trade. Furthermore, interstate trade between New South Wales and Queensland cannot occur until Queensland has completed 'capping' entitlement. The NCC expressed concerned at the lack of progress in NSW/Queensland cross-border trading (NCC 1999b).

The explanatory material for the *Water Bill 2000* notes that under the proposed Water Act:

> *Transfers and leases of water allocations may be made across Queensland borders. This contemplates the transfer of water allocations into and out of Queensland. Interstate transfer of water allocations will be subject to transfer rules developed in Queensland under the water resource planning and resource operations planning processes. These processes will take into account all interstate transfer agreements negotiated in border areas (DNRQ 1999b, p. 36).*

Interstate water transfer procedures will be determined as part of the catchment level planning processes and will include:

- determining any physical barriers that will prevent delivery;
- construction of a model to simulate the flow system;
- determination of transfer rules that are consistent with existing obligations under interstate agreements; and
- exchange and recording of information for transfers and the delivery of interstate water allocations (DNRQ 1999b, p. 36).

***Conclusion***

The NCC (1999b) assessed the current allocation and trading framework in June 1999 and found that:

- Queensland does not at present have in place a comprehensive system of water entitlements backed by separation of water property rights from land title and a clear specification of entitlements in terms of volume, reliability or transferability. Proposed legislation will substantially address the reform commitment
- Allocations have not as yet been developed for the environment. The Council, while recognising the development of Water Allocation and Management Plans and Water Management Plans, notes that Water Allocation and Management Plans have no legislative basis at present.
- While some trading in water is occurring in Queensland, the existing statutory provisions are insufficient to permit widespread trade of permanent and temporary rights in water. The proposed reforms will provide a basis for trade substantially consistent with reform commitments (NCC 1999b, p. 450).

The *Water Bill 2000* was introduced to the Queensland Parliament on Thursday 22 June 2000 and the *Water Act 2000* came into effect on 13 September 2000. The NCC (2000b) considered that where there is a Water Release Plan, the new Bill provides for arrangements that can be consistent with water reform commitments. In particular, a Water Release Plan:

- may provide for a comprehensive system of water entitlements backed by separation of water property rights from land title and clear specification of entitlements in terms of ownership, volume and transferability;
- will provide for environmental water provisions that have regard to relevant scientific information; and
- may provide for tradeable water entitlements, including any relevant trading rules.

The NCC (2000) considered that the Bill provides an opportunity for planning that has regard to the environment's needs, specifies clearly users' rights, has regard to intergovernmental agreements and downstream users and includes substantial community consultation. Furthermore, that it is a dramatic improvement on existing legislative arrangements. The NCC concluded that, with appropriate administrative arrangements, the *Water Bill 2000* provides a framework consistent with second tranche water reform commitments.

### 4.2.4 Victoria

This section examines the implementation progress of the NCP water reforms, in terms of water rights and water trading for Victoria. Discussion considers the legislative definition of water rights and the extent and nature of water trading (including interstate trading).

### *Water Rights*

Victoria's system of water entitlements is based on a bulk entitlement program which provides for allocations of water to authorities and the environment and establishes a comprehensive framework for the trading of surface water entitlements. Table 4.7 presents features of water rights in Victoria. The *Victorian Water Act 1989* provides the statutory basis for these arrangements (HLSGOW 1999).

Table 4.7 Key features of rights to water in Victoria

| | **Bulk Water Entitlement (for Authorities) (s43)** | **Water Licence - Extractive Use (s51;s56)** | **Water Licence - In-stream use (s52;s56)** |
|---|---|---|---|
| **Regulated** | • defines the annual volumetric share of the total storage capacity available to an authority<br>• specifies the share of the inflow to the storage available to an authority<br>• specifies the volumetric share of releases from the storage available to an authority<br>• specifies the seepage and evaporation losses to be debited to an authority<br>• specifies the share of inflow to be credited to an authority when its share of storage capacity does not allow it to receive its full share of inflow<br>• the extent to which the entitlement is transferable<br>• the obligations of storage operators and resource managers<br><br>Where appropriate conditions relating to other matters including:<br>• the protection of the waterway<br>• returning water to the source<br>• the protection of the environment<br>• government conservation policy | Extractive licences may be defined in terms of any or all of the following:<br>• the maximum amount of water that may be take in particular periods or circumstances<br>• the purpose for which the water may be used<br>• the manner in which a licencee must compensate other licence holders adversely and materially affected by the allocation and use of water under the licence<br><br>Where appropriate the licence may be subject to conditions relating matters including:<br>• the efficient use of water<br>• the installation and use of measuring devices and pumps<br>• the protection or control of instream uses<br>• the management of the waterway<br>• the protection of the waterway<br>• the protection of the environment<br>• the drainage regime<br>• government conservation policy | • defines the rate or level of flow<br>• the location at which that rate or level is required<br>• the time(s) at which it is requried<br><br>Where appropriate the licence is subject to conditions relating matters including:<br>• the efficient use of water<br>• the purpose for which the water may be used<br>• the protection or control of instream uses<br>• the management of the waterway<br>• the protection of the waterway<br>• the protection of the environment<br>• the drainage regime<br>• government conservation policy |
| **Unregulated** | • defines the share of flow to which an authority is entitled with reference to a specified point<br>• the extent to which the entitlement is transferable<br><br>Where appropriate conditions relating to other matters including:<br>• the protection of the waterway<br>• returning water to the source<br>• the protection of the environment<br>• government conservation policy | As Above | As Above |

NB: Water rights within irrigation districts are defined as a share of total for that region, Source: *Water Act 1989 (Vic)*

The second tranche report (NCC 1999b) noted that:

> *The Water Act 1989 (the Act) provides that the Crown has the right to the use, flow and control of all water in a waterway[30] and all groundwater (section 7). The Act continues the private right to take water for domestic and stock use (section 8). The Act permits the granting of bulk entitlements by the Crown to water authorities and other specified users. Bulk Entitlements include source entitlements (the right to harvest water directly from a waterway), delivery entitlements (the right to divert water from a regulated waterway operated by another Authority) and hybrid entitlements (such as the Murray Bulk Entitlements) which are adapted to take into account special circumstances (NCC 1999b, p. 396).*

Bulk entitlements replace the previous ill-defined bulk rights to water and the *Water Act 1989* provides for the conversion of existing entitlements to water to Bulk Entitlements (Section E47). In addition, the Act defines the relationship between the Crown, bulk entitlement holders, users and the environment (HLSGOW 1999).

The water reform implementation report to COAG (HLSGOW 1999) noted that:

> *The process by which bulk entitlements are established is complex, with some systems requiring up to three years of public consultation with stakeholders before the entitlement is finalised. Once established, bulk entitlements are explicitly available from a specified location and source; have an exclusive share granted to the authority and no other authority; are tradeable; and are enforceable at law through proper monitoring and policing arrangements (HLSGOW 1999, p. 45).*

In terms of specifying Bulk Entitlements, the following general principles apply:

- Bulk Entitlements are generally held by water authorities with a retail function;
- existing legal rights to water will be converted;
- the process of conversion of entitlements will not result in new resource commitments;
- total Bulk Entitlements for a basin will not exceed 100 per cent of the available resources at an agreed level of security;
- conversion should be fair to all claimants and give due consideration to the environment; and
- an open and participatory conversion process will be used (NCC 1999b, p. 397).

The Bulk Entitlement may specify matters such as:

- the means of quantifying the amount of water such as by volume, reference to the measure of flow at any point or reference to a share of flow or storage;
- various obligations including financial obligations and obligations of the storage operator and resource manager;
- whether and to what extent the water supply is transferable; and
- the protection of the environment including the riverine and riparian environment (NCC 1999b, p. 397).

Environmental effects are managed by categorising each Bulk Entitlement application into one of three types depending on the potential environmental impact or impact on other water users:

- *Category 1* applications involving water entitlements in systems that are operating near capacity and environmental values and the interests of downstream users are not at risk. These can be converted without further consultation.
- *Category 2* applications where water supplies can be converted following confirmation with the Department of Natural Resources and Environment (Victoria) and rural water authorities that existing and proposed operating arrangements are satisfactory.
- *Category 3* applications where water supplies cannot be converted without further assessment of the impact of higher extractions on flow regimes. This category is relevant where, for example, utilisation of resources at design intent will cause significant risk to downstream water user rights and/or environmental values (NCC 1999b, p. 398).

[30]Including a river, creek, streamwater, watercourse, natural channel into which water regularly flows (whether or not continuous), lake, lagoon, swamp, marsh etcetera: section 3.

The second tranche report noted that:

> *The GMW [Goulburn-Murray Water] order provides that all of GMW's entitlement to take water from the River Murray is converted to a bulk entitlement on the conditions set out in the order. The order sets out the Bulk Entitlement, including definition of the water available and also the requirement to supply primary entitlements (domestic and stock allowances, take and use water licences, Bulk Entitlements to urban and other water authorities and the environment) to water users. GMW is required to propose and implement a metering program approved by the Minister responsible for the Act and report on matters such as the amount of water extracted and other specified particulars. The GMW order provides for financial arrangements concerning water storage and supply costs (operator costs) and the costs of the resource manager (NCC 1999b, p. 398).*

In addition to converting existing water entitlements to Bulk Entitlements, the Act provides for the grant of new Bulk Entitlements. In determining an application the Minister/Governor in Council/delegated person is to have regard to matters including:

- any report prepared by a panel convened to consider a Bulk Entitlement entitlement;
- the existing and projected availability and quality of water in the area;
- any adverse effect that the allocation or use of water under the Bulk Entitlement is likely to have on existing authorised water users, waterways or aquifers and the environment including the riverine and riparian environment;
- the need to protect the environment, including the riverine and riparian environment; and
- the approved management plan for any relevant groundwater supply protection areas (NCC 1999b, p. 399).

Bulk Entitlements are recorded in a register of entitlements maintained by the Director-General (NCC 1999b).

In terms of the conversion process to Bulk Entitlements, the water reform implementation report to COAG noted that:

> *This program has reached the stage where flow sharing arrangements at approximately 70 per cent of the diversion sites across the State have been negotiated and agreed with stakeholders. At the vast majority of sites this has resulted in improved environmental outcomes. Formal bulk entitlements are being progressively granted and regulatory systems, to monitor and manage the entitlement system including water trading, are being implemented (HLSGOW 1999, p. 45).*

The Act also provides for Take and Use Water Licences. On regulated waterways, Take and Use Water Licences can be converted into notional delivery Bulk Entitlements (NCC 1999b). Licenced diversions from unregulated waterways are not included within the bulk entitlement regime (HLSGOW 1999). The second tranche report (NCC 1999b, p. 400) notes that "Take and Use Water Licences on unregulated waterways are managed by such tools as performance contracts that specify resource commitments and Streamflow Management Plans for priority waterways (determined by scarcity, environmental values and other issues)… Streamflow Management Plans include a description of the total resource commitments, trading rules, minimum flow sharing arrangements and consultative mechanisms."

In terms of water for the environment, "the bulk entitlement program enables the provision of water for the environment in regulated systems either by establishing bulk entitlements for the environment or by imposing conditions which specify an environmental flow regime on entitlements held by other authorities" (HLSGOW 1999, p. 46). As discussed above, the environmental aspects for unregulated waterways are managed through Streamflow Management Plans. The second tranche report noted that protection of environmental values occurs through:

- environmental impact assessment including: assessing environmental impacts of proposals to convert existing rights to water to Bulk Entitlements; assessing environmental impacts of Take and Use Water Licences via Streamflow Management Plans; assessing the impacts of proposed new Bulk Entitlements or water developments; and

- providing environmental Bulk Entitlements by conversion of the environment's few existing legal rights to water to bulk entitlements and issuing new Bulk Entitlements for priority rivers following applications made by environmental managers (NCC 1999b, p. 400).

The second tranche report noted that other water rights are issued in addition to Bulk Entitlements and used the following example:

> *In irrigation districts, water authorities are required to make available to owners of irrigation holdings the amount of water for irrigation that is specified in the register in relation to that holding. Authorities are required to keep registers in irrigation districts showing all holdings of land in the district and the volume of water rights attached to the holdings. The register must be revised to reflect transfer of water rights (NCC 1999b, p. 400).*

The NCC considered that Victoria has implemented a comprehensive scheme for implementing a system of water entitlements and noted that attributes of the scheme include:

- a clear definition of the rights of the Crown to the State's water, and a clear separation of water rights from land title;
- a clear system of distributing those rights to users through Bulk Entitlements, Take and Use Water Licences and water rights separate from land title;
- entitlements that specify in detail rights (including for example rights to specified volumes or flow of water) and responsibilities (such as financial and environmental responsibilities);
- entitlements that can be transferred by holders; classification of Bulk Entitlement conversion applications according to the impact on the environment. This process provides for further assessment of the particular water supplies as required;
- a roll-out program for converting existing water rights into Bulk Entitlements with an estimated completion date of 2002 for all Bulk Entitlement conversions; and
- provision for public education and consultation regarding the Bulk Entitlement process and management of applications (NCC 1999b, p. 402).

