SUPPLY PRICING OF URBAN WATER IN SOUTH AFRICA

VOLUME 1

SUMMARY REPORT

by

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Report to the
WATER RESEARCH COMMISSION
on the project
"Pricing water as an economic resource:
implications for South Africa"

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Preface

This report forms part of the output of the Water Research Commission funded project titled "Pricing water as an economic resource: implications for South Africa" (Project K5/678). The scope and focus of the project was narrowed by the Commission on the recommendation of the steering committee to examine water pricing issues related primarily to urban water use, including the wholesale of water to (or by) local government. The report title has therefore been shortened to "Supply pricing of urban water in South Africa".

The principle objectives of the project are as follows: (1) to review water pricing theory, (2) to review the international practice of water pricing, (3) to review and assess pricing policy principles and goals for South Africa, (4) to assess available methodologies (and to develop new methodologies as necessary) to aid in the process of establishing water pricing policies and setting wholesale and retail water tariffs in South Africa, (5) to recommend policies for, and an approach to, urban water pricing in South Africa, and (6) to assess the implications of the policies and approach with reference to an urban case study in South Africa.

The primary outputs from the project comprise the following set of reports:

Main reports

Supply pricing of urban water in South Africa: Summary report.

Supply pricing of urban water in South Africa: Main report.

Working Papers (prefix: "Supply pricing of urban water in South Africa:")

1. Theoretical approaches to urban water pricing - a review.
2. Urban water pricing in practice - a comparative review.
3. Principles and goals for urban water pricing in South Africa - a discussion document.
4. Modelling urban water demand to understand efficiency and equity effects - towards a new methodology.
5. Water pricing in Grahamstown - a case study.

The research was undertaken and all reports written by Rolfe Eberhard with the oversight of Mr Ian Palmer (both of Palmer Development Group) and Profs John Sender, Mushtaq Kahn and Ben Fine of the School of Oriental and African Studies, University of London.

The views and opinions expressed in this report and the working papers are made on the basis of the research undertaken by the researcher and do not necessarily reflect the views and opinions of the Water Research Commission, the members of the steering committee, the researcher's supervisors at SOAS and colleagues at PDG. The author retains responsibility for all errors and omissions.

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The steering committee responsible for this project consisted of the following persons:

Dr Gerhard Backeberg	Water Research Commission (chairman)
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Ms Bee Thompson	Palmer Development Group
Mr Steven Cridland	Grahamstown Municipality

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1. Introduction

The primary purpose of this project is to assess the current South African second and third tier pricing policies, to make policy recommendations for pricing policy reform and to provide operational guidelines to assist water managers in setting price structures and levels. The primary outputs of the report are the set of reports indicated in the preface. This executive summary highlights the key points arising in the main report and presents the final recommendations in full.

2. The South African context

The contextual factors pertinent to the development of a South African specific water pricing policy, and their implications for pricing policy are summarised below.

Water resources

The pressure on South Africa's limited water resources is both significant and increasing. To the extent that water pricing can be used to assist in the allocation of water between different uses and users, encourage the more efficient use of water and promote the sustainability of the water resource, a water pricing policy is likely to be a very important element of an overall strategy seeking to manage the water resource in an equitable, efficient and environmentally sustainable manner.

Water use

The growth in overall water demand in South Africa is likely to arise predominantly from new domestic and industrial/commercial demand. The causal factors underlying this growth are three-fold: population growth, improvement in access to water supply infrastructure, and economic growth. It is therefore particularly important that the additional water demanded be used wisely, beneficially and efficiently.

The major metropolitan areas dominate urban water use in South Africa, hence water management issues in these areas should receive priority attention. Domestic water use accounts for the largest share of urban water use in South Africa and a particular focus on domestic water pricing is therefore justified. Comparative analysis of international experience suggests that an average domestic consumption of between 100 and 200 litres per capita per day (lcd) is sufficient to maintain a high standard of living. Such an *average* level of consumption is already attained in South Africa's major urban areas. However, domestic consumption in South Africa is highly skewed with a minority consuming much higher quantities of water (often in excess of 300 lcd) and a majority consuming less than 100 lcd (with many consuming less than 50 lcd). This suggests that it may be appropriate for pricing policy to seek to achieve the dual goals of encouraging consumption where this is less than 50 lcd and discouraging consumption where this is in excess of 200 lcd.

Although the standard of water management in South Africa's urban areas compares favourably with cities in other developing countries, there is scope for improvement.

There is significant potential for innovation and investments in water-wise technologies to improve technical efficiency and reduce water use. Higher water

prices are likely to promote such investments and innovation. However, on their own, pricing strategies may not be sufficient.

The direct relationship between water consumption and effluent production highlights the complementarity of water and effluent pricing policies.

Water infrastructure

Domestic water use is strongly related to water infrastructure and access to water services. One third of households lack access to water services in South Africa, hence the primary equity contribution that can be made in the water sector is the improvement in access to water services. Most households without access to water services reside in rural areas. Policies are needed to address the funding and sustainability of water supplies in rural areas in particular and urban water pricing policies should not be made in isolation from these broader considerations. Because historic investments in infrastructure have favoured certain groups at the expense of others, "neutral" forward looking policies which ignore past investments will serve only to entrench existing inequalities. The population is expected to grow most rapidly in the urban areas, hence the demands for new infrastructure to meet this growth will be highest in these areas; it is particularly important that investments to meet these needs are sustainable.

Pricing policy may have a profound impact on total investment requirements in a number of ways. First, pricing policy will affect the pattern of demand for connections, in particular the distribution of demand for different service levels. Second, pricing policy may also affect demand itself, hence impacting significantly on the timing of investments in new capacity. Third, pricing policy will affect the distribution of the cost and benefits in accordance with how it allocates revenue responsibility.

In many areas in South Africa, the costs of new water resource development are significantly higher than historic costs. In this context, two important questions related to pricing need to be addressed. First, how should the costs of capacity expansion be distributed or allocated? Second, should pricing be used to signal the high marginal costs of development, and if so, how?

Water policy

Water policy in South Africa is undergoing a process of rapid and significant evolution. Existing policies and important policy initiatives are described in the main report. There is a complex interaction between existing policy and this project because the current water policy in South Africa provides both the context within which this pricing study is being undertaken as well as the material for a critique of existing policies.

In view of the fact that the Bill of Rights forms a cornerstone of South Africa's new democracy, these rights are taken as given in this project. The key implications of these rights for water pricing are as follows: First, water pricing should not, at the very least, jeopardise the right of people to an environment that is not harmful to health or well being. Second, pricing should promote access to, and the consumption of, an adequate amount of clean potable water. The following national policies are also accepted as givens in this project:

- The absence of private water rights.
- The setting aside and prioritisation of the basic needs and ecological reserves
- The principle of equitable access of all water using sectors to the water resource.
- The need to protect consumers against monopoly interests.
- The political prioritisation of the provision of infrastructure to meet basic needs and issues of equity.

The DWAF first tier pricing strategy aims to achieve four overall objectives. First, *financial sustainability* of water resource planning, development, management and operation is ensured through full-cost recovery. Second, *ecological sustainability* is promoted through setting aside an ecological reserve and managing water quantity and quality through a combination of water use permits and economic incentives (pollution charges). Third, *equity* is promoted through making the first tier water for basic needs available free of charge. Fourth, *efficient and equitable use* is promoted through the introduction of the economic charge reflecting the scarcity value of water in any particular catchment.

Institutional framework

A brief description of the institutional framework in the water and wastewater sector in South Africa is presented in the main report. The primary implications of these for water pricing are summarised here. The national government has the ability to directly affect the second and third tier prices of water through the setting of the first tier water price. As custodian of the national water resource, the national government can also exert an indirect influence over second and third water prices through the establishment of norms and standards. This is provided for in the National Water Act of 1998. In the case of second tier prices, the government has the power to review, and if necessary veto, prices set by water boards. Where municipalities wholesale water to other municipalities, the price is usually negotiated between the contracting parties.

In all cases, the water services authority (WSA), that is local government, has the final responsibility in setting third tier water prices. This responsibility is defined in the Water Services Act of 1997. The right of municipalities to set tariffs locally is also established in the 1998 White Paper on Local Government. In practice, where a local government is also the water service provider (WSP), that is, the organisation that physically carries out the functions of providing water services, their ability to influence the third tier water pricing structure and level will be much greater than where this function is undertaken by Water Boards, other municipalities, private companies or other organisations. The discretion that private companies have to set third tier water prices will depend on the nature of the contract between the WSA and the company.

