Guidelines for Economic Regulation of Water Services in South Africa

Palmer Development Group

Department:
Water Affairs
and Forestry

TT 229/04

Water Research
Commission

GUIDELINES FOR ECONOMIC REGULATION OF WATER SERVICES IN SOUTH AFRICA

Report to the
WATER RESEARCH COMMISSION

by

Palmer Development Group

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FOREWORD

"It gives me pleasure to present this WRC funded study on the economic regulation of water services. It comes at a very opportune time, as DWAF and the water sector seek to improve service delivery.

The objectives of regulating water services in South Africa are to:

* Promote equitable access and the public interest:
* Ensure sustainability
* Promote efficiency and effectiveness.

International experience has demonstrated that there are many challenges to be overcome before an effective regulatory framework can be established. A critical lesson is that all sector stakeholders should be involved in its development. This research should help to empower all those - from consumers to service providers - who have an interest in the development of a new regulatory system.

In South Africa, the water services sector is still dominated by public sector monopolies which are owned and operated either by national government (in the case of Water Boards) or by municipalities (most retail operations).

Historically, regulation of the water sector has focussed on the technical and environmental aspects of water services. It sought to influence service outcomes such as the quality of water supplied to consumers or the protection and conservation of ecosystems from the environmental impacts of wastewater systems.

Since 1994, greater attention has been paid to the regulation of services for public benefit, specifically with respect to the universal provision of basic services.

Although equally important from a sustainability point of view, less attention has been given to economic regulation to date. Yet much of the urban economy depends on the existence of effective services. And the water sector is in itself a significant and important industry in South Africa with an annual turnover estimated to be in the region of R10 billion. An overall efficiency gain of just 1% would result in a benefit to the country as a whole of R100 million per annum.

There are obviously strong links between social, technical, environmental and economic regulation in that they will influence investment requirements and operating costs in the sector. All four spheres of regulation must therefore form part of an integrated regulatory framework.

The research undertaken in this study of the economic regulation of water services in South Africa will therefore make an important contribution to the continued development of the sector."

Mr Mike Muller
Director General
Department: Water Affairs and Forestry

Preface

This report forms part of the Water Research Commission project titled: "Regulation of water services: models for South African municipalities." (K5/1383//3)

The project had two primary objectives:

1. To review relevant international experience related to the *economic* regulation of water services with a view to highlighting best practices which may be appropriate for South African municipalities.

2. To identify and develop appropriate and practical models and methods of economic regulation which are suited to the South African municipal water services context, and which cover the spectrum of ownership and contracting arrangements that currently exist and/or are likely to exist in the future.

A secondary objective of the project is to make economic regulation discourse more generally accessible to a broader audience in South Africa.

The aim of Phase 1 is to identify appropriate and practical models and methods of economic regulation. Phase 2 of the project will develop guidelines for the application of these models if appropriate.

The outputs of this project are as follows:

- Report 1: Economic Regulation of Water Services in South Africa (WRC 1383/1/04).

  Annexure A: Economic regulation of water services in Africa – a review.

  Annexure B: Economic regulation of water services in Australia – a review.

  Annexure C: Economic regulation of water service in Chile – a case study.

  Annexure D: Economic regulation of water service in Johannesburg – a case study.

- Report 2: Draft guidelines for economic regulation of water services in South Africa – (WRC TT229/04).

  Annexure A: Methods and tools for the economic regulation of water services – a review.

The project team comprised Dr Rolfe Eberhard (project leader), Mthobeli Kolisa, Gillian Sykes, Amiena Bayat, Mike Goldblatt and Mark Pickering of Palmer Development Group, Prof Anton Eberhard of the Graduate School of Business (University of Cape Town), Ahmed Mohammed (Economics Masters graduate and researcher at the University of the Western Cape) and Samuel Asfaha (recent Economics Masters graduate from the University of the Western Cape).

The assistance of the Mr Jay Bagwan (Chairperson of the Steering Committee) and all of the members of the steering committee is greatly appreciated. The committee comprised: Mr B Jackson (DBSA), Ms M. Snyman (DPLG), Mr P. Pybus (consultant), Mr D. Ramsay (City of Cape Town), Mr F. Sherrif (Tshwane), Dr J. Leigland (MIIU), Mr. H Sussens (DWAF), Ms S. Muravan (DWAF), Ms C. Kere, (CMU, City of Johannesburg), Mr N. Macleod (Ethekwini), Ms K. Kassie (DPLG), Mr A. Still (Johannesburg Water), Mr J. Connolly (SAAUW) and Ms B. Pretorius (SALGA).

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1. Introduction

Purpose. The purpose of this guideline is to set out a draft practical methodology for the application of *economic* regulation to water utilities in South Africa. This guideline only related to *economic* regulation. For discussion of how economic regulation related to other areas of regulation, see the Final Report listed in the Preface.

Rationale. To date there has been little rigorous thinking concerning the application of economic regulation to water services in South Africa. The most obvious starting point for the application of economic regulation is for financially ring-fenced water services providers. (Application of meaningful economic regulation of water services in the absence of financial ring-fencing[1] is to all intents and purposes impractical.) The development of a draft guideline which sets out a practical approach to economic regulation of water utilities would serve to stimulate thinking and meaningful debate in the sector. This guideline could be used as a starting point should any water services *regulator*[2] (either at a national or local level) wish to commence with the implementation of economic regulation. The recently approved national Strategic Framework for Water Services (DWAF, 2003) clarifies the regulatory framework for water services and raises the profile of economic regulation. The development of this guideline is therefore timely and it is hoped that the guideline will assist in the development of economic regulation in South Africa.

Scope of application. This guideline is intended to be used as a starting point for the application of formal economic regulation to a ring-fenced public water services provider. The guideline does not deal with contract regulation (for example, the regulation of concession or lease contracts). The guideline is also applicable to water utilities which are partly (or fully) privately owned *and* who are not providing services in terms of a time-limited concession or lease contract.

For discussion only. This guideline is intended to be a *draft* to stimulate discussion on the subject. It is not intended that this guideline be used in its present form. Rather, it is intended to provide a basis for further thinking and debate. Before this guideline could be used in practice, it would need further detailed work in many respects (as indicated in the body of the guideline). At that stage, the guideline also should be made public with a view to obtaining public comment and inputs.

Sources. This guideline has drawn extensively from the following sources:

- The Regulatory Framework for the Economic Regulation of the Electricity Supply Industry of South Africa (Discussion document, 29th July 2002; Summary of

[1] The term "Ring-fencing" refers to an institutional and financial accounting set up where it is possible to accurately determine costs and revenues directly related to the water services provision activity and to clearly, systematically and transparently distinguish these from other activities not directly related.

[2] That is, the person, government body or agency that undertakes the regulatory function. The term "regulator"" is synonymous with the term "regulatory authority" and is preferred for two reasons: it is used widely internationally and it makes for easier reading.

written responses received, 2 May 2003) available on the NER web-site (www.ner.org.za).

- The information and knowledge gained in this research project.
- Relevant international literature as referenced in this guideline.

The study team is particular indebted to the first source (which has been used as the point of departure for this guideline) and has also benefited from discussions with people who have been (and are) directly involved in the *practical application* of this regulatory framework with respect to the rate of return regulation of Eskom during the last two years, including the October 2003 price review.

2. Context

2.1 Policy context

The policy framework within which the economic regulation of water services is to take place in South Africa is clearly set out in Section 7 of the national Strategic Framework for Water Services which was approved by Cabinet in September 2003 (DWAF, 2003). The key features of this framework as they impact on economic regulation are summarized below:

- The constitutional responsibility for water services rests with local government (water services authorities) who are the local regulators of water services.
- The Department of Water Affairs and Forestry is the national regulator of water services.
- Formal economic regulation of water services will only be realizable where there is an arms-length relationship between the regulator and the water services provider (the institution which accepts operational responsibility for the provisions of water services).
- The institutional reform process set out in the Strategic Framework (particularly as it applies to regional water services provision and providers, including water boards) will have important implications for how economic regulation is practiced in the future.

2.2 Rationale for economic regulation

Water services (when directly associated with a piped water distribution network) is a natural monopoly service with high fixed costs relative to variable costs and with reducing average costs due to economies of scale. In this context, provision of water services by a single network operator (in a geographic area) is more efficient than provision by more than one operator in the same area (as this would require the inefficient duplication of an expensive infrastructure network). For this reason, water

services are provided by monopolies. In South Africa, water utility[3] monopolies take three principal forms:

- State-owned, autonomously-managed bulk water utility;
- Municipal owned, autonomously managed water utility; and
- Municipal owned and run water utility.

State-owned bulk water utilities and municipal owned, autonomously managed water utilities have incentives to over-capitalise and to set prices above economically efficient prices. On the other hand, municipal owned and run utilities are under direct political pressure to keep prices down and hence are more likely to under-invest and set prices below economically efficient prices. In both cases, economic outcomes are inefficient and economic regulation is necessary to promote greater efficiency in investments and ensure efficient pricing.

2.3 Regulatory objectives

According to the Strategic Framework for Water Services (DWAF, 2003), "The overall objective of [water] regulation is to protect consumer and public interests by:

- Ensuring compliance with minimum national norms and standards;
- Ensuring good performance and the efficient use of resources; and
- Ensuring good contracting practice."

The specific objectives of *economic regulation* are to promote the efficient use of resources through promoting or ensuring efficient investments and operations and ensuring appropriate pricing. It is important to note that economic regulation and standards regulation are highly interconnected because standards directly affect service costs.

2.4 Approaches to regulation

The possible approaches to the economic regulation of water services are discussed in Annexure A (Methods and Tools). In addition, the experience of regulation in Australia and Chile are instructive (See Annexures B and C of WRC 1383/1/04). In the light of these reviews, three approaches to economic regulation are addressed in this guideline:

- **Rate of return regulation**: An understanding of allowed expenses and the appropriate rate of return on assets and equity within a specific context is an important foundation for any form of regulation undertaken. For this reason alone, it is important to develop a detailed understanding of rate of return regulation and how it might be practically applied.

[3] The term "water utility" or "utility" is synonymously used in preference to the term "water services provider" because the term water utility is widely used internationally and because it makes for easier reading.

- **Incentive-based regulation (Price path)**: The differences between incentive-based regulatory approaches and rate-of-return regulation are often exaggerated. Any incentive-based regulation should be built on an understanding of allowed expenses and an appropriate rate of return. In this guideline, incentive-based approaches are discussed as a point of departure from rate-or-return regulation.
- **Ideal model regulation**: The Chilean model of regulation (in which an ideal model company is postulated) is worthy of further exploration in the South African context. For this reason, this approach is also addressed in this guideline.

The following forms of regulation are not considered in this guideline:

- **Yard-stick competition regulation** is not considered to be able to provide an effective form of economic regulation in the South African context and is therefore not considered here.[4]
- **Contract regulation**. The economic principles contained within contract regulation draw on the same core principles contained within rate of return regulation and incentive-based regulation. Beyond this, the specifics of regulation relate to the nature of the contract (concession, affermage, lease, management) and the specific local institutional context.[5]

2.5 Separating out social and economic provision

There is a perception in South Africa that the provision of water is predominantly a social service. This has been used to argue that the economic regulation of water services is inappropriate and unnecessary. This argument is misleading for two reasons:

- The provision of water up to about 50 litres per person per day (lcd) can be considered to be a social service in terms of the public health benefit to be derived from water services (Gleick, 1997). (In South Africa the first 25 lcd are provided free on charge in terms of a national free basic water policy.) It is these first 50 litres of water per person per day which are both essential and sufficient for life and for maintaining a healthy living environment (Gleick, 1998). Beyond this, the provision of water for domestic use (over and above the 50 lcd) may be considered to be a private benefit and this and all other non-domestic uses of water could be considered to an economic service (World Bank, 1992). Water provided in terms of an economic service should be subject to economic demand and willingness to pay. A very significant portion of the water sector can therefore be considered to be an economic service which should be subject to economic regulation given the monopolistic provision of this service.

[4] The lack of effectiveness of yard-stick regulation as applied to the municipal-run electricity industry in South Africa is instructive in this regard. So also is the experience of regulating local governments in Australia (See Report 1).

[5] Contract regulation has been widely used internationally where private operators have become involved in the provision of water services. See, for example, Klein (1999). This is not unique to the water sector. See, for example, Bakovic *et al* (2003). This study did not address contract regulation.

- Programmes to deliver “social water services” are made more secure and cost-effective if the utility is given appropriate incentives to operate more efficiently through economic regulation.