***Trading***

The NCC (1999b) outlined the statutory framework for trading and noted that:

> *The Water Act permits the permanent or temporary trading of Bulk Entitlements[31] between authorities by auction, tender or in any other manner with the approval of the Minister. Sale of Bulk Entitlements in these circumstances must be advertised. The Act also provides for the trading of Bulk Entitlements between the authorities and landholders in irrigation districts or Take and Use Water Licence holders, permanent transfers requiring advertisement and the approval of the Minister. The Act permits the temporary inter-state trade of a Bulk Entitlement with the approval of the Minister. In addition the Act provides for the sale of unallocated water by the Minister in certain circumstances. The Act provides that amendments or transfers of Bulk Entitlements must be entered into the Register of Entitlements kept by the Director General. As regards Take and Use Water Licences, the Act provides[32] for the sale of Take and Use Water Licences by the Minister and the permanent or temporary transfer inter or intrastate of a licence. The Act permits the permanent and temporary transfer of water rights intrastate with the approval of the rural water authority responsible for delivering the water and, in the case of permanent trades, with the approval of both rural water authorities. It also provides for the permanent and temporary transfers of water rights (other than sales water) interstate with the approval of the Victorian rural water authority (for temporary trades) and the receiving authority. In addition, the Act permits the Governor in Council to make regulations for the transfer of water rights including setting maximum and minimum amounts of water that may be held by land owners (having regard to salinity and the need to protect the water*

[31]Section 46-46B, Water Act.

[32]Section 57-63, Water Act.

*rights of other users) and setting limits on the amount of water that can be transferred out of districts. Authorities must review the water rights register to reflect permanent interstate transfers of water rights (section 230) (NCC 1999b, p. 411).*

Water rights and Take and Use Water Licences have been temporarily transferable since 1989, with permanent transfers of water rights introduced in 1991/92. Such trades "may occur through direct farmer to farmer transactions, through a water broker or via a water exchange" (HLSGOW 1999, p. 46).

Table 4.8 provides some information on water trading in Victoria. The water reform report to COAG noted that:

*With the Victorian Water Act's sound property rights system in place, water trading is already starting to play an ever-increasing role in agricultural production. In 1997/98 many irrigators only coped with the low allocations of water by turning to the water market. This prompted record levels of water trading with permanent transfers up to 20,000 ML and temporary transfers of up to 250,000 ML (HLSGOW 1999, p. 46).*

The NCC (1999b) noted that the rules for the permanent trading of water entitlements are fairly rudimentary and include:

- a 1:1 exchange rate and same security at destination as for source;
- a two per cent limit on permanent trades out of respective water systems each year (the 2 per cent rule);
- no increase in saline drainage to the River Murray;
- channel capacity constraints must be considered; and
- certain statutory requirements (for example, the seller must advertise 28 days in advance) for less frequent, more expensive permanent trades (NCC 1999b, p. 412).

The second tranche report notes that:

*The 2 per cent rule, the only trade-restricting rule, was introduced to allay fears that increased permanent trade could cause rapid structural adjustment which may have undesirable social impacts on a particular region. At this stage, trades out of any of the systems have not reached the 2 per cent per annum limit. However, the Victorian*

Table 4.8 Water trading in Victoria

| Type of trade | February 1991 | May 1995 August 1997 | 1991-1997 |
|---|---|---|---|
| **Permanent** | 50 trades totalling 2,000 ML | 190 transfers averaging 75 ML (total 14,369 ML or 0.6 per cent of water rights) | 250 trades totalling 17,000 ML at $800-$1,200 per ML |
| **Temporary** | | | up to 250,000 ML at > $90 per ML |

Source: NCC (1999b)

*Government will consider removing the rule as it develops more sophisticated trading rules. The regulations prescribe forms, outline the procedure including the obtaining of consents from rural water authorities, minimum and maximum amounts of water rights that can attach to a property and limits on transfers into and out of districts. The Council was advised that work in trading rules is needed in the following areas:*

- *limiting trades in sales water;*
- *limiting trade out of upper tributaries;*
- *distinguishing between winter and summer use;*
- *accounting for flow and financial adjustments; and*
- *fraud prevention measures (NCC 1999b, p 412).*

The NCC (1999b) noted that the Northern Victorian Water Exchange, operated by Goulburn Murray Rural Water Authority, is an example of the market in temporary water trades and that its role is to facilitate and encourage temporary (annual) water trading by establishing a transparent process that will provide market information on prices and volumes.

The exchange commenced in September 1998, is operated on a periodic basis and provides for buyers and sellers of water to make offers. An exchange does not occur unless traders can obtain the prices offered or better. Buyers only pay the maximum price they have offered or lower. Sellers receive the minimum price they have offered water for or higher. Trade on the exchange accounts for about 10 per cent of total trade with private trading being the dominant mechanism (NCC 1999b). Table 4.9 provides some example figures (4 February 1999) for trade.

The second tranche report (NCC 1999b) notes that the pool price for temporary trades on the Goulburn River has now reached $200 per ML and $80 per ML on the Murray River. The volume traded at the exchange has varied between 400-1,400 ML.

The Goulburn-Murray region has had a functioning water market for over a decade (Earl and Flett 1998). Table 4.10 presents water trading data for the Goulburn-Murray region.

In terms of permanent trading, market volumes are around 10,000 ML a year or 0.5 per cent of district water rights. Water is moving to higher economic uses, generally from sheep and cattle grazing enterprises to dairy farming. Most of these purchases (57 per cent) centre on a desire to increase security of supply rather to increase water use while most of the sales (58 per cent) stem from unused water (which reduces supply security) rather than water use efficiency gains (Earl and Flett 1998).

Table 4.9 Northern Victorian water exchange (example figures)

| | |
|---|---|
| Pool price established | $92.50 per ML |
| ML traded | 655 |
| Offers to sell unsatisfied (ML) | 2740 ($92-$120 per ML) |
| Offers to buy unsatisfied (ML) | 235.6 ($90 per ML) |

Source: NCC (1999b)

In terms of temporary trading, market volumes are strongly influenced by climatic conditions. In favourable climatic conditions, when demand for water is low, temporary trade centres on a desire to reduce the cost of delivery by selling part of the allocation. In addition to dry climatic conditions, the application of the CAP in 1994-95 also substantially increased the volume of temporary trade (Earl and Flett 1998).

In considering water trade in the Goulburn-Murray region, Earl and Flett (1998) noted that the market was working and water was moving to higher value economic uses, however, significant problems exist due to the range and poor definition of water entitlements. It was further noted that the introduction of the Murray-Darling Basin CAP on water use has significantly changed current entitlements and their value. However, it was also noted that a simple and robust system of water entitlements is currently being established through the bulk entitlements process.

In considering water trading in the Goulburn-Murray region, Earl and Flett (1998) considered that:

> *A realistic and compelling vision for the establishment of a full property rights regime and an effective water trading market in the Goulburn-Murray region has been developed. Despite the transitioning difficulties the progress to date and the goodwill among stakeholders affords great optimism that practice will align with the theory of the COAG strategic framework. We are close to the choice and responsibility to appropriately match water entitlements to their enterprise needs (p. 176).*

Table 4.10 Water trading in the Goulburn-Murray region

| | Temporary | | Permanent | |
|---|---|---|---|---|
| **Season** | **No.** | **Volume ML** | **No.** | **Volume ML** |
| 1989-90 | 43 | 21,927 | | |
| 1990-91 | 400 | 31,955 | | |
| 1991-1992 | 406 | 32,148 | 51 | 2,715 |
| 1992-1993 | 258 | 22,829 | 140 | 8,100 |
| 1993-1994 | 375 | 29,961 | 114 | 6,369 |
| 1994-1995 | 2578 | 206,872 | 176 | 9,941 |
| 1995-1996 | 1993 | 132,955 | 170 | 8,230 |
| 1996-1997 | 1367 | 102,924 | 232 | 10,573 |
| 1997-1998* | 313 | 29,834 | 143 | 10,882 |

* to 30 November

Source: Earl and Flett (1998)

In a study of the Goulburn-Murray Irrigation District and the Murray in South Australia, Bjornlund and McKay considered that:

> *The irrigation communities have become more familiar with the market and more confident with its operation and the opportunities it presents for both buyers and sellers. The increased use of brokers and agents as well as the increased market activities and the removal of spatial and other impediments to trade have caused the market to mature (Bjornlund and McKay 1999b, p. 45).*

Their research indicated some dissatisfaction with the water market operations and suggested that for the future operation of water markets it is imperative that the transfer processes be streamlined and predictable procedures be developed which offer water buyers more certainty of outcome and limit the costs associated with water trade (Bjornlund and McKay 1999b).

***Interstate water trading***

Temporary interstate trade has been possible since 1995. In 1994, 5000 ML of excess environmental water was sold to New South Wales in 1994 (HLSGOW 1999).

Victoria is also an active participant in the MDBC's pilot interstate trading project, which is confined to high-security licences between Nyah and the Barrages. So far, nine permanent interstate trades have been processed. The first, under the project, occurred in September 1988 and at 15 February 1999, 248 ML had been transferred from New South Wales to Victoria, 600 ML from Victoria to South Australia and 528 ML from New South Wales to South Australia. The present price for trades is about $1000 per ML (HLSGOW 1999).

The NCC (1999b) considered that Victoria has implemented a system for trading of water entitlements that:

- provides for the trading of the spectrum of water rights (including groundwater) both interstate and intrastate;
- has now been operating for some considerable time in both temporary and permanent intrastate trading of water rights;
- includes legislative provisions enabling transfer of water rights;
- provides for regulations and bylaws to govern water trading;
- incorporates voluntary markets run by a rural water authority providing information and support to water traders; and
- protects the environment through such mechanisms as the prohibition on water trades from high impact zone areas to non-high impact zone areas (NCC 1999b, p. 414).

***Conclusion***

In June 1999, the NCC (1999b) considered that Victoria had met its reform commitments for the second tranche payments and considered that:

- Victoria has implemented a comprehensive system of water entitlements backed by separation of water property rights from land title and a clear specification of entitlements in terms of volume, reliability or transferability. The Council is satisfied that the system meets the requirements of the strategic framework.
- Victoria has in place detailed procedures and policies that will permit allocations to be developed for the environment. The Council is also satisfied that the policies have regard to relevant scientific information.
- Victoria has implemented a legislative and regulatory system for trading in water that permits trading in the spectrum of water rights. The Council notes that trading rules are being developed over time. In addition, Victorian authorities have supported the development of trade through providing a voluntary exchange that informs the water market. Interstate trade is developing carefully and the Council notes that the present trading project is being reviewed (NCC 1999b, p. 372).

## 5. The Economic Characteristics of Water Markets

The prevailing milieu of a highly variable physical water environment in concert with an enthusiastically pursued policy of national development were the dominant precursors of historical water management. Musgrave (2000) and Pigram (1993) note that the strategy failed to capture the multiplicity of water benefits, the value of ecosystem functions and respond to changing societal objectives. Greig (1998), Paterson (1987a) and Randall (1981) note that in addition to the over-allocation of water diversions, resulting environmental degradation and unrelated agency revenues and costs, water management at the time was characterised by a net transfer of public wealth to the domain of riparian water users.

The institutional failure, at most jurisdictional constituencies, to recognise and treat water as an economic good is viewed by many commentators as the primary causal agent of the current suite of water associated problems (*inter alia* Easter *et al.* 1999, Davidson 1969, Musgrave 1991, 1996; Paterson 1987a, Pigram 1993, 1999; Randall 1981, Winpenny 1994).

Traditional water management strategies have been reliant on a regime of centralised planning instruments, extensive water supply augmentation and a raft of legal and administrative instruments to allocate diversions and to resolve demand issues (Randall 1981, Smith 1998). The regulatory approach was similarly relied on in more recent times to mitigate for water quality and environmental degradation (Musgrave 1996, 2000; Pigram 1993).

The primary focus of water reform, and subsequently this review, is reliant on economic instruments, specifically the implementation of functioning and predictable markets in transferable water entitlements. The water reform process is articulated in the Council of Australian Governments (COAG) water reform initiatives (COAG 1994), directed by the enforced compliance with the National Competition Council's (NCC) recommendations (Hilmer *et al.* 1993) and shaped by the in principle agreements of the National Strategy of Ecologically Sustainable Development (COAG 1992). The development, implementation and jurisdictional compliance of the COAG and NCC directives of water reform are discussed extensively in Chapters 3 and 4.

The three main institutional strategies or approaches deployed by agencies to correct for water supply and demand imbalances are regulatory, economic and suasive instruments (Common 1995, Hussen 2000, Young *et al.* 1996). Natural resource management and the achievement of multiple policy directives, is often characterised by a strategic, dynamic mix of all three categories of instruments, rather than a singular instrument reliance (Common 1995, Watson 1996, Young *et al.* 1996). Brennan and Scoccimarro (1999), Dinar (2000), Quiggin (1998), Freyfogle (1996), Musgrave and Kaine (1991) and Young *et al.* (1996) recognise that the determination of an incremental and adaptive blend of policy instruments, capable of shaping water management is necessary, although the strategy remains unresolved and contentious. The process is subordinate to an already ratified and committed policy direction of tradeable water rights across Australian water constituencies (COAG 1994). The discussion of the proposed instrument mixes described in the literature is limited to their application as an heuristic tool to highlight predicted market and property-right limits and boundaries.