Macro-economic linkages

Understanding the macro-economic linkages between investment in water and sanitation and economic development, the economic impact of investment in water and sanitation *vis-à-vis* investment in other sectors, and the impact of water pricing reform on economic and social development is critical if the overall social and economic infrastructure investment programme in South Africa is to be designed and implemented in such a way that its contribution towards rapid and sustained economic growth is optimised.

Large-scale investment in social and economic infrastructure is necessary for political and social stability. Basic services should be universally accessible. Pricing policies must seek to ensure that such investments are both feasible and sustainable.

The long-term economic vision in South Africa is for an internationally competitive economy which implies low production costs. Unnecessarily high water prices may jeopardise this.

A core component of the macro-economic policy is the redistribution of both income and opportunities in favour of the poor. Water pricing reform should therefore aim to have a progressive (or at the very least neutral) impact on income distribution.

It is national macro-economic policy that, where feasible and desirable, greater reliance will be placed on cost-recovery and private finance. Appropriate pricing policies have an important role to play in ensuring the financial sustainability of the sector, in harnessing user-contributions (hence releasing government resources for other priority uses), and in attracting private finance or capital into the sector (hence reducing government borrowing requirements).

Although there are positive health externalities associated with investment in water services, the income distribution rationale for the subsidisation of basic services is stronger than the health rationale.

Investments that are premature, overdue, or not least-cost waste valuable and scarce capital sources that may have had better alternative uses. The appropriate pricing of water can have an important role in ensuring that the timing and choice of investments is optimised.

Water investments must be viewed holistically and co-ordinated with investments in wastewater, sanitation services and other associated infrastructure. Similarly, the pricing of water must be addressed in conjunction with the pricing and regulation of wastewater flows.

Social context

The social context, in particular the level and distribution of household income and the degree of inequality, are of considerable importance in the consideration of the pricing of domestic water consumption because they will have an important influence on the pattern of water demand and the affordability of water services.

Assuming that expenditure of less than 5% of expendable income on water services is affordable, less than 5% of black households in South Africa can afford the full cost of a high-use in-house water connection, and only some 15% of black households can afford the full cost of a moderate use in-house water connection. However, some 40% of black households can afford the full operating and maintenance costs of a high-use in-house connection and about 60% can afford the full operating and maintenance cost of a normal use in-house connection. More than 80% of households can afford the operating and maintenance costs for an off-site water supply, and about 70% of households can afford the operating and maintenance costs of a yard tank supply.

Income distribution in South Africa is highly skewed. Pricing policy that exacerbates this inequality is undesirable. Cost-based pricing typically will exacerbate income inequality because the income elasticity of water demand is low. The indiscriminate application of cost-based pricing therefore is not recommended. Marginal cost pricing

of the form "price equals long-run marginal cost" typically will have an even more regressive impact on income distribution compared to cost-based pricing.

Financial context

Both the national and local government financial frameworks are of critical importance to water tariff policy because they determine the financial constraints within which water tariffs must operate. It is reasonable to assume that both the nature and level of general (not water-specific) national subsidies related to infrastructure and services should be taken as a given because it is unlikely that this project will be able to alter these in any significant way. There are no national subsidies that are specifically dedicated to the urban water sector. The general national policy is that urban water supply should be largely self-financing, with assistance for poor households provided through more general subsidy mechanisms (the low-income housing grant, the bulk infrastructure grant linked to the housing grant, and the equitable share policy).

The sustainability of services requires that total revenues (from all sources) match total costs over the long run. At the local government level, service tariffs are typically used as a financial balancing tool to ensure that revenues match costs. Given the dependence of local authorities on tariff income for a large share of their income, this function is critically important. However, there is some leeway within this role because it is possible for water revenue to be used to subsidise other services and *visa versa*. These financial trade-offs, together with their economic and social implications, lie at the heart of water tariff policy.

Concluding remarks

Improving the efficiency of water use is important in the light of the increasing water scarcity faced by South Africa and the unsustainability of a purely supply oriented approach to water provision and use. Sustainable water provision requires that the ecological resource base be adequately protected. Equity concerns are of particular concern within the South African context because past policies deliberately denied people equal economic opportunities. For political reasons, it is not desirable that pricing policy focus exclusively on the efficiency of water use; pricing policies should also take equity impacts into account. The key to a successful water pricing policy in South Africa is achieving the appropriate balance between three objectives: efficiency, sustainability and equity.

3. Water pricing theory - a review

A detailed critical review of the theory of water pricing was undertaken as part of this project and is presented in Working Paper 1. The key points arising from this review are presented in the main report and are summarised very briefly below.

The welfare maximisation claim of marginal cost pricing is theoretically weak. In the presence of capital indivisibility there is ambiguity in the definition of marginal cost. Market distortions place significant restrictions of the optimality claims of marginal cost pricing. Hence, an exclusive focus on marginal cost pricing is inappropriate.

Even if the welfare maximisation claim of the marginal cost pricing rule is accepted, the application of this rule may impact negatively on inequality and hence may be

undesirable. Neo-classical economics relies on the Kaldor-Hicks compensation principle to negate this objection. This claim is not valid because it is impossible to achieved non-distortionary, costless lump sum transfers. Further, the structure of demand is directly influenced by the prevailing income distribution. Hence, a consistent and comprehensive analysis of pricing policy should include an examination of the likely impacts of price changes on income distribution and address issues related to inequality.

An exclusive focus on allocative efficiency is inappropriate. Technical efficiency is a more direct measure of the efficiency of resource use and can be useful in assessing the efficiency impacts of pricing reform. Optimal beneficial use emphasises the social value of water and the need for social choice in the way in which water is allocated and used. Pricing policy should recognise both the economic and social nature of water and make use of all three definitions of efficiency as appropriate to the particular context.

Institutions impact on the structure of markets and hence on market outcomes. Therefore an analysis which ignores the institutional structures underlying and impacting on markets is incomplete.

Pricing rules will typically be a function of the institutional and ownership form. In particular it is likely that there will be a difference in the pricing rules adopted by state owned, privately owned unregulated, privately owned regulated and privately owned franchised water utilities. The former is more likely to pursue an array of objectives in their pricing strategies (hence pricing rules are likely to be heterodox). Pricing rules for regulated private water utilities will depend on the nature of the regulation (such as cost-plus or maximum return on investment). In general, average cost pricing rules are simpler to regulate although marginal cost pricing rules are also possible.

4. Comparative review of water pricing practice

The review of pricing practice covered four areas: cross-country policy recommendations for water tariffs emanating from prominent multinational agencies, environment-based approaches to water pricing, a survey of water pricing in a wide range of countries and cities, and case studies of water pricing in seven cities.

The policy making process and multinational agencies

Neo-classical economic thinking has come to dominate the policy advocacy of important multinational agencies. Of the three agencies reviewed (United Nations, OECD and World Bank), the World Bank has the most significant influence on water pricing policy in developing countries because of its role as financier. The influence of neo-classical economics is also most evident in the World Bank. The essences of the World Bank policy prescriptions are marginal cost pricing, eradication of subsidies, managerial autonomy from political influence and privatisation. Although a closer reading of World Bank policy advocacy admits to a more nuanced contextualised approach to policy making, World Bank practice is not always in accordance with this.

In the light of the above, the policy advocacy of multinational agencies should, at the very least, be critically tested within the receiving context. For it is only proper

contextual analysis within the political-economy reality that will enable appropriate and feasible policies to be developed in any particular context.

Water pricing and the environment

As water resources have become scarcer the issue of sustainability has become more important. A strong definition of sustainability requires that the stock of water (quantity and quality) be maintained over time. Some environmentalists operating within the neo-classical framework believe that sustainability can be assured through the privatisation of water rights and/or appropriate resource and marginal cost pricing. However, the privatisation of water rights has inherently high transaction costs and problematic equity implications; hence many environmental economists remain pessimistic about an exclusive reliance on the efficacy of water markets to ensure sustainability. The appropriate valuation of the water resource itself and marginal cost pricing are seen as alternative "objective" ways of ensuring sustainability. However, this approach also has is limitations because the valuation of water resources is inherently subjective, and pricing, on its own, will not necessarily ensure sustainability. These objections bring pricing and sustainability into the realm of political-economy: legislative intervention appears to be necessary to ensure the sustainability of the water resource; and the valuation of the water resource raises important questions related to who is doing the valuation and whose interests the valuation serves.

Disjunctures between pricing theory and practice

No instances of marginal cost pricing in which the long-run marginal cost price was applied to *all* units of water sold was found in the tariff survey (although instances of selective marginal cost pricing were found). The disjuncture between neo-classical pricing advocacy and the practice of water pricing is stark.

