TOWARDS A REGULATORY FRAMEWORK FOR THE MANAGEMENT OF GROUNDWATER IN SOUTH AFRICA

By Peter Lazarus

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Final Report on the Project

"The Development of a Legal Framework to Provide for the Effective Management and Sustainable Utilization of South Africa's Groundwater Resources"

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PART 1

INTRODUCTION

The instruction given to the task teams involved in the South African water law review was in essence to develop a range of options that would provide for the practical implementation of the Water Law Principles. Simultaneously, the task teams were requested to develop various legal scenarios to inform the drafting team of provisions to be included in the new Water Act that would provide for the implementation of the practical scenarios referred to above. These tasks are quite distinct. The former task involves the development of practical (and often technical) solutions to problems experienced in the management of water resources in South Africa. These solutions must be consistent with the Principles developed by the Water Law Steering Committee. The latter task is more legal in nature and may be divided into two phases dictated by the political and strategic agenda of the Water Law review process. The first phase involves providing legal content to the policy embodied in the Water Law Principles (as they relate to groundwater) for incorporation into broad enabling legislation. The second phase comprises the legal formulation of the practical scenarios mentioned above for inclusion in regulations to be developed at a later stage.

In the case of groundwater there is a further step in the process. As yet no comprehensive groundwater policy has been developed by the Directorate : Geohydrology of the Department of Water Affairs and Forestry. This is urgently required and is a further aspect of the work of the groundwater policy task team.

There are thus four inter-related components to the work of the task team :

- The formulation of a coherent national groundwater policy;
- The development of a broad enabling legal framework which gives effect to the national groundwater policy;
- The development of practical procedures for the implementation of the national groundwater policy;
- The development of scenarios to inform the drafting team of provisions to be included in regulations to the new Water Act which provide for the practical implementation of the national groundwater policy.

Clearly the formulation of policy should precede the formulation of legislation, since legislation generally gives effect to policy. For political and strategic reasons, the formulation of enabling or framework legislation has been prioritized. In view of this, the groundwater policy task team has focused its work on the more legal task of developing legal scenarios to inform the drafting team of provisions to be included in new enabling legislation. This has unfortunately had to be done in the absence

of a fully developed, coherent groundwater policy.

This document is aimed therefore, at developing a range of legal scenarios to inform the drafting team of provisions to be included in new enabling water legislation. More detailed regulatory scenarios which give effect to the practical implementation of a coherent national groundwater policy, will accordingly be developed at a later stage.

The approach of the task team has been to develop a regulatory framework that addresses groundwater management problems experienced in practice by water managers and others working in the groundwater field. The task team is aware of the problem of developing a new regulatory framework, modeled on foreign experience, which does not address management problems unique to the South African context. Foreign experience may not take into consideration the wealth of experience that has been developed by local groundwater managers and experts. This is not to say that the task team is unappreciative of the dire need to ensure that groundwater management policy requires a paradigm shift so as to address the development needs of the country. Social equity cannot be achieved by imposing unworkable and unsustainable management policies that do not take cognisance of local conditions and local management experience.

The point of departure for the task team, as reflected in this report, was to ascertain the problems experienced 'on the ground' in relation to the management and allocation of groundwater at present. This involved two stages. Part 2 of this report outlines the current legal framework governing groundwater management in South Africa and highlights some of the legal problems that have been encountered. Part 3 of the report deals with practical problems experienced in the management of South Africa's groundwater resources. This information has been obtained from questionnaires and a workshop involving a range of both public and private sector groundwater managers and experts.

Having ascertained the problems for which solutions have to be developed, Part 4 contains a review of international trends in groundwater law and management. The focus of the review is on developing and examining international solutions to local problems. This was undertaken essentially as a desktop study and thus necessarily has shortcomings. From a review of legislation and commentaries from the various countries selected, it is impossible to uncover and explore practical difficulties that are experienced in the implementation of legislation. It is recommended therefore, that before foreign legislation is 'imported' into South African legislation, a thorough investigation of the enforceability and applicability of that legislation be undertaken. This will involve visits to the countries involved.

Part 5 contains recommendations to the drafting team concerning the protection

and utilisation of groundwater to be include in a new water code. The recommendations are derived from an assessment of the appropriateness of various legal regimes for addressing South Africa's groundwater problems. It includes not only foreign experience but draws extensively on local experience and practice. It must be emphasised that only broad legislative options or approaches for inclusion in enabling legislation are considered in this report. Detailed consideration of regulatory provisions will occur at a later stage in the process. This is in accordance with the approach of the Drafting Team which is only to develop enabling legislation at this stage leaving much of the detail for regulations. Although it is clearly necessary for the details of permitting, licensing and groundwater classification procedures and the declaration of special protections areas to be included in separate regulations, the groundwater task team is weary of an Act that allows too much discretionary power and thus masks the management policy and approach from direct public scrutiny.

Part 6 contains a draft Preamble to the chapter on groundwater for inclusion in a new Water Act. The Preamble contains the fundamental principles and approaches that are intended to guide the implementation and enforcement of the new regulatory code. To an extent the Preamble contains the legislative policy on groundwater which acts as a constraint on administrative discretion.

PART 2

AN OVERVIEW OF THE CURRENT LEGAL FRAMEWORK GOVERNING GROUNDWATER MANAGEMENT AND ALLOCATION IN SOUTH AFRICAN LAW[1]

INTRODUCTION

It is a commonly held perception in South Africa that all groundwater is private and capable of individual ownership and somehow beyond the regulatory jurisdiction of the State. This perception has created enormous problems for authorities charged with controlling the abstraction and, to a lessor extent, the pollution of scarce groundwater resources. It is furthermore expected to provide the impetus for vigilant resistance to any process aimed at re-defining rights to use groundwater, which is inherent in the water law review process.