Market based water transfers are seen as an integral component of the water reform process and a means of correcting the economic and environmental aberrations associated with the historical construct of supply directed water diversion and reticulation (Dudley and Musgrave 1988, Pigram 1993, 1999; Randall 1981). The realisation of the perceived reform benefits are contingent on the existence of an effective competitive water market, in turn reliant on tradeable, enforceable and specified water entitlements. The latter are seen as an instrument primarily to ensure the mobility of water from lower to higher valued uses.

This chapter seeks to discuss the elementary economic theory underpinning current water reform. There exists an extensive literature on the efficient allocation and pricing of water, both in scale and the range of subject matter. The discussion is primarily focussed on the diversion and use of irrigation water, specifically surface water, a corollary of the sectors observed dominance of total water use and the water reform landscape in Australia (ABS 2000, Musgrave 1996 2000; Pigram 1999). Whilst it is recognised, as several

authors suggest (Bromley 2000, Dinar 2000, Paterson 1987a), the success of water reform is conditioned on a comprehensive cross-sectoral implementation, an appraisal of current irrigation initiatives is viewed as emblematic of overall Australian water policy directions.

This chapter also provides an elementary discussion of the axiomatic requirements of functional, competitive markets and the economic theory of allocative efficiency. The nature and typology of specified property rights and prescribed management regimes pertaining to water are reviewed. Current opinions regarding the validity and potential for the application of the policy directive of full cost accounting is also briefly discussed as is a synopsis of the prescriptions, procedures, institutional structure and the administration of effective water markets described in the literature.

The literature highlights several benefits and advantages of tradeable water rights. These are broadly categorised as an improved mobility of water towards higher valued uses, ongoing incentives to conserve water and innovate, improved tenure and security of entitlements, a procedure to account for external costs, an inducement to impose the full opportunity cost of water and a more flexible agricultural system, responsive to changes in crop prices, climatic variables and opportunities to diversify (Dinar *et al.* 1997, Pigram 1999, Sturgess and Wright 1993).

Bromley (2000), Colby (1995), Pigram (1999) and Randall (1981), state that the interdependencies of water outputs and uses may preclude the unequivocal application of property rights common to most factors of production. The cardinal nature of water and the heterogeneous demands placed on it makes standardised, immediate and anonymous market transactions undesirable and improbable (Colby 1995). The chapter includes a synthesis of literature based insights pertaining to the limits of market structures and proposed caveats and augmentations to correct for the magnitude of third party effects (externalities) and to resolve issues of distributional equity and justice.

In light of the potential limits of water markets, commentators note that the reliance on a singular metric of economic efficiency may not provide the necessary analytical scope to enable comprehensive decisions by policy makers. Proposed value specific measures to evaluate instrument and water market effectiveness, provided as a composite measurement index are discussed (Common 1995, Howe *et al.* 1986, Winpenny 1994).

### 5.1 The Economic Characteristics of Water

The vital and essential nature of water makes its characterisation as an economic good enigmatic and something of a technical curiosity (Colby 1995, Paterson 1987b, Tietenburg 2000). Defining property rights to water is complicated by the provision of multiple benefits and services. Water transgresses agency, state and national jurisdictions; it seeps, drains, evaporates and flows according to the forces of gravity, regardless of prescribed statutes. Water exists as solid, liquid and gaseous phases within different facets of the hydrological cycle and is characterised by a dynamic, stochastic supply according to extant meteorological and biophysical parameters.

Water resources have both consumptive and non-consumptive uses, constitute market and non-market values, include private good and public good values and are characterised by a high likelihood of external effects[33]. Water can be defined as a stock resource, such as groundwater and surface water subject to intractable chemical changes and permanent depletion when abstractions exceed recharge rates. Water is also classified as a replenishable flow resource, such as unimpeded natural flows used for recreation, maintaining riverine environments and the re-entry of consumed water into the hydrological cycle.

[33]An externality or external effect occurs as an unintentional or incidental outcome, which affects a third parties, perceived benefits or utility, arising as a result of a firm or individual's production activities. Those effects remain unaccounted for in the benefits and costs associated with the production activity (Common 1995).

An analysis of the disaggregation[34] of water into constituent economic benefits is complicated by the confounding effects of changes in water quality and its measures[35] (Spulber and Sabbaghi 1994). As noted by Colby (1995), water rights have quality attributes, that significantly affect their economic value, which have been ostensibly disregarded in the formal determination and specification of property rights. Water quality is a function of, *inter alia*, sediment and turbidity, pathogen content, salinity, biologically available oxygen and contaminate levels. Different users can tolerate different water qualities. The same consumer can tolerate different qualities when applied to different uses, for example safe pathogen and chemical free drinking water compared to non-potable water suitable for sewerage and drainage (Rix 1993).

Consumptive uses consist of off-stream extractions and processing that alters the chemical or physical constitution of water. The reduced volume of accessible water of a designated quality level effectively excludes utilisation by other water users. Water users that cause a deterioration of water quality impose an opportunity cost (in the form of diminished perceived benefits) increasing relative scarcity and resource costs (Sturgess and Wright 1993). Consumptive abstractions are inclusive of municipal and domestic use, drainage, sewerage, commercial and industrial processing, mining and the major consumptive use, irrigation and agricultural abstractions. Abstractions for environmental purposes (for example off-stream wetland preservation) also constitute consumptive use (Brennan and Scoccimarro 1999, Greig 1998). There is a temporal dimension to abstractions from in-stream flows for the preservation of riverine and wetland environs, whereby water may constitute an option value for future flooding simulations (Brennan and Scoccimarro 1999).

Factors leading to potential breaches of the waste assimilative capacity of water include increased nutrient loads (nitrate and phosphates), sediments and colloidal particles, heavy metals, microbial pathogens, blue-green algae, organic matter, chemical residues and toxins, changes in water temperatures, biologically available oxygen, introduced species, sea water intrusion and salt contamination. Industrial or agricultural processes that result in increased evapotranspiration also constitute a consumptive use of water (Smith 1998, SOEAC 1996).

The non-consumptive use of water does not diminish or impinge on the utilisation of another consumer, whether consuming the same output or another. Generally, non-consumptive uses are in situ and are inclusive of the production of hydro-electricity, transportation, recreational boating, swimming, fishing, wildlife viewing, preserving environmental flows and uses which convey aesthetic, cultural and spiritual values.

Water as a public good is characterised by non-exclusive and non-rival consumption. Recreational uses, for example, are non-exclusive, in that one user cannot prevent the use of water by another, and non-rival in that in the gaining of the benefit of recreational use, it does not diminish the recreational experience of another user. The use of the waste assimilative capacity of water to carry pollutant and contaminate loads is non-exclusive. In contrast, the pollution and contamination are non-rival disutilities to affected parties. The benefits accruing by provision of instream flows for the riverine and riparian ecosystems are non-rival (Randall 1981).

[34]The simultaneous provision of multiple benefits conferred by water precludes the determination of relative scarcity as described by a single marginal benefit estimate. The consumption of each benefit attributable to water is described by a specific demand schedule, indicative of perceived relative scarcity. The schedule represents the relationship between the marginal benefit gained (in dollars) and the number of units consumed. The responsiveness of the quantity consumed as a function of price (that is the elasticity of demand) is similarly benefit specific. The total economic value of water represents the aggregate of the partial marginal benefit estimates and is not simply a function of a scalar and an "average" partial benefit. The difficulty in imputing a reliable metric of scarcity for many of the attributes of water precludes the unambiguous partial and hence total determination of benefits and costs (Adger and Luttrell 2000, Bromley 1991).

[35]The importance of the synergies between water quality and accessible quantity are recognised. The agencies administering the legislation of water quality operate independently from the agencies managing water allocations and entitlements, leading to further uncertainty (Colby 1995). However, a full consideration of the water quality issue is beyond the scope of this research. For an extensive summary of water quality in Australia see Smith (1998) and SOEAC (1996) and in general Spulber and Sabbaghi (1994).

### 5.2 Competitive Markets and the Conditions for Effective Operation

Prior to the water reform process and the ensuing reliance on water markets, the ideology and ensuing pressures of national economic development were a potent impetus to bypass private market structures. Water Authority reticence to deploy market institutions for water management was seen as a corollary of prevailing technical and fiscal impediments. As noted by Hartman and Seastone (1970) these included a perceived ubiquity of external effects of water diversion, the difficulty in estimating the extensive suite of non-market values associated with water use and the perceived magnitude of investment needed to facilitate water transfers.

The development of Australian water resources has entered a mature water phase, characterised by rising incremental supply costs, intensified competition between disparate users and increased interdependencies amongst water uses (Randall 1981, Watson and Rose 1980). The initial agency response of embargoes on new water licenses and additional allocations, referred to as the CAP, imposed absolute limits to irrigation water supply, recognising the extant levels of relative water scarcity, a need to mitigate environmental degradation and to protect riverine environments (Murray-Darling Basin Commission 1995).

The CAP, implemented in November 1996 by the Murray-Darling Basin Ministerial Council, acts as an upper threshold of water diversion and entitlements, determined by the 1993-94 level of water diversions of regulated, unregulated and off-allocation water sources. The implications have meant new enterprises must either improve on existing technical efficiencies or obtain water from existing users. The objective of the CAP is to enable the determination of environmental flows for the Murray-Darling Basin, according to the specifications of the COAG directives. The Independent Audit Group (1996) recommended:

- to maintain and, where appropriate, improve existing flows regimes in the waterways of the Murray-Darling Basin to protect and enhance the riverine environment;
- to achieve sustainable consumptive use by developing and managing Basin water resources to meet ecological, commercial and social needs (Independent Audit Group 1996, p. viii).

The intact nexus between land and water significantly attenuated[36] users rights to water and, in concert with the statutory impediments to water transfers, were seen as a source of substantial institutional obstruction to the redistribution of water to alternative uses (Dudley 1991, Pigram 1993, Sturgess and Wright 1993).

The impediments perpetuated a regime of below-cost water supply, resulting in a continuance of low value water use, wastage and a denial of access to high value users, despite a willingness to pay higher prices. Sturgess and Wright (1993) argue that the prevailing water strategies exacerbated intrinsic economic inefficiencies, failed to account for external costs and promote water conservation. The corollary was that the tension between competing water users remained (Pigram 1993, Sturgess and Wright 1993).

Various fiscal solutions and institutional arrangements to enable water reform have been explored. They have generally been based either on an administered water pricing system, calibrating resource and opportunity costs or a regime of negotiated, constitutional contracts, founded on voluntary consent, distributional equity and the maintenance of existing water related benefits (Dinar *et al.* 1997, Pigram 1993, Randall 1981). Generally, managing authorities have recently viewed these arrangements less favourably than market based approaches (Easter *et al.* 1998a).

A market based solution, reliant on a nascent regime of transferable water property rights, vested in the individual and negotiated independently of land, was promoted throughout Australian and International water sectors and gained widespread acceptance (Saleth and Dinar 1999, Hartman and Seastone 1970, Randall 1981).

[36]The nexus between land and water precluded the exclusive sale, or transfer of water only. That is water could not be treated as an independent chattel and traded as such.

There are numerous benefits conferred by water entitlement transfers mentioned in the literature, contingent on a functional, effective water market framework. Water markets provide:

- an institutional framework enabling the flexible transfer to a range of alternative water uses characterised by higher marginal benefits and value (Pigram 1993, Randall 1981);
- a mechanism for smoothing obligate structural adjustment required of water users and suppliers associated with mature water economies (Crase *et al.* 2000);
- a mechanism for the partial or complete exit of low value users, unable to meet the requirements of full cost water supply, with compensation for the relinquishment of entitlements. Payment should be commensurate with the net present value of the entitlement for permanent transfers or the marginal benefit for temporary transfers (Sturgess and Wright 1993, Tietenburg 2000);
- an opportunity for governments to enter the water market to acquire entitlements and if needed, reallocate or retire them (Pigram 1999);
- high value, profit maximising users, are presumed to plan their enterprises around the true costs of water. The profit maximising axiom ensures a constant cost incentive for users to seek improved technical productivity, innovation and onsite efficiency gains (for example strategies to improve delivery of water to plant root and moderate return flows);
- sufficient price signals to promote the conservation of water, reducing over use and resultant impacts of salination, water-logging and environmental degradation;
- a means of entry for newcomers into a mature water economy, constrained by allocation thresholds. Markets do not create shelters for established companies or competitive impediments for new entrants (Turner and Opschoor 1994);
- an improved revenue stream for agencies, enabling funds for ongoing maintenance to extant diversion and transmission infrastructure, reduced transmission losses and investments in superior reticulation strategies (Pigram 1999);
- an increased incentive to invest, a corollary of the incentive to accrue excess water entitlements, which can be traded profitably (Dinar *et al.* 1997, Crase *et al.* 2000);
- an approach, which, where appropriate, can be administered from a decentralised network (Turner and Opschoor 1994)
- an institutional framework to ensure that water management and use occurs where marginal costs are lowest and therefore they offer the least cost for society (Turner and Opschoor 1994)

The effective operation of water markets are primarily conditional on the recognised relative scarcity of water and the establishment of a regulatory framework to ensure the specification and enforcement of property rights and contractual regimes[37].