Another striking feature of the pricing experiences studied is the general absence of a systematic or rigorous equity impact analysis. The fundamental reason for this appears to be a lack of consensus on the meaning of equity. A clear and common understanding of the meaning of equity and the development of clear (and attainable) equity goals would greatly facilitate both the development of tariff policy and the evaluation of the effectiveness of the implementation of that policy. A key challenge in tariff design appears to be the establishment of an appropriate equity framework. The notion of what is equitable and fair may vary significantly from context to context, particularly where there are large disparities in wealth. The provision of guidelines and tools to aid policy makers in the development of such a framework can make an important contribution to tariff reform in developing countries.

Some institutional and political-economy considerations

Governance

Institutional arrangements have a profound effect on pricing decisions and outcomes. In particular, the institutional arrangements affect who makes the decisions and what the distributional impacts of these decisions are. As a general democratic principle it seems important that people who are affected by a decision should have say in that decision. If this principle is accepted, then institutional and governance arrangements should be designed so as to enable this. Within the water sector this has two basic implications: water resource management should take place at a catchment level; there

is a need for political oversight in the management of water services because of the important social good nature of water. A generic model for political oversight of the management of water services is shown in Figure 1.

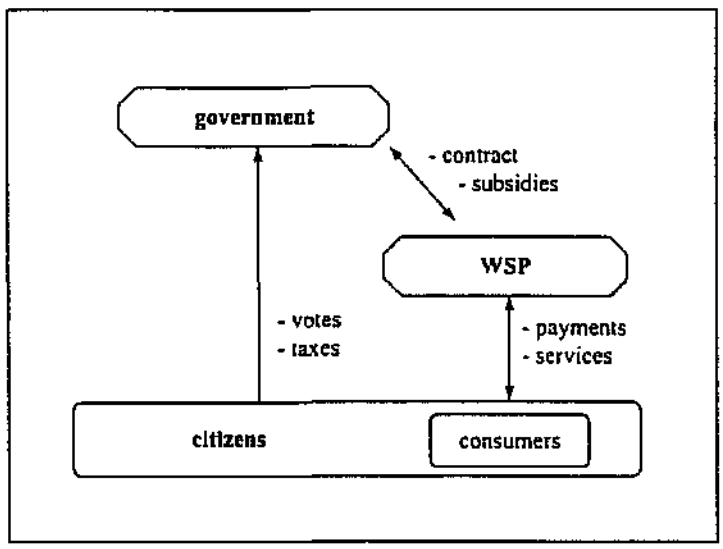

Figure 1: Governance in the water sector

The following features of the model are of note. Distinctions are made between citizens and consumers and between government and the WSP. Government undertakes the political (or allocative) function. This function can be exercised at the neighbourhood, city, regional (district) and/or country level. The function of service delivery is undertaken by the WSP. The WSP could be government (local, regional or national), a public utility or a private company. Similarly, the WSP could operate at the neighbourhood, city, regional or country scale. Hence, important questions related to the governance of water services are as follows: At what level should the political oversight be exercised? How should the political oversight be exercised? What institutional model is appropriate for the WSP? At what scale should the WSP operate? The case studies show that there are no universal answers to these questions.

Privatisation

Although the successful management of water services may be associated with a wide range of governance arrangements, the lack of availability of adequate resources, lack of managerial skills, patronage, corruption and the absence of clear objectives and managerial mandates may hinder the achievement of this goal. Many neo-classical economists contend that privatisation provides a governance structure which overcomes these constraints. However, the fact that privatisation itself is not necessarily a panacea is apparent from the case studies. Failures of private management can be blamed, at least in part, on an inadequate regulatory environment. In this context, there is a distinct danger that the push for privatisation by multinational agencies may result in exacerbated inequalities in the longer term.

Responses to significant price increases

Resistance on the part of consumers to large tariff increases is an understandable and natural phenomenon. However, the likely consequences of this resistance to tariff reform ought to be understood by the tariff reformer. Failure to do this may undermine the objectives of the original reform as illustrated in two of the city case studies.

Marginal cost pricing

No instances of full marginal cost pricing (in which the long-run marginal cost price is applied to all units of water sold) were found in the tariff survey. Furthermore, the case studies show unequivocally that political-economy factors mitigate against the implementation of full long-run marginal cost pricing where these costs are significantly above average historic costs. Increases in the marginal price of water above average historic cost, even within a rising block structure, have been resisted and WSPs have not applied these same marginal rates to commerce and industry.

Methodological implications

Changing the starting premises

The neo-classical approach to pricing commences with a consideration of Pareto-efficient allocation in perfect markets and then seeks to adjust this for market failures, equity considerations and other practical considerations. Environmentalists within the neo-classical school concerned with sustainability adopt essentially the same model. In the case of water supply, where both equity and sustainability considerations are of paramount importance, this neo-classical model essentially fails. It is preferable to change the premises and reverse the process by starting out with well-developed equity and sustainability frameworks and, within these frameworks, examine the ways in which efficiency in water use can be improved.

A contextualised approach

An approach that emphasises the primary importance of equity and sustainability must take into account the political-economy context. The extent of the protection of the environment and the degree of equity desired are essentially political decisions. Any policy advocacy that is to stand a realistic chance of successful implementation must be firmly rooted within such a contextualised political-economy analysis. The implication of this is that policy advocacy must be undertaken on a case by case basis.

Developing a political-economy informed pricing methodology

The above arguments suggest that a new pricing methodology that is sensitive to political-economy issues would comprise the following elements: the development of an understanding of the political-economy context at the country and city level; the development of equity and sustainability frameworks that address the political-economic realities; the development of a consensual understanding of resource efficiency in general and water use efficiency in particular; the development of a consensual understanding of appropriate and practical *sets* of indicators for equity, sustainability and resource efficiency; the development of explicit pricing objectives together with measurable goals; and the determination of price structure and setting price levels.

This approach emphasises the iterative nature of the pricing process whereby incremental improvements are made over time so that the objectives are more fully achieved. The availability of practical measures whereby the extent of attainment of the specified objectives can be assessed greatly assists this incremental reform process.

5. A review of measurement methods

Measurement methods that may be helpful in the development of urban water pricing policies and designing tariffs were reviewed as part of this project. Three aspects were examined: the measurement of efficiency, the measurement of welfare and equity, and modelling financial sustainability.

The measurement of efficiency

The neo-classical assertion that marginal cost pricing will result in the Pareto-efficient allocation of resources relies on the assumption that demand is price elastic. There is therefore a considerable body of literature in the economics journals on this topic.

Although the exposition of the neo-classical theory of water demand is relatively straightforward, it is no easy matter to apply this theory in a general and consistent matter to the empirical analysis of water demand. The review of the empirical literature on water demand showed that there is considerable controversy and little agreement on three key methodological considerations: the choice of the appropriate equation form, the specification of the price variable and the choice of estimation technique. All of these impact significantly on the empirical results. There is therefore considerable methodologically induced "noise" in all water demand estimates. The lack of data availability and reliability are particular problems in developing countries. If this problem is added to the methodologically induced uncertainties, then it may be expected that the results obtained from empirical studies are likely to have very wide confidence intervals rendering the results to all intents and purposes meaningless. Indeed, the review of the empirical results confirms this expectation.

Further important limitations exist. The Lucas critique states that the parameters estimated from an econometric model are dependent on the policy prevailing at the time and will change if there is a policy change. Therefore, significant changes in the price structure or price level outside the historical range will render the application of price-elasticity estimates obtained under different conditions invalid. There is a lack of homogeneity amongst consumers as a whole. Hence, aggregate estimates of price elasticities hide very real differences between consumers. The results from different demand studies are generally not comparable with one another; similarly, the results of demand studies are generally not transferable from one context to another. Hence, in general, an understanding of water demand in a particular context cannot rely on the empirical findings of other studies. The calculation of point elasticity estimates in a developing country context may be inappropriate as there are no *a priori* grounds for assuming the demand curve to be of any particular form and point elasticities are only accurate at the respective mean values of the estimating equation. Therefore, there appears to be little merit in employing complex methodologies that attempt to estimate point elasticities of demand.

In conclusion, a methodology for the analysis of water demand in developing countries is needed which is appropriate in terms of the accuracy of the available data and the level of confidence required for the predictions; does not treat consumers as homogenous aggregates; lends itself to welfare analysis (because of the importance of equity issues); is able to make predictions of demand response and welfare effects over a wide range of income and demand values (that is, it is not dependent on point elasticities and functional form assumptions); and is widely applicable but context specific.