When undertaking the economic regulation of water services it is important to account separately for the economic and social components of the service. This means that the subsidies applied (whatever their source) should be properly accounted for. The best way of doing this is to treat the business as a whole as if it were an economic business, and then to apply subsidies in a clear and transparent way to address the social objectives within the service. Using this method it is still possible to apply cross-subsidies through pricing policy. The key difference is that the social objectives of these pricing policies are made explicit.

3. Rate of return regulation

3.1 Overview of the methodology

Rate of Return (ROR) regulation seeks to limit excessive prices (applied by a monopoly utility) while at the same time allowing the utility (and its investors) sufficient revenue to operate, maintain and extend infrastructure and to make a return on their investment which is appropriate to the risk profile of the utility. It allows the utility to cover its expenses (directly related to the regulated business), plus a prescribed rate of return on capital. In the initial period, regulation is typically undertaken on an annual basis to allow for an improved determination of the required cost and revenue adjustments. In time, a rate regime could be set for a period of years with automatic adjustment factors.

> *Under pure rate-of-return regulation, a company is guaranteed an agreed rate of return on capital and its prices are adjusted as required to ensure that this rate is earned. In this situation, the company bears very little risk as any unforeseen costs can quickly be passed on to customers. Due to the lack of risk, the agreed rate of return can be fairly low and prices to customers can be kept down.*
>
> *In practice, however, rate-of-return regulation is not this straightforward or free from risk. Price adjustment reviews, although frequent, do not allow instantaneous cost pass-through and the company is exposed to some risk. The rate-of-return system encourages over-capitalisation by companies, as allowable profits are directly related to the size of the capital base, and regulators in the United States have responded to this by disallowing (for regulatory purposes) any capital expenditure seen to have been imprudently incurred.*

> *The need for regulatory approval adds to investment risks, particularly if the regulator cannot pre-commit to including the asset in the capital base. If investors feel that they are not assured of gaining a return on their investment, a higher allowed rate of return will be required on projects that gain approval so that the ex ante expected rate of return is sufficient for funds to be obtained. (Alexander et al, 1996)*

One of the main drawbacks of this methodology is the poor incentives to reduce costs. The allowed revenue is sufficient to cover all costs, regardless of whether they were incurred efficiently or inefficiently. There is therefore an incentive to overstate both costs and assets, and also to over-invest in their assets.[6] The regulator can, however, create incentives to improve operating efficiency in the way that it deals with allowed expenses.

The total amount of revenue which the utility is allowed to earn can be determined using the following formula :

Revenues = Operating expenses + Depreciation + Taxes + (asset base x Rate of Return) [1]

Alternatively, this can be restated as follows:

$R = E + (V - d + w)\, r$ [2]

Where:

- **R** = the required revenue of the regulated entity
- **E** = the expenses including depreciation and taxes
- **V** = the value of the qualifying property, plant and equipment
- **d** = the accumulated depreciation on qualifying property, plant and equipment held by the regulated entity
- **w** = the allowance for working capital held by the regulated entity
- **r** = the calculated rate of return using the weighted average cost of capital (WACC)

The expenses include all expenses that are directly or indirectly incurred in the regulated business (the treatment, supply and distribution of water, and collection and treatment of wastewater, as the case may be). This would mean that any expenses that are not necessary in order for the utility to fulfil its necessary obligations (in terms of its core business) should be excluded from the allowed expenses.

The prescribed rate of return is applied to the utility's "rate base" which is the sum of the productive fixed assets directly employed for the purposes of undertaking the regulated business (property plant and equipment) and the necessary working capital.

[6] This is known as the Averch-Johnson effect or gold-plating.

The return is calculated using the weighted average cost of capital (WACC), which is an average cost of capital determined by the cost of debt, the cost of equity and the debt-equity ratio. (The WACC is described in section 3.2.6.)

The required tariffs are determined on the basis of the calculated revenue requirement and forecast demand. The rate of return regulation usually specifies an average percentage increase (or decrease) in tariffs allowed for the following year. This percentage is then applied across the different tariff structures. Tariff structures are also regulated (through a separate process).

3.2 Guidelines for application

3.2.1 Establishing the rate base

The rate base is defined as follows:

> *All productive assets employed by the utility in fulfilling its regulated core-functions including the storage, treatment and distribution of water, the collection and treatment of wastewater and the associated business processes. This includes used and usable property, plant and equipment which are necessary for the utility to fulfil its regulated core functions and an allowance for working capital.*

It is important to note that the definition restricts the rates base to "used and usable" fixed assets. Assets which have been constructed but which are not being used are therefore excluded from the calculation.[7]

For the purposes of rate of return methodology, it is the *value* attributed to the rates base that is important (see formula [2]). The value of the rates base is calculated as the sum of the value of the fixed assets plus a working capital allowance.

If the value of the assets is over-stated, then is goes without saying that the revenue received by the utility will be higher than is appropriate for a given rate of return, and *vice versa*.

Principles typically used for calculating the rates base suggest the adoption of the following approaches:

Historical cost basis. The most objective method of measuring the value of an asset is to use its historical cost (which can be obtained from the audited financial statements of the utility) and this is therefore recommended as the preferred asset valuation methodology.[8]

[7] For example, in the case of the electricity industry, mothballed power stations are excluded from the asset base.

[8] The valuation of assets using the historical cost method is widely used in practice for rate of return regulation. This method is simple, easily understood and based on reliable and audited information. The method complies with standard accounting conventions. The asset is recorded in the asset register at its purchase price which does not change over time. A disadvantage of this approach is that the economic value of assets is overstated during periods of significant technological change. However due to the slow-rate of technological change in the water and sanitation sector, this is unlikely to be a factor. The major disadvantage of the historical cost method is the risk of assets being understated

Depreciation. Depreciation is calculated on a straight-line basis over the useful economic life of the various components and types of assets.

Capital work in progress is capitalised as the expenditure is incurred and added to the rate base.

The rate base also includes an allowance for *working capital*, which is required to finance the time delays in the cycles of payment of operating expenses, and the receipt of income from customers. The shorter the receipt cycle and the longer the payment cycle, the greater the benefit to the utility. The utility should ensure that it has sufficient (but not excess) working capital to cover the net time delay in the payment of expenses and the receipt of income. The required working capital should also be adjusted for changes in stock. For example, if an increase in stock if planned, then the working capital requirement should be increased accordingly.

Guidelines:

1. *Fixed assets should be long term (fixed) in nature and should be "used and usable"*.
2. *Used and usable means that assets should be in a condition that makes it possible to satisfy demand in the short term*.
3. *Assets should be depreciated over their useful economic lives, based on historical cost and on a straight-line basis.*
4. *Capital work in progress is capitalised as and when construction costs are incurred*.
5. *Working capital is calculated as follows: total revenue x 60 days / 365 less operating costs x 30 days / 365 plus net change in the value of stock.*

3.2.2 Alternative methods of valuing the fixed assets

There exist alternative methods of valuing fixed assets (property, plant and equipment. These include current cost (or replacement cost) and the optimised deprival valuation (or optimised depreciated replacement cost) methodologies. These are not considered to be appropriate for use in the water sector because of the difficulty in estimating current asset values and the inherent subjectivity involved these methods.[9]

3.2.3 Calculating depreciation

The two primary methods of calculating depreciation are the straight-line basis and the diminishing balance method. Straight-line depreciation depreciates the asset over a fixed period at a constant nominal amount. When using the diminishing balance method, the depreciation is calculated on the net book value, which is decreasing over time. The diminishing balance is not used as extensively as the straight-line method. For historical

during periods of high inflation. The appropriate basis for valuing assets in the water industry is widely debated internationally and this debate should inform South African practice.

[9] For a discussion of alternative asset valuation methodologies, see NER (2002). For an explanation of the Optimised Deprival Valuation methodology, see Ministry of Economic Development, New Zealand (no date).

valuation, depreciation is usually over a fixed period, in equal nominal amounts, that is, on a straight-line basis.

3.2.4 The rate of return on assets – considering risk

Any person who invests capital expects a return on his/her investment. The rate of return is the compensation (return) received by the investor expressed as a percentage of the amount invested. There is general consensus in the economic and financial literature that there is a direct relationship between investment risk and the expectation of reward from that investment. Hence it is necessary to understand risk when determining an appropriate rate of return for investments in the water sector.

The important elements of risk that need to be taken into account are as follows:

- "Risk free" returns on investments, and the behaviour of these over time.
- Market risk, and how this relates to risk-free investments.
- Systemic industry risk (risk inherent to the specific industry) and how this relates to market risk.
- Non-systemic risk (risk specific to a local industry context) and how this relates to systemic industry risk. For example, Force Majeur and external or political risks.

It is necessary to understand these risks in order to ensure that the rate of return is set at a level which sends the correct signals to potential investors for the regulated utilities. If the rate of return is too low then investors will not invest in the utility. If the rate is too high, then the price of water will be higher than necessary leading to "super profits". In both cases there will be a sub-optimal allocation of resources.

3.2.5 The risk-free rate of return on capital

The risk-free rate of return on capital is an important input into calculating the cost of both equity and debt which are discussed below. The risk-free rate is generally determined on the basis of the average yields on long-term government bonds. In the literature on regulation there has been considerable debate over the extent to which current or historic yields on index-linked bonds are the most appropriate measure of the risk-free rate. Therefore opinions differ with respect to how to determine the risk-free rate. Some use short average yields over one to one-and-a-half years to capture current performance and views on inflation, while others use long-term historic yields over five years. The use of long-term yields is intended to smooth out the greater fluctuations that occur over shorter periods.

The NER has used the R153 South African government bond as the proxy for the risk-free rate of return. More specifically it has calculated the rate of return as the three-year monthly average realised yield on this bond. The three year period is considered inappropriate given the volatility in the financial markets in South Africa and a five-year period is recommended instead.

Guideline:

6. *The 5-year monthly average yield on the R153 should be used as a proxy for the risk-free rate.*

3.2.6 Weighted average cost of capital

A standard methodology for calculating the appropriate rate of return has been developed and is widely used in the financial sector. This methodology is called the Weighted Average Cost of Capital (WACC) methodology.

The WACC provides an estimate for a utility's cost of capital (rate of return on assets or investments), based on a set of generic and utility-specific parameters. These include the cost of equity, the cost of debt, the tax rate (if applicable) and the capital structure.

The assets of a company are financed by a combination of debt and equity. WACC is the average of the cost of each of these sources of finance, weighted by their respective usage in the given situation. This may be expressed as follows: (after Cooper, 1999):

WACC = Proportion of debt x after-tax[10] cost of debt + proportion of equity x cost of equity. [3]

Alternatively:

$$WACC = r_e \frac{E}{E+D} + r_d \frac{D}{E+D} \quad [4]$$

Where:

- r_e = the expected rate of return on equity capital
- r_d = the expected rate of return on debt capital
- E = the book value of equity capital held by the firm
- D = the book value of debt capital raised by the firm

A utility's WACC is a proxy for the overall return on capital (assets) for the utility as a whole. If a utility's allowed ROR is greater than the WACC, then the utility is considered to be making above normal ("super") profits, and vice-versa. If the utility is subject to company tax, then equation (4) should be adjusted to reflect after tax returns. As described in equation (3).

[10] If applicable.

Guideline:

7. *The weighted average cost of capital methodology should be used to calculate the appropriate rate of return on assets.*
8. *The current capital structure should be used when calculating the WACC, excluding non-allowed assets (see below).*
9. *The regulation methodology should seek to build in incentives for a utility to move from its current capital structure to an agreed optimal capital structure over time.*[11]

3.2.7 Cost of debt

South Africa has a well developed market for debt instruments including an active bond market. It is considered appropriate that water utilities use established government bonds as the benchmark for risk-free debt. The appropriate benchmark in the South African context is the R153 bond.[12] Nevertheless, it is unlikely that water utilities will be able to raise debt at the risk-free rate. Hence it is appropriate to determine an appropriate debt premium.[13] This debt premium would need to be agreed to through a dialogue with industry players and taking note of the fact that the debt premium of regulated firms is likely to be lower than that of non-regulated firms, due to both the protection provided by regulation and the limited competition faced by regulated firms. In New South Wales, IPART use a debt premium of 0.8 to 1 percentage points which was based on margins achieved in debt issues at that time. In South Africa, one approach might be to use DBSA's lending rate to premier clients as an indicator and calculate the debt premium as the difference between this rate and the risk-free rate.