When consumers can abstract water from a common source without impinging or diminishing the perceived needs of other consumers, there is no need or incentive for the voluntary exchange in water or defined rights to water. In the absence of water scarcity (both actual or perceived), there is little pressure for the clear allocation of decision making entitlements to water resources as all demands can be adequately met with current supplies. It precludes the need for a social solution (Demsetz 1967). As the level of relative scarcity increases, a concordant escalation in tension arises between competing uses, necessitating some form of adjudication or the striking of a judicious balance between users.

A competent and willing regulatory framework to ensure the coherent specification and enforcement of specified property regimes and the entrained rights to those benefits is antecedent to effective markets (Quiggin 1998, Bromley 1991, Randall 1981)[38].

[37]Grief (1997) and Cooter (1997) both argue that neo-classical theory does not imply the prerequisite existence of a formalised legal system for water right contracting and jurisdictional enforcement. Whilst not necessarily costless, and often typified by asymmetric information, informal water markets, based on social ties, personal trust and compliance with social norms are common.

[38]Section 5.4 provides an appraisal of property rights pertaining to water resources. The consequent changes to institutional settings, including statutory and organizational frameworks to accommodate the operation of water transfers, is discussed in Chapter 3.

### 5.3 The Neo-classical Economic Measures of Market Efficiency

The economic value of water can be defined in terms of resource cost, opportunity cost or social cost (Randall 1981). Resource cost is the infrastructure and operational cost of diversion and reticulation, opportunity cost is the value of water utilised in the next best alternative and social cost is the total cost to society inclusive of those economic values not described by market values (Randall 1981).

A prescribed, mandated determination of the legislative reform process is the accommodation of an efficient allocation of water at least social cost and maximum social benefit (COAG 1994)[39]. The optimal solution that describes economic efficiency is inclusive of the legitimate, often non-monetary, environmental and social claims to water, and is not limited to the financial transactions of traditional markets (Adger and Luttrell 2000, Dudley and Musgrave 1988, Quiggin 1986, Randall 1981). Failure to account for non-priced values may result in a significant divergence of social costs and resource or opportunity costs (Randall 1981). That is, the determination of the marginal costs of water supply, representing a supply volume commensurate with private, environmental and social values and articulated in the policy context, is a critical determinate of an optimal economic solution. In an efficient equilibrium, the resource cost, opportunity cost and social cost are equal at the margin and calibrated to the price of water (Randall 1981). In order to fulfil policy mandates of the water reform (COAG 1992, 1994), the imputed social cost is the appropriate numeraire of the economic value of water.

Neo-classical economics takes the aggregation of individual consumption preferences as the foundation of the primary criterion for the assessment of social benefits (Common 1995). The criterion relies on the efficient allocation of resources as the determinant of a social benefit. If a change in the distribution and allocation of natural resources results in a net benefit to society, it is deemed as being efficient. Allocative efficiency is defined by the axioms developed by Pareto (Freeman 1993) and the more recent extension of the original philosophy postulated by Kaldor and Hicks (Common 1995, Freeman 1993). According to the criteria formulated by Pareto, a state of allocative efficiency applies when it is not possible to make one individual better off (by their own assessment) without making some other individual worse off (by their own assessment). Thus:

> *The attainment of efficiency is the exhaustion of the possibilities for mutually beneficial voluntary exchange (Common 1995 p. 126).*

The Kaldor-Hicks criteria recognise that it is probable that changes that confer a benefit to one individual are likely to result in some diminution to someone else. The criteria state that if the beneficiary is able to compensate the losers, and still be better off, the change is still allocatively efficient. Freeman (1993) and Hanley and Spash (1993) note that the compensation process only has to be conceivable, it does not have to actually occur for the change in distribution to be considered beneficial to society. The state of efficient exchange does not confer equitable outcomes, and, as noted by Hanley and Spash (1993) and Common (1995), lump sum transfers and payments potentially correct for the cumulative imbalances.

According to these models, assuming perfect competition, functioning markets are presumed to deliver an efficient allocation of resources. If the conditions of perfect competition are not met, market failure occurs and the utilisation of resources will not reflect the efficient level. There are four main conditions to be met for perfect competition or competitive general equilibrium (Common 1995). They are:

1. The rationality condition is satisfied when consumers and producers act competitively to maximise utility and profits and minimise costs, given their circumstances and constraints.
2. The price-taker condition is satisfied when there are sufficient numbers of buyers and sellers in market transactions such that no one participant can influence the terms on which the transaction occurs.

[39]As noted by Pigram (1999), the outcomes of the COAG water reform process are not merely recommendations or guidelines. They are non-negotiable with ratified, articulated implementation prescriptions. Substantial Commonwealth payments to the States are contingent on the implementation of the reform agenda, monitored annually.

3. The complete information condition is satisfied when all participants have a full and complete knowledge of prices in all markets. To meet the conditions of Pareto optimality, and for the market to deliver what individuals desire (consumer sovereignty), the participating individuals must know all the opportunities available to them, in terms of the common metric of price, and the consequences of them enacting on that decision. To satisfy this criteria, market systems must send accurate signals to individuals about relative resource scarcities.
4. The complete set of market condition implies the existence of a market for all potential transactions and contingencies, with well-defined property rights, such that buyers and sellers can exchange assets freely.

The four axioms of competitive markets benchmark market performance and the likelihood of optimal solutions. The failure to meet any one of these conditions results in a sub-optimal market performance. The degree of sub-optimality is a function of divergence of extant market conditions and the axioms of market competition. These conditions are generally not met completely, including market transactions involving water entitlements (Bateman and Turner 1993, Common 1995, Randall 1987). The reasons for market failure include incomplete markets, government failure and subsequent poorly-defined or non-existent property rights, leading to the presence of externalities.

Poorly-defined property rights are a characteristic of public goods, defined as non-rival in consumption and non-excludable. Incomplete information leads to market failure, as the lack of adequate price signals about one element of water outputs (for example recreation) can lead to the over exploitation of another component (for example abstractions or return flow contamination). The dominance of a market by one or a few producers (as a monopoly or oligopoly) or a single buyer (monopsony) is similarly a common condition of market failure.

As Common (1995) and Hanley *et al.* (1997) point out, incomplete markets, (a corollary of institutional failure to assign well-defined property rights) are the primary reason for natural resource market failure. The implication is that many valued water outputs are outside conventional markets. The institutional failure to account for those alternate values in the strategic prescription of water utilisation, potentially leads to an inefficient resource allocation, incorrect resource pricing and the failure to achieve a socially optimal market equilibrium.

### 5.4 Property Rights and Water Entitlements

According to Bromley (1991),

> *Property …is a benefit (or income) stream, and a property right is a claim to a benefit stream that the state will agree to protect through the assignment of duty to others who may covert, or somehow interfere with the benefit stream…Property is not an object but rather a social relation that defined the property holder with respect to something of value (the benefit stream) against all others (Bromley 1991 p. 2).*

The construct of property is predicated on the social recognition of the legitimacy of the claim to a benefit (gained by using a resource) and the preparedness to enter into a contract of compliance to enforce the rights to that claim (Bromley 1991). Bromley (1991) states that the proposed pre-existing immutable property rights afforded to individuals under a Lockean system are subordinate to the social recognition of those rights. Rights can only exist where there is a social mechanism that specifies duties and binds individuals to those duties. If the state, according to prevailing social axioms, will not recognise and enforce the property right claim, then the right fails to gain legitimacy as an instrument (Bromley 1991, Locke 1690). The assumption of defined, non-attenuated property rights is predicated on the removal of institutional constraints preventing their initial assignment.

The proposals of Coase (1960) are considered the seminal property rights article in the economics literature, although as suggested by Randall (1978), authors such as Commons (1924) and Clark (1926) anticipated much of the Coasian argument. Coase (1960) provided an alternative economic approach to Pigou's theory of external effects which, via taxes commensurate with the magnitude of external effects, allowed a legitimate role for government intervention in correcting market failures (Pigou 1920).

The Coase theorem posits that given the conditions for competitive markets exist, negotiating (or transaction) costs are zero (or negligible), property rights are non-attenuated and affected consumers can freely negotiate with each other, an economically efficient allocation will arise irrespective of the distribution of property rights (Randall 1987). That is, there is no possible reallocation of any resources (including water) that would improve the utility of one person without a diminution in the utility of at least one other person (Bromley 1991).

Randall (1978) states that the allocation of resources (such as water) according to the property rights strategy assumes a uni-dimensional, hedonistic model of human motivation, a behaviour which ensures participants will only act in the most advantageous, rational manner, specific for each individual. Rational behaviour is consistent with, and a predicate of, the Pareto-efficiency criterion. Adherents of non-attenuated property rights advocate an institutional environment that maximises the opportunity to trade, is free of government intervention and impediments restricting trade and minimises the costs of market transactions. Couched exclusively in terms of the behaviour of the individual, the proponents of the property rights approach view Pareto-efficiency as the singular metric of allocation and efficiency.

A set of non-attenuated property rights, articulated by Randall (1987) and Bromley (1991) specifies that property rights are:

1. completely specified, so that it can serve as a perfect system of information about the rights that accompany ownership, the restriction on those rights and the penalties for their violation;
2. exclusive, so that all rewards and penalties resulting from an action accrue directly to the individual empowered to take action;
3. transferable so that rights may gravitate to their highest-value use;
4. enforceable and completely enforced. (An un-enforced right is no right at all).

Commenting specifically on water rights, Randall (1981) states that negotiable water entitlements must be specified in terms of the secure, enforceable rights and duties of the right holder and the duties and obligations of the managing authority. Water rights need to be resolved and articulated in terms of:

1. the time-span of the entitlement and provisions for rental rights to deliveries in the event that long term entitlements are specified;
2. the method of accommodating the stochastic nature of water availability. Possibilities include individual rights to some specified small fraction of deliverable water available, and the specification of different entitlement classes in terms of reliability that is, the probability of water delivery;
3. the time and place of delivery;
4. the ownership of tail waters and return flows and the attendant obligations upon the owner.
5. the conditions under which entitlements could be transferred, with special reference to transfers which would change the time and /or location of water demand. (Randall 1981 p. 202)

The reform framework adopted by COAG (1995) propose a number of guiding principles, along similar themes to that of Randall (1981), for the effective implementation of functioning water markets. The guidelines stipulate that water entitlements be clearly articulated in terms of the:

1. rights and conditions of ownership tenure;
2. share of the resource being allocated;
3. details of agreed standards of services to be delivered;
4. constraints on transferability;
5. constraints on resource use or access.

The extensive bio-physical and demographic diversity typifying Australian water resources has resulted in a range of jurisdiction specific management approaches to initiate legislative reform, water entitlement specification and the implementation of the COAG property-right directives (Fisher 2000).[40]

There are several proposed limits to the ubiquitous application of property right approaches to natural resource management, especially where there are likely negative environmental externalities. Perman *et al.*

[40]Chapters 3 and 4 discuss state specific implementations and procedures in the specification of property rights and market operation.

(1999) note that the initial distribution of property rights determines the division of the net gains which accrue to the negotiating parties. Hence, as Randall (1987) states, the estimated Pareto efficient solution is specific and unique to the initial distribution of rights, inclusive of income, wealth, legal rights and non-attenuated property rights of the trading parties. That is, the allocative neutrality originally posited by Coase (1960), ignored income effects (Randall 1987). When equity and wealth distribution outcomes are factors conditioning policy directives, a sole reliance on Pareto efficiency will not provide sufficient information for comprehensive decision making (Bromley 1991, Freyfogle 1996, Howe 1996, Randall 1978, 1987, Syme *et al.* 1999).

As identified by Common (1995), to ensure the efficient outcome of property right solutions associated with external affects, the bargaining process requires the accurate identification and inclusion of all affected parties, and the source of the externality. The efficacy of implementation is compromised by the problem of identifying and tracing the perpetrators, the spatial and temporal diffusion of effects, quantifying and valuing the impacts and apportioning the costs. Identifying an extensive and diverse cohort of affected parties, nominally without assigned rights, and enabling a compensation system is similarly intractable. Perman *et al.* (1999) note the difficulty of non-compensation also applies to producers who create positive external effects.

Common (1995) notes that unless market failure is absent elsewhere in the economy, the efficient outcome arising from the transaction will be a second best solution. Randall (1981) identifies the potential impact of second best solutions thus:

> *where an economy is fundamentally and pervasively inefficient, elimination of one source of inefficiency will not necessarily improve matters, but make them worse (Randall 1981 p. 198).*

As a corollary, Randall (1981) states that voluntary transfers of water among users may promote an efficient allocation, but potentially result in increased use of water to produce heavily subsidised commodities.

As Common (1995) identifies, most environmental degradation problems are non-rival in their disutility. That is, the impact imposed on one consumer does not diminish the impact imposed on another and is enough to preclude the bargaining solution. Non-rivalry is conducive to free-rider behaviour, providing inaccurate price signals and a consequent inefficiency of outcomes.