The measurement of welfare

Social welfare analysis requires that the welfare of all households be examined. Welfare analysis that relies on the analysis of a representative consumer is therefore flawed. The social welfare function can be a useful tool in analysing welfare; however, the reduction of welfare measures to a single scalar number is problematic because it hides much more than it illuminates. An alternative approach to welfare measurement is the use of nonparametric density functions. The advantages of this method are that it is descriptive of the data and is theoretically neutral, that is, the results obtained are not dependent on any theoretical assumptions. The method can also be used to examine the likely distributional impacts of price reform.

The empirical literature on the welfare effects of water price reform is very weak. It is proposed that nonparametric density functions offer a practical methodology for the analysis of the welfare impacts of water price reform. This methodology is applied in the case study presented in Working Paper 5.

Modelling financial sustainability

A set of spreadsheet based financial models has been developed to assist South African local authorities in assessing the long-term financial viability of alternative investment strategies and tariff policies and have been fairly widely used. These models can be a useful tool for assessing the financial viability of alternative investment strategies and tariff policies and are briefly described in the main report.

6. Pricing policy goals and principles

Pricing policy goals

Four national water policy goals are identified in the National Water Act of 1998: improving social equity, ensuring ecological sustainability, ensuring financial sustainability and improving efficiency. These are described in the main report. The national water pricing strategy accepts these four goals as the starting point for its deliberations and asserts that each of these goals are of equal importance.

Pricing policy principles

The following principles are proposed as a means of promoting *equity*:

1. In the allocation of water between sectors, water use for basic human needs should enjoy priority.
2. In the allocation of financial resources, the provision of services to meet basic needs for water should enjoy priority. This implies the effective targeting of subsidies.
3. Water and other pricing policies at the very least should not jeopardise access to the basic needs amount of water, and preferably promote such access.
4. The impact of water price reform on inequality with respect to access to water resources in particular, and on income-inequality in general, should be recognised and taken into consideration when proposing water price reform.

5. Water pricing reform, at the very least, should not increase inequality in access or income, and preferably reduce inequality. This implies targeted subsidies for poor consumers.

The following principles are proposed in relation to the promotion of *ecological sustainability*:

1. Legislative intervention is necessary to secure ecological sustainability.
2. External environmental costs should be internalised into the water price.
3. Higher water prices will generally promote ecological sustainability but not necessarily guarantee it. Moreover, the equity implications of higher prices must be taken into account.

Three general principles related to *financial sustainability* are proposed:

1. Full cost recovery from users is not necessarily desirable from both an equity and efficiency point of view.
2. Nevertheless, it is generally desirable that consumers face a positive marginal price implying that at least a portion of revenue should be derived from a volume related charge if this both practicable and cost effective (see below).
3. Within a defined context of subsidies and inter-government transfers from the national tax base, local water services should be financially sustainable; that is, revenue from water tariffs and other local revenue sources should be sufficient to cover ongoing costs (both capital and operating).

The following general principles are proposed to promote *efficiency*:

1. Pricing policy should recognise both the economic and social nature of water and make use of all three definitions of efficiency (described in the main report) as appropriate to the particular context.
2. Higher prices will generally promote the more efficient use of water, however, the equity impacts need to be assessed and taken into account.
3. Where practical and cost-effective, payment should be in proportion to the amount consumed.
4. Prices should promote the development of competitive businesses. Hence business tariffs should not be loaded with excessive taxes or cross-subsidy requirements.

Governance: who decides?

Potential trade-offs exist between the different goals of water pricing Water prices mediate the extent to which the different policy goals are realised: they affect the distribution of benefits and costs, they determine the nature and distribution of incentives, and they typically impact on the financial sustainability of services. Hence the issue of who decides, and in whose interests decisions are made, is of particular importance.

First tier

Although first tier pricing is not strictly within the scope of this project, it has a direct impact on second and third tier prices and is briefly outlined and evaluated here. The means of attaining and balancing the four goals of equity, ecological sustainability,

financial sustainability and efficiency at the national level according to current national policy is summarised and commented on here.

Equity is promoted through making available 25 lcd free of charge to second and third tier water suppliers. **Comment**: This equity policy, although desirable, is likely to be administratively cumbersome and financially insignificant. Hence the wisdom of this policy is questionable.

Ecological sustainability is ensured through the establishment of an ecological reserve (a legislative intervention), environmental management at the catchment level (whose costs are recovered through the price of water in that catchment) and water quality control (legislative and pricing interventions in accordance with a "polluter pays" philosophy). **Comment**: This strategy is sound, though few details on how it will be applied in practice are available. The major burden of ensuring ecological sustainability falls at the national water resource level and hence the efficacy of the proposed approaches is particularly important. For example, first tier tariffs should, as a general rule, internalise all external environmental costs related to water resource development.

Financial sustainability is ensured through full financial cost recovery (including the capital costs of scheme development) from "major users" of bulk raw water schemes (first tier water). The "major users" are municipalities, industries, mines, power generation facilities and irrigators. **Comment**: Notwithstanding the comments on financial sustainability made above, this policy (operating at the first tier) is both pragmatic and desirable.

Efficiency is promoted through the introduction of economic incentives in water-stressed catchments to encourage conservation of water and to move water from lower to higher value uses. It is envisaged that this will be done administratively, although the efficacy and desirability of market-related mechanisms are to be examined. **Comment**: The policy is very vague and the economic arguments confusing. Little attention has been given to this aspect because the focus of the pricing strategy is on achieving financial cost-recovery as a short-term (five year) goal and "economic" resource pricing as a medium term goal.

Second tier

Water Boards, who set the wholesale price for much of the water supplied to urban areas in South Africa, are not directly accountable to customers or consumers, although there is consumer representation on Water Boards and they are directly regulated by DWAF. **Comment**: The fact that Water Boards have no direct accountability to citizens or consumers means that is inappropriate for the wholesale price to mediate the sometimes conflicting goals of equity, sustainability and efficiency. This has direct implications for pricing policy at the wholesale level (see below).

Third tier

The basic governance model described above with reference to Figure 1 may be adapted to describe the institutional context in South Africa with respect to water retail (third tier) pricing. This is shown in Figure 2.

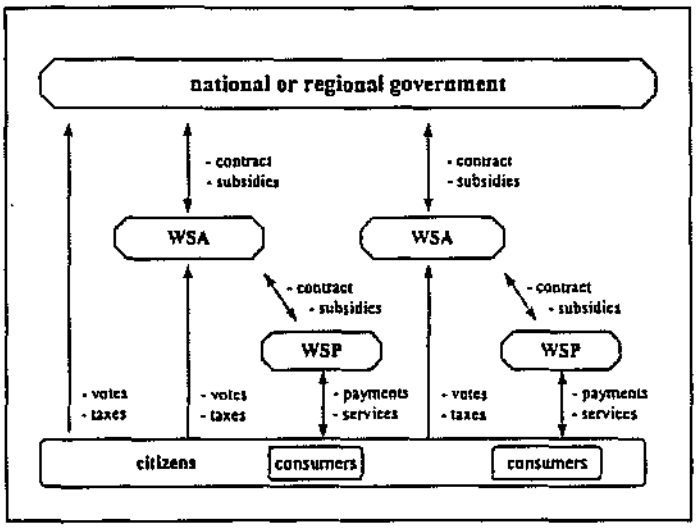

Figure 2: Governance of water services in South Africa

In many cases the retail WSP is part of the WSA (that is, local government), however, this is not necessarily the case. In this model (prevalent in South Africa), democratic local government has political oversight over the WSP and will typically have final say over water tariffs. This model enables the goals of equity, sustainability and efficiency to be negotiated and reconciled largely at a local level. National or regional equity issues may be negotiated at the national or regional government level and enacted through taxes and transfers, and national or regional sustainability and efficiency issues can be enacted though legislation and/or other appropriate measures (see "first tier" above). **Comment**: This is an essentially sound model for setting water prices at the third tier provided that there is adequate environmental protection of the water resource.

Governance: general principles of good management practice

The following principles of good practice are proposed:

1. Tariffs should be fair in that they treat all consumers in the same circumstances in a consistent manner.
2. Tariffs and subsidies should be clear and easily understood.
3. Tariff enforcement should be fair and consistent.
4. The benefits derived from implementing a tariff (or tariff reform) must exceed the cost of implementation, that is, they should be cost-effective.
5. Tariffs should seek to generate revenue that is reasonably stable and predictable.
6. Consumers should have easy access to relevant information.

7. Pricing policy recommendations

First tier water pricing

Although first tier pricing is not strictly within the scope of this project, some recommendations relating to first tier pricing may be made. These are summarised here.