THE RIGHT TO USE GROUNDWATER IN SOUTH AFRICAN LAW

The right to use water in South African law is determined by the legal status of the water in question. By application of the common law and statutory provisions, groundwater is capable of qualifying as numerous legal categories, most of which are dealt with in terms of statutory provisions while others still fall exclusively within the domain of the common law. It is the latter category of groundwater in particular that has engendered considerable debate which concerns the constitutionality of legislation proposing to regulate this previously largely unregulated resource.[2] Each category will be dealt with in turn.

Subterranean water

The Water Act 54 of 1956 draws a distinction between subterranean water and underground water. Subterranean water includes, 'water naturally occurring underground or obtained from underground in an area declared . . . as a subterranean Government water control area'.[3] Subterranean water is not defined

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1 For the purposes of this report it is unnecessary to delve into the complex jurisprudential history and detail surrounding groundwater in South African law. For a comprehensive analysis see P Lazarus and R Lyster, The problem with groundwater in South African law, 1995 SALJ. This section of the report thus aims to provide an overview of the principal features of groundwater legislation that impact upon its management and allocation.

2 See P Lazarus and R Lyster, The problem with groundwater in South African law, 1995 SALJ _____ and P Lazarus and I Currie _____.

3 s27 of Act 54 of 1956

as either public or private water in the Act. It is a separate category of water, distinct from underground water and subject to different allocation rules.

The most extensive regulation of large scale abstraction of groundwater occurs by means of the declaration of subterranean government water control areas in terms of s28 of the Act. In terms of this section the Minister of Water Affairs and Forestry is empowered to declare a subterranean Government water control area when he is of the opinion that it is in the public interest that the abstraction, use, supply or distribution of subterranean water in the area should be controlled.[4] To date ten such control areas have been declared.

In terms of the Act, as soon as a subterranean government water control area is declared, the right to the use and control of subterranean water, vests in the Minister.[5] From that point on, no rights of use vest in the owners of the land within the control area unless allocated by the Minister.[6] Similarly, the construction, alteration, enlargement or use of water works in connection with subterranean water may only be undertaken in accordance with the provisions of the Act. The use of this water is thus subject to statutory allocation rules and the right granted is a restricted right of use in prescribed quantities and for prescribed purposes and is not a right of ownership.

The application of this section is limited by the provisions of section 30(1) of the Act. This section implies a distinction between water that was allocated and used immediately prior to the declaration of a subterranean government water control area and water that was not so allocated and used. The right to the use and control of subterranean water that was allocated and used immediately prior to the declaration of the control area vests in the land owners to which the right was allocated. The right to the use and control of subterranean water only vests in the Minister if the water was unallocated or unused immediately prior to the declaration of the area as a subterranean government water control area.

As soon as possible after the declaration of a control area, the Director-General is required to make a survey of existing use in the area and to collect information on all water works used in connection with subterranean water. Once this survey is complete and all information considered necessary for a final allocation of abstraction rights has been collected, the Minister is required, on the information available, to :-

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[4] s28

[5] s29

[6] S29, 31, 32A and 32B.

- make an estimate of the quantity of subterranean water that is annually available in the control area for abstraction; and
- make an allocation, in his discretion, on a specified quantity to each piece of land in the area which may annually be abstracted in available. Such an allocation shall not be for a lessor quantity of water than -
    - the quantity abstracted annually just before control was instituted; or
    - where no water was used, a quantity which in his opinion will be adequate to provide for domestic use and stock-watering purposes on such pieces of land (section 32B).[7]

To assist the Department in its control function, the construction, alteration or enlargement of any water work used in connection with subterranean water is regulated by means of authorisations (section 32C)

Section 32E affords the Minister the right to construct a Government water work (such as boreholes) on land in a control area and abstract any quantity of water by means of such work, if he is convinced that sufficient subterranean water is available in the area. During periods of water shortages, the Minister may place restrictions on the abstraction of subterranean water.[8]

Labuschagne has argued that the control measures outlined above do provide for 'the judicious exploitation of groundwater resources in South Africa in the public interest' and it is the task of 'specialists in the field of hydrology and geohydrology to furnish the information necessary to make use of these mechanisms and to devise operational models which will promote the utilisation of subterranean water on a dependable basis by all persons entitled to it, in the public interest.[9]

Be that as it may, the fact remains however, that important aquifers, such as in the Uitenhage and Grootfontein control areas, are still heavily over-utilised despite being proclaimed many years ago.[10] The provision for the recognition of existing rights specifically is making proper groundwater management virtually impossible. Furthermore, the State, because of limited resources has exercised very little actual control in the declared areas and has been reluctant to proclaim more control

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[7] See W A Labuschagne, Legal aspects relating to the development of dolomitic groundwater resources. Workshop on dolomitic groundwater of the PWV area, Pretoria, 1988.

[8] Labuschagne, Op Cit

[9] Labuschagne, Op Cit

[10] Braune, An overall strategy for groundwater management in South Africa, Water Week Conference 1992.

areas, particularly since only one sector, namely irrigation agriculture, is involved.[11]

'Public' Surplus water

A second category of groundwater that is regulated by statute is that water which falls within the statutory definition of public water. Thus, provided the underground water complies with this definition it qualifies as a public stream containing public water. In practice such water would only exist in a connected system of fairly large aquifers. The allocation of water from public streams depends upon a further categorisation of the water within public streams as either normal flow or surplus water. Since underground water cannot qualify as normal flow since this must visibly flow, it qualifies as surplus water which is any public water other than normal flow.