When calculating the cost of debt and the debt premium, the appropriate time-frame of analysis needs to be considered. The NER has used the historic three-year monthly average yield of the R153 for calculating the risk-free rate. Some commentators have

[11] "One of the issues involved when determining the gearing level is whether an optimal gearing level or actual/projected gearing levels should be used as inputs. Firms with too low a level of financial gearing might carry too high a cost of capital and hence in their view optimum gearing levels should be established. Although the CAA shares the view that the firm's capital structure is important in calculating its cost of capital, the CAA is not aware of any satisfactory model indicating what the optimal capital structure would be." (CAA, 2001)

[12] This bond is used as the proxy for the risk-free rate by the NER (2002) and appears to have been widely accepted in the industry as no comments on this benchmark were received (NER, 2003.)

[13] This is consistent with international experience. See, for example, CAA (2001): Financial markets demand a premium on corporate debt over equivalent gilts to allow for the greater risk of default on corporate debt. The cost of debt is the incremental cost of debt, i.e. not the existing debt. It is necessary to take into account the incremental cost of raising debt as existing debt may have been contracted when interest rates were different." From IPART (2003): "Regulatory decisions in Australia have generally determined the cost of debt as a margin over the risk free rate, while the cost of equity is calculated using CAPM." From Consigna (UK postal service): "The debt premium is perhaps the most straightforward of all parameters to estimate using objectively verifiable data. At the time of writing, Consignia was borrowing from the National Loans Fund at various rates equal to AA-rated corporate bonds. The average *nominal* cost of debt is about 5.8 per cent. For expected inflation of 2.5 per cent, the real effective interest rate is about 3.3 per cent. Assuming a forward-looking return on debt of the risk-free rate of 3.0 per cent, the debt premium for Consignia is about 0.3 per cent."

suggested that this period is too short and it might be more appropriate to use a five year period.

Guideline:

10. *The cost of debt should be calculated as the risk-free cost of debt plus a debt premium.*
11. *The historic five-year monthly average of the realised yield of the R153 bond should be used as the proxy for the risk-free cost of debt.*
12. *The debt premium should be based on the difference between the five-year (?) average of the monthly interest rate (offered by DBSA to its premier clients) and the risk-free rate.*

3.2.8 Return on equity - the capital asset pricing model

The capital asset pricing model (CAPM) is a widely used and accepted methodology for estimating the return on equity. For example, the CAPM is applied by regulatory agencies to determine the return on equity for regulated industries in Australia, Canada, the USA and the UK.

The CAPM provides a methodology for measuring risk-spreads and relating these risk-spreads to an appropriate return on assets. The methodology measures the correlation between distribution of returns on assets for a specific company (or group of companies) with the distribution of returns for the market as a whole. This gives a measure of the relative risk exposure for specific firms (or groups or firms) relative to the market as a whole. From this a risk premium is derived. This risk premium is known as the Beta co-efficient.

For publicly owned companies for which there is no share price, there is no direct means of assessing the equity or asset-beta value through the standard CAPM approach. However, a determination of the appropriate beta value can be made from, amongst other factors, consideration of regulatory precedent, the characteristics of the utility and the environment in which the utility operates that affect the correlation between utility risk and overall market risk.

The CAPM is based on the following approach: (1) determine what an investor can expect to earn on the market as a whole, (2) evaluate the utility's risk premium (compared to overall market risk), and (3) use the risk premium to adjust the investor's expected return to reflect the utility's risk. This can be represented as:

$$R_e = R_f + ß_e (R_m - R_f) \quad [5]$$

where:

R_e	=	return on equity
R_f	=	risk free rate as observed in the market
R_m	=	market rate of return
$R_m - R_f$	=	market risk premium
$ß_e$	=	equity beta measures the correlation of the asset's risk to the overall market

However there is considerable uncertainty surrounding the validity of the data used in calculating the cost of equity. This is partly due to the fact that proxies have to be used to calculate the main variables in the CAPM, which may be inadequate. The volatility of the base data is another problem. The CAPM is based on expected returns, however only past returns are observed. Therefore, variables such as beta are based on average past returns, the idea being that past returns will on average equal expected future returns. In calculating the CAPM this raises two issues: (1) how to calculate average returns from historic data and (2) are past returns on average a good measure of expected returns? This will be discussed further under the section on expected market return.

Guideline:

13. The CAPM should be used to calculate the cost of equity

Note: There are also alternative methodologies for calculating the return on equity. However, these are not considered to be appropriate.[14]

3.2.9 Return on equity - expected market return

The market risk premium is what investors expect to earn over and above the risk free rate in order to compensate for the additional risk of not investing in risk-free bonds. The market risk premium is a market-wide parameter and is not affected by firm-specific or industry-specific factors. As expected returns cannot be observed, past returns are generally used as a proxy for future returns, in order to obtain an estimate of the expected market return, or market risk premium.

The All Share Index (ALSI) of the Johannesburg Stock Exchange is used in South Africa as a proxy for measuring the market portfolio. Expected market returns are based on the historic performance of the ALSI index to determine the market risk premium.

The market premium is generally calculated over a number of years usually using the average of returns on the ALSI. The NER originally recommended a 3-year monthly average return, but has changed to a 20-year average return.

[14] Alternative methodologies include the Dividend Growth Model and Price/Earnings Ratios which rely on the availability of information on a firm's share price or dividend payments. Because such information in not available in the case of water utilities in South Africa, these methods cannot be used.

Whichever method is used to calculate the expected market return, it is important that there is agreement on this method.

It should be noted that when calculating average returns, the arithmetic average should be used if expected returns are constant and the estimation period is long. However the arithmetic returns might be misleading when returns vary significantly between periods. The arithmetic mean is always larger than the geometric mean, therefore the arithmetic average might be overstating expected future returns over long periods of time. The more volatile the sequence of returns, the greater the difference between the geometric and average mean return will be. It has therefore been argued that the geometric average is a better measure when taking the long-term perspective.[15]

Guideline:

14. *The All-Share index (ALSI) quoted on the Johannesburg Stick Exchange should be used as a proxy for calculating the expected market return.*

15. *A 20-year geometric average monthly performance should be used in determining the expected market return.*[16]

3.2.10 Return on equity – accounting for industry-specific risk using the equity beta

(This is a technical topic and could be skipped by a lay reader. In practical terms, a discussion on equity betas in the South African context is probably premature as the calculation of an equity beta in the water industry in South Africa is unlikely to happen in the short term. Nevertheless, this section is included for completeness.)

The standard measure of firm or industry risk is the equity beta. This is an adjustment to the market risk premium based upon the risk perception for the firm or industry in question, that is, it measures the non-diversifiable risk of the firm or industry. Non-diversifiable or systematic risk that cannot be diversified even in a well-balanced portfolio is measured by beta. It is a measure of the firm's (or industry's) risk profile in comparison to the market as a whole. A beta of 1 means that the firm's (or industry's) risk is the same as the market risk. A beta of 0.8 means the return from a firm or industry has 20% less risk than the market as a whole while a beta of 1.2 means the firm or industry has 20% more risk than the market as a whole. That is, a beta of less than 1 implies a lower variability of earnings for the firm or industry compared to the market as a whole and a beta of more that 1 implies a greater variability of earnings for the firm or industry compared to the market as a whole.

It should be noted that that betas have a large multiplier effect in the calculation of WACC. Great care should therefore be taken in establishing appropriate betas for water

[15] Research by Campbell cited by the CAA, shows that under the assumption of constant long-term growth of the economy, the geometric average return on US equity would no longer be 7% but rather would be in the 3.7% - 4.7% range.

[16] The international financial literature has shown that market returns have remained remarkably constant over decades (The Economist, December 1999 – Millennium edition). An appropriate time horizon for the South African context will need to be determined.

utilities. In particular, there should be widespread agreement on the *method* for determining the water industry-specific beta.

When determining betas it is important to take note of two factors influencing betas, namely:

- Systematic factors which are inherent to the nature of the industry as a whole (and not likely to differ much between countries); and
- Non-systematic factors which are country specific and affect the risk-exposure of the industry.

Examples of the latter include the political and policy context (for example, the credibility and independence of the regulator; and the prospects for market and institutional reform in the particular local context).

It is also important to bear in mind that the regulatory methodology employed will have a significant influence on the determination of the industry-specific beta. For example, the betas for the water industry in the US and the UK differ quite significantly, with lower betas in the US (0.29) compared to the UK (0.7 to 1.0).

With respect to the impact of regulatory approaches on industry risk and hence betas, Alexander (1996) notes that:

> *Regulatory regimes can be classified according to the strength of cost-efficiency incentives: RPI - X and revenue-cap regimes involve high-powered incentives, rate-of-return regulation is low-powered, while European discretionary systems are classed as intermediate.*

And further that:

> *Both the sector averages and the overall [regulator] regime estimates show a clear trend: high-powered incentives appear to be related to higher systematic risk, while low-powered incentives imply low market risk.*

Table 1: Asset betas for water industry by regulatory regime

Efficiency-incentives	Average betas
High-powered	0.67
Intermediate	0.46
Low-powered	0.29

Source: Alexander (1996)

Cooper (1999) comments that:

Regulatory systems cannot eliminate risk, they can only reallocate it. The US system puts a large amount of risk on customers by guaranteeing rates of return to investors. Investors in the UK appear to believe that they will bear almost all of the risk, which means that the beta of the horizon value could be quite large.

Increased competition in a sector will also result in greater profit volatility, which should result in a higher beta figure. A World Bank study (Alexander, 1998) concluded that firms regulated by price caps should be permitted to earn higher returns. If they are not, they will be unable to attract new investment capital and the quality of their service will decline.

The chosen regulatory model will therefore also have an impact on the calculation of betas in the water industry.

When estimating betas it is also important to bear in mind the distinction between asset and equity betas. (The relationship is shown in formula 6 below.) Equity betas are (or should be) calculated for the equity component only. That is, the effect of gearing on the overall return on the capital employed in a firm should be taken into account. (For example, a high gearing increases risk and hence the pure equity beta is likely to be higher than for the same firm with a low gearing.) Asset betas are calculated based on the returns to the total capital employed by a firm. This is also influenced by the gearing of the firm.

$$\text{Asset Beta} = \text{Equity Beta} \times (1 - \text{Gearing}) \qquad [6]$$

Table 2: Asset and equity betas for New South Wales

Betas for water utilities	Average betas
Equity beta	0.65 – 1.02
Asset beta	0.30 – 0.45

Source: IPART (2002)

When determining betas for the South African water industry, the following distinctions need to be made:[17]

- The sale of raw water by DWAF to municipalities has a particularly low market risk attached to it and hence this beta should be low relative to the beta's for other sectors of the water industry.
- The wholesale of water to other water services institutions is also a low risk business and the beta for this business would be lower than the beta for an integrated source to tap utility or a retail water services utility.

[17] Some work on Betas for the South African water industry context was undertaken at the time of the establishment of Johannesburg Water. This work should be taken into account when establishing local water betas.

- The retail water business carries the largest risk which arises from customer debt risk and hence it would be expected that the beta for an integrated or retail business would be higher than that for treated and raw water wholesale.

Guideline:

16. The methodology for determining the appropriate equity-beta for the water industry should be developed through a widely consultative process and take into account the systematic and non-systematic industry-specific risks in the South African context which are relevant to the particular type of industry structure and regulatory regime imposed.

3.2.11 Return on equity – the influence of ownership

The appropriate return on equity in the context of public ownership of water utilities needs to be specifically considered. For example, the water boards were set up as state-owned enterprises with no return on equity required.[18] In place of a return on equity going to government, the price of electricity and water was kept lower, that is, the return on equity was passed on to consumers in the form of lower prices. This raises as important question: when introducing formal economic regulation to a state or municipal-owned enterprise, what is the appropriate return on equity? Should this be calculated in the same way as for private equity using the methodologies describe above?

There are three main alternative approaches:

- **Apply a zero rate of return on public equity**. This has been the approach used in South Africa for Eskom in the past (pre-1987) and the water boards. The argument underpinning this approach is that the infrastructure providing the service should belong to the consumers of the service and hence the dividends arising from investment in capital should be passed on to consumers in the form of lower prices. The argument against this approach is that the prices arising through this form of regulation are lower than the true economic (opportunity cost) prices. Hence the resource tends to be over-used and too much capital is invested than would be the case if the relative prices reflected the true opportunity cost of capital. A further disadvantage of this method is that the benefits accruing to consumers are skewed in favour of large consumers, leading to inequitable outcomes. That is, the larger the consumption, the greater the benefit received in the form of lower prices. This disadvantage can be corrected through the proper application of progressive pricing policies.[19]

[18] The model was similar to that of Eskom prior to 1987. This change with the 1987 Eskom Act which says that "the electricity needs of the consumer may be satisfied in the most cost-effective manner, subject to the resource constraints and the national interest". That is, there was no longer a prohibition on making a profit. Eskom did make profits, primarily in the form of retained earnings. Once Eskom was corporatised it was expected to make a profit.