1. **First tier water subsidy**. The existing policy states that the water necessary for a basic domestic supply should be supplied free of charge. Although the sentiment of this policy is admirable, its efficacy in practice is doubtful. First, the cost of raw water relative to the infrastructure costs at the second and third tiers is reasonably small. Second, the cost of the free water must be borne by the other water uses in the same system, which simply means that the cost of the remaining water will be increased proportionately, resulting in effectively the same average cost for the total amount of water supplied. Third, such a subsidy is complex to administer. In the light of this, it is recommended that all first-tier water be priced at cost (resource charge plus full financial cost of infrastructure plus catchment management charge). Further, it is recommended that the subsidy for basic water supply be effected directly at the third tier along the lines discussed for retail water pricing. One possible source of the funding for the retail subsidy could be a resource tax on all first-tier water abstraction.

2. **Assurance of supply**. The financial cost of first tier water should be related to the assurance of supply required by the respective users.

Wholesale water pricing

The following policy recommendations pertaining to wholesale (second tier) water pricing are made:

1. **Ring-fencing**: The water wholesale function should be ring-fenced as a separate business unit and regarded primarily as a commercial operation whose aim is to deliver water at the required quality and reliability at the lowest possible cost.

2. **Cost-based pricing**. The wholesale price should be set as the sum of the price (or cost) of the raw water and the costs entailed in the wholesale function (typically treatment, conveyance and storage).

3. **Calculation of costs**. There are three generally accepted approaches of calculating or accounting for capital costs, namely, the *funding approach*, the *depreciation approach* and the *rate of return approach*. Fund accounting has been used for many years by water boards and other public sector utilities, and is therefore well understood in that sector. It is also reasonably objective and could therefore be monitored or regulated without too much difficulty. However, fund accounting is less well accepted in capital markets where depreciation accounting is the norm, preferably based on the current value of assets. The dependence of water boards on external loan finance – a situation that is likely to become more rather than less significant – suggests a move towards depreciation accounting. **Comment**: Some water boards are involved in exercises to investigate the implications of switching from fund to depreciation accounting and this is an appropriate first step. However, it is desirable that a uniform approach to cost accounting be adopted for the purpose of establishing wholesale water prices in South Africa.

4. **Cross-subsidisation**. As a general principle, there should not be cross-subsidisation between consumers supplied by a wholesale WSP because this is typically not transparent and it is not subject to direct political review or control. However, there is a pragmatic argument for a uniform wholesale price where cost differentials between wholesale consumers are not large.

5. **Performance indicators.** It is difficult for an outside agency to accurately monitor wholesale costs because cost-structures will be specific to local circumstances. Nevertheless the development of performance indicators and best-practice benchmarks may provide useful references for comparison between different wholesale WSPs.

6. **Institutional support costs for the third tier.** The costs of supporting institutional development at the third tier should be accounted for separately. It is preferable that the revenue for these costs comes from the national budget (or a national levy on first tier water sales) as this is more equitable. (Areas in most need of institutional support may not have capable wholesale WSPs to assist.) Failing that, the revenue may be obtained through a uniform surcharge of bulk treated water sales. It is recommended that the equitable share subsidy not be used for this purpose.

Retail urban water pricing

The following policy recommendations pertaining to retail (third tier) water pricing are proposed:

1. **Governance.** Retail water tariff levels should continue to be determined or mediated at the local level by local governments through locally elected political representatives.

2. **Definition of a minimum basic water supply.** A minimum basic water supply should be regarded as access to 25 lcd in South Africa as a whole.

3. **Definition of a target basic water supply.** A target basic water supply in urban areas should be regarded as access to and consumption of 50 lcd. This implies a general preference for on-site supplies in urban areas because off-site access typically constrains consumption to less than 30 lcd.

4. **Capital cost subsidy for basic supply.** To the extent that it is financially feasible, the capital costs of the provision of infrastructure which makes 50 lcd available and accessible to households which otherwise would not be able to afford it and be willing to pay for it should be subsidised. (Current policy is for 25 lcd.)

5. **Cost of basic access (connecting).** On purely equity grounds there should be a zero access price for a basic domestic water supply where affordability is constrained and where implementation of a non-zero access price limits access. However, requiring a partial contribution from households towards the cost of access may be important, especially in rural areas, to achieve development goals, to match a purely supply side approach with demand responsiveness and to improve the sustainability of systems.

6. **Basic consumption subsidy.** There are strong social and equity grounds for making available an affordable lifeline tariff which will encourage (or at least not discourage) the use of a certain minimum amount of water (50 lcd) necessary to maintain basic health standards. (The imposition of volume related pricing at a significant level amongst poor households for low levels of consumption may have the unintended effect of discouraging the adequate use of water and therefore is not recommended.) Such subsidies should also apply to communal standpipes and other restricted supplies.

7. **Volume related pricing for unrestricted on-site supplies.** Where domestic water use is unrestricted, it is important that consumers face a positive marginal price for additional water used in excess of that needed for basic domestic needs (50 lcd).

8. **Full cost recovery for non-domestic users.** Non-domestic users should pay at least the full costs of the water services provided (both capital and operating).

9. **Encouraging water-use efficiency and conservation: domestic users.** Domestic water usage in excess of 200 lcd in South Africa may be considered to be luxury use.[1] Therefore, there should be strong incentives that encourage water conservation where consumption exceeds 200 lcd. These incentives should include higher tariffs, which could be related to the average incremental cost of new water resource development. Education and informative billing should complement higher tariffs. Seasonal tariffs may be warranted in certain areas.

10. **Encouraging water use efficiency and conservation: non-domestic users.** The establishment of best-practice water-use benchmarks by consumer type and the implementation of disincentive or penalty tariffs for the wasteful use of water will encourage investments in water saving technologies and practices.

11. **WSP investments in conservation.** WSPs should apply cost-benefit analyses to investments in water savings in relation to supply augmentation. The scope of WSP investments in water savings may include the full or partial subsidisation of water saving technologies including plumbing and appliances at the consumer level. Supply-side investments of this nature may be particularly important among poor and older households where credit markets are prone to failure.

12. **Revenue sufficiency.** Outside of known, well-defined, quantified and secure inter-governmental transfers, revenue from tariffs (including property taxes) should fully recover costs and ensure financial sustainability.

13. **New industrial demand.** Water using industries should face the correct economic incentives when making investments in new capacity. This means that the cost or price that new water using investments face should be related to the incremental cost of capacity expansion in that water supply system.

14. **Cross-subsidies.** Residential consumers should not cross-subsidise non-residential consumers. Cross-subsidies from non-residential to residential consumers should be limited to reasonable levels and should not jeopardise the international competitiveness of industries.

8. Proposed retail pricing methodology

A methodology for the implementation of the retail (third tier) water tariff policy recommendations is proposed in the main report. It is the intention that the proposed methodology build on what has come before, namely the existing set of management

[1] This assertion is supported by three facts. First, it is possible to enjoy a high standard of living while using less than 200 lcd. Second, in many *developed* countries, average domestic per capita use is significantly below 200 lcd. Third, in South Africa, many people do not have access to adequate water supplies and often consume much less water than is necessary to achieve a healthy living environment. In this context, consumption in excess of 200 lcd can be considered to be a luxury. For further discussion of these points, see Working Papers 2 and 3.

guidelines for setting urban water tariffs in South Africa (referred to hereafter as the *guidelines*) and the Water Supply Services Model (WSSM).[2]

Proposed retail pricing process

The following general approach to water pricing is proposed: Develop an understanding of the national policy context and local (city level) context. Define and reach consensus on the equity, sustainability and efficiency goals related to water pricing, and in particular, on the prioritisation and weighting of these goals. Develop and reach consensus on an appropriate and practical set of indicators for determining the influence of price reform on the defined equity, sustainability and efficiency goals. Reach consensus on the specific and practical meaning of the best practice principles for pricing policy. Develop the pricing structure and determine the price level with reference to the defined goals and principles. Evaluate the impacts of the price reform in relation to the defined objectives. Refine the price structure and level incrementally so as to better achieve the defined goals and to adhere more closely to the best practice principles.

This approach emphasises the iterative nature of the pricing process whereby improvements are made so that the objectives are more fully achieved. The availability of practical indicators, whereby the extent of attainment of the specified objectives can be assessed, greatly assists this incremental reform process.

Understanding the context

The following types of contextual information are important to inform the water pricing process: existing policies and legislation, governance structure, historical context, demographics and income, economic profile, water resources context, consumer and consumption data, and financial data. Specific data requirements are set out in the main report.

The new data requirements and analysis that are proposed (and which are not currently recommended or used in the existing *guidelines* and the WSSM) relate to household size distribution, a different decile-based format for reporting and analysing household income distribution, the analysis of income incidence from property values, explicit summary tables on the "services gap", an emphasis on historical data and how (and why) things have changed over time, seasonal analysis of water use, a different decile-based format for analysing water consumption distribution data and the analysis of cost structures. The specific nature of, and reasons for, the additions and modifications are discussed in the main report.