The right to use groundwater that qualifies as surplus water is governed by the rights applicable to the use of public water. It is thus available for beneficial use for domestic purposes, stock watering, agricultural and urban purposes and it may be impounded and stored for those purposes by the owners riparian[12] to the public stream where the surplus water is found.[13]

That the nature of the right to public water is not ownership is clear from the wording of section 6(1) of the Act, which states that 'There shall be no right of property in public water and the control and use thereof shall be regulated as provided in this Act'.

'Deemed' Private water

The final category of groundwater that is regulated by statute is water that is pumped from underground such as the water from boreholes. Provided this water is not derived from a public stream, section 6(2) of the Act deems this water to be private water'. Statutory private water includes rain water, the water from springs, wells, certain dams and wetlands. It does not include underground water.

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[11] Ibid

[12] A riparian owner is defined in section 1 of the Act as an owner of land 'whereon or along any portion of any boundary whereof a public stream exists ... .' It is a moot point whether riparian ownership of an underground stream is possible in terms of this definition. The use of the word 'along' in the definition, which is defined in the Oxford Dictionary as 'through part or whole of things' length', seems to indicate that riparian ownership of underground streams is possible. This limitation is however merely technical and is rectifiable with a simple amendment.

[13] s10(1)

It is this categorisation of groundwater as 'deemed private water' that has in the past created the greatest obstacles to water managers concerned with managing all water resources in the national interest.

The use of private water is governed principally by section 5 of the Act which provides that the sole and exclusive use and enjoyment of private water vests in the owner of the land on which it is found. This right of exclusive use is subject to sections 5(2), 12, 21-24, 'rights lawfully acquired and existing at the commencement of the Act' and the rights of lower land owners to a reasonable share of water flowing to their land which they have used beneficially for thirty years.[14]

The right to private water is fettered by numerous statutory restrictions preventing it from being conveyed, negotiated or disposed of without ministerial permission.[15] It is restricted as far as qualitative and quantitative use is concerned and by constraints on the purposes for which it may be used. Thus 'although the wording of section 5(1) could create the impression that private water is uncontrolled water, simply accruing to the land owner on whose land it occurs, the occurrence of this water could materially influence or even replace rights in respect of public water'.[16]

In light of these restrictions it is clear that the right of sole and exclusive use applicable to private water is a right severely restricted by statutory control measures. It has been suggested that 'the right of exclusive use is therefore a statutory preferential right of beneficial use for particular purposes and in particular qualities and quantities, as far as the public interest or the control of government water works are not injured thereby'.[17] In essence it is a statutory right of use, not dissimilar to the right of use granted in respect of public water.

Groundwater not regulated by the Water Act

It has been demonstrated that the Water Act of 1956 regulates the right to groundwater found in a subterranean government water control area, groundwater that complies with the statutory definition of public water and groundwater that is pumped from a source other than a public stream. Groundwater that exists or flows beneath a land owners property but which is not public water and has not been abstracted appears however, not to be regulated by the Water Act. This water is regulated exclusively by the common law and the rights to it are expressly reserved

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[14] s5(1)

[15] s10(1)

[16] s10(1)

[17] Uys Op cit p30

by s5(1) of the Act.[18] It is the rights to this un-abstracted groundwater that fuel the constitutional debate which arises over initiatives to re-allocate or re-define rights to groundwater reserves.

Although many courts have upheld the right of a land owner to use groundwater, few cases have actually defined the nature of the right to the water. The majority of the cases dealing with the rights to use groundwater have been concerned with identifying the circumstances where the owner of land is not entitled to the exclusive use of the water which flows beneath their land. Disputes have generally occurred where one land owner has intercepted the spring or well of another (lower) land owner.

The case law remains unsettled as to whether land owners 'own' the unappropriated water flowing beneath their land. Those cases that classify the right as ownership rely essentially on the Roman law doctrine of *cuius est solum eius est usque ad coelum et ad inferos*, which implied that an owner of land was owner of everything above and beneath the surface of his land. Certain exceptions to this doctrine, namely the existence of a servitude or the presence of malice on the part of the 'upper' land owner were developed by the courts to limit the application of the doctrine. Contention exists over the implications of another test developed by the courts to limit the application of the doctrine. In virtually every case dealing with rights to groundwater, the courts have held that a land owner may appropriate groundwater flowing beneath his land only if the water does not flow in a known and defined channel. A distinction was later drawn between private underground water (water percolating through the earth) and public underground water ('submerged water in visible known and defined channels'[19]). As far as the nature of the right to private underground water is concerned, the fact that the courts have never granted relief to a landowner whose supply of underground water has been intercepted militates against classification of the right as one of ownership.[20] The only reference to ownership of groundwater in the case law refers to water that rises on land such as spring water and water that has been artificially abstracted by the land owner. As has been shown above, these categories of groundwater are now dealt with by statute and references to ownership of this water have been expressly repealed.

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18 Cf W. J. Vos, S.C. who is of the view that all underground water is not governed by the Water Act of 1956.

19 Uys op cit p 138

20 Indeed in Gien v Gien 1979 (2) SA 1113 (T) Spoelstra AJ stated that, it may be difficult to define dominium comprehensively ... but there can be little doubt ... that one of its incidents is the right of exclusive possession of the res, with the necessary corollary that the owner may claim his property whenever found, from whomsoever holding it.'