[19] It should be noted, however, that progressive pricing policies often have unintended consequences in practice. See, for example, Whittington (1992).

- **Apply an equity rate of return appropriate to the risk profile of the utility** and use tax revenues to fund the social component of the service. The argument for this approach is that the prices arising from this method of regulation reflect the true opportunity cost of capital and hence this approach would promote the optimal use of resources. The social benefits of the service can be funded from tax revenues with allocation decisions subject to normal political processes. If this approach is followed, then the best of both worlds is attained: there is optimal allocation of resources and the allocation of public benefits are decided through a political process. This option can be more progressive than the first option in the way that public benefits are allocated. However, this is dependent on national taxation and subsidy policies.

- **Apply a social rate of return on public equity**. This method was introduced by DWAF in its raw water pricing policy which required a 4% real rate of return. (Although it could be argued that the 4% real return is hardly a social rate.) This is an in between approach. It could be viewed as combining the worst of both worlds. It does not result in the correct price signals which take into account the true opportunity cost of capital and it does not pass on the full benefits either to consumers (through lower prices) or through a "redistribution of the dividend".

In the light of the above discussion, the second approach is the preferred approach *provided that the appropriate taxation and subsidy allocation policies are in place for the funding of the social component of the service*. This raises the question of the transition from current practice to preferred practice. Where this would result in significant increases in prices, it is recommended that the approach be phased in.

Note: These approaches have important implications for public finance. The *guidelines set out below are tentative* and need to be debated thoroughly prior to adoption.

Guideline:

17. *The appropriate risk-related equity return should be used for the purposes of calculating the rate of return on public equity, that is, the CAPM.*

18. *Taxation (national taxes and local property taxes) and the allocation of subsidies at the national and local levels are the appropriate mechanisms for providing for the social component of the water service.*

19. *The transition from current practice to desired practice in terms of the above guidelines should be phased-in where this would result in significant price increases.*

3.2.12 Regulated expenses

Operating expenses account for a significant proportion of total annual expenses. Effective regulation of these expenses is therefore very important

Allowed expenses. In determining the operating costs to be included in calculating the revenue required by the regulated utility, it is important to establish clear guidelines as to what expenses may be included in calculating a reasonable price to be paid for that water. There needs to be agreement as to which costs are excluded, and which can be included

when determining the cost of supplying water. The cost of supplying water will include operating and maintenance costs, labour, energy, chemical, general expenses and depreciation costs. Where there is disagreement between the regulator and the utility with respect to allowed expenses, there needs to be clear procedures for resolving the dispute. A resource variability analysis (REVA) can be used to determine if any input costs are out-of-the ordinary and warrant further investigation and analysis.

Regulated and unregulated activities. It is necessary to separate the regulated from the unregulated activities of a utility. Where there are regulated and unregulated activities within a single utility, there is a risk of cross-subsidy between businesses through transfer pricing. This is likely to disadvantage the customers of the regulated business. True economic regulation is only possible where an accounting framework is in place which clearly delineates the true costs of the service provided. Activity-based costing and ring-fencing of the regulated activity is therefore required. Transfer pricing will be a problem in the case of municipal water utilities where activities are not adequately ring-fenced and where the costs of shared services are not market related.

Transfer pricing, for example through the exclusive use of a sister company or subsidiary at above market rates, may lead to greater costs for the regulated business, and ultimately to higher bills for customers. To prevent this from happening, regulated utilities should put all contracts out to tender where possible, so the cost can be determined or "tested" by the market.

In the UK water industry, regulated utilities are responsible for ensuring that transactions between themselves and their associated companies are at arm's length, and that cross-subsidies do not exist. The accounts presented to the regulator are expected to make this transparent. Unfair transfer pricing is discouraged by the ruling that where cross-subsidies are found, base costs will be adjusted downward to ensure that customers do not pay more than they should.

The principles informing a "transfer pricing guideline" should include the following:

- The utility should pay a fair price for services and products received;
- Transfer prices for transactions between the regulated utility and their associate companies should be based on market price or less. Where no market exists, transfer prices are to be based on cost;
- Market testing should be used to establish market prices for supplies, works and services provided to the regulated utility; and
- Costs should be allocated in relation to the way resources are consumed.

Utilities should be required to demonstrate, through the application of these principles, the basis of arm's length trading and that cross-subsidies do not occur. Utilities should be responsible for developing open and transparent processes and procedures to suit their own circumstances, to ensure that transactions are supported and documented, and to retain records for audit purposes by the regulator.

Activity-based costing. Cost allocation is the means by which costs are divided between the regulated and non-regulated activities within the utility, and to specific products and services. The key principle is that costs should be allocated in relation to the way resources are consumed. Allocations based entirely on turnover, volume or direct labour rates should not be used as they are unlikely to reflect the activities involved.

Cost allocation should be done in such as way as to prevent regulated activities from cross-subsidising non-regulated activities. It is, however, recognised that not all costs will be driven by activities and that some subjective allocation will be necessary to arrive at the full cost. The principles governing this allocation should be clearly set out.

Social expenditure. Social investments and expenditure are excluded and should come either from dividends (under the direction of the shareholder) or from government tax revenues and subsidy allocations.

Research and development. Research and development expenditure needs to be scrutinised to ensure that the expense are directly related to the core function being regulated.

Claw-back of unexpended items. Where budgeted expenditure is not used, the following year's revenue determination should take account of this unused expense. This expense should be "clawed back".

Other adjustments. Claw-back is not only applicable to unexpended expenses but also to revenue adjustments as a result of adjustments to forecast volumes. This can be very significant and also controversial. However, this is necessary to incentivise a utility to accurately forecast its sales.

Surplus revenue sharing. Other options also exist, for example, partial claw-back and surplus revenue sharing arrangements.

Productivity improvement. The regulator should expect the utility to improve its productivity over time. Productivity improvements should be particularly significant when economic regulation is first introduced. It would be helpful for the regulator to determine an appropriate set of productivity indicators and to determine industry best-practice benchmarks for these indicators. On the basis of this, the regulator can set out a programme of productivity improvements expected of a utility over a multi-year period and use this to inform allowed expenditures. These should be reviewed on an annual basis.

Guideline:

20. Costing should be activity based;

21. Expenses should be incurred in an arms length transaction; where possible suppliers are treated equally without prejudice.

22. Expenses should be incurred in the normal operations for the regulated water services business inside the Republic of South Africa; the utility will be responsible for proving that expenses are necessary and justified;

23. *Expenses should be prudently incurred after careful consideration of available options.*
24. *Transfer pricing should occur at market rates;*
25. *The regulated entity will have the responsibility for justifying to the regulator that the expenses incurred conform to the above criteria.*
26. *The regulator should have the final discretion in allowing or disallowing an expense based on the above criteria. (The final decision is subject to an appeal process.)*
27. *The utility should, in its price increase application, highlight all transactions with sister companies and subsidiaries*
28. *Unexpended items should be clawed back in the next regulation cycle.*
29. *Allowed expenses should take into account expected productivity improvements.*
30. *A clear process for dispute resolution (appeal process) with respect to allowed expenses will be established.*

3.3 Recommendations

An understanding of rate of return regulation forms an essential basis for undertaking economic regulation in the water services sector. The NER experience shows that, even with a budget of R50 million per annum, it has taken the NER at least a couple of years to begin to get to grips with economic regulation using the ROR approach and to make headway in the application of the regulation methodology to Eskom Price reviews.

Because ROR regulation is such an important learning exercise, and because the development of effective economic regulation in the water services sector will necessarily be an incremental process, the following recommendations are made:

- The national water services regulator (DWAF) should become the custodian of the draft guidelines.
- This draft rate-of-return guideline be published for public comment.
- The draft guideline be revised in light of public comment.
- The revised draft guideline be used to implement rate-of-return regulation on a trial basis for two water boards (one large water board and one medium one).

4. Incentive-based regulation

4.1 Overview

A description of price-cap regulation is given in Annexure A and is not repeated here. Incentive-based regulation approaches have gained favour internationally because they

provide stronger incentives for efficiency gains compared to the rate of return approach to regulation. However, it is important to note that the ROR and RPI-X approaches are actually quite similar in many ways. A key similarity relates to the fact that both approaches need to undertake the same kind of financial analysis and assessment. That is, the starting points, namely a determination of the utility's costs of operation, assets (or rates) base and cost of capital, are very similar. For example, it has been noted that the information the water industry regulator in the UK requires to reset the price cap is similar to the information required for ROR. Hence both methods are information-intensive. Both options face the same difficulties in gathering data on operational costs, capital value and costs of capital to make efficient decisions about the cost basis for allowed pricing.

The RPI-X is however more complex and expands the type of analysis required for ROR regulation into a longer term and more dynamic framework. This gives rise to greater risks associated with information inaccuracies since the price path of the utility is locked in for a number of years, typically for 5 years. Overestimation of the initial revenue requirement can lead to windfall gains, while underestimation can lead to bankruptcy.

Whereas ROR regulation follows an annual cycle (at least initially), the RPI-X regulation follows a multiyear cycle with a medium term projection of capital requirements, operating costs and available productivity gains to allow the setting of X. In both cases total revenues should cover all *allowable* costs. These include:

- operating costs

- cost of constructing new assets, suitably depreciated (whatever this means)

- depreciation or maintenance of existing investments, and

- the cost of capital.

Information asymmetries contribute to the need for regulatory approaches which result in the required information being revealed by the utility or where incentives are established to lead the utility to act in the desired way, even in the presence of information asymmetries. Incentive regulation uses rewards and penalties to induce the utility to meet desired goals, while allowing the utility to maximize on its internal information and to use its discretion in how it meets those goals.

However, incentive-based approaches such as price-cap regulation change the risk profile of the business:

> *Price-cap regulation is usually recognized for creating incentives to improve efficiency, however this type of regulation takes no account of cost or demand changes related to the economic cycle, thus raising the degree of market risk to which a company is exposed. This 'regulatory risk' increases the company's cost of capital as investors require higher average returns in compensation. Ultimately, consumer prices should be raised so that the company can finance its investments, undermining the benefits in terms of lower prices from the efficiency gains associated with the system.*

> *…, the desirable incentive properties of price-cap regulation have a cost in terms of the risk to which the company is exposed. The lack of automatic price adjustment mechanisms means that the company is exposed to all cost changes, including those over which it has no control. The risks involved in price-cap regulation are likely to be reflected in its cost of capital, as investors will demand a higher average rate of return in compensation for bearing additional risk.*
>
> *In practice, price-cap regulation requires periodic price reviews in order to correct imbalances and eventually to pass the benefits of greater efficiency on to customers. At this point, the price-cap system bears some similarities to rate-of-return regulation, as one important consideration in the setting of prices is the rate of return that the company may be expected to earn at those levels.*
>
> *In recognition of the fact that certain cost elements are beyond the control of the regulated company and that exposure to such variables increases risk with no benefit in terms of incentives, most price-cap regimes allow for some cost pass-through. These mechanisms allow certain cost changes outside of the company's control to be passed on to customers without waiting for the next periodic price review. The level of risk borne by investors is lowered and the company's cost of capital should therefore be reduced, while the incentive properties of the system are not undermined as long as these cost elements are truly uncontrollable. (Alexander et al, 1996)*

In developing countries, the appropriate price path may be difficult to determine where there are significant new infrastructure extension requirements for new, low income consumers and where required capital costs are not known. This is especially the case at the outset of establishing an economic regulation regime.

Notwithstanding the initial disadvantages of incentive-based regulation (due to added complexity and uncertainly), it is probably desirable that the economic regulation regime evolve to incentive-based regulation over time. For this reason, a practical guideline for the implementation of incentive-based regulation in the water sector is not given in this section.

4.2 Recommendations

The details of the application of price-cap or other incentive-based regulation will depend on the specific approach adopted and the local context. It is therefore neither possible nor appropriate at this point to provide specific guidelines for how price-cap regulation should be implemented. Rather, some generic recommendations are given.

- Price-cap or incentive-based regulation is a more desirable form of regulation compared to rate of return regulation because it creates stronger incentives for efficiency gains. Therefore, the implementation of regulation in the water services

sector should move in the direction of incentive-based regulation taking practical constraints into account and with the provisos given below.