Setting measurable pricing and management goals

In general, and for the reasons already outlined, it is neither desirable nor possible to set specific universal goals that are applicable to all urban areas in South Africa. Hence, in most cases, only the indicators themselves are proposed and not specific targets. These are defined and discussed in more detail in the main report.

[2] Management guidelines for water service providers (urban). Module 4: Setting water tariffs, prepared by Palmer Development Group for the Water Research Commission, January 1988. Water Supply Services Model Manual, prepared by Palmer Development Group for the Water Research Commission, July 1998.

Financial sustainability requires revenues to exceed costs over the long run and the ability of the WSP to raise capital finance to sustain and expand its operations. The following indicators are proposed which may be used to establish specific financial sustainability goals in each urban area: annual revenue target, cash flow ratio, the ratio of water sales revenue to operating expenses, financial dependence ratio, debt to revenue ratio and the non-payment ratio.

On the water supply side, the goal of *ecological sustainability* is essentially taken care of through first and second tier pricing and other water management policies. Thus there is no need for any further explicit ecological sustainability goals for water supply pricing at the third tier.

The following indicators are proposed which may be used to establish specific *equity goals* or to measure the *equity impacts* of price reform: the service gap in relation to universal coverage at a minimum basic level; the service gap in relation to universal coverage at a target basic level, that is, on-site water supplies in an urban context; the adequacy of consumption, that is, the percentage of households (or population) in the supply consuming less than 50 lcd; the maximum budget share, that is, the target maximum share of household budget spent on water services; and the progressivity of the price reform, that is, the budget share spent on water services by population decile (ranked by income) before and after the reform.

The following indicators are proposed which may be used to establish specific *efficiency goals* in each urban area: unaccounted-for water; meter coverage; water losses; commercial and institutional water-use efficiencies, through, for example, measuring the penetration of water saving technologies through self-disclosure requirements; household water use efficiencies, for example, the percentage of households using more than 200 lcd and the percentage of domestic consumption in excess of 200 lcd; and industrial water use efficiencies, for example, the recycle ratio, specific water use and specific effluent production.

It may not be possible to achieve all of the goals simultaneous. Specific priorities will depend on local circumstances and hence it is desirable that the prioritisation of goals and negotiation of trade-offs between goals be undertaken at the local level with appropriate political and customer representation.

Establishing best practice principles

The practical implications of the best practice principles presented in Section 6 are as follows: The notion of fairness is inherently subjective. The implication of this is that the fairness of tariff reform can only be tested within a democratic political realm. This point therefore stresses the need for retail tariff reform to be subject to the democratic political process. There should be a general preference for simple (non-complex) tariff structures that are easily understood. Subsidies should be clearly targeted and the subsidy amounts known (transparent); the efficacy of targeting and transparency of different subsidy options are shown and discussed in the main report. Consistent and fair tariff enforcement implies that tariffs are politically acceptable and emphases the point that tariff reform must be subject to due political process. Equally, the WSP must have the capability and willingness to enforce revenue collection. In the context where access to water is regarded as a constitutional right and cutting off domestic supplies because of non-payment is not politically desirable and/or feasible, an alternative aid to tariff enforcement is to replace unrestricted on-site access with

restricted on-site access (flow and pressure restrictions) or communal access through a public standpipe. The principle that the benefits of any action should always exceed the costs should be implemented wherever practical; this is particularly pertinent to metering and investments in water saving. Revenue that is based on a mix of fixed fees and volume related tariffs would be more stable than one that relies exclusively on a volume-related tariff. However, the benefits of this must be weighed against the efficiency, water conserving and cost advantages of higher marginal tariffs that would result if greater reliance is placed on volume-related tariffs. Uncertainty in relation to both the underlying consumption data (distribution) and behavioural responses to price changes implies that, in general, a cautious and incremental approach to pricing reform should be adopted. There may, however, be circumstances where significant and relatively rapid changes in pricing structures and levels may be desirable. Consumers have a right to be fully informed and it is the responsibility of the WSP to facilitate this. Communication can be improved in the areas of language capability of the WSP, telephonic access to the WSP, and informative billing.

Tariff design - some practical guidelines

A set of practical guidelines for tariff design is provided in the main report. These guidelines provide a coarse-grained approach that is helpful to assess the broad feasibility of different subsidy and tariff structure options. Once a broad outline has been worked out following this approach, the estimates can be tested and refined using available or custom-developed financial and tariff models. A summary is presented here. The reader is referred to the main report for the necessary details.

The key differences between the proposed and existing *guidelines* for setting tariffs are as follows: (1) The equity impacts of deriving a proportion of revenues for water services from the property tax are evaluated. (2) A proposed method for introducing subsidies is presented. (3) A new benchmark for the minimum revenue requirement from water sales is proposed. (4) A new benchmark for the maximum revenue requirement from fixed fees is proposed. (5) A new benchmark for the recommended minimum volumetric tariff is proposed. (6) A benchmark for the maximum average volumetric tariff that can be levied whilst still maintaining revenue neutrality is proposed. (7) The methodology includes an analysis of the equity impacts of moving between the minimum recommended tariff and the maximum tariff possible while maintaining revenue neutrality. (8) An explicit methodology for the prioritisation of the subsidies in the tariff design process is proposed. (9) A methodology for estimating the cross-subsidy requirement and cross-subsidy burden is proposed.

The proposed methodology of applying the recurrent subsidies is as follows: The calculated feasible recurrent subsidy should go towards off-site water supplies first, then restricted on-site water supplies and then unrestricted on-site water supplies with consumption of less than 50 lcd. If financially feasible, off-site water supplies should be made free. If this is not possible, the maximum water fees should be based on the maximum lifeline tariff benchmark. This logic also should be applied to restricted flow on-site water supplies. Recurrent subsidies should be applied *only if* full or very significant subsidisation is applied to off-site and restricted flow on-site water supplies. Two principal subsidy options exist: direct credit or lifeline. In the case of lifeline tariffs, the cut-off should be based on 50 lcd (if possible), otherwise 25 lcd. This should be translated to a monthly consumption figure based on an analysis of household size distribution. The maximum tariff should be set at the maximum lifeline tariff benchmark, or lower if possible. The income qualified direct credit tariff

may be both more targeted and transparent than the lifeline tariff and it should be considered as a feasible and possibly preferable alternative to the lifeline tariff.

The following methodology for setting residential volumetric tariffs is proposed: Normal residential consumption: if water conservation is important in the local and regional context, then, to promote conservation, normal residential consumption should be priced at T_{MAX+} (parameters and their calculation are defined in the main report), unless revenue stability was particularly important - see "fixed fees" below. Otherwise, normal water consumption could be priced anywhere between T_{MIN} and T_{MAX} depending on the impact of the equity trade-offs described above. Luxury consumption: If T_{MC} is higher than T_{MAX+}, then luxury consumption (> 200 lcd) should be priced at T_{MC} (or at least somewhere between T_{MAX+} and T_{MC}). Two or three step tariffs: A two or three step (block) tariff is proposed. If a direct credit subsidy is implemented, then a two-block tariff is proposed, with the first block set at T_{MAX+} and the second block set at the T_{MC} (if $T_{MC} > T_{MAX+}$). The break point should be at 200 lcd (translated to a kl/month figure based on an analysis of household size distribution - see below). If a lifeline subsidy is implemented, then a three-block tariff is proposed, with the first block set equal to the lifeline (see above) and the remaining two blocks set in the same way as the two-block tariff. The two-block tariff with a direct credit is simpler than the three-block tariff and is preferred. Tariffs with more than three blocks are not recommended because they are unnecessarily complicated and have no advantages over the simpler two or three block tariffs proposed here.

The following guidelines for the generation of revenue from fixed fees are also proposed: Unmetered unrestricted on-site supplies: it is not possible to implement a volumetric tariff for unmetered supplies. Revenue can be collected either through direct charges or property taxes (see below). Where average consumption per unmetered connection is large, it is particular important that metering be implemented as a priority for efficiency, water conservation and equity reasons. The balance of the residential income requirement should be made up from property taxes or direct charges. Property taxes are preferred because they are much more progressive. If direct charges are implemented, these should be waived or reduced for poor households or in poor areas. In certain instances, fixed fees may be particularly important for revenue stability and equity. This is typically the case in "holiday communities". Where multiple residential units share a common meter, it is not possible to bill individual residential units in direct proportion to their actual use. The existing *guidelines* suggest that either a uniform volumetric charge be implemented (based on total consumption), or that a block tariff be implemented based on the concept of residential unit equivalents. It is recommended that this decision be left to WSAs. Supply-side investment in water saving devices may be an appropriate option if water conservation goals are important.