PROVISION FOR INFORMATION FLOW IN CURRENT WATER LEGISLATION

It is widely recognised that the lack of knowledge and information about groundwater resources at all levels has been a major, if not the major, problem with regard to optimal utilisation of the resource in South Africa.[21] Numerous provisions exist in the current Act which are designed to facilitate information flow. These include the general power granted to the Minister to obtain and record information as to the quantity of water used or required for irrigation, information obtained through the discretionary powers to grant permits subject to certain conditions and information obtained in terms of regulations aimed at the prevention of pollution. The most important groundwater information clause is contained in section 12C of the Water Act. This section authorises the Minister to declare an area in which it is necessary to give written notice of the intention to sink a borehole, to keep a borehole journal and to provide a copy of the journal to the Director-General. The responsibility of a drilling contractor and the handling of confidentiality is also dealt with in this section.

Notwithstanding these provisions, information flow continues to hamper effective groundwater management. By virtue of the fact that the Department has never had the resources or information system available to manage such a flow of information, section 12C has never been used. Abstraction information provided in terms of permit conditions has also never been systematically controlled, stored and utilised wider than for specific permit purposes. Furthermore, no data is available on the extent of groundwater abstraction for irrigation, the largest user sector. Braune has suggested that this is largely due to the legal categorisation of groundwater as private water which may, outside control areas, be used without a permit on the property where it occurs and there is no requirement to provide information.

It is clear that the statutory and common law bifurcation between surface and groundwater is artificial and at odds with hydrological reality.[22] Water law in fact has created a 'hydrological bicycle' instead of conforming to the hydrological cycle.[23]

It is submitted that private rights to water, whether they are ownership rights or not, run contrary to the principle that all water resources should be regarded as common property which should be managed by the state in the public interest. They hamper the achievement of equity in access to the resource granting land owners extensive rights to the use and even abuse of the resource. Social costs are also imposed by

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21 Braune, Legislation for improved groundwater information

22 Note (1989) Illinois State Water Survey at 3.

23 Leshy and Belanger at 657.

notions of private rights to groundwater, since the resource itself is not protected.

Thus economic efficiency, maximum beneficial use of the resource and the public interest are not encouraged.

It is clear that in a country where water is an increasingly scarce resource and where groundwater is urgently needed for rural development, it can no longer be afforded to allow a haphazard set of water rights to hamper equitable and sustainable management of national groundwater resources.

Legal certainty is required to determine the status of and rights to groundwater in South Africa. Groundwater law reform should aim to vest control of groundwater in the state who may allocate it in the public interest so as to achieve the greatest sustainable economic benefit from groundwater use, while conserving the resource, and implementing its developmental policy.

PART 3

AN OVERVIEW OF PRACTICAL PROBLEMS EXPERIENCED BY WATER MANAGERS AND EXPERTS INVOLVED IN THE MANAGEMENT OF GROUNDWATER IN SOUTH AFRICA

INTRODUCTION

From a review of numerous articles, responses from a questionnaire and discussions arising at a workshop involving managers and experts involved in groundwater management, the following themes emerged as the key problem areas that prevent equitable, efficient and sustainable management of the country's groundwater resources and which should accordingly be addressed in new legislation. In exploring the problem areas, participants in the process made suggestions as to how problems could be addressed in future legislation. These suggestions are recorded below but are developed in much greater detail in Part 5 of this report.

THE ABSENCE OF A NATIONAL GROUNDWATER MANAGEMENT POLICY WHICH LAYS DOWN NORMS AND STANDARDS TO GUIDE REGIONAL AND LOCAL GROUNDWATER MANAGEMENT PRACTICES

Although perhaps symptomatic of other fundamental issues hampering effective groundwater management, the fact that no coherent national management policy has been developed and enforced by the National Directorate of Geohydrology clearly lies at the core of a management system that has been criticised for being too ad hoc and thus lacking uniformity and consistency. The absence of national norms and standards governing utilisation, conservation, resource characterisation, which are monitored and enforced contributes to the general fragmentation of groundwater management.

THE LACK OF AN EFFICIENT INFORMATION RETRIEVAL SYSTEM

Lack of knowledge and information about groundwater resources at all levels has arguably been the greatest obstacle to optimal utilisation of the resource. Development and management of water resources can only be sustainable when planners, politicians and the public have an adequate knowledge of the resource and of the constraints within which it must be managed.[24] Insufficient information is available generally on the status and trends of groundwater quantity and quality, significant contaminant sites and all major abstractions, most notably the extent of

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[24] Legislation for improved groundwater information, E Braune

the use of groundwater by irrigation agriculture. The lack of information is particularly evident at the local level where groundwater is largely developed. Contributing to this problem is the absence of decentralised (catchment based) water authorities which continue to hamper effective information flow between local, regional and national levels.

In discussion with various managers and experts involved in the field, numerous other issues related to the status of information collection were raised. Of particular concern was the issue, which is also dealt with below, of which institution should be responsible for information collection. It is generally agreed that data collection should be co-ordinated at the lowest 'technically competent' level - if possible by communities or consultants familiar with the area - that would ensure reliable data collection.

In order to provide for differentiated management, allowing for greater protection in certain areas and less stringent controls in others and in which information requirements will vary, requires the development of guidelines detailing information requirements pertinent to different regions. This is alluded to above.

Another issue raised considered the question of incentives that could be used to encourage information collection particularly by the private sector. Although opinion appears to vary over the extent to which competition for information between the public and private sector hampers information flow, there is general agreement that greater effort should be made to encourage the private sector to participate in data collection programmes.

THE ABSENCE OF AN INSTITUTIONAL STRUCTURE THAT PROMOTES EFFECTIVE GROUNDWATER MANAGEMENT AT LOCAL, REGIONAL AND NATIONAL LEVEL

It has been argued that the most important problem and policy challenge is an institutional not a technical one. The challenge lies in devising institutional mechanisms that correctly signal the emerging social scarcities of land and water ...[25]

There is general agreement in the sector that devolution of groundwater management functions to the lowest technically competent level should be encouraged while retaining a strong central authority for overall management of all water resources. Clearly the promotion of education and training programmes at local level is a pre-requisite to such a devolved management strategy.