- Price-cap or incentive-based regulation should be applied within a multi-year framework. The most appropriate time-frame for this is five years.
- Until there is some level of certainty with respect to the starting point of the incentive-based regulation, it is not desirable to enter straight into an incentive-based regulatory regime.
- The nature of the specific incentive-based regulatory approach to be adopted will depend on the outcomes of the institutional reform process set out in the Strategic Framework (DWAF, 2003). It is therefore premature to commence incentive-based or price-cap regulation at this point.

5. Benchmark regulation using the ideal company model

5.1 Overview

Economic regulation using the ideal company model approach is described and evaluated in Annexure C to WRC 1383/1/04 with reference to Chile. Key features are highlighted below:

- The approach requires the construction of a detailed financial and economic model for each utility regulated which seeks to define optimal economic and financial performance for a particular utility taking into account the physical context and constraints within which the company is operating. The model is therefore resource and information intensive.
- The regulatory approach requires an agreement on the appropriate rate of return of assets. For this, the thinking presented in the rate of return methodology is applicable.
- The Chilean regulatory approach has an innovative dispute resolution mechanism which creates incentives for the disclosure of information thereby overcoming some of the information asymmetry problems experienced in both the rate of return and price-cap regulatory approaches.

Furthermore, it is interesting to note that the Chilean model of regulation evolved out of a rate of return regulatory regime.

Although it can be argued that South Africa does not have the capacity to undertake this kind of regulation (see Annexure C to WRC 1383/1/04), a research-base or experimental application of the Chilean approach in the South African context to, say, Johannesburg Water and possibly to one Water Board, could have important advantages in the South African context. These include:

- In-depth learning about the water business in these two contexts on the part of the regulator;

- Testing the efficacy of the dispute resolution mechanism and its incentive effects with respect to the generation of information; and
- Providing an appropriate benchmark for the possible later implementation of price-cap regulation in other utilities.

5.2 Recommendations

In the light of the review of this regulatory approach presented in Annexure C to WRC 1383/1/04 and the overview presented above, the following recommendations are made:

- An ideal company model be developed for Johannesburg Water for the purposes of research and learning.
- The dispute resolution mechanism be implemented together with the ideal company model approach to the regulation to Johannesburg Water
- That both the Contracts Management Unit of the City of Johannesburg and the national water services regulator participate in this economic regulation exercise.

6. Conclusion: implementing economic regulation

6.1 Towards an economic regulation strategy

6.1.1 A national regulation strategy for water services

DWAF is in the process of development a national water services regulation strategy based on the policy framework set out in the Strategic Framework (DWAF, 2003). The comments that follow suggest how economic regulation can be incorporated into this strategy which is focused on the practical application of regulation in South Africa.

6.1.2 Understanding the importance of economic regulation

Before economic regulation can be effectively implemented in South Africa, it will be necessary to demonstrate more conclusively the benefits that can arise from the effective application of formal economic regulation in the South African context. A specific study aimed at quantifying the financial and economic benefits accruing from economic regulation of water should be undertaken. This study should do the following:

- Assess the economic performance of the water sector over the past 8 years, focusing on:

  The financial and economic performance of the water boards (the 2 major water boards and a selection of two or more smaller water boards) over the last 5 years

  The financial and economic performance of Johannesburg Water since 1 July 2001.

The financial and economic performance of Ethekwini, City of Cape Town, Ekurhuleni, Tshwane, Buffalo City, Mangaung, Umsunduzi and Nelson Mandela since 1 July 2001.

The effectiveness of "social spending" in the sector since 1994 particularly with respect to sustainability of infrastructure.

- An assessment of the economic and financial gains that are practically achievable considering actual financial performance in the sector and how this might be influenced by formal economic regulation.
- Give an indication of the scale of operation at which economic regulation becomes feasible and consequently propose an appropriate scale of country spending of regulation. This should be done in terms of a regulatory impact assessment where the costs and benefits of economic regulation (also in terms of scale) are assessed.

6.1.3 Creating a culture of economic regulation

The experience of economic regulation in the electricity industry (as well as the experience of the contracts management unit) suggests that it will take a number of years to effectively implement a formal economic regulatory framework in South Africa. Nevertheless, it is important to get started. Progress will be incremental and will need to take into account capacity constraints. However, the real learning and capacity development will occur through the process of implementing economic regulation and the associated institutional reforms (see section 6.2.1). The recommendations made in Sections 3.3, 4.2 and 5.2 support this incremental approach with early commencement of the process.

6.1.4 First things first

The application of economic regulation should be strategic. Implementation should focus on these areas where the most gains can be made for a given level of effort (both in terms of learning and in terms of actual economic gains from the application of economic regulation). The most obvious starting points for the application of economic regulation are:

- Johannesburg Water (the only truly ring-fence municipal water services provider)[20]; and
- Rand Water and Umgeni (the two most economically significant water boards).

The learning can inform the evolution of the economic regulation strategy and the economic gains demonstrated can help to build a stronger case for the wider application of economic regulation.

From this starting point, economic regulation could expand to encompass the metropolitan areas and other water boards and utilities in South Africa.

[20] Excluding private water service providers providing services in terms of concessions or leases.

It will not be practical to undertake the economic regulation of water services in all 240 or so municipalities in South Africa as demonstrated by the review of the Australian regulation experience (see WRC 1383/1/04, Annexure B).

6.1.5 Economic regulation of small municipalities

In the short term it will not be practical to undertake the economic regulation of water services in smaller and more rural municipalities in South Africa.

6.1.6 Compliance regulation: service standards

Economic regulation should also ensure that compliance with service standards is achieved cost-effectively. Service standards include the reliable provision of service; quality of supply and service; customer satisfaction and resolution of complaints and disputes. There is a direct relationship between the quality of standards imposed and the cost of meeting these standards.

When understanding economic regulation it is important that this be seen not as a parallel process to other areas of regulation (standards, environmental and so forth) but as an integral part of deciding on those standards. A better understanding between the different areas of "regulation" needs to be developed and ROR regulation, with a focus on allowable and required costs can foster this.

In the case of rate of return regulation there is little incentive to cheat on standards because all costs incurred by the utility for the provision of reliable services, quality supply and customer satisfaction, are allowed in the ROR methodology.

In the case of incentive-based regulation, utilities may have an incentive to cut costs at the expense of meeting service standards. The regulator will have to ensure that quality assurance programmes are undertaken by the regulated entities.

6.1.7 Understanding performance through benchmarking

Benchmarking initiatives which seek to understand performance are an important complementary initiative.

6.1.8 Choosing the method of regulation

Rate of return regulation is the first stage of incentive-based regulation (IBR). It is therefore relatively academic at this stage which methodology is used. IBR has a higher incentive power for efficiency but is also more complex to implement and carries greater risk in the context of market uncertainties. Because of the proposed restructuring of the water services industry (as set out in the national Strategic Framework for Water Services, DWAF 2003) and the consequent uncertainty within the South African water industry, it is recommended that revenue and price reviews be done on an annual basis rather than in terms of a three to five year cycle. The annual application of economic regulation will also increase learning in the sector and help in the development of capacity. For these reasons, it is recommended that rate of return regulation be implemented initially with a view to evolving towards incentive based regulation. See the more detailed recommendations in Sections 3.3, 4.2 and 5.2.

6.1.9 Developing regulatory capacity

According to Kim & Horn (1999) in addition to the incentives problems, in most developing countries where professional skills are scarce the opportunity cost of scarce human capital devoted to regulation is significant and should also be considered when developing an institutional reform and regulation strategy. These considerations should form part of the study recommendation made in section 6.1.1.

6.1.10 Transition to independent regulation

Ultimately it is probable that effective economic regulation will only be achieved once an independent regulator with adequate capacity has been created. This is a position advocated by the South African Utility Regulator's Association (SAURA). However, it is not likely that an independent regulator for water services will be established in the short term. In this context, there are some intermediate steps that can be adopted with a future transition to independent regulation in mind. These include:

- Establishment of a dedicated regulatory unit within a ministry or department to co-ordinate regulatory activity and to foster the development of technical skills and professional standards;
- Creating a separate agency but retaining decision making with the relevant government ministers (for example, Ministers of Water Affairs and Finance); and
- Creating an autonomous agency with power to make recommendations but retaining final decision making powers (or review powers) with the relevant government ministers (for example, Ministers of Water Affairs and Finance).

For further discussion, see Smith (1997).

6.2 Complementary initiatives

6.2.1 Institutional reform

Probably the most pressing economic issue facing the water services sector is that inadequate resources are being made available for rehabilitation and maintenance of systems. This, together with almost certain inefficient use of existing resources, will result in the collapse of water services infrastructure in the medium term. The most important means of addressing this problem is the institutional reform of the sector with the view to professionalising the water services industry, especially for the major urban centres. The national Strategic Framework for Water Services (DWAF, 2003) sets out a policy framework for this reform which is currently being pursued.

6.2.2 Regulating subsidies

The decentralization to local government of decision-making with respect to the allocation of capital and operating subsidies poses particular challenges to the water services sector. It is important, from an economic regulatory point of view, to be assured that capital and operating subsidies are being allocated and used efficiently.

The best way of ensuring this is to insist on the proper ring-fencing of water services provision. In this way, formal economic regulation can be conducted and the efficiency of resource use in general, and subsidy use in particular, can be assessed. However, in many cases (particularly for the smaller rural municipalities), it will not be practical to ring-fence water services in this way. Methods to ensure efficient subsidy spending in this context need to be developed.

6.2.3 Regulating contracts with private and public providers

Improving contract regulation is an important complementary initiative to the development and implementation of this guideline. The most immediate priority is to review the Water Services Act and Section 19 regulation in light of the cabinet approved national Strategic Framework for Water Services (DWAF, 2003). In addition to this, additional capacity in the national water services regulator (DWAF) is needed to review all contracts before approval and to assist with contractual amendments and disputes. The economic principles set out in this guideline can be used to inform the regulation of investments and tariffs within contracts.

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ANNEXURE A

Methods and tools

Table of Contents

1. Objective

The objective of this report is to describe and explain the predominant approaches that are used in the economic regulation of water services internationally and to initiate a debate on their potential application in South Africa. The paper explains the motivation for the use of the available tools and methods as well as their limitations, data requirements and other factors impinging on their use for the regulation of water services in South Africa.

2. Method followed

The report is primarily a literature review supported by internal team discussions. The review will also benefit from the WRC Steering Committee comments as well as limited discussions with individuals with expertise in the field as required.

While the purpose of the paper is to inform economic regulation of water services in South Africa the vast majority of the literature on regulation of water services is from developed countries and has stemmed from their experience with the regulation of privatized water utilities. The circumstances in which economic regulation may be applied in SA are somewhat different. The majority of water service providers in SA are line departments within municipalities, while the vast majority of bulk water suppliers, in the form of Water Boards, are wholly owned by national government. A discussion on the translation of the developed country experience to the SA situation is included in the final section and forms a key issue to be addressed in the project more broadly.

2.1 Location of the review within the "typical" regulatory process

The key concepts in the regulatory process have been described in the background discussion document prepared for the WRC (PDG, 2003). In the document it is noted that regulation of water services involves a range of areas, including price levels, tariff structures, quality, and service access. The first, overall price level regulation, is the primary consideration of this paper. The paper, however, also includes some discussion on whether it is possible and appropriate to entirely separate the other regulatory areas (and of these, the tariff structure in particular) from regulation of overall price levels.

The review addresses the various approaches to price control, the measurement of utility financial performance required to establish these approaches, and the timing and enforcement of economic regulation of water services providers.

Within the broad sphere of "price regulation" the paper also touches on issues of competition and regulation, as the introduction of competition in one form or the other is often seen as the endpoint of regulation by many commentators.

3. Objectives of economic regulation of water services

3.1 Rationale for economic regulation

The existence of natural monopolies is the primary underlying rationale for economic regulation. A natural monopoly can be simply defined as a situation where the market can most cheaply be supplied by a single firm. This situation arises typically because of significant economies of scale, density and scope. The water and sanitation services sector is a particularly strong natural monopoly, with less scope for competition than most other utility industries.

Monopoly pricing

Monopoly providers are in a position to maximise their profits by establishing prices above their marginal and average costs of production because they face no competition for the service provided and no expected competition from new entrants to the market. Such pricing is economically inefficient (for maximum efficiency, price should be set equal to marginal cost) and allows the utility to make an excessive return on investments.

Even if a water service provider is not a profit maximiser the existence of natural monopolies in the water and sanitation sectors allow unregulated local authorities (or other owners of water utilities) to establish prices for water services with reference to factors outside of the costs of production of the service. These factors typically include the need to make up shortfalls in other areas of the municipal budget or the need to cross-subsidise poor consumers.