The following guidelines for setting non-residential tariffs are proposed: Non-residential tariffs should be based on cost. If water conservation is important, then the tariff should be based on T_{MAX} with no fixed fees, else it could be based on T_{MIN} with the remaining revenue raised from direct fixed charges based on actual costs (if these are known) or average costs per connection, or property taxes. If cross subsidies are implemented, then these should be from non-residential to residential consumers and not the other way round. In this case, the appropriate maximum tariff benchmark is T_{MAX+}. The application of the "residential unit equivalent" concept to non-residential consumption is not recommended. More detailed research on industrial and

commercial tariffs is currently being undertaken by the WRC and hence more detailed guidelines are not presented.

Guidelines proposed in relation to seasonal tariffs are as follows: Residential: where two or three block tariffs are implemented with the upper block set at or near T_{MC}, then seasonal variations in tariff will be catered for within the existing tariff structure. Non-residential: where peak seasonal use is an issue, seasonal tariffs can be introduced for non-residential consumers. One method of doing this is to measure the differential between peak season and low season water use and to charge the differential water use at T_{MC}.

Guidelines for translating lcd guidelines to kl per month per consumer unit or connection based on the household size distribution are given in the main report.

Tariff reform: getting from here to there

The tariff reform *process*, that is, moving from the existing situation to the proposed situation, is important. Some cautionary points related to this are summarised below.

Price reform must start with the existing pricing structure and levels. The dangers of radical tariff reform are clear. Hence, it is strongly recommended that an incremental approach to tariff reform be adopted. The tariff reform being advocated here is an iterative one. Existing data may not always be adequate, therefore an incremental approach to improving the reliability and accuracy of available data should also be adopted. Spreadsheets provide a useful tool for scenario analysis. The WSSM is a possible tool that may be used. However, in many instances, developing smaller custom designed spreadsheets to test specific scenarios may be more appropriate. Histograms provide an accessible tool for analysing distributions. They are, however, a rough and ready tool and may miss important patterns in the data distribution because of the coarseness of the analysis. In many cases, the reliability of the data may not warrant a more fine-grained analysis. Where this is warranted, nonparametric density functions may be an appropriate tool.

9. Implications for South Africa

The implications for South Africa of following the recommended pricing policies and proposed pricing methodology are outlined in this section. It should be pointed at the many of the pricing outcomes will largely be determined at the local level and will differ depending on local circumstances. The limitations of econometric analysis for predicting demand responses to changes in prices have also been pointed out. For these two reasons, it is not possible to draw definitive quantitative conclusions as to the likely general impact of the proposed pricing reform. Nevertheless, it is possible to suggest in broad outline what some of the likely impacts might be.

Implications of first tier pricing reform

Although quantifying the impacts of first tier pricing reform was not within the scope of this project it is possible to make the following general comments.

The price of water to irrigators will increase over the next five or so years. Catchment management fees will be introduced. The absolute quantity of the ecological reserve is likely to increase in future, which will increase the financial cost of the available

water and increase the scarcity value of water in the catchment. The introduction of an economic resource charge in the medium term will increase the price of first tier water in water scarce catchments. Making first tier water that is used for basic needs available free of charge is likely to have only a small impact on water prices because the basic needs use is estimated to be only about 2% of total water use in South Africa.

The overall impact of these reforms over time will be to move water use away from lower value use to higher value use. Therefore, it may be expected that water use for irrigation may decline as a proportion of total use over time. Increases in the first tier water prices will be passed down to the second and third tiers. However, current first tier prices are already based on full costs for urban supplies, hence the impact of first tier water price reform on urban water prices is, in general, likely to be small in the short term and only moderate in the medium term. This is because raw water costs are only a small fraction of total water costs at the retail level. However, in the longer term, water resource development costs are likely to rise steeply, which will impact significantly on third tier urban water prices. In some water-stressed catchments, for example, the Vaal River system, first tier water prices will increase significantly in the near term.

Implications of second tier pricing reform

A "clean" second tier role for water wholesale has been recommended, which implies that the wholesale function is run as a commercial operation. Water wholesalers should raise private capital at the lowest possible cost, set tariffs to fully recover costs (but no more) and operate the wholesale function as a distinct (ring-fenced) business entity. It is also recommended that tariffs reflect differences in supply costs between wholesale customers where there are significant cost differentials.

It is more equitable if rural subsidies are made available from the national budget and it is therefore not appropriate that urban-rural cross-subsidies take place at a regional level. The principle of "common pool" wholesale water pricing appears to have been taken too far in South Africa: setting prices to reflect costs more closely at the wholesale level will result in much higher water prices for some consumers and a lowering of prices for the remaining customers in the common pool system. To the extent that Water Boards and other wholesale WSPs carry out institutional support functions to assist retail WSPs, these costs should be accounted for separately. Preferably, these costs should be funded from the national budget, alternatively they can be funded by adding a surcharge onto bulk treated water sales. Wholesale WSPs should not try to effect conservation pricing because this is taken care of at the first and third tiers. Implementation of capital subsidies at the second tier level are not targeted neither are they equitable and are therefore not recommended. The marginal cost of expanding the second tier network to meet increasing demand should be calculated using a nationally defined methodology and reported annually.

There is not likely to be any significant *overall* impact on water demand arising from second tier pricing reform because existing prices at this level are already cost based. Increased first tier water prices will be passed onto the third tier. In some instances there may be significant adjustments because of the implementation of cost-based differential wholesale pricing and the elimination of second tier cross-subsidies.

Implications of third tier pricing reform

The impact of pricing reform at the retail level will be dependent on local circumstances to a very large extent. Not only will the tariff design be influenced by local factors such as costs, demographics and the pattern of water demand, but also the starting point of price reform will be different in each case. Nevertheless, it is possible to illustrate the possible implication of retail price reform in broad terms and to describe the factors that will determine the feasibility of cross-subsidies.

Broad implications of domestic price reform

The primary goal of the pricing policies advocated here is to improve access to water services. The implementation of these policies should help to facilitate a significant improvement in access to water in South Africa. There should be a strong preference for on-site water supplies, particularly in the urban areas of South Africa. The pricing policies put forward support this preference. The provision of restricted on-site supplies offers an intermediate option between off-site supplies such as communal standpipes (where consumption of water is generally inadequate) and unrestricted on-site access (which may be prohibitively expensive).

The policies seek to ensure that households not only have access to adequate water services, but also can *afford* to consume a target of 50 lcd. Thus the pricing policies and methodologies recommended here have the twin goals of encouraging domestic water use where this is less than 50 lcd and discouraging water use where this is in excess of 200 lcd. The overall effect of this should be to reduce the existing disparities in domestic water use arising from apartheid policies; specific effects will be locally determined. Setting higher tariffs for luxury water use (water use in excess of 200 lcd) will have the impact of improving water-use efficiencies through investments in water saving devices and reducing wasteful water use. Thus water conservation will be promoted. Cost-based tariffs for non-residential consumers will help to ensure financial sustainability.

Financial sustainability and cross-subsidies

The key premise in the analysis presented here is that the WSP must be financially sustainable. The extent of subsidies that are sustainable and the leeway that WSAs or WSPs have to incorporate cross-subsidies into urban water tariff design will depend principally on the following factors: (1) the capital subsidies made available to the water sector from higher tiers of government; (2) the total equitable share subsidy made available to the WSA from higher tiers of government; (3) the share of this subsidy made available to the retail water sector by the WSA; (4) regional and local cost factors which determine the cost of supply; (5) the total wealth of the supply area; (6) the proportion of water consumed by the non-residential compared to the residential sector; (7) the income distribution within the supply area; (8) the consumption distribution in the supply area and (9) the political feasibility of introducing cross-subsidies. Many of these factors are locally specific. Hence it is not possible to quantify the impacts of retail price reform at the national level.

Durban - setting an example

The strategic plan for water services supply, management and pricing adopted by Durban Metropolitan Council offers a good example. The plan ensures universal access to on-site water while maintaining financial sustainability, targeting subsidies to those most in need, ensuring affordability of services and encouraging conservation

amongst large domestic consumers. Financial modelling of alternative scenarios played an indispensable part in the development of the strategic plan. Other WSAs in South Africa should use the approach adopted by Durban, which is described in the main report, as a model.