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[25] Crossen and Rosenberg, Strategies for agriculture, quoted in An overall strategy for groundwater management, E Braune, Water Week conference 1992

The absence of a decentralised water authority as an obstacle to efficient information flow has been mentioned above.

The failure to recognise and utilise the catchment as the basic management unit in water (including groundwater) management and to establish catchment based institutions with defined management powers and functions

Although there is unanimous support in the sector for the concept of integrated catchment management there is some reservation concerning the capacity of the Directorate or even the Department to implement and regulate it. There appears even greater scepticism over the practicality of a system of aquifer level management.

Notwithstanding these concerns, it is widely recognised that sustainable water resource management including the allocation of water requires the considerations of all users of surface and groundwater in the catchment to be taken into consideration. This function is clearly most effectively dealt with by a catchment based authority, operating within guidelines developed and monitored by a national level authority.

Insufficient co-operation between different government departments involved in land use management and activities which impact upon groundwater resources

The lack of structured co-operation between different government departments involved in land use management is regarded as a serious impediment to comprehensive water resource management generally and groundwater management specifically. Mechanisms to ensure greater co-operation require investigation.

THE BIAS TOWARDS SURFACE WATER IN WATER QUALITY MANAGEMENT POLICIES AND STRATEGIES AND THE RESULTANT LACK OF COHERENT GROUNDWATER QUALITY MANAGEMENT STRATEGIES

Present groundwater pollution problems are mainly associated with the mining and industrial sectors. Rapid urbanisation and inadequate waste disposal are seen as a major emerging problem for groundwater resources. Diffuse pollution from agricultural sources and informal settlements also pose a threat.[26]

Although pollution control legislation applies equally to surface and groundwater, the application of control has largely been directed towards surface water because

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[26] E Braune, Op Cit

of the difference in importance and the nature of the two sources. Control measures tend to be reactive, whereas groundwater, because of the slow and long term impacts of pollution, requires a much more pro-active and planned approach.

The development of a differentiated protection policy to be incorporated in a groundwater quality management programme and plan have recently been developed.

THE ABSENCE OF CLEAR AND EFFECTIVE REGULATION OF SUBTERRANEAN GOVERNMENT WATER CONTROL AREAS

There is a clear perception in the sector that control on groundwater abstractions within these areas is ineffective. Reasons given for this range from inadequacies in the present Water Act, such as the reservation of existing rights, a lack of consistency in enforcement practices, the lack of public participation in the management of these areas and the overwhelming lack of resources within the Directorate to manage the areas effectively.

It is felt however, that transitional arrangements need to be developed for the assumption of control of these areas by new, yet to be performed institutions. In this regard, procedures for controlling existing over-abstraction within these areas need also to be developed.

THE ABSENCE OF STRATEGIES TO INVOLVE THE PRIVATE SECTOR AND COMMUNITIES IN THE REGULATION AND MANAGEMENT OF GROUNDWATER RESOURCES

The suggestion concerning the use of economic incentives to encourage information collection amongst the private sector has been mentioned above. It is similarly felt, particularly by consultants involved in the sector, that greater use of consultants should be made particularly to bridge the initial period of devolution of management functions until technical capacity is established at lower levels of management.

There is further a general perception that greater effort should be made to encourage private sector involvement in groundwater management generally.

THE LACK OF PROFESSIONALISM IN THE GROUNDWATER INDUSTRY

Poor performance in a large portion of the groundwater industry (success rate of 20% on boreholes drilled) stemming from a lack of information and appropriate education and training, is seen as a major stumbling block to efficient groundwater utilisation. There is accordingly widespread support for the promotion of a legally

sanctioned professional association in the sector aimed at ensuring levels of competence within the industry. For this to operate effectively guidelines for the registration and operation of groundwater practitioners should be developed by the Directorate which would not only ensure a level of competence but would facilitate a greater flow of information to the Directorate.

THE ABSENCE OF AN EFFECTIVE CONFLICT RESOLUTION MECHANISM TO RESOLVE DISPUTES BETWEEN COMPETING USERS CONCERNING OVER-ABSTRACTION OR INTERCEPTION OF GROUNDWATER RESOURCES

There is a general perception in the sector that water courts are inappropriate and inefficient institutions for conflict resolution. Once again the general sentiment is that conflict between competing users should be resolved in the catchment context by an institution consisting of catchment representatives which take catchment considerations into account. For this to operate effectively it is felt that clear conflict resolution directives need to be developed which are applicable in each area and which are variable from aquifer to aquifer.

There is expectedly wide spread disagreement concerning the issue of when compensation should be payable for the loss or reduction of rights which are presently enjoyed. Apart from the constitutional debate over when compensation is legally payable, there is fairly wide support for the approach that compensation should only be payable where one's beneficial use of groundwater is restricted or diminished.

THE ABSENCE OF CLEAR POLICY AND STRATEGIES TO ENSURE PROTECTION OF THE RESOURCE ITSELF

A new concept that was developed as part of the water law principles was that of the ecological reserve. It is aimed, in essence, of that quantity and quality of water necessary to sustain ecosystem function and biotic integrity at a desired state of ecological health based on management decisions which determine a balance between environmental and 'human' development needs. The ecological reserve has its origin in surface water considerations, but clearly also has relevance for groundwater.[27] Groundwater is part of the total aquatic ecosystem and is affected by and has an effect on processes on land and in surface water resources. It supports vegetation, springs and baseflow and its recharge is in turn effected by water and land management on the surface.