Perman *et al.* (1999) note that efficient outcomes derived from unregulated market behaviour are predicated on the assumption that all participants are perfectly informed about direct and external effects. Insufficient information may represent fundamental scientific uncertainty, or the limits of individual knowledge in a complex and dynamic world. Where ignorance is acute and the potential external effects large and irreversible, government intervention may be the most efficacious way of generating and disseminating required information (Perman *et al.* 1999). That is, without government intervention the cost to individuals of obtaining accurate market transaction information may be prohibitive. The ensuing economies of scale achieved through government information schemes may provide a least cost solution. The incentives for unregulated markets to provide sufficient information may be too weak or diffuse, and the subsequent market failure may preclude any efficiency gains.

### 5.4.1 Transaction costs

The theoretical ideal of market efficiency can be achieved if the transactions of non-attenuated property rights are cost-less or at least negligible (Colby 1995, Common 1995, Randall 1975). That is the specification, transfer and enforcement of rights occur without practical costs. Transaction costs between bargaining parties, seeking prospects for the resolution of unmet demand or external effects, are broadly categorised as information costs, bargaining or contracting costs and enforcement costs (Bromley 1991). Transactions require identification and knowledge of willing participants, the opportunities and strategy of exchange and the nature of the goods to be exchanged. The gaining of relevant information is not costless and a paucity of information can prevent or compromise transactions. The relativity, incidence and extent of the costs in obtaining this information, as perceived by the individual participants is an important policy issue (Bromley 1991). The negotiating and contractual arrangements similarly confer costs to the participants, measured as time or opportunities lost as do the

specification and costs of arbitration and enforcement when needed (Randall 1975).

Fulfilling the predicates of the Coase theorem and the specification and exchange of property rights is not cost-less, evidenced by the operation and presence of a non-trivial service sector providing information, agents transaction services, contractual specification, monitoring, policing and judicial and commercial enforcement. All these services are provided at a substantive cost. As noted by Randall (1987)

> *In a more realistic economic model, Pareto-efficiency can be achieved if in addition to all the other necessary and sufficient conditions, the investment in specification, transfer, and enforcement of property rights proceeds to the point at which the marginal conditions for efficiency are satisfied (Randall 1987 p. 158).*

Colby[41] (1995) observes that a common theme throughout the literature is that despite the inevitability of transaction costs, and the variable influence they exert in contractual behaviour, the considered opinion of most authors is they should be minimised to allow market transactions to proceed without obstruction. Howe *et al.* (1986) and Easter *et al.* (1998a,b) identified the lack of property rights, high transaction costs and institutional restrictions as impediments to the development of water markets. Pigram (1999) notes that the magnitude of transaction costs (both actual and perceived) may be a factor in explaining the slow adoption and endorsement of alternative institutional arrangements for water allocation.

The transaction costs of water transfers in the United States range in value from 2-20 per cent of the value of water transactions, with and average value of 6 per cent (Colby 1990).

The Australian Academy of Technological Sciences and Engineering (AATSE) (1999) identifies the administrative costs per water transaction at $75 and state that a modelled $100 fee per transaction had a significant impact on the volume of water trading for dairy farm operators in the southern Murray-Darling Basin. The demand schedule for water traded in temporary markets is considered to be more elastic to price increases as a result of transaction costs. Crase *et al.* (2000) identified the levied administrative and conveyancing fees for temporary trades in the Murrumbidgee Irrigation district as a 3 per cent commission (paid by the purchaser) and a $75 processing fee, per transaction, imposed by the Department of Land and Water Conservation. Marsden Jacob and Associates (1999) state that transaction costs are higher in NSW unregulated systems and lower for bulk licensees.

Research into perceptions of market traders in the Goulburn-Murray and River Murray Irrigation districts by Bjornland and McKay (1999b) provided an indication of water transfer costs from 1994-96. In the Goulburn-Murray, mean transfer costs per ML of $20.43 for sellers and $14.15 for buyers were observed (sellers range of $8.54 to $33.19 per ML; buyers range of $4.00 to $16.54 per ML). Variation in sellers transfer costs is attributed to the size of the transfer (ML sold). Mean transfer costs in the River Murray region were $22.74 for sellers and $21.20 for buyers (sellers range of $0.00 to $26.64 and buyers range of $10.89 to $29.32). Data from the Bjornland and McKay (1999b) study show that the transfer costs of sellers in the eastern districts of the Goulburn-Murray region for the 1994-96 period were 9.2 per cent of the mean ML sales value and 4.2 per cent for buyers. Proportional values of transfer costs for sellers and buyers in the western districts were 3.6 per cent and 3.2 per cent per ML of the mean sales value respectively. The observed proportional values are in accord with the range of values observed for United States transfers (Colby 1995).

In contrast, Crase *et al.* (2000) note that permanent transfers attract higher transaction costs. The total conveyancing and environmental assessment fee imposed on the individual is $700 per transaction, in addition to the cost of the preparation of Farm Management Plans, infrastructure assessments and potential delays of six to twelve months for the issuing of a replacement license.

[41]Colby (1995) cites several examples provided by early authors such as Coase, Demsetz Buchanan and Cheung.

### 5.4.2 The use of transaction costs as a policy tool

Colby (1995) proposes an innovative approach using appropriately structured transaction costs as a policy tool enabling transacting parties a means to account for the social costs of transfers and therefore facilitate efficient reallocation of water. The means of accounting for external costs, provides an operational dimension to the reasoning of Bromley (1991). Bromley states that the burden of proof (and the majority of the transaction costs) is borne by the injured party and it is that party, not protected by specified property rights and the extant legal system that must initiate the action. Bromley illustrates that the outcome of the bargaining process is dependent on the initial distribution of transaction costs and property rights. Each bargaining outcome is unique and efficient (Colby 1995).

Colby (1995) proposes that the magnitude of transaction costs reflect the magnitude of externalities related to water transfers, and do not necessarily indicate over-regulation and inefficiency. Significantly higher transaction costs occur in regions of full allocation, where further diversions are expensive and water demand is increasing. The conflict of interests between the beneficiaries of the heterogeneous outputs of water are more pervasive and pronounced. The recognition and accommodation of transaction costs, determined by externality affected parties as a function of costs and benefits, and the necessary compensation to mitigate externalities is, as Colby (1995 p. 499) states *"a reasonable means to account for the social costs of water transfers"*. By giving affected parties, both entitlement and non-entitlement holders, the ability to impose transactions costs, they gain the ability to erode anticipated economic gains and exert leverage on market participants. The leverage provides, via state policies, incentives in the form of price signals for negotiating participants to consider externalities that otherwise may not be accounted for (Colby 1995).

As noted by Randall (1978), where natural resources, such as water, provide multiple, indivisible, non-exclusive and non-rival benefits, numerous parties may need to be involved to account for and internalize the diverse and potentially large scale external effects, imposing extensive transaction costs that may outweigh the marginal benefits of efficiency gains (Randall 1978). Randall states that given the likely magnitude of transaction costs, the confounding effects of benefit indivisibility and non-exclusiveness of water, regulation in the form of Pigouvian tax solutions or direct regulation may confer more efficient solutions than property right approaches. Bromley (1991), Common (1995) and Quiggin (1998) suggest similar outcomes.

### 5.4.3 Management regimes and property institutions.

Institutions are the self-perpetuating *'going concerns'* that order the relationships between individuals in society, providing the laws, constitutions, contractual regimes and moral and ethical precepts (Randall 1987). The market, implemented in the context of non-attenuated property rights, is itself an institution, subject to the same social milieu influencing the whole institutional framework. Institutions shape, direct, influence and constrain; they define the incentives, disincentives, obligations and freedoms facing individuals. Institutions exist in a dynamic state of tension between stability and modification. They need to be malleable enough to accommodate change, brought about by extensive and pressing social consensus, within a necessarily predictable and stable framework (Randall 1987). They must be in accord with the value system of society, without substantial variance, or they run the risk of social divergence resulting in excessive monitoring and compliance costs and at the extreme, civil disobedience and anarchy (Bromley 1991, Randall 1978).

Property rights are one of the elements of the institutional framework, which subsequently places thresholds and restrictions on the specification and manipulation of property rights for social and economic purposes (Randall 1987). Some specifications will be socially or ethically inappropriate or unacceptable, despite the potential for gains in allocative efficiency. That is, the divergence of the metric of economic efficiency and those specific to equity, distributional justice and the scale of water diversion, interpreted according to extant social norms and values, may be of sufficient magnitude to preclude the implementation of market measures alone. As Randall (1978, 1987) notes, there are constraints to the manipulation and specification of non-attenuated rights.

Private property and non-property (open access) right management regimes are not the only choices available to policy makers (Quiggin 1986). They represent the extremes of a continuum of possible property

management regimes, articulated by Randall (1978, 1987) and Bromley (1991). Four of the intervals on that continuum are as follows:

Crase *et al.* (2000) describe the rights accruing to licensed irrigators in NSW, specified and administered according to *NSW Water Act 1912*, as a State Property management regime.

Table 5.1 Classification of property regimes

| Type of Regime | Implications |
|---|---|
| **State Property** | Individuals have a duty to observe the use and access rules determined by the controlling (or management) agency of the state. The agency has the right to determine these access and use rules. |
| **Private Property** | Individuals have a right to undertake socially acceptable uses and a duty to refrain from socially unacceptable uses. Non-owners have a duty to allow socially acceptable uses to occur unimpeded, and a right to expect that only socially acceptable uses will occur. |
| **Common Property** | The management group (owners) has a right to exclude non-members (a right sanctioned and enforced by the same authority structure pertinent to private property). Non-members have a duty to abide by the exclusion. Individual members of the management group (the co-owners) have both rights and duties with respect to use rates and maintenance of the resource owned. |
| **Non-Property (open access)** | There is no defined group of users or owners and the benefit stream is available to anyone. Individuals have both privilege (the ability to act without regard to the interest of others) and the right (the incapacity to affect the actions of others) with respect to use rates and maintenance of the asset. The asset assumes the status of an open access resource. |

(Source Bromley 1991, 2000)

Dudley and Musgrave (1988) proposed a system of capacity sharing of water resources, based in part on a common property regime. Capacity sharing is explained thus:

> *Capacity sharing is a water allocation system by which users are allocated a share of the capacity of the storage as well as inflows and seepage and evaporation loss. In effect the storage is partitioned into sub-storages which are credited with a volume of water according to the hydrological behaviour of the storage and its catchment. Users have non-attenuated rights in this water and can direct the manager of the storage concerning its retention or release (Musgrave 1991 p. 7).*

Bromley (1991, 2000) and Quiggin (1986) propose a similar common pool approach to water management. According to Dudley and Musgrave (1988), capacity sharing confers advantages over release sharing approaches in that tradeable property rights are defined at the source rather than at the point of delivery, reducing uncertainty and minimising transaction costs. Alaouze and Whelan (1996), Brennan and Scoccimarro (1999) and Musgrave and Kaine (1991) discuss capacity sharing as a means of conferring tradeable property rights to environmental flows in Australian river systems.

## 5.5 Defining and Accounting for Environmental Flows

There exists an extensive Australian literature regarding the issue of defining, allocating, preserving and legitimising environmental flows (*inter alia* Alaouze and Whelan 1996, Arthington *et al.* 1991, Musgrave and Kaine 1991, Brennan and Scoccimarro 1999, Greig 1998, Smith 1998, van der Lee 1999). As noted by Young (1997) and Greig (1998) the specification, valuation and allocation of environmental flows is one of the most difficult and vexatious implementations of the water reform directives (COAG 1994). At issue is the magnitude of the trade-off between preserving the intrinsic, self organising ability of riverine ecosystems and riparian environs and maximising the social benefits arising from resource utilisation.

A common theme throughout the literature, noted by Brennan and Scoccimarro (1999) and Alaouze and Whelan (1996) is that sustainable environmental flows, to date have been poorly specified and residual to commercial and agricultural interests. Of concern to most authors, and articulated in the COAG guidelines, is the need for a more formalised policy to specify and protect environmental flows, inclusive of; instream values, identifiable private benefits of downstream consumption, dilution flows, maintenance of water quality, wetland abstractions, non-consumptive benefits and attributes of a public good nature (Alaouze and Whelan 1996, Brennan and Scoccimarro 1999, Musgrave and Kaine 1991, Randall 1981).

### 5.5.1 The place of environmental flows within economic debate

One of the main sources of contention between defining economic and ecological sustainability is the degree of substitutability between man-made and natural capital. According to (Pearce 1993), 'weak sustainability' allows for unlimited substitution without the loss of welfare, and implies an indifference to the form of capital left for future generations. Conversely, 'strong sustainability' limits possible substitution, due to a perceived inability to replace essential environmental goods and services, including those not normally traded in the market place such as ecosystem and recreational amenity services. The incremental gains in technical innovation, human knowledge and capital are not seen as adequately compensating the loss of intangible environmental attributes. Proponents of weak sustainability rely on the capacities of resource substitution to ameliorate scarcity and depreciation, whereas strong sustainability adherents see this as an immutable constraint (Toman 1993).