Grahamstown - dealing with difficult legacies

A detailed analysis of water pricing in Grahamstown was undertaken as part of this project. Specific conclusions arising from this study are presented in the main report and in Working Paper 5. Only the more general conclusions arising from the study are replicated here. The particularities of the historical institutional and political-economy context in Grahamstown highlight the need for a context specific approach to pricing reform. It may not be feasible to implement progressive block pricing where institutional capacity is weak. Choosing the appropriate definition of the marginal cost may be complex and hence using marginal costs as a benchmark may be inappropriate in certain contexts. In cases where significant excess capacity exists and where there are simultaneous high fixed costs, it is not in the WSPs interests to promote water conservation. In certain contexts, higher prices for non-residential consumption arising from the need and desire to cross-subsidise residential consumption may jeopardise the already fragile economic and institutional base and is not advisable.

10. Summary of recommendations

This section provides a summary of the recommendations as they relate to methodology, institutions and further research needs. (Policy recommendations have already been presented in Section 7).

Methodological recommendations

The recommendations made with respect to the methodology of pricing and price reform are summarised here.

No mechanistic method: A generalised method which can be applied in order to determine the appropriate price structures and tariffs in any specific urban area does not exist and is not desirable.

Political-economy context: The development of an appropriate pricing policy must be informed by both the national *and locally specific* historical, socio-economic and political-economic contexts.

What is, is: Pricing reform must start with the existing situation. Existing conditions have arisen for particular reasons that need to be understood. It is not possible to impose a uniform blueprint.

Decision-making: The appropriate pricing policy for a particular context cannot be decided on by an "impartial expert". The very real political-economy trade-offs integral to price reform must be made with reference to local political decision making processes.

Process: The following pricing process is recommended: (see Figure 3) (1) develop an understanding of the political-economy context at the country and city level; (2) develop consensus on equity, sustainability and efficiency frameworks that address the political-economic realities; (3) develop consensus on an appropriate and practical

set of indicators for equity, sustainability and resource efficiency; (4) develop explicit pricing objectives linked with measurable goals; (5) determine the price structure and set the price levels so as to achieve the defined objectives; (6) evaluate the impacts; and (7) refine the price structure and level. This approach emphasises the iterative nature of the pricing process whereby improvements are made so that the objectives are more fully achieved. The availability of practical measures whereby the extent of attainment of the specified objectives can be assessed greatly assists this incremental reform process.

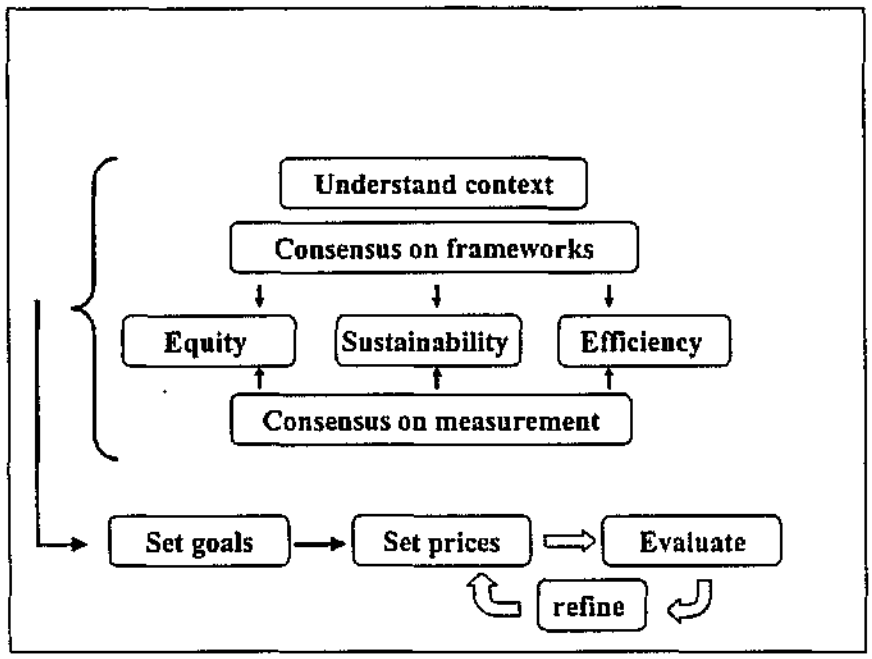

Figure 3: Recommended pricing process

Best practice principles: A set of best practice principles is proposed and their practical application discussed (see Section 8).

Data requirements: Specific data sets, which are necessary and/or desirable for use in the tariff reform process, are proposed (see main report). These data sets take the likely data limitations into account.

Practical performance indicators: A number of practical performance indicators are proposed (see Section 8). These indicators will allow the tariff reform process to be more transparent and enable progress to be more easily assessed.

Measurable goals: A set of measurable pricing and performance goals is proposed (see Section 8).

Estimation techniques: The use of sophisticated econometric estimation techniques is highly unlikely to yield meaningful results and is therefore not recommended for general application. On the other hand, descriptive techniques for analysing data are likely to be useful. Histograms and nonparametric density functions are likely to be useful tools. These do not impose theory on data form, allowing the "data to speak for themselves", and are particularly useful for examining issues related to distribution and inequality.

Financial modelling: Spreadsheet-based financial models are very useful for evaluating the impacts of alternative tariff structures and levels.

Tariff design: Practical guidelines for setting tariffs are given in the main report and have been summarised above. These are largely complementary to the existing *guidelines*. However some important amendments are proposed which are highlighted in the main report.

Subsidy design: An explicit process for quantifying, prioritising and applying subsidies is proposed (see Section 8).

Institutional recommendations

Governance: The governance structure for wholesale and retail water supply advocated in the Water Service Act of 1997 is endorsed in this report as an appropriate model for the South African context.

Ring-fencing the wholesale WSP function: The wholesale function undertaken by WSPs should be ring-fenced and a separate cost-centre established.

Separation of wholesale supply-systems: Separate cost centres should be established for different wholesale supply-systems.

Institutional support for third tier water management: It is recommended that consideration be given to the establishment of a small specialised "retail support agency" whose task would be to assist with institutional reform and provide specialist technical, economic and financial services to third tier WSPs. Such an agency could facilitate greatly improved water resources management amongst retail WSPs in all areas in South Africa through a strategic approach and is an improvement on the sole reliance on Water Boards to fulfil this function.

Amendment of the tariff guidelines for WSP managers: The existing *guidelines* should be amended to take into account the recommendations from this research project.

Learning by example: More emphasis should be placed on institutional learning through the communication of successes and failures in water management at the retail level. Successful examples of water pricing reform such as that achieved by Durban Water and Waste should be actively promoted.

Informative billing: Informative billing should be more actively promoted in addition to other important improvements to customer support, namely language capability, more accessible payment points and improved communication with consumers.

Areas for further research

Performance benchmarks for wholesale WSPs: Best practise performance indicators and standards are needed to enable the comparison of wholesale WSPs and to encourage greater efficiencies in wholesale WSPs.

Restricted on-site access: The options for (and technical, institutional, financial and social implications of) providing an intermediate water supply option between off-site access and unrestricted on-site access should be *more fully* explored. The innovations in this area undertaken by Durban Water and Waste, and their preliminary experiences

of using this technology, suggest that such an intermediate option has significant potential to fill an existing gap in the demand for water services.

Grey water disposal. The potential for creative intermediate solutions needs to be explored.

Water-use efficiencies and technology: There is scope for dramatic improvements in technical water-use efficiencies in all water using sectors in South Africa which will have significant social benefits. Public investment of funds into research and development in this area is therefore warranted.

Industrial water use efficiencies: Little work has been undertaken on industrial water use efficiencies and research into locally appropriate best practice standards for specific water use, specific effluent production and recycle ratios is needed. Available evidence suggests there is significant scope for improvement.

System efficiency. Further investigation should be undertaken into the implications of water management reform on overall system efficiency.

Focus on major industrial water users: A few industrial sectors use a very large share of total manufacturing water use. A specific focus on water use efficiencies and pricing in these sectors is therefore warranted.

Industrial effluent pricing policy: Research into effluent pricing policy is needed. The strong relationship between water intake and effluent production in manufacturing industries suggests that one consideration should be adding at least a portion of the effluent charge directly onto the price of water. An effective effluent pricing policy has the potential to reduce effluent volumes (and hence the costs of treatment), increase water recycling and reduce water consumption.

Location of new water using industry: The location decisions for new water using industry should be based on the costs of securing addition water supplies in the area and not on the existing average historic costs of water supply. This is particularly important where the marginal costs of extending supply capacity are high relative to historic costs. Practical and cost-effective methods of implementing such a policy need to be investigated.

Pricing in times of drought and plenty. This project has not addressed the question of pricing in times of drought and plenty in any detail. However, this issue was prominent in the Los Angeles case study. It is recommended that the Los Angeles pricing methodology be investigated further to ascertain its applicability to the South African context.