Inefficiency and Inadequate Investment

Although the standard economic rationale for regulation is the potential for monopoly pricing it is important to note that in practice the existence of natural monopolies leads to other problems that regulators typically seek to address (Baldwin and Cave, 1999). The absence of effective competition within the market creates a range of incentives problems for managers and owners of monopoly utilities. These problems include the lack of pressure to improve service standards, inadequate incentives for allocating and using resources efficiently, and inadequate incentives to maintain infrastructure.

The latter issue, that of inadequate incentives for investment in and maintenance of infrastructure, is a particular concern of utility regulators internationally (see Berg, 2001). In privatized utilities that are subject to price controls there is a danger that profit will be sought through cost cutting by means of reduced investment. In a number of countries in the developing world the main constraint on utility performance, in terms of service extension to the poor and system maintenance, is inadequate investment in the sector (see Barja and Urqiola, 2001, for the example of Bolivia).

3.2 Objectives of economic regulation

Regulation is therefore aimed at addressing the market failures of allocative and productive inefficiency and monopoly pricing. These are essentially *static* failures. In addition much regulation is focused on other considerations, such as *dynamic* efficiency, distributional considerations and equity issues. In developing countries dynamic efficiency (or developmental issues) are especially important. The key dynamic efficiency consideration is whether an unregulated natural monopoly will make the investments necessary to extend services and maintain current services at a quality appropriate to the country's needs (Kim and Horn, 1999).

Economic regulation aims to prevent the abuse of dominant monopoly provisions while enabling well managed utilities to finance the delivery of required services and at the same time introduce incentives for the improvement of service delivery and efficiency over time. Regulatory approaches are therefore not simply about price controls, they typically have multiple objectives alongside price regulation aimed at ensuring adequate investment in the sector and creating the right set of incentives for performance and efficiency.

The core objectives of economic regulation are generally expressed as being to:

- Curb excessive monopoly profits
- Share efficiency benefits between investors and customers
- Introduce incentives to increase efficiency
- Create incentives for appropriate levels of infrastructure investment (neither excessive nor insufficient)

Regulation and utility reform

The approach taken to the regulation of utilities is also determined by the structure of the industry. In the international literature a conventional path of utility reform is often used as the backdrop to understanding regulatory approaches. This is clearly an idealised view and not necessarily the path of utility reform underway in South Africa.

Nevertheless, it is useful to locate economic regulation in this typical" path of utility reform to demonstrate the relationship between industry structure and regulatory objectives.

The conventional starting point is a government owned, state monopoly, located within the bureaucracy.

- Stage-one utility reforms are some form of corporatisation where the corporatised utility remains a statutory monopoly but one with possible incentive to exploit its monopoly position. This invites regulation to prevent the exercise of monopoly power.

- Stage-two reforms address inefficiencies within the corporatised utility, such as excess costs of production and inefficient pricing structures. This typically involves the introduction of more indirect and incentive-based regulatory forms.
- Stage-three of the reform process is a move towards greater competition. Most utility reform programs do not stop with corporatisation and move on to reduce monopoly power and, in many cases, to some form of privatisation. The introduction of greater competition gives rise to new regulatory challenges aimed at maintaining the benefits of competition (Albon, 2000) while maintaining performance standards.

The end-point of utility reform is often viewed as introducing competition either *within* or *for* the relevant market (Kim and Horn, 1999). Methods to achieve this final "goal" are not addressed directly in this paper, i.e. the rationale for, and mechanisms of, privatization. One point that can be made is that true competition is very difficult within the water sector and it is likely that the primary means of introducing competitive forces will be via competition *for* the market (so-called Demsetz-competition) rather the creation of competitive markets for service provision.

Regulation and social welfare

Whatever the ultimate preferred industry structure the over-arching goal of economic regulation is the improved management of natural monopolies providing public services. The ultimate objectives of regulation are, therefore, the social goals surrounding the provision of public services. These are typically the goals of universal access to basic goods and services; adequate provision of public goods; the maximization of social welfare and horizontal and vertical equity to public services. Although a system of economic regulation may have narrow short term performance objectives, such as the control of price levels below inflation, any regulatory system should ultimately be measured against its success in allowing the sector to achieve the broader social welfare goals.

3.3 Performance regulation

Although the focus of the project is on economic regulation in some respects this creates an artificial distinction between the various regulatory components. Quality and standards of services regulation have cost implications and therefore the regulation of these elements of a utility's performance has economic implications, affecting both cost and revenue, which need to be considered alongside narrow economic regulation (Byatt, 1997)

Improvements in financial performance that flow from productivity improvements while still maintaining the same service quality unambiguously reflect efficiency gains. However, where cost reductions come at the expense of service quality there is a counteracting negative effect on consumers. Therefore productivity changes and the concomitant financial results have to be considered in the light of quality of service provided.

Klein (1996) advances the argument that where quality of service is paramount (for example, drinking water quality) then performance and economic regulation should be separate. On the other hand, where affordability is more important then price and quality regulation can be combined to allow trade-offs to take place between the two.

In general, when quality is difficult to observe or can at best be observed only after the fact, the incentives for the utility to provide good quality water supply may be weakened when the utility faces a regulated price of its services. It may then be tempted to make profit by reducing quality. To guard against this perverse incentive one may have to choose a type of price regulation where the utility will be suitably compensated for quality improvement measures (Klein, 1996)[1].

4. Approaches to economic regulation

It should be noted that in developing countries the bulk of privatization and introduction of competition has occurred in the telecoms and electricity sector. Private sector involvement in water services is relatively recent and small relative to other sectors (Kim and Horn, 1999). Typically in the water sector concession contracts, where the government retains ownership of the asset base, are the most common method used to introduce efficiency and investment incentives to the sector. The water sector regulatory literature from developing countries remains focused largely on issues of tariff policy and related issues of equity and performance regulation. This paper therefore draws on experience in other sectors and, as discussed above, in the water sector in developed countries.

There is a very wide range of approaches that have been used in practice to regulate water services internationally, with many overlaps between the approaches. For ease of exposition , however, these are categorised into a limited number of distinct approaches and sub-approaches as follows:

- Rate-of return (cost-of-service) regulation
- RPI-X (incentive) regulation
- Comparative regulation

    Benchmarking

    Yard-stick competition

Each of these approaches is discussed in turn below, with some comparison between the approaches included.

[1] The relationship between performance (quality) regulation and economic regulation is not dealt with in depth here. Suffice it to say that where regulators impose significant and new performance standards on water service providers the investment requirements to meet these standards are typically taken into account in the setting of economic regulation parameters.

The categories used to explain the major regulatory approaches are somewhat stylized. In practice there is much overlap between the approaches, with different approaches sharing common elements. The regulatory mechanisms used are also distinguished by a wide number of detailed differences in many dimensions. For example there are differences in timing, consultation, measurement, benefits sharing and other components – generally determined by the particular nature of the utilities being regulated and the political environment of the regulator.

4.1 Incentives

An important thread through the regulation literature is the existence of information asymmetries that exist between the regulators and those regulated. It is largely the existence of these asymmetries that create the need for regulatory approaches distinct from simple command-and-control approaches (Berg, 2001). If the regulator had perfect insight into the nature of the utility it would simply be able to prescribe the exact investment, operational and pricing requirements. Since the regulator does not have such information it needs to introduce a system whereby the required information is revealed by the regulated utility or whereby incentives are established to lead the utility to act in the desired way even if the regulator does not have the same degree of information as the regulated organization.

Incentive regulation is the use of rewards and penalties to induce the utility to meet desired goals while allowing the utility to maximise on its internal information and to use its discretion in how it meets those goals (Berg, 2001). Regulatory mechanisms that create these types of incentives are referred to as "incentive compatible" regulations. Incentive compatibility is one of the key criteria used when choosing between different regulatory approaches.

4.2 Legal and institutional frameworks

The setting in which a regulator operates, including both the institutional independence of the regulator and the legal framework in which it operates is important in determining the effectiveness and credibility of the regulatory process. This topic is not addressed here in any detail but is a central factor to be considered in the design of a regulatory system.

Recent work in the electricity sector has paid close attention to the possible frameworks in which regulation can occur and the merits of alternative systems. A possible approach is one in which the parameters of the tariff-setting process are provided in some detail through a contractual process between the regulator and the regulated while the actual administration of the contract is managed by an independent regulator. Under this approach, the regulatory contract does not replace the regulator but substantially limits the regulator's discretion. In particular, it forces the regulator to set tariffs based on specific formulas rather than just general principles (Bakovic, Tenebaum and Woolf, 2003).

5. Rate of Return (ROR) regulation

The predominant method of economic regulation of utilities is some form of imposed price or revenue cap. This control seeks to limit excessive pricing behaviour of a monopoly utility while at the same time allowing the utility (and it investors) sufficient revenue to maintain and extend infrastructure and to make an acceptable return on their investment. Without the latter requirement it is clear that investors would rapidly exit the sector (and certainly not enter it). There are two broad approaches to price-capping. The first is termed cost-plus pricing or rate-of-return regulation, while the second is conventionally called RPI-X. These approaches are discussed below.

5.1 Cost of service approaches

What has come to be known as rate-of-return regulation is a direct regulatory structure that places specific bounds on prices and profitability by allowing the regulated utility to cover its costs inclusive of a prescribed rate of return on capital. This form of regulation was widely used in the US until the last decade or so and is still used in many cases (such as the regulation of Eskom's prices by the National Electricity Regulator (NER, 2003)).

It is also known as cost-of-service or cost-plus regulation because under such a scheme the regulator sets prices for the utility in such a way that they cover the utility's costs of production and include a rate-of-return on capital that is sufficient to maintain investor's willingness to finance the utility (be they debt or equity investors) (Baldwin and Cave, 1999). In some cases the utility is obligated to set the price for each service (for example, water and sanitation) equal to its respective costs, while in other cases the overall price level is controlled but the utility is free to determine the price of individual services.

Low powered incentives

There are obvious weaknesses with the use of rate-of-return regulation as a form of control. The primary problem identified in the literature is that the utility has no incentive to operate efficiently as it knows that it will be able to recover any cost increase with an increase in price, provided that price reviews occur with sufficient frequency (see Klein, 1996, Baldwin and Cave, 1999). Further, the utility knows that any efficiency gains that are made will be quickly taken away from the utility and given to consumers in the form of lower prices.

Over-capitalisation and gold-plating

The second, more subtle, problem is that rate-of-return regulation can lead to an incentive to over-capitalise. Where the allowed rate of return exceeds the cost of capital, the utility has an incentive to expand the base on which the return is reckoned and thereby increase profitability within the constraint. This is known as the Averch–Johnson effect after Averch and Johnson (1962). Broadening the base is a two-edged

sword. While expansion of the base produces benefits to the utility in terms of higher profits as a given rate of return above the cost of capital is applied to a larger capital base, it also results in inefficiently high production costs because of the distortion of the choice between capital and labour inputs. The regulated utility would therefore expand the capital base until marginal benefit from base expansion is equal to the marginal cost from the input distortion (see Kim and Horn, 1999, Albon, 2002).

A second related concern is termed "gold-plating" which is slightly different from the Averch-Johnson effect and refers to the excessive expansion of the capital base but with surplus capital resources simply being left to stand idle.

> *Capitalisation and rate-of-return regulation in Bolivia's water sector*
>
> *The Bolivian Potable Water and Sewerage Law's most important elements are:*
>
> *Responsibility for the provision of these services is assigned to the municipal governments, but can be transferred to water and sewerage providers (WSPs) that are private, municipal, or mixed firms, cooperatives, or other civil associations recognized by law;*
>
> *The territory is divided into concession and non-concession areas. The concession areas are financially sustainable and services are provided only by WSP's. Non-concession areas are not financially sustainable, and the service can be provided by a local government;*
>
> *Regulation of WSPs includes tariff regulation using the rate-of-return criteria, investment and efficiency targets, and a five-year regulatory lag; and*
>
> *Universal access in non-concession areas will be supported by public investment.*
>
> *It appears that regulation of the newly privatized utilities was effective in restricting prices increases to moderate levels, although the privatization process did leave to a 'rebalancing" of tariffs which had the affect of removing a free basic amount (10kl/month) of water provided by the municipal utility. These welfare losses were more than compensated for by welfare gains from increased access due to substantial increases in investment. (Barja and Urguiola, 2001)*

6. RPI-X regulation

The RPI-X (Retail price index less X) approach seeks to address the incentives problems of rate-of-return regulation by allowing the utility to keep at least some of the efficiency gains it makes by decoupling the revenues that the firm generates from the costs that it incurs, but within a controlled price framework.