Acceptance of a limited and imperfect substitution implies the treatment of natural capital as a distinct and separate category from man-made capital and minimal thresholds intrinsically preserved to attain sustainable development (MacDonald *et al.* 1999). The prescribed, critical level of natural capital can be thought of as irreplaceable, complementary and antecedent to man made capital. As Christensen (1989) proposes, the elements of natural capital are the primary inputs, the elements of man-made and human capital are the agents of transformation. According to Hanley *et al.* (1997), the gaining of utility from outputs that are strongly reliant on natural capital invokes the principle of critical, natural capital preservation.

Both consumptive and non-consumptive uses of water are highly dependent on the intrinsic, natural capital value of water resources. To achieve a defined level of sustainable water management, regardless of the accepted degree of capital substitutability, the conservation of critical natural capital is a primary condition.

As noted by Bateman and Turner (1993) and detailed by MacDonald *et al.* (1999) the primacy of critical natural capital supersedes the issues of economic valuation of total capital inventory and stock flows. MacDonald *et al.* (1999) argue the primary and essential nature of critical natural capital renders it beyond valuation and priceless. The issues of irreversibility and uncertainty (Common 1995) add further weight to the argument of critical natural capital being a priceless asset. The absolute constraint of maintaining a constant level of critical natural capital nullifies any form of trade-off comparison with man-made capital and therefore precludes the need to establish an economic value. In this respect the principle of critical natural capital implies a set of biophysical limits, in contrast with neo-classical economics, which with inherent trade-offs, does not. Bateman and Turner (1993) and MacDonald *et al.* (1999) argue that the physical measurement of a defined critical natural capital, or its indicators, is the only empirical requirement for the assessment of sustainability.[42]

Common (1995) notes that a cautious approach should be applied when outcomes are characterised by uncertainty and potentially lead to irreversible environmental impacts. Bishop (1978),[43] originally formalised the setting of constraints and thresholds to maintain the functional integrity of ecosystems under conditions where there is uncertainty in specifying a range of possible outcomes (Common 1995). Of two possible outcomes, conservation or exploitation of a natural resource, conservation is seen as risk-minimising if there is uncertainty about the consequences of environmental degradation. Importantly, safe minimum standards are seen as a means of minimising the maximum potential cost to society (Hanley *et al.* 1997, Hohl and Tisdell 1993).

The principle of safe minimum standards proposes a socially determined delineation or threshold between the conservation of natural resources and the trade-off of resource exploitation. To comply with the obligations of intergenerational equality, the current generation agrees to limit in advance any potential environmental degradation beyond that threshold of estimated cost and irreversibility (Toman 1993). The useful application of the approach relies on sufficient information and guidelines to determine the standards and levels of environmental thresholds. MacDonald *et al.* (1999) have noted that data of sufficient detail are not commonly available for natural resources, inclusive of water. Van der Lee (1999) notes a similar paucity of substantive Australian baseline data, and a lack of standardised approaches, methodologies and ongoing monitoring for establishing flow requirements. The difficulty of insufficient data is further compounded when establishing targets for ecosystems, demanding systems analysis as well as a full complement of individual values (Hohl and Tisdell 1993). Furthermore, the thresholds are socially determined and implicitly need to include social welfare values and incorporate a public decision-making process (Toman 1993, van der Lee 1999).

The strong sustainability model imposes an absolute constraint on the preservation of critical natural capital, regardless of cost. In contrast, the safe minimal standards model proposes that the predetermined levels of preserved natural capital can be breached if the social opportunity costs of conservation are unacceptably large. However, Hanley *et al.* (1997) and Macdonald *et al.* (1999) argue that the definition of unacceptable social costs is arbitrary and lacks consensus. Similarly, the proposed methods to determine the economic costs and benefits are often absent or are too diffuse or ill defined for pragmatic implementation.

[42]The identification, definition and quantification of critical natural capital (CNC), can be seen as contentious and context specific. In particular is the designated level of substitution between natural and man-made capital before the threshold of criticality is reached (Tacconi and Bennett 1995). As pointed out by MacDonald *et al.* (1999) and Turner (1993) that part of natural capital referred to as critical, includes environmental components that are vital to the functional self-organisation and integrity of ecosystems and measures of CNC can be thought of more in ecological than economic terms (van der Lee 1999).

[43]Based on original work by Ciracy-Wantrup (1968). Bishop (1978) applied game theory to the protection of endangered species and pointed out that extinction is irreversible and the potential future value of that species is uncertain. Using a simple two way matrix, the strategy that minimised maximum loss to society was conservation with safe minimum standards.

Significantly, the process of water allocation under the resolution of safe minimum standards places greater emphasis on minimising the potential degradation of ecosystems rather than the potential social costs of restricted water utilisation (Toman 1993). As Randall and Farmer (1995) note, the approach places the onus of proof on the proponent of development, rather than the adherents of conservation.

Randall (1981) presciently anticipated the current debate on environmental flow determination in suggesting that all other water uses are subordinate to sustaining river health and maintaining in-stream flows.

> *...the matter of in-stream flow requires resolution. The easiest solution would be one in which the water authorities were required to maintain satisfactory minimum in-stream flows, regardless of water demand in other uses (Randall 1981 p. 215).*

Similarly, Bromley (1991) argues that the primacy of riverine ecosystems, the uncertain consequences of future interventions, the indivisibility of benefit streams,[44] and the potential of irreversible degradation invokes the 'inalienability rule' of property rights (Bromley 1991 p. 45-6). According to Bromley, the inalienability rule confers immunity on the riverine environment from all developmental circumstance, without the need to compensate for a resulting diminution of consumptive benefits.

The manner of complying with the COAG (1992, 1995) directive of ecologically sustainable development of water resources, and the subsequent determination and preservation of environmental flows remains unresolved. Brennan and Scoccimarro (1999), Smith (1998) and van der Lee (1999) imply that the definition of what constitutes *satisfactory minimum in-stream flows* is agency dependent, context specific, and lacks standardisation and consensus across jurisdictions. The manner of incorporation into the operational dimension at all constituencies remains unresolved and contentious.

The institutional arrangements to accommodate the quantification and preservation of the critical natural capital of water resources and to reconcile the tension between conservation and utilisation is also unclear. Whether defined environmental flows are categorised as critical natural capital, and therefore defined as an inviolate and inalienable level of scarcity, or represent safe minimum thresholds, conditioned by socially unacceptable opportunity costs (and subsequent variation in relative scarcity), determines the specification of property rights, the potential for trading and the prescribed management regime.

Alaouze and Whelan (1996), Brennan and Scoccimarro (1999) and Crase *et al.* (2000) note that the activation of sleeper licenses[45] either threatens the extant CAP on total allocations or the preservation of rights embodied in existing active entitlements. In settling this issue, a diminution of the CAP to accommodate the activation of previously unused licences would imply a precedence for social opportunity cost, that is environmental thresholds are subject to change according to extant social parameters. In contrast, preservation of the CAP, and a veto on un-activated licences, implies the conservation of environmental flows assume a mantle of primacy, precluding valuation and transferability.

The resolution of sleeper licences may provide some insight into the likely management regime and the role that environmental flows may play in a market environment. Under these circumstances, a less speculative appraisal of proposed institutional arrangements for environmental flows, including the assignment of transferable rights, is possible. Brennan and Scoccimarro (1999), Collins and Scoccimarro (1996), Musgrave and Kaine (1991) and Greig (1998) discuss a range of property right regimes and subsequent proposals for transactions in environmental flows.

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[44]The indivisibility of economic outputs confounds the accurate measurement of attribute scarcity. The difficulty in imputing a reliable metric of scarcity for many of the attributes of water precludes the unambiguous determination of benefits and costs (Adger and Luttrell 2000).

[45]Sleeper licenses are those entitlements that have not been activated or are irrigators currently not using allocations. Crase *et al.* (2000) note that the activation of sleeper licenses either threatens the extant CAP on total allocations or the preservation of rights embodied in existing active entitlements. Alaouze and Whelan (1996) and Brennan and Scoccimarro (1999) state that activation of sleeper licensees and increased farm storage may result in a potential increase of up to 14.5 % in total diversions in the Murray-Darling Basin.

### 5.6 Full Resource Acounting

A cornerstone of the COAG directives for water reform advocates consumptive based pricing, transparent, full cost resource accounting, and the removal of cross-subsidies (COAG 1995). Below cost pricing has typified irrigation water, resulting in water sales to consumers with negligible marginal benefit (Paterson 1987b). According to Paterson (1987b), the loss of the necessary price signals to conserve water and condition the appropriate investment decisions has inflated consumption and therefore artificially justified the need for further supply diversions.

Greig (1998 p. 135) summarises the five principles which form the basis of the COAG pricing structure:

- water charges should be based on the most efficient way of providing water services;
- the department's administration of water resources should achieve financial stability and deliver a sustainable level of water services;
- pricing policy should encourage the best overall outcome for the community from the use of water and other resources to store, manage and deliver water;
- the cost of water services should be paid by those who are responsible for causing, or benefit from, those services. Those who demand more services or benefit more should pay more;
- pricing policy should promote ecologically sustainable use of water and the resources to store, manage and deliver water.

A further guideline of the COAG price directives is the apportioning of costs of a public nature. The benefits or impacts, which are unable to be attributed to specific consumers, should be treated as community service obligations, and charged accordingly (COAG 1995). The policy in NSW for bulk water pricing is 70 per cent of operational costs apportioned to private beneficiaries and 30 per cent of costs paid by the government for public goods that benefit the wider community (Musgrave 2000, Sturgess and Wright 1993).

The inclusion of commercial rates of return on the public capital investment in diversionary infrastructure has been a contentious issue (Musgrave 2000, Paterson 1987a, Watson 1996). Watson (1996) and Paterson (1987a) contend that the appropriate pricing metric is the current opportunity cost of irrigation water, of the value of its next most productive use, not one that is based on the original costs of making it available. According to Watson (1996) and Paterson (1987a) the capital costs of infrastructure are sunk and correspond to a zero opportunity cost, precluding the inclusion of the recovery of previous capital costs in the current pricing structure. The pricing stance is in contrast to those originally proposed by COAG (1994, 1995). Watson (1996) qualifies this by including capital costs into prices for water delivered by new infrastructure. Watson states;

> *The price of water influences the value of irrigation, not the other way round (Watson 1996 p. 216).*

According to Easter *et al.* (1998a,b) subsidised below-cost pricing results in the transfer of public wealth to the private sector, invoking issues of inequity and distributional justice. The sale by irrigators of subsidized water at higher market prices, may disadvantage and prejudice unsubsidized poorer water users. Easter *et al.* (1998a,b) note that the equity issue may impose a significant impediment to the acceptance of water reform in some constituencies.

The Independent Pricing and Regulatory Tribunal (1996) benchmarks the maximum prices that government agencies can charge. According to Musgrave (2000) the Tribunal determines bulk water prices based on low opportunity costs of infrastructure, an inability of irrigators to pay higher prices (also stated by Alaouze and Whelan 1996 and Watson 1996) and a historical precedent of low charges. In accord with Watson (1996) the Tribunal prescribes that new investments should earn a positive rate of return.

A number of pricing regimes and rate structures have been proposed and discussed throughout the literature. According to Tietenburg (2000) *inter alia*, the marginal cost of supply, such that the consumer pays the cost of supplying the last unit consumed, should benchmark prices, in contrast to historic average prices. Failure to use a marginal pricing scheme fails to account for relative scarcity of water and social costs (Dinar *et al.* 1997, Randall 1981).

Spulber and Sabbaghi (1994) have determined that marginal pricing can be used to develop prices for variable water qualities, where higher quality water confers a higher marginal benefit. Spulber and Sabbaghi

(1994) also note that whilst theoretically efficient, marginal pricing suffers from several definitional problems. Firstly it is multi-dimensional in nature, in that it includes quality and quantity. Secondly, marginal costs vary depending on the period over which it is measured (that is short versus long term) a function of storage and delivery variation (Randall 1981). Lastly, marginal costs vary dependent on the nature of the demand increment that is permanent or temporary water transfers.

The valuation of the extensive non-market benefits of water is complex and typified by variable reliability (Adger and Luttrell 2000). The accurate costing of all economic values and subsequent charging is a critical element in the determination of social marginal costs. The issue of environmental costing is discussed in Section 5.9.

According to Dinar *et al.* (1997), Freyfogle (1996), Hawken *et al.* (1999), Randall (1981) and Syme *et al.* (1999) marginal cost pricing does not account for equity and distributional justice issues, in that low income groups may be negatively affected in times of shortage and price increases that reflect marginal costs.

Randall (1981) proposes that multi-part or increasing block tariffs may be appropriate for non-profit water authorities. *Inter alia*, Alaouze and Whelan (1996), Musgrave (2000) and Tietenburg (2000) discuss similar pricing structures and proposals. The pricing structure of the Hunter Water Corporation, discussed by Musgrave (2000) is based on a two-tiered pricing structure.