Protection of the resource base clearly has a qualitative and quantitative dimension. The water quality aspect of groundwater protection has been mentioned above.

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[27] E Braune, Sustainable water resources management - a groundwater perspective.

At present there are few quantitative restrictions on the utilisation of groundwater resources existing outside subterranean government water control areas. As a result, and even within such control areas, due to management problems mentioned above, over-exploitation of aquifers is widespread. One reason for this is the legal separation of groundwater from surface water (by virtue of the public/private water distinction) and resultant different approaches to management of the resources. This is creating particular problems in alluvial aquifers along many of the major rivers and in cases where aquifers make a major contribution to river base flow and to fountains.[28]

In essence, current thinking in the sector is that strategies need to be developed to ensure that groundwater resources are utilised within their capacity of renewal. It is recognised however that quantification of 'sustainable use levels' requires extensive research.

To address the current lack of quantitative regulation of groundwater abstraction, there is widespread support for the introduction of a licensing and/or registration system. This is dealt with below.

THE LACK OF EFFECTIVE MONITORING AND CONTROL SYSTEMS REGULATING GROUNDWATER ABSTRACTION. THE NEED FOR A LICENSING SYSTEM

As mentioned above, there are at present few quantitative restrictions on the utilisation of groundwater resources. There is accordingly a dire need for the introduction of quantity controls on groundwater abstraction. It is suggested by managers in the sector that these should, in essence, involve a system of borehole registration (permit) (including the duty to furnish information) and a system of pumping entitlements (licence) where necessary (in proclaimed areas or for large abstractions).

Note : The details of the licensing and permit system are discussed in detail in Part 4 of this Report.

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[28] E Braune, Op Cit

INSUFFICIENT ATTENTION GIVEN TO THE INTERACTION BETWEEN SANITATION AND GROUNDWATER SYSTEMS AND ADDRESSING THE POTENTIAL CONFLICT BETWEEN GROUNDWATER QUALITY MANAGEMENT AND SANITATION PROVISION

It has been suggested that groundwater quality management potentially conflicts with short term sanitation demands.[29] This occurs where developers incur additional costs in the development of sanitation to protect groundwater against pollution. Although it is clear that in the absence of effective sanitation there is a threat of groundwater pollution, the unfortunate fact is that in low-income communities, the cost of sanitation is often so high in relation to community incomes that residents cannot afford the operating and maintenance costs, let alone the cost of constructing sanitation systems.

The pollution threat from inadequate sanitation is currently being addressed in the groundwater quality management plan. The creation of separate water services provision legislation however, creates a potential problem of lack of co-ordination between sanitation and supply provision and groundwater management. Over-arching quality and quantity management guidelines must therefore, be integrated into service provision considerations.

THE DISTINCTION AND SEPARATION OF GROUNDWATER MANAGEMENT FROM SURFACE WATER MANAGEMENT STEMMING FROM THE LEGAL DISTINCTION BETWEEN PUBLIC AND PRIVATE WATER

Problems stemming from this distinction lie at the core of many of the problems highlighted above. In essence the distinction prevents integrated management over all water resources and in particular, creates an artificial distinction between surface and groundwater resources. The inability to manage groundwater effectively is greatly exacerbated by the fact that the allocation of surface and groundwater resources are governed by distinct allocation rules, which in the case of groundwater, as mentioned above, contain few quantitative restrictions.

Although there is unanimous support in the sector for the integration of surface and groundwater management, there is scepticism over the practicality of creating a uniform allocation mechanism for the two sources. This is based on the large differences in quantity available from the two sources and the inherent uncertainty in groundwater yields, compounded by current levels of inadequate information. An allocation system that provides for integrated or conjunctive use of surface and groundwater within an integrated management structure must thus be strived for in new legislation.

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[29] M Muller, How groundwater development can contribute to achieving the goals of the RDP.

PART 4

INTERNATIONAL TRENDS IN GROUNDWATER LAW AND MANAGEMENT

INTRODUCTION

As mentioned earlier, the aim of this part of the Report is to explore international solutions to local problems. It is not intended therefore, to provide a comprehensive analysis of foreign groundwater management regimes. The methodology adopted is rather to limit the comparative analysis to an examination of how various foreign jurisdictions approach specific problems that plague effective groundwater management in South Africa. The analysis has attempted to provide a balance between, on the one hand, a general overview of the foreign legislation for input into the development of broad enabling legislation and, on the other hand, details of legislative methodologies used in foreign jurisdictions to address specific problems encountered in groundwater management for input into the development of more detailed legislation or regulations, which provide for the practical implementation of a national groundwater policy. Legislation from the following jurisdictions have been examined in this part of the report :

United Kingdom
Australia (South Australia in particular)
United States (Arizona in particular)
Botswana
Spain
New Zealand
Canada (British Columbia and Alberta in particular)
Germany
Israel

The discussion below has been structured around the following topics which have been extracted from the discussion in the previous section, which identified the major problems faced by managers and other experts involved in the development on South African groundwater resources :

- The legal status of groundwater.

- Distinctions drawn in the legal allocation mechanism applicable to surface and groundwater. Distinctions drawn between the right of use granted in respect of each source.

- The institutional structure of groundwater management. The role of national, regional and local institutions.

    - Strategies to ensure co-operation between different government departments involved in land use management and activities which impact upon groundwater resources.

- Methods used to control groundwater abstraction. The operation and functioning of licence procedures regulating groundwater abstraction.