Under RPI-X the utility is allowed to increase the weighted average of the prices of a basket of its services by no more than the increase in an inflation index less a percentage amount, X. Physical quantities of each service are the weights used in determining the weighted average. Usually these are previous period weights. It is possible that not all services are included in the basket. In particular, services in

competitive areas are often left out. There may also be sub-baskets of services subject to specific restrictions.

Based on the average price of services RPI-X revenue capping places a ceiling on overall revenue and circumscribes a price path for the utility. Typically the price-cap is recalculated on a regular basis (five years in the case of UK water regulation) in order to bring prices back in line with underlying cost changes or other factors.

There are four main objectives of RPI–X price capping:

- *Achieving greater productivity*: the utility has a strong incentive to pursue productivity improvements. Where it fails to achieve cost reductions consistent with X, its profits will fall. Further, as it can keep any cost savings above those reflected in X, at least in the regulatory period, it has an incentive to aim for greater cost reductions than are provided by productivity growth of X per cent.
- *Passing on productivity growth to customers*: RPI–X forces the utility to pass on part of the cost reductions (reflected in the set value of X) in lower prices to customers rather than let them through to higher profits.
- *Whittling away monopoly profit or existing cost-inefficiency*: where the utility commences regulation with above normal profits and/or existing cost inefficiency, X can be set above productivity growth in order to whittle these away.
- *Restructuring prices*: RPI–X allows the utility to restructure its pricing towards greater efficiency. As the cap applies to the weighted average of the utility's prices and not to specific prices, the utility is able to raise (at least relative to the RPI change) one or more of its prices if other prices are reduced sufficiently to satisfy the cap. When freed in this way, the pursuit of profitability will lead the utility to change its pricing structure towards a Ramsey–Boiteux configuration to exploit the more inelastic demands in keeping with the inverse elasticity rule of this configuration. The pursuit of profits means that the utility will have an incentive to move prices towards a more efficient structure (Albon, 2000).

As opposed to rate-of-return regulation the general view from the literature is that CPI–X belongs to the group of 'incentive compatible' regulations and has clear advantages over previous command-and-control regulatory structures and the US-style rate-of-return regulation with respect to the incentives it provides the utility to pursue pricing and operational efficiency. Although it also has administrative and compliance advantages, these can be overstated. As with rate-of-return approaches it requires very careful design and is far more informationally demanding than it is often depicted. In particular it requires

- Careful investigation of the starting point for the regulation with respect to the existing degree of cost recovery and profit levels;

- The extent of cost inefficiency (how much does the utilities cost differ from best-practice cost levels after taking into account operating factors beyond the control of management?);
- The extent of inefficiency of the existing pricing structure;
- A determination of the likely course of productivity growth, usually based on past performance but with a forward-looking perspective as well (Albon, 2000).

6.1 Implementation of RPI-X: Cost determination

To implement RPI-X a determination needs to take place of the utility's operating costs and capital costs so as not to establish an X that either drives the utility into bankruptcy or allows it to generate excess profits (Martin and Cave, 1999). In essence the regulator attempts to make a projection of costs into the future, and coupled with assumed productivity gains, sets price levels sufficient to cover these costs.

In practice all regulatory schemes try to define as best as possible the criteria for price adjustments. Often the price itself will be indexed to various cost factors. In the simplest case, prices would periodically be adjusted in line with inflation. More complex adjustment formulas are also possible. In some cases prices are first decomposed into various cost elements. Each cost element is then adjusted with indices that reflect changes in those costs. For example, operating costs may be adjusted with an index of wage costs, maintenance costs with a weighted average of wage and equipment costs and financing costs with interest rate and exchange rate movements reflecting the currency mix of finance (Klein, 1996).

Several cost factors do not lend themselves to indexation. For example, if in the course of water pipeline construction a company encounters unforeseen soil conditions or if new environmental standards are imposed, costs may change significantly. The price of water may then have to be adjusted to reflect these costs. The regulator will need to make a judgment whether the event giving rise to cost increases actually was outside the company's control and how to compensate the company for the change in costs. Both the United Kingdom and France have rules embedded in their regulatory schemes that allow price adjustments in cases of major unforeseen events. For symmetry, there are also cost "claw-backs" in the UK. For example, in the years 1992 to 1994, the regulator decreed lower price increases than foreseen under the 1989 price indexation formula, because construction costs had dropped due to recession in the United Kingdom (Klein, 1996).

The setting of X

Productivity measurement (including the influence of factors external to the utility's management) is an essential input to the devising of price capping regulatory regimes and the establishment of X in particular. Productivity is a measure of how good the producer is at turning inputs into outputs; and is usually defined in the form of a ratio

of output(s) to input(s). Productivity can be measured on a partial or a total basis. There are, however, severe measurement difficulties on both the output side and the input side; especially as most utilities produce multiple outputs and all use multiple inputs (Albon, 2000). A number of approaches are typically used to try to address these difficulties:

- *Partial productivity*: This approach relates some measure of output to the quantity of a single input, such as the volume of water sold per employee.
- *Total factor productivity (TFP):* TFP indicators require aggregation of the utility's outputs and inputs. The various outputs and inputs have to be weighted in some way. TFP is conceptually correct but has numerous practical difficulties.
- *Data envelopment analysis (DEA):* DEA involves determining an efficiency frontier using linear programming techniques and uses a definition of how far a particular producer is from this frontier. If best-practice efficiency is normalised to a score of one, then the efficiency of particular producers can be gauged by how far they are from one. Stochastic frontier analysis is a variant of DEA that accounts for random impacts.

The roles of X are to ensure that productivity improvements are passed on and that existing above normal profits and cost inefficiencies are removed. Usually X is set to reflect expected growth in total factor productivity (TFP) based on past TFP growth, but also with consideration of possible future developments affecting costs. It may also include an amount to reduce existing monopoly profits and/or existing cost inefficiency.

The greater the X, the tighter is the constraint. Obviously the regulated utility would prefer a lower X (allowing higher prices and profits) while customers would prefer a higher X (lower prices). But the setting of X primarily has to make reference to, on the one hand, the incentive for the utility to reduce its costs and, on the other, its need to cover its full operating and capital investments and maintenance costs.

6.2 Sharing of Benefits

CPI–X regulatory regimes do not involve setting X at one level for all time. The value of X is reassessed towards the end of each discrete regulatory period, usually every three to five years. Where the regulated utility had been able to increase its profitability over the period, there is *prima facie* evidence that X was too low, and this needs to be taken into account in setting the X for the next regulatory period. However, the regulator would need to distinguish between impacts on profitability that were within and beyond the utility's control.

On the other hand, if the utility was unable to cover all of its costs, it is possible that X had been set too high and, all things being equal, should be reduced in the next regulatory period. Again, a distinction should be made between controllable and uncontrollable influences.

There is considerable debate about the sharing of excess productivity gains between the utility and consumers. Some argue that while the ultimate objective is to pass efficiency improvements on to the consumer the best way to do this is to allow regulated utilities to retain the benefits from efficiency gains for some period as this provides them with the greatest incentives to deliver efficiently over the long term.

Albon (2000) outlines one approach to benefits sharing where benefits are reduced in the next regulatory period according to a predetermined schedule. Another approach, termed the 'P_0 adjustment', passes the entire efficiency gains on to consumers at the start of the next regulatory period.

Giving utilities themselves an option regarding price caps and the particular sharing rules have some desirable features. The utilities can have input on setting performance objectives, but regulators should recognize that the utilities have an incentive to understate their abilities to reduce costs. With a policy of creating options, the regulator establishes several plans, with different productivity (X) factors. Low performance targets (prices that fall more slowly) are linked to lower rewards, with high performance targets having sharing rules that yield higher profit potential for the utility. Such optional schemes induce utilities with substantial potential for cost containment to self-select into the appropriate plan (Berg, 2001).

7. Information required for ROR and RPI-X regulation

Although the two approaches of rate-of-return and RPI-X regulation appear to be very different methods of regulation they are in fact closely related in a number of ways, largely pertaining to the type of financial analysis and assessment that the regulator needs to carry out. In particular the starting point for both types of regulatory approach are very similar – a determination of the utility's costs of operation, asset (rate) base and costs of capital. In the case of rate-of-return regulation this determination is followed by the establishment of a fixed allowable rate of return (i.e. revenue) for a short period (typically a year), while in the case of RPI-X regulation a medium term projection of capital requirements, operating costs and available productivity gains is made to allow the setting of X. In both cases total revenues should be sufficient to cover all costs. The costs that have to be covered are:

- operating costs i.e. the cost the water provider may pay for buying water and for managing the water system, including workers' wages,
- the cost of constructing new pipelines, water plants etc. suitably depreciated;
- depreciation or maintenance of existing investments; and
- the cost of capital (Klein, 1996).

Cooper (1998) notes that analyses shows that the information the water industry regulator, in the UK, requires to reset the price cap is similar to the information

required for rate-of-return regulation. The level of capital expenditure, the asset base, the required rate of return, and operating costs are all needed.

For rate-of-return regulation, in simple terms the regulator determines the total revenues allowed using the following formula:

Revenues = Operating expenses + Depreciation + Taxes + (Rate of Return * Asset Base)

Rate hearings occur on a frequent basis necessitating a large amount of effort on the part of the regulated utility and the regulatory body. At times of general inflation of costs and prices there can be difficulties of regulatory lag if rates are not adjusted frequently.

In RPI-X regulation it is typical for a more formal long-term model of the utility to be developed, with the inclusion in the model of projections of demand, capital expenditure required to meet this demand, operating expenses and potential efficiency gains.

Both forms of regulation tends to be informationally demanding. RPI-X is somewhat more complex and expands the type of analysis required for rate-or-return regulation into a longer term and more dynamic framework. In addition, there are greater risks associated with information inaccuracies in RPI-X regulation since the price path of the utility is locked in for a number of years. Overestimation of the revenue starting point can lead to windfall gains by the utility, while underestimation can lead to bankruptcy. Similar risks apply to the setting of X.

In both forms of regulation there are inherent problems of gathering and interpreting the information on operational costs, capital value and costs of capital to make efficient decisions about the cost basis for allowed pricing. There is also scope for a substantial amount of 'gaming' between the regulator and the utility on the basis of information asymmetries (for example, private utilities have substantial control over when they realize profits which affects the price-setting for the following period).

According to Kim and Horn (1999) in addition to the incentives problems, in most developing countries where professional skills are scarce the opportunity cost of scarce human capital devoted to regulation is significant and should also be considered when evaluating whether formal economic regulation is cost-effective.

Operating costs

The determination of the operating costs of the utility is strongly dependent on the degree to which the utility's regulated operations are well circumscribed from other operations and costs of the organization. Activity based costing is therefore relevant in utility regulation, especially where the utility has both regulated and unregulated activities. It is of considerable importance that there is internal accounting separation of the regulated from the unregulated activities to allow the performance of the

regulated activities to be measured. In some cases this has been achieved by placing the different activities in specific subsidiaries.

Cooper (1998) draws attention to the possibility that where there is regulated and unregulated activity within a single company (or a group of companies), the issue of transfer pricing, and its potential abuse through the movement of resources, is raised. This is to say that, for example, services or products provided through an unregulated activity may be sold to the regulated activity at higher than market prices, the result of which is to transfer profits from the regulated to the unregulated activity. Again this is an area in which the company controls the information and therefore may be able to gain an advantage (Cooper, 1998). It is likely that similar problems could occur with regulated municipal water utilities where it is relatively easy to transfer resources and costs from one component of the municipal system to the other. It is apparent from the literature that economic regulation of water services is only possible when an accounting framework is in place clearly delineating the true costs of the service provided. This would typically require the so-called "ring-fencing" of the activity concerned.

Determination of capital costs

The determination of capital costs is difficult and subject to significant debate in the literature. Determining the capital cost requires establishing the weighted average cost of capital (WACC) and the capital base to which the WACC is to be applied. The WACC is the sum of the weighted average of the expected rate of return on debt and the expected rate of return on equity capital. In its simplest form, without considering any tax or divided issues, it can be written as:

$$WACC = r_e \frac{E}{E+D} + r_d \frac{D}{E+D}$$

where:

- r_e is the expected rate of return on equity capital;
- r_d is the expected rate of return on debt capital;
- E is the market value of equity capital held by the firm;
- D is the market value of debt capital held by the firm; and
- $E+D$ is the total market value of assets of the firm.

