APPENDICES

APPENDIX 1

POLICY CRITERIA FOR WATER RESOURCES MANAGEMENT

Efficacy: The implemented policy must be capable of or successful in producing an intended result, thereby ensuring the continued optimal management of the resource.

Economic efficiency: Fundamental to the understanding of welfare economics, are the themes of efficiency and equity - the latter is discussed below. Efficiency is defined by Collins (1986) as "functioning or producing effectively with the least waste of effort". In terms of economics, this approach is captured through allocative efficiency, which determines the extent to which the economy is using its scarce resources and provides a value judgement on whether they are being squandered or used sustainably. Resource allocations are not only carried out through market mechanisms but are also determined by the feasibility of the allocations, the technology and resources available to the economy, the tastes and preferences of consumers and ultimately the value they place on these tastes and preferences. An allocation is deemed pareto-efficient for a given set of consumer tastes, resources and technologies when it is no longer possible to move to a better level of allocation without making someone worse-off. However, such an allocation is rarely determined without some form of intervention where markets either do not exist or are imperfect, evident in the case of fresh water resources (Begg et. al, 1991; Teitenberg, 1992). Two forms of efficiency are evident, first-best efficiency and second-best efficiency. The former refers to the situation where all distortions within a market are removed and full efficiency is achieved, the later refers to the imposition of other distortions in order to counter balance existing distortions that cannot be removed (Begg et. al, 1991). For the allocation of scarce resources such as water, efficiency in allocation is highly dependent on the type or sources of water being drawn. For surface water, in the absence of storage, the challenge is to allocate renewable water among different competing users. Future supplies are dependent more on natural processes such as precipitation, run-off, evaporation and temperature than on existing demand patterns and intergenerational effects are not as significant. However, for non-renewable groundwater allocations, intergenerational effects are far more consequential and allocations over time become part of the efficiency criteria. Restrictions on transfers of water, water pricing structures, common property problems and the nature of the resource have lead to inefficient water allocations (Tietenberg, 1991).

Equity: Equity refers to the fairness of distribution of goods between people. Horizontal equity is the identical treatment of identical people and vertical equity is the different

treatment of different people in order to redress these innate differences (Begg et. al, 1991). The principles of equity, equity between like users and equity principles aimed at addressing the imbalances of marginalised areas increasingly govern water resources policy.

Environmental impacts: Any policy measures implemented for water management must in turn minimise damage to the related environment. This refers to supply-side and demand-side management approaches.

Fiscal impacts: In order for a water resources policy to remain feasible it needs to take into consideration all fiscal impacts. Returns on investment, long-term financial sustainability, the availability of current capital to service the policy measure, and tax and subsidy effects are all factors that will determine the continued success of a water management policy.

Political and public acceptability: Intrinsic to the nature of water policy measures is the stability of the political and public climate as well as the willingness of decision-making authorities and the general public to accept and implement the proposed suggestions.

Sustainability: Water resources will not be sustained if the governing policies are not sustainable. By sustainable, I am referring to economic sustainability that depends intrinsically on environmental sustainability. Water resources will be sustainable while the resources are used in a manner that ensures intergenerational growth. This means use in a way that ensures the resource is not depleted or polluted to a point beyond which it cannot be regenerated or replenished.

Administrative feasibility: Capacity within government, water management associations and water user structures needs to exist in order to carry out the administrative responsibilities of the water policies.

APPENDIX 2

THE SOUTHERN AFRICA WATER DEMAND MANAGEMENT DECLARATION,

March 1999

We the participants of the first Southern Africa Water Demand Management Conference, do hereby adopt the following vision:

The efficient, equitable and sustainable integrated approach where demand-based options precede the traditional supply options at National and Southern African Regional levels.

We recognise that with current demand patterns, Southern Africa will not be able to reconcile demand and supply by 2025 and that in many areas in the region there is already considerable competition for the meagre resources. This is in the wake of the considerable challenge to meet the needs of a large unserviced population and a high growth rate of a relatively young peoples.

We also realise that there is considerable potential for increased water availability through more efficient allocation and use patterns. This will be guided by but not limited to:

- *Economic efficiency*
- *Equity of access*
- *Environmental protection*
- *Governance based on maximum participation, responsibility and accountability*
- *The adoption of Water Demand Management into regional policy for shared water resources*

We therefore resolve to:

Advance the cause of Water Demand Management throughout Southern Africa and undertake to advocate for the inclusion of Water Demand Management as an essential component of development planning.

Agreed in March 1999 in Johannesburg, South Africa

Source: Reproduced from Goldblatt et al, 2000.

APPENDIX 3

FUNCTIONAL FORMS

1. Utility theory

Some of the most commonly used functional forms that represent preferences in utility theory are the following:

1.1 preferences for perfect substitutes

$u(x1, x2) = ax1 + bx2$

1.2 preferences for perfect compliments

$u(x1, x2) = \min\{ax1, bx2\}$

1.3 Cobb-douglas

$u(x1, x2) = x1c\ x2d$

2. Engel curves

The most commonly used engel functions are the following:

Curve	Mathematical formula	Income elasticity
Linear	$Q = a + b\ y$	$\eta = (q - a) / q$
Double logarithmic	$\ln q = a + b \ln y$	$\eta = b$
Semilogarithmic	$Q = a + b \ln y$	$\eta = b / q$
Logarithmic reciprical	$Ln\ q = a - b / y$	$\eta = b / y$

(Sadoulet and De Janvry,1995)