Despite the extensive research and discussion on water pricing, Adger and Luttrell (2000) Bromley (2000), Greig (1998) Randall (1981) and Watson (1996) propose that the issue of full cost water pricing implementation alone is insufficient to achieve water reform initiatives. According to Bromley (2000) water pricing and management should be seen as a component of the institutional arrangements of property right structures in which water and irrigators are embedded. Without adequate institutional change towards a common property regime as proposed by Bromley (2000), Brennan and Scoccimarro (1999) and Musgrave and Kaine (1991), water pricing reform implemented in isolation will be inadequate and misplaced. A system of common property and the implied individual contribution to the public good and ensuing reciprocity that benefits all members, would provide the necessary framework for the uptake of pricing reform.

Adger and Luttrell (2000), Freyfogle, (1996), Watson (1996) and Young (1997) for example, propose the need for additional regulatory instruments as a means to correct for the inability of pricing measures to account for non-priced environmental benefits.

### 5.7 Requirements for Operational Markets

Research into water market operation and structure in the Goulburn-Murray and River Murray irrigation districts by Bjornland and MacKay (1995, 1999b) indicates that while water markets are immature and typified by erratic pricing, there are signs that community acceptance of market procedures is increasing.

Initially, the transfer of water from low to high value uses, represented only a partial structural adjustment in that sellers were mainly offering farm surpluses, (that is dozer and sleeper allocations). According to Bjornland and MacKay (1995), land and water values are highly correlated, linking land improvements with water allocations. It is unlikely that irrigators will sell part of their allocation that buttresses extant land values. The sale of water in those cases will lead to a depreciation of the residual land and infrastructure values. Survey results indicate there were potential environmental impacts with water transfers. Sellers with salinity problems or under financial duress were selling water in large volumes at low prices. The results indicated a thin, immature market resulting in erratic prices (Bjornlund and McKay 1995).

Later appraisals indicate irrigation communities are more familiar with water markets and less apprehensive in its operation and outcomes (Bjornland and MacKay 1999b). The removal of spatial impediments to trade and increasing use of brokers to facilitate exchange are cited as indicators of a maturing market. According to Bjornlund and McKay (1999b) improved educational programmes to introduce communities to market procedures and a streamlining of transfer processes, in concert with reduced costs and more predictable market outcomes, will enhance the implementation of the reform process.

Crase and Jackson (1998) found similar low market participation, transfer conditions and outcomes in NSW permanent water markets. Crase *et al.* (2000) nominate reductions in high transfer costs, (comprised of search costs, conveyancing and administration fees and stamp duty), a stable legislative framework and improved educational programmes to allay community scepticism as necessary innovations to improve market performance.

In determining the administrative, structural and institutional arrangements of the Colorado-Big Thompson scheme, Michelsen (1994) determined that the success of the schemes permanent water market is attributable to the establishment of well specified property rights, an effective distribution scheme, high reliability of water supply and a large number and diversity of market participants. Whilst providing guidance to market structural requirements, Michelsen (1994) concludes that the scheme is unique and unlikely to be duplicated in the United States.

To ensure the successful implementation of a water reform agenda, Cordova (1994) states:

> *A reform program will be successful if there is economic rationality in its design, political sensitivity in its implementation, and close and constant attention to political-economic interactions and social-institutional factors, so as to determine in each case the dynamics to follow (Cordova 1994, p. 277).*

Bromley (2000) suggests that water pricing reforms, in concert with appropriate property right specification, comprehensively implemented across all sectors have a greater likelihood of succeeding.

Williamson (1994) posits that the timing of the implementation of the reform agenda may be critical in its success. The author suggests that implementation should occur after a publicly perceived crisis or immediately after a government takes office.

Williamson and Haggard (1994) suggest that the implementation of an efficient reform process is reliant on low transition costs, the implementation of safety nets for the poor and dispossessed, transparent compensation packages for affected third parties, a specialised media team to convey the reform message, the creation of an independent and dedicated implementation team and importantly, an effort to ensure community participation, adoption and support.

Easter *et al.* (1998b) and Dinar (2000), suggest that the inclusion and participation of stakeholders and water users in the decision making process is a vital component of the implementation process, and as a corollary, the adoption and diffusion of the reform agenda. In the Australian context, Greig (1998) agrees that farmer education, understanding and compliance predicates the success of the COAG water reform agenda.

In addition, Dinar (2000) proposes that successful market reform programmes must adjust to the prevailing political reality, sequence the reform agenda to minimise opposition and acknowledge the extant social and traditional customs. They also recommend that;

- the gains from reforms be shared;
- pricing reforms should acknowledge asymmetric upstream-downstream externalities
- reformers should acknowledge that reform is not a generic process

### 5.8 Market Evaluation and Performance Criteria

Markets are highly articulated institutions to direct individual aspirations, initiative, acquisitiveness and competitiveness into hopefully useful and benign directions (Bromley 1991). A favourable solution would entail a reliance on market processes to efficiently achieve specified policy objectives, determined as a collective, multi-disciplinary index of social and environmental goals (Bromley 1991). The COAG directives for water reform, inclusive of social and environmental objectives, are an example of such a collective.

A recurring theme evident in the literature is the sufficient and comprehensive accounting for the resource characteristics of water when formulating market structures, administration and evaluation procedures (Dinar *et al.* 1997, Howe *et al.* 1986, Winpenny 1994).

The heterogeneous outputs of water are jointly produced, physically interdependent and the attributes often empirically indivisible, confounding the accurate

measurement of attribute scarcity (Musgrave and Kaine 1991). The difficulty in imputing a reliable metric of scarcity for many of the attributes of water may confound the unambiguous partial determination of benefits and costs (Adger and Luttrell 2000).

A focus of economic efficiency and effectiveness has been the traditional evaluation criteria for policy instruments. Several authors state that the interdependencies of outputs and uses may preclude the unequivocal reliance on the singular metric of economic efficiency as a measure of market effectiveness. (Adger and Luttrell 2000, Bromley 1991, Izac 1986, Quiggin 1998, Watson 1990). The sole measure of optimality, that is Pareto efficiency, may not provide information of sufficient analytical and descriptive scope to enable informed, comprehensive policy decisions commensurate with the multi-faceted and stochastic nature of water (Common 1995, Howe *et al.* 1986, Winpenny 1994).

The tendency has been to evaluate market instruments generically or in isolation. There is however a complex array of interactions between policy instruments, between the environment and with societal processes. The implementation of instruments and their operation initiates a cycle of innovation, resulting in evolving and dynamic economic and environmental objectives, as are the applicable instruments and the criteria to evaluate them (Turner and Opschoor 1994).

The application of market based instruments is therefore context specific and necessitates continual monitoring. The ranking, weighting and relevancy of evaluation criteria will similarly change with the changing circumstance of instrument and policy objectives (Common 1995). Randall (1981) observes that the proposed evaluation indices provide a mechanism to expand the methodological orientation of economics towards simplification and abstract analysis, an approach which may not adequately reflect the multiple outputs and complexity of water. Turner and Opschoor (1994) come to similar conclusions in an appraisal of the implementation of economic instruments to achieve environmental objectives in the OECD.

In an attempt to account for the multi-faceted nature of the benefits derived from water, a composite index of value specific criteria to evaluate instrument and water market effectiveness have been proposed by several authors (*inter alia* Howe *et al.* 1986, Winpenny 1994). According to Turner and Opschoor (1994) the criteria can be broadly categorised as the notions of concordance and optimality. Concordance refers to compatibility and acceptability within the extant social, political and institutional milieu and by vested economic agents. Optimality criteria are concerned with the issue of instruments achieving acceptable performance levels, measured as effectiveness and efficiency. The optimality measures of market efficiency have been extended to include equity, flexibility, innovation, and an assessment of risk and uncertainty (Common 1995, Howe *et al.* 1986, Young *et al.* 1996, Winpenny 1994).

### 5.8.1 Criteria to evaluate water market performance

Howe *et al.* (1986) proposes the following criteria to benchmark and compare the alternative mechanisms and instruments for water allocation at the catchment scale.

1. *The gains in economic efficiency* as a result of instrument implementation and the reallocation of water.
2. *Equity of the allocation:* the introduction of an instrument and the subsequent resource allocation should not unfairly disadvantage or unduly favour any group of people or firms, including future generations. The allocation should be perceived by prospective market agents and water users as providing equal opportunity gains to every potential user and market participant. Water users for example should not impose uncompensated costs on third parties. Similarly users forgoing water or disadvantaged by variations in diversion or return flows should be compensated.
3. *Flexibility* (mobility) in the allocation of existing supplies to ensure water can be shifted from place to place and from use to use in response to variation in demographic, climatic and economic conditions. Flexibility permits the calibration and equating of marginal benefits of the diverse use of water. The consideration of both short and long term flexibility may be necessary. The stochastic nature of the factors affecting climate and subsequent annual water supply, exacerbated by the highly variable Australian conditions, may create opportunities for beneficial water exchange. Incentives for both intra and inter-sectoral transfer

may occur if the short term marginal benefits of individual users fluctuates. The reallocation of water to higher value uses generates a net social benefit, concordant with the difference between the value of water at its old and new uses. Long term effects of changing population patterns or municipal usage may initiate a differential in marginal benefits between users. As noted by Howe *et al.* (1986), for flexibility to exist in the operational sense, it is not contingent on total available water being subject to low cost reallocation, only that there be a sufficient tradeable quantity within each trading district. Common (1995) notes that the extant instrument specification should also be assessed on the ability to adapt to changing economic or biophysical conditions, without a diminution of the rights of the holder. Noss (1993) flags the need for property rights and market frameworks which are responsive to change without being capricious or erratic.

4. *Security of tenure* of sufficient duration for entitlement holders and the ensuing assurance of long term use, provides an ongoing incentive to invest in high value, innovative enterprises. Security of tenure may not be incompatible with flexibility as long as there is sufficient reserve water to meet unexpected demands and users can voluntarily respond to incentives for reallocating water.
5. *Full resource accounting* and the real opportunity cost of water supply is paid by the user, so that other water demands or externalities are internalised. A competitive market that sets an efficient clearing price, directly confronts the market participant with the real opportunity cost and precludes the voluntary acceptance of less valuable water uses. The efficient market price requires that external effects are identified, quantified and accounted for in the exchange process. As noted by Dinar *et al.* (1997) the pervasiveness of externalities, inclusive of non-marketed values such as changes in downstream and return flows, waterlogging, changes to soil and water salinity, water quality degradation and other irreversible environmental effects provide the fundamental argument against markets. From an economic efficiency perspective these should be accounted for in the costs of exchange; from an equity position, compensation should be available to those who have been harmed as a result of the exchange.
6. *Predictability* of the outcome of the allocation process, such that the best allocation can be realised, with minimal uncertainty and cost. This is particularly relevant in mitigating against the inertia of prevailing arrangements and habits and minimising community apprehension and scepticism towards operational water markets.
7. *Political and public acceptability:* to ensure successful implementation, an instrument must be clearly understood and transparent by all stakeholders. The instrument requirements, effectiveness and function must be clearly and adequately explained, as must the management objectives, environmental and economic benefits and the decision making process itself. The successful implementation of any system of instruments must be predicated by a notion of fairness for all parties. Stakeholder acceptance of the environmental and efficiency benefits and understanding of instrument objectives is essential for the successful implementation of any reallocation mechanism. The water allocation must be capable of reflecting the public good values of water that may not be included in the formulation of individual market behaviour. Whatever the instrument or mix of instruments employed, stakeholder willingness to comply is essential.[46]

Winpenny (1994) includes two additional criteria when assessing the reallocation of water.

8. *Efficacy:* or the effectiveness of the instrument in altering undesirable effects of the existing allocation. Effectiveness refers to the dependability of an instrument achieving the desired policy objectives or targets. The efficacy of an instrument is dynamic and may change with time and location depending on variation in environmental

[46]Both government and corporate business appears to have a preference for regulatory standards rather than economic instruments (Verbruggen 1994). Despite the wide discourse on economic instruments, the limited application found by Opschoor and Vos (1989) and followed up by the OECD (Verbruggen 1994) reflects the extent of bureaucratic inertia and intransigence of regulatory instruments.

and economic parameters and components. The mechanism should encourage the innovation, adoption and diffusion of new technologies and systems management. There should be an ongoing incentive to improve policy targets or standards to conserve water and minimise waste and to continually reduce compliance and transfer costs.

9. *Administrative compatibility and feasibility:* the administration, monitoring, information and enforcement costs should be cost effective and minimal. The instrument should reflect a high degree of concordance with existing or proposed conventions, institutions, principles and policies. Operationally, the instrument should dovetail with administration systems, be compatible with relevant jurisdictions, and have a clearly defined position within all the levels of government to minimise institutional impediments.

Young *et al.* (1996) introduce two additional criteria to account for risk, uncertainty and precaution.

10. *Dependability under conditions of uncertainty:* the precautionary principle[47] should be applied where the consequences of resource use cannot be predicted with precision, where the resource is unique and has no replacement, where a use outcome may have adverse impacts on future generations or where use may threaten another irreplaceable resource. The evaluation of an instrument under circumstances of uncertainty may be an essential criterion, particularly as many public good and non-consumptive uses of water are highly reliant and dependent on complex ecosystem services and associated amenity values.
11. *Reversibility under conditions of risk:* risk differs in that a probability of environmental damage and cost can be assigned to designated resource outcomes. The precautionary principle does not imply that all development with associated risk should not proceed, as that would unjustifiably prejudice future generations. However, where high risk does exist, all endeavour must be made to ensure that stringent safe minimum standards are imposed and are continually monitored.