When a utility's allowed rate of return exceeds WACC it is considered to be making above-normal profits, and vice versa if the rate of return is less than WACC and therefore calculation of the WACC has been the subject of a great deal of debate in the regulation literature. While the expected rate of return on debt capital has remained relatively uncontroversial — with the regulator normally just using the rate of return on some stable government bond as a proxy — the same cannot be said of

the rate of return on equity capital. Much of the initial WACC debate has related to the appropriate method for calculating the expected rate of return on equity capital (Albon, 2000).

The favoured approach (although there are others) to estimating a return on equity is the capital asset pricing model (CAPM). Since the early to mid-1990s most regulatory bodies in Australia, the US, the UK and Canada have adopted CAPM in preference to such alternatives as the dividend growth model (DGM) and arbitrage pricing theory (APT).

The CAPM model is based on the following approach:

Determine what an investor may expect to earn on the market as a whole;

Evaluate the utility's risk premium (the risk of the utility compared to the overall market risk);

Use the risk premium to adjust the investors expected return to reflect the utility's risk.

The CAPM can be formally expressed as:

$$Re = R_f + ß_e (R_m - R_f)$$

- R_e = Return on equity
- R_f = Risk free rate as observed in the market
- R_m = Market rate of return
- $ß_e$ = Equity beta measures the correlation between the asset's risk to the overall market

There are a range of issues related to the application of the CAPM, such as the determination of the appropriate beta's, or measures of risk, that should be applied to the particular utility under consideration.

7.1 Information asymmetries

Regardless of how well designed the regulatory institutions are, the regulators are still dependent on information provided by utilities, who know the business better and hold superior information. When the regulator faces a single utility it is at a disadvantage in terms of information and it may have to accept many of the utility's arguments because there is no alternative information source. The strength of regulators is thus particularly dependent on the ability to find better sources of information, partly by playing differing utilities against each other (see below).

Better information can be generated by public hearings, the use of interest groups and rivals and consultations for arriving at regulatory decisions. For example, when information about equipment costs provided by a water company is public,

competing equipment suppliers may be able to detect overpriced supply contracts and complain. Equally various interest groups will provide information to support their various claims. Where various companies compete for water contracts - even if only from time to time - the regulator may benefit from information generated by an aggressively bidding competitor (Klein, 1996).

8. Benchmarking and yardstick competition

The comparison of similar utilities against each other to determine the appropriate price and revenue level has been used in a number of countries as a regulatory tool. Although benchmarking various service providers against each other may seem to be a simple way to avoid the information problems facing regulators this is seldom the case in practice. There are uncontrollable factors influencing costs in different areas such as network size, differences in the mix of residential and business customers, population density and terrain. In principle, the cost impact of these factors can be measured and taken into account through a system of adjustments. In practice, however, this is very difficult.

Different utilities will also use different methods of cost assignment and accounting; will be at different stages of their network expansion; and will have different costs of capital depending on the size and nature of their customer base and ownership. These factors combined make it very complex for a regulator to ensure that appropriate benchmarks are being used.

8.1 Yardstick regulation

Another related form of incentive regulation, termed yardstick regulation, is potentially suitable for the regulation of utilities with regional monopolies (as in electricity distribution). Also known as competition by comparison, yardstick regulation seeks to provide an incentive for utilities to strive for lower costs by inducing them to compete with one another for cost reductions.

In one form of yardstick regulation, prices allowed for each utility are related to that utility's costs and to the costs of the other utilities in other regions. Abstracting from unassigned cost recovery and cost factors beyond the utility's control, it is assumed that each utility is able to set a price equal to the mean unit cost of all utilities in the group. This means that it has an incentive to lower its own costs as it is the 'residual claimant' of any excess of price over own unit cost. (At the same time reducing its own costs feeds through to a lower cost for the group and therefore to a lower price.)

Key problems with yardstick competition are related to the problems of benchmarking discussed above and include:

- Risks of collusion: this diminishes as the number of utilities grows
- Appropriate adjustments for different service conditions

- Time lags, as prices have to be set before cost observations are made

9. Franchise regulation

As mentioned above the general aim of economic regulation is to replicate the positive aspects of competition and market forces. Due to the technical nature of water as a network industry with substantial capital costs there is limited scope for the introduction of actual market competition for water supply, however there is certain scope for the introduction of competition for the market itself. Firms can be invited to compete, typically through some bidding or auction process, for the sole right to deliver water services in a particular area.

This is sometimes termed "franchise regulation" in the international literature and is highly relevant to South Africa, where the few attempts at the introduction of private sector involvement in water supply have typically followed the pattern of some form of franchise or concession being granted to a private sector operator. Franchise regulation is, in some ways, a misnomer as this is not a regulatory approach as such but rather an approach to the restructuring of the industry. Once a franchise has been granted to an private (or another public) operator the franchise contract itself will need to be regulated – typically by the local authority responsible. The methods of regulation available to the local authority are essentially the same as those general regulatory methods discussed above.

If the regulator is the same organization that previously provided the service it will typically be in a better position than a national level regulator to understand the nature of the utility and its cost structure. Although, as discussed in the final section, this is no guarantee of successful regulation.

9.1 Competition for parts of the market

In a water supply system it may be possible to allow some parts of the service to be run in a competitive fashion. For example, the meter-reading component is not capital intensive and is very amenable to the introduction of some form of competition. By allowing different parts of a water system to be run by different companies or municipal units a number of benefits may be obtained. First, more and better information about costs and performance of the various parts of the system are likely to be generated for the regulator, because ways to shift costs and revenues in company or municipal accounts are limited when each unit keeps independent records and accounts. Second, by generating information about relatively well defined components of a water and sewerage system (e.g. treatment plants) it may be somewhat easier to compare utility performance across municipalities. This would render it easier to detect poorly performing, high-cost utilities and to set prices correctly i.e. not to reward high cost companies with high prices.

By creating several players in the water system, divergent interests among the units or firms may be exploited by the regulator, who would receive information from each from their differing perspective. Finally, by allowing companies to run only small part of an overall system, non-performing companies may be easier to change than when they control all of a water system (Klein, 1996).

As an example of approaches towards the alteration of industry structure, OFWAT, the UK water utilities regulator, indicated in 2001 that it intended to create regulations allowing so-called "self-lay" where developers would have the option of laying new on-site mains and service infrastructure (connector infrastructure) themselves or requiring water companies to bid on a competitive basis for such work (OFWAT, 2001).

At the same time there may be benefits of system integration,, such as easier deployment of resources across the utility, economies of scale and better coordination between different service components. This is clearly a trade-off that needs to be considered.

10. Application to Water Supply in South Africa

The focus of this literature review has been on the methods and tools used in the economic regulation of water services internationally. The review concludes in this section with a brief discussion on the potential application of these approaches to South Africa.

Incentive based approaches

As discussed the predominant methods used in water services regulation are rate-of-return and RPI-X regulation. There is a strong argument that in practice the difference between rate-of-return, RPI-X (and in fact yardstick) regulation is not all that great. The boundaries between the various types of regulation become somewhat blurred when the regulator carries out the *de facto* examination of a utility's cost structure and revenue. Many of the differences reside in the timing of regulatory reviews, the duration of price caps; and the degree to which gains are shared between the state, consumers and the utility. The NER, in fact, makes this point to justify their focus on rate-of-return regulation.

While there is merit in this argument it perhaps can be overstated and thereby miss the key incentives differences between the approaches. In particular, RPI-X does appear to introduce real pressures for improvements in efficiency and cost reduction, while rate-of-return regulation appears to create problematic incentives for over- and inappropriate investment. Evidence from the USA, where there have been a large enough number of observations, suggests that a move from rate-of-return regulation to RPI-X based price-caps has led to efficiency gains. (Martin and Cave, 1999).

10.1 Application to South Africa

The application of economic regulation to South African water service providers poses a number of questions and challenges. Some of the key challenges are outlined below in point form and will be discussed further in other components of the overall project.

- *Utility ownership*: The experience with economic regulation primarily relates to the regulation of privatized utilities. The translation of this experience to the regulation of municipal owned utilities in South Africa will pose many difficulties. The incentives facing managers of local authorities differ from those in the private sector, and many other factors constrain productivity improvements in the public sector which are outside the control of utility managers.

- *Ring-fencing requirements*: The determination of costs is the starting point for all economic regulation methods. This determination cannot be done with a sufficient degree of accuracy if the operations that are regulated and their financial reporting are not well separated from non-regulated activities. This implies that the first step in establishing a regulatory system for a local water service provider is the ring-fencing of the operations of the provider. Experience has shown that this is not an easy exercise, and even the larger municipalities struggle to ring-fence operations. In the case of smaller authorities, where water services share many operational costs with other services (such as billing, management support, and payroll control) there will be enormous challenges in the separation of the costs of these services.

- *Calculation of costs of debt and equity*: The experience with the calculation of the costs of debt and equity primarily relate to applications in the private sector. There are a number of factors that will differ in determining these parameters for public utilities. These include different risk profiles and borrowing costs; the availability of internal capital funds; and difficulties in assessing the relevant return on equity for a public sector owner.

- *Limited scope for benchmarking:* Although benchmarking appears to offer some way out of the informational requirements of the other regulatory approaches there are likely to be serious difficulties in abstracting away the different local conditions that affect costs of water supply. These include both physical differences in topography and water availability as well as historical differences and differences in local costs of labour and services and local levels and standards of service. It is not clear that these difficulties are surmountable.

- *RPI-X in a developing country context*: The appropriate price path under RPI-X may be difficult to determine in a developing country setting where there a significant new infrastructure extension requirements for new, low income, consumers. In particular may be hard to establish a price-path when the required capital costs are not known. Even in the UK, which has more stable institutions

with longer reporting histories, there are serious problems with forecasting financial performance over a five year review period (Cooper, 1998). In South Africa this forecasting is likely to be yet more difficult. Some factors, which may outside of the control of the utility, may have a dramatic impact on performance. Important variables include the degree of cost-recovery from consumers and input costs (particularly raw or bulk water supplies). Regulatory systems will need to account for these unknown variables – either by improving their information and understanding of them or by accommodating the variability they create from the regulatory price setting process. Cost recovery is particularly difficult as it should be a performance requirement for utilities but it is not always wholly within their control.

- *Industry structure and regulation*: The local industry structure affects the scope of regulation and price controls and should help to determine the appropriate point in the water supply system at which to impose regulatory controls. For example, there may be little point in attempting to regulate water service providers that are themselves subject to monopolistic behaviour from suppliers, primarily Water Boards who may not be similarly regulated.

Tariff structure and economic regulation

Pricing structure is an important efficiency and equity concern. It is important to have an appropriate balance of revenue from different consumers, allowing the cross subsidisation of poor consumers while not over-burdening productive activities and firms with unduly high prices. The balance between access and consumption charges is also important in creating the correct incentives for network expansion and consumption.

A utility can perform poorly by having an individual service price either too high or too low relative to cost, or it may have an inefficient mix of revenue coming from access and service prices (Albon, 2000). The regulation of tariff structure is clearly a component of economic regulation of water services. This aspect of regulation has been well dealt with in South Africa and has formed an important part of water services policy and guidance from national government. The focus of this research project is on the overall revenue and price parameters that can be used to regulate water utilities and no further consideration is given to tariff structure. However, any expansion of the regulatory system for water services in the country would need to ensure that approaches to internal tariff structure and overall price and revenue levels were consistent and compatible.

Location and capabilities of the regulator

The location, capabilities and incentives of the regulator itself are important issues in the eventual success of a regulatory system. This review has focused on the methods used, rather than the institutional approach to regulation. However, the institutional

setting of the regulatory authority is a core issue in the establishment of a system of economic regulation.

A first question is the appropriate location of a regulator within the government hierarchy. For example, should regulatory authority be located alongside water service authority or should it be at a higher level of government? Related to this question are a range of issues concerned with the regulatory independence and the potential "capture" of the regulator by the regulated utility or other interest groups (consumers and government, for example). These issues are dealt with in detail in the public choice theory and related literature (see McLean, 1987 and Klein, 1996).

A fairly pessimistic view is expressed by Irwin (1999) about the capability of regulators in developing countries, with particular reference to newly privatized or corporatised utilities. He asks, "how well can we expect a government to regulate when the same government performed poorly when it provided the infrastructure service itself. If the government lacked the information it needed to run the infrastructure company well, will it acquire the information needed to regulate well after privatization? Will a government that succumbed to pressures to pursue socially harmful infrastructure policies while it was an owner be able to resist those pressures as a regulator? Will politicians and officials who extracted bribes from suppliers under public ownership refuse to accept them from a regulated private firm?" (Irwin, 1999)

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