- Provisions made for the protection of existing rights to groundwater

  Although this topic is of crucial concern to current groundwater users, it is not dealt with in this report as it is the subject of specific legal research currently being undertaken by other task teams.

- Strategies to ensure effective information flow between different groundwater management institutions.

- Methods used to protect groundwater quality.

  This topic forms the subject of a separate task team and is thus only cursorily dealt with in this report.

- Institutional structures for the resolution of conflict between competing users and conflict management in the licensing process.

- Strategies to ensure protection of the resource itself.

DISCUSSION

THE LEGAL STATUS OF GROUNDWATER

Since groundwater and surface watercourses are interconnected, the common-law bifurcation between surface and groundwater is clearly artificial and at odds with hydrological reality.

As a result, no distinction is drawn between surface and groundwater in most modern jurisdictions. An exception is the United Kingdom, which continues to apply the common law distinction. The distinction is however, only relevant to subterranean water which flows in a known and defined channel. This water may be the subject of riparian rights. All other underground water (water from underground strata) falls to be regulated in terms of the Water Resources Act of 1991 and is subject to the same controls as surface water.

Where groundwater ownership is a concept foreign to a given legal system, other substitute concepts have been developed, whereby groundwater resources are subject to a 'public trust', vested in the State or in the community. The concern underlying the various approaches is the same, viz. to pursue the public interest and minimise conflict among resource users by curtailing the landowner's right of disposition of the resource.

In the British Columbia Water Act 1979 a 'stream' is defined as a natural watercourse or source of water supply, groundwater, a lake, river, creek, spring, ravine, swamp and gulch.

In the 1979 Alberta Water Resources Act, amended in 1981, 'water' is defined as all water on or under the surface of the ground. Interestingly, both pieces of Canadian legislation vest the property in and the right to the diversion and use of all water in Her Majesty in right of the particular province of Alberta. The vesting of title in the state is not a common feature of foreign legislation and may be regarded as the exception rather than the rule. Generally all water resources are classified as public property, regulated by statute.

The Spanish Water Law of 1985 defines groundwater resources as public property. To avoid opposition to the transition to a public resource, the Spanish Act gave extensive protection to existing right holders. Complete transition will only occur in 75 years when all groundwater will be classified as public domain and existing rights lapse. The state reserves the right however, to declare groundwater public domain in areas where over-exploitation could lead to conflict.

In terms of the New Zealand Resource Management Act 1991[30] 'water' is defined as 'water in all its physical forms whether flowing or not and whether over or under the ground'. It includes fresh, coastal and geothermal water, but does not include any water in any form while in any pipe, tank or cistern.

The German Federal Water Amendment Act 1986 applies to surface water, coastal waters and groundwater, thereby recognising the hydrological cycle. Ownership of land does not bestow an entitlement to any use of water.

The Israeli Water Law of 1959 states clearly that all water resources in Israel are public property, subject to the control of the State. A person's land rights do not confer rights to any water sources running through or under that persons' land. Water resources are defined to mean springs, streams, rivers, lakes and other currents and accumulations of water, whether above ground or underground.

In Botswana in terms of the Water Act of 1968, underground water (water naturally stored or flowing below the surface of the ground and not apparent on the surface of the ground) made available by means of works (including boreholes) is defined as public water. It is specifically stated that there is no right of property in public water.

In Australia generally, all internal waters are Crown property, on a public law basis and there can be no ownership of flowing water. Water use is thus related to, though separate from, land ownership.

The general trend is clearly to regard all water as a resource common to all subject to state control and not to draw a distinction between surface water and groundwater as far as the classification of water is concerned. By implication all water resource management approaches apply equally to surface and groundwater sources. The single status however, may make the imposition of control measures to take cognisance of the unique features of groundwater legally more cumbersome. The constitutionality of this position is beyond the scope of this report, but the Spanish experience of allowing a long transition period would appear to be a practical method of avoiding unnecessary opposition to the shift in legal status. Legislative recognition, in South Africa, of the hydrological cycle would however, follow strong international precedent.

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[30] Act 69 of 1991. This Act is unique in that it provides for the integrated management of all the country's natural resources. It treats the environment as a holistic entity to be managed according to national, regional and district plans and policies. The purpose of the Act is to promote sustainable management of natural and physical resources. This entails, inter alia, safeguarding the life-supporting capacity of air, water, soil, and ecosystems.

DISTINCTIONS DRAWN IN THE LEGAL ALLOCATION MECHANISM APPLICABLE TO SURFACE AND GROUNDWATER. DISTINCTIONS DRAWN BETWEEN THE RIGHT OF USE GRANTED IN RESPECT OF EACH SOURCE

From the discussion above it is clear that most foreign jurisdictions do not draw a distinction, as far as the legal status of water is concerned, between groundwater and surface water. The issue remains however, whether it is necessary to draw a distinction between the two sources for the purpose of allocating rights to its use, which take cognisance of the unique features of both sources.

South Australia is currently involved in a process of reviewing its water legislation in terms of the Water Resources Bill of 1996 which repeals the Catchment Water Management Act 1995 and the Water Resources Act 1990. The review process is remarkably similar to the process that has been followed in South Africa.

Although the Bill distinguishes between surface water and underground water (the latter being water occurring naturally below ground level or water pumped, diverted or released into a well for storage underground) the distinction does not fundamentally affect the right of use which attaches to the resource. Instead the Act draws a distinction between the right of use of water in proclaimed and unproclaimed areas which may attach to any watercourse, lake or well.[31] Subject to the proviso that one's use must not detrimentally affect the ability of another person to exercise a right to take water from the source, in unproclaimed areas anyone who has lawful access to a water source may take water from the source for any purpose not in conflict with the provisions of a water resources management plan. A water resource management plan is in essence a catchment management plan. In the case of a proclaimed watercourse, lake or well however, a water licence or a special authorisation is always required. Licences are endorsed with specific water allocations which must be consistent with the relevant water allocation plan drawn up by Water Allocation Planning Committees. A general exemption applies to the use of water for domestic purposes or for stock watering.