## 5.9 The Caveats and Proposed Augmentations for Effective Water Markets

The effectiveness of natural resource markets (inclusive of water), in concert with relative scarcity and specified property rights, is predicated on goods conforming to the following characteristics (Bromley 1991):

1. Highly divisible factors of production and outputs (to enable specific determination of attribute scarcity)
2. The absence of public good characteristics (implying non-rival and non-exclusive outputs)
3. The absence of external effects (that is adverse or beneficial effects not accounted for in production costs)
4. An absence of irreversibilities

Colby (1995) posits that the cardinal nature of water and the heterogeneous demands placed on it makes standardised, immediate and anonymous market transactions undesirable and improbable. The detrimental aspects ascribed to a systemic price-making market for water demands are compounded and complicated when measures of water quality are included in the transaction protocols. The dependence and reliance on water is summarised by Polanyi thus;

> *The economic function is but one of the many vital functions of land. It invests man's life with stability, it is the site of his habitation; it is a condition of his physical safety; it is the landscape and the seasons (Polanyi 1944 p. 178).*

As noted by Colby (1995) Polanyi is not objecting to land (and by inference) water market transactions *per se*, but rather to a market system that commandeers and appropriates all activity related to the economic-environmental interface. Daly (1996), Bromley (1991) and Vatn and Bromley (1995) discuss the limitations of economic theory to determine sustainable levels of scale, equity of distribution and to provide, for example, "decisive guidance on whether or not a particular scenic vista ought to be protected for perpetuity" (Bromley 1991 p. 21). According to Common and Perrings (1992), the explicit determination of environmental flows that preserve the dynamic, fundamental self-organising ability of ecosystems is beyond the sphere of

[47]The precautionary principle states that where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

economics. The optimal economic solution is dependent on data, analysis and determinations from an extensive array of biological and environmental disciplines. But once determined, market theory can provide important insights into the efficient attainment of that goal (Bromley 1991, Young 1997).

Adger and Luttrell (2000) and Musgrave and Kaine (1991), *inter alia*, note that the indivisible benefits of water compromises the reliable estimation of attribute scarcity, precluding the unambiguous partial determination of benefits and costs. The permutations and combinations of the interactions between the hydrological cycle, ecosystems, climate and economic systems result in an array of tradeoffs and balances between competing uses, described by specific economic outcomes of variable reliability.

Several authors state that the interdependencies of water outputs and uses may preclude the unequivocal application of property rights to water resources common to most factors of production (Adger and Luttrell 2000, Bromley 1991, Izac 1986, Quiggin 1998, Watson 1990). The perceived inability of unregulated markets to accurately account for the ubiquity and magnitude of externalities and non-market factors has resulted in the proposed augmentation of market structures and the measurement of their effectiveness (Hartman and Seastone 1970, Livingston 1998, Randall 1981, Thobani 1997).

Natural resource management and the achievement of multiple policy directives is often characterised by a strategic mix of regulatory, economic and suasive instruments, rather than a singular instrument reliance (Common 1995, Watson 1996, Young *et al.* 1996).

Brennan and Scoccimarro (1999), Dinar (2000), Quiggin (1998), Freyfogle (1996), Musgrave and Kaine (1991) and Young (1997) recognise that the determination of an incremental and adaptive blend of policy instruments, capable of shaping water management is necessary, although the strategy remains unresolved and contentious.

Bromley (1991) states it would be a mistake of the first rank to assume that leaving things to the market will offer a solution to environmental conflicts that are characterised by high transaction costs, large and important non-monetary benefits and costs, uncertainty over the future and potential irreversibilities.

Alaouze and Whelan (1996), Brennan and Scoccimarro (1999), Pigram (1993) and Randall (1981) note that Australian water resources are typified by poorly specified property rights, an indivisibility of outputs, are public in nature, subject to spatial and temporal externalities and substantial irreversible environmental effects.

### 5.10 Stakeholder Apprehension Towards Water Markets

There exists an inherent and ongoing aversion to the application of economic instruments to correct for poorly allocated natural resources, inclusive of water. Turner and Opschoor (1994) and Verbruggen (1994) note that whilst seemingly embracing general market theory, corporate and government stakeholders appear to have a preference for regulatory standards rather than economic instruments. The reasons for this preference can be summarised as a fear of erosion of international competitive advantage through additional charges, a proven predictability of standards, more corporate control of decision making outcomes and bureaucratic inertia. Opschoor and Vos (1989) found 85 examples of economic instruments in OECD countries from 1980 to 1987. Eighty per cent of these were for financing purposes, in the form of charges or subsidies, not as incentives of behavioural change. An OECD update in 1994 (Verbruggen 1994) indicated a modest increase of 20 economic instruments in that period. Despite the wide discourse on economic instruments, this limited application reflects the extent of bureaucratic inertia, the intransigence of regulatory instruments and a reticence to translate the abstract into reality.

According to Colby (1995), institutions and policy makers have tended to cautiously explore the implementation of water markets, generally when the level of impacts and inefficiencies arising from their absence become unacceptable.

The suspicion and tentativeness towards market determined water transfers has been noted by several international authors and highlighted by Tregarthen (1983) in an essay entitled “Water in Colorado: fear and loathing of the marketplace”. Bjornlund and McKay (1995), note that a similar apprehension exists for irrigation communities in South Australia, albeit amidst a growing acceptance of market based transfers (Bjornlund and McKay 1999b), which has resulted

in markets that are thin, immature and erratic. Crase *et al.* (2000), observe a similar outcome for the motivation for permanent water transfers in NSW irrigation communities. In both cases, the financial hardship of the most desperate entitlement holders is identified as a primary incentive for sellers of water allocations.

Randall (1981) postulates that market apprehension by irrigators may be correlated with perceived declines in less favoured rural communities, a loss of subsidies, the eventual closure of channels with only residual irrigators remaining and the threat of foreign or monopoly ownership.

Gaffney (1997) in a study of permanent water markets in the United States, identifies the following impediments to functioning permanent water markets:

1. a lack of seller motivation and market distortions exacerbated by hoarding behaviour. Crase and Jackson (1998) found 2 per cent of irrigators (n>200) in the Murray Land and Water Management Plan area, were prepared to sell their water entitlement independent of their land. Samaranayaka *et al.* (1997) observed 5 per cent of irrigators (n=43) in the Murrumbidgee Irrigation Area trading in permanent rights.
2. licensees withholding entitlements for fear of creating a public perception of surplus entitlements;
3. institutional inconsistencies in the treatment of groundwater and differential levels and transparency of subsidies;
4. the divesting of public property to the private sector, to enhance market activity, encourages rent seeking behaviour.

Bauer (1997) identifies four obstacles in the development of water markets in Chile and an explanation of market thinness:

1. geographic and infrastructure constraints, including the difficulty and cost of inter basin movements;
2. legal and administrative restrictions and failures including the failure to identify and quantify unused or non-activated entitlements (that is sleeper licenses) and ill-defined rights;
3. cultural and psychological attitudes regarding the importance of irrigation as a symbol of national endeavour, willpower and overcoming hardship in concert with an ingrained scepticism of market processes. Results from the research of Bjornland and McKay (1995) Crase and Jackson (1998) and Samaranayaka *et al.* (1997) suggest a similar reticence of Australian irrigators to enter permanent water markets;
4. ambiguous market price signals, eliciting a view that markets do not adequately reflect the value of water. Sellers represent those that are the weaker and more desperate water users. The latter is in accord with the results of Bjornlund and McKay (1995), identifying financially vulnerable irrigators and those with salinity problems as the most likely to sell water, often at a discounted price.

Crase *et al.* (2000) identify a likely correlation of potential under-investment in high value water using enterprises and the small number of market transactions in permanent water in NSW. The transfer of water from low value uses to high value uses, and the associated economic efficiency increase, is viewed as a primary benefit of water markets. The thinness of permanent water markets and lack of market support by irrigators is seen as potentially a source of market destabilisation and an impediment to the reform process (Bjornlund and McKay 1995, 1999b; Crase *et al.* 2000). Crase *et al.* (2000) identify the following obstacles to the formation of effective and functioning water markets trading in permanent entitlements in New South Wales as:

1. ill-defined property rights;
2. an inherently unstable and unreliable hydrology, which is currently not reflected in the price of entitlements;
3. geographical obstacles to some inter-regional transfers;
4. high transaction costs
5. delays in obtaining price information from agents and the associated administrative encumbrance;
6. an intrinsic cultural reticence and scepticism of water markets, associated with hoarding behaviour for speculative gain and to offset uncertainty (Crase *et al.* 2000 p. 319).

Easter *et al.* (1998b) notes that water authority or agency reticence may be correlated with a concern of potential litigation and compensation claims due to a failure to fulfil more stringently specified contracts of supply and transmission. The diminution of centralised

decisions, relevant to allocations and diversions, as markets appropriate the bureaucratic domain are also seen as an obstacle to market implementation.

Pigram (1999) lists a number of possible reasons, originally proposed by Thobani (1997) and reiterated by Easter *et al.* (1998a p. 15), which summarise the stakeholder "reluctance to adopt markets as a suitable instrument for water resources management." They are:

- cultural or religious objections to the notion that acquisition of water should be traded in a market;
- equity and monopoly concerns regarding the acquisition of water rights by large organisations and exclusion of the poor from access to water;
- concern that small scale operators will sell their rights cheaply, in times of duress, and lose their livelihood;
- fears that water transfers will damage the environment, cause aquifer depletion and degradation of river systems;
- fears of change and loss of public sector control over sovereign water resources;
- need for new legal regulatory and institutional frameworks;
- difficulty in defining, measuring and enforcing water rights;
- changes needed to infrastructure and delivery systems;
- difficulties in establishing or strengthening public and private institutions to facilitate a properly functioning water market;
- challenge of convincing governments that the potential benefits from trading water in a market are sufficient to offset the costs of establishing tradeable water rights.

### 5.11 Summary

The controls and management of water resources rests predominately in the public domain, administered by statutory authorities and government enterprises. The management, planning and modelling of water resources has relied on, or implicitly assumed, a centrally regulated system. Governments are striving to improve on past water management regimes, which have almost ubiquitously failed to account for and reflect the actual scarcity value of water.

The institutional recognition of the increasing relative scarcity of water, manifested as enforced allocation limits, has resulted in the emergence and wider acceptance of the notion of water as an economic resource.

Strategies to offset supply constraints on future economic growth include a more technically efficient application of existing supplies in conjunction with the transfer of low value water uses to higher value uses. Constrained by physical, ecological, environmental and social thresholds, ensuring the mobility of water to facilitate higher valued uses is fundamental to the water allocation decision-making process. Managing agencies have embraced market structures and processes as the most effective means to facilitate structural change to higher valued uses, without increasing available water supplies.

A market based solution, conditional on relative scarcity and reliant on transferable, enforceable and fully specified property rights, vested in the individual and negotiated independently of land are cornerstones in the reform strategy. Efficient market solutions are predicated on the satisfaction of the conditions of rational behaviour, sufficient buyers and sellers, complete symmetric information and fully specified property rights.

In addition to proposed efficiency gains, tradeable water rights confer the benefits of ongoing incentives to conserve water, improved entitlement tenure and security, an inducement to impose the full opportunity cost of water and a more flexible agricultural system, responsive to changes in crop prices, climatic variables and opportunities to diversify. Tradeable water rights are also proposed as a means of ensuring environmental flows.

The interdependencies of water outputs and uses may preclude the unambiguous, comprehensive assignment of property rights to water, and as a corollary the determination of partial benefits and costs. This is particularly relevant for the determination of in-stream and riparian ecosystem and environmental values. The strategy deployed to comply with the directive of ecological sustainability will influence the specified property right regime for environmental flows and their role in market processes. In concert with the essential nature of water and the heterogeneous demands

placed on it, standardised, immediate and anonymous market transactions are in most cases, undesirable and improbable. The perceived inability of markets to account for the ubiquity and magnitude of externalities and non-market factors has resulted in the proposed augmentation of market structures. Proposed adaptive blends of regulatory, economic and suasive instruments remains iterative and unresolved.

Mindful of the potential limits of water markets, commentators note that the reliance on a singular metric of economic efficiency may not provide the necessary analytical scope to enable comprehensive decisions by policy makers. The evaluation of instrument and water market effectiveness relies on a composite index of the value specific measures of equity, compatibility, efficiency, efficacy, flexibility, uncertainty, security, full cost accounting and risk.

Generally, Australian water markets are characterised as thin and immature and associated with erratic prices. Exposure to water trading has resulted to a reduction in community apprehension and increased trading. Trading in temporary water accounts for approximately 95 per cent of the traded volume.

This review of water management in Australia, combined with the results of extensive surveying of irrigator and rural community attitudes to water reform, provides a sound and informed basis for developing potential water trading rules and procedures in the next phase of CRC for Catchment Hydrology Project 3.2 ‘Enhancement of the Water Market Reform Process’.

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***Legislation***

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