In Arizona, surface water and water flowing in definite underground channels are considered public property and governed by the doctrine of prior appropriation. Percolating groundwater is governed, at common law, by the rule of reasonable use but this has largely been regulated by the provisions of the 1980 Arizona

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[31] A well is defined as :

- an opening in the ground excavated for the purpose of obtaining access to underground water
- an opening in the ground excavated for some other purpose but that gives access to underground water
- a natural opening in the ground that gives access to underground water.

Groundwater Management Act. This Act only regulates groundwater uses and is not intended to affect decreed and appropriative surface water rights. However, because most surface water use in Active Management Areas (established in areas where groundwater is most imperilled) occurs in reclamation projects where surface and groundwater are used conjunctively, the controls imposed on groundwater may indirectly affect use of surface water. Since the purpose of the Act is to reduce groundwater overdraft, it requires maximum use of surface before groundwater is used.

In most other jurisdictions examined, the right to use any water (including underground water) necessitates a permit. This is discussed in more detail below. As far as the legislation is concerned however, no separate provisions are made regarding the allocation procedure or rights that follow in respect of surface or groundwater. Distinctions are however, made in the purpose for which the water may be used.

It would appear that once the legal separation between different sources of water is removed, the allocation mechanism also tends to be unified. Provisions tend to be made however, to take cognisance of hydrological plans which cater for imperilled groundwater resources. Although these provisions have the de facto effect of applying different considerations to the granting of a licence to abstract groundwater as opposed to surface water, they do not necessitate the creation of separate legal allocation criteria, but simply subject the allocation system to an administrative management plan that caters for all water resources in the catchment or other management area.

THE INSTITUTIONAL STRUCTURE OF GROUNDWATER MANAGEMENT. THE ROLE OF NATIONAL, REGIONAL AND LOCAL INSTITUTIONS

The holistic management of water resources is, in all countries assessed, placed in the hands of a centralised regulatory authority. In Germany, the Lander is required, for the purpose of managing water, to draw up specific water-management schemes which take into account the need to protect waters as an integral part of the ecosystem and the rational use of ground-water resources. The goals of regional planning and planning at Lander level must be taken into consideration. Water registers must be kept for all water under the Act. The register must reflect permits, licences, existing rights and authorities, water-protection areas and flood plains.

In Spain, Basin Authorities and the National Water Council act on behalf of the state. The latter is the supreme consultative body on the matter in which the State, the Autonomous Communities (municipal authorities), the Basin Authorities,

professional and economic organisations are represented. The National Water Council is obliged to draft a National Hydrological Plan and hydrological plans for each different basin for submission to Parliament; measures of a general nature to be applied to the whole of Spain with respect to the planning of the water resources; plans and projects of a general nature concerning agricultural, urban and industrial planning, exploitation of energy resources or land-use planning, in so far as they have a substantial effect on water-resources planning or water use; and matters common to two of more Basin authorities in relation to the exploitation of water resource and other public property.

Each Basin Authority has the responsibility to prepare, follow up and revise the hydrological plan for the particular basin; to administer and control the water-resources public domain; and to design, construct and operate works financed by the Authority's own funds. The Authority has the power to grant permits and concessions in relation to the water resources of the public domain, except those referring to works and action of general state interest which are the responsibility of the Minister of Public Works; to inspect and monitor operations to ensure the fulfilment of the conditions laid down in the concessions and permits; to carry out gauging and hydrological studies, and to collect information about floods and to control water quality; to study and design, construct, maintain, operate and improve the works included in their own plans; and to define the aims of quality programmes in accordance with water-resources planning.

Local involvement in groundwater management is largely facilitated by the establishment of user associations which represent the users in each basin area. These associations are public bodies that can levy fines. They have similar powers and roles as irrigation boards, although they have a broader focus, and are the principal institutions through which basin plans are practically implemented.

The New Zealand legislation charges local authorities with a duty to monitor the resource consents in their districts and to take appropriate action where necessary. A local authority may authorise any of its officers to carry out all or any of the functions and powers as an enforcement officer under the Act.

In terms of the new South Australian Water Resources Bill of 1996, the Minister for Environment and Natural Resources is ultimately responsible for administration of Act and specifically for ensuring fair allocations between users, including the environment. The central role of the Minister is the administration of the licensing regime for proclaimed resources. Proclamation occurs where there is a threat to the quality or sufficiency of a resource. Once a resource is proclaimed one needs a licence to abstract water. The Bill provides for allocation and licensing decisions to be made by the Minister in accordance with the relevant water management plan made by a water allocation and planning committee or a water resources

management board which are established in proclaimed areas. Water resources management boards are established to manage the water resources of a particular area. Boards are representative of the users within the board's area, environmental groups and government representatives. Boards are accountable to the Minister and to the general community.

All authorities exercising power under the Bill are required to prepare water management plans which must accord with the State water plan. Water allocation and licensing plans are prepared by water resources management boards as part of their management plan. Such plans will be the guidelines for the exercise of the Ministers powers in relation to the allocation and licensing of proclaimed water resources.

In the United Kingdom a division between the resource user and the resource protector has been achieved by the privatisation of water service utilities such as Thames Water or Severn Trent Water. The National Rivers Authority (NRA) acts in the capacity of resource protector having overall control of the water use licensing and permit system. The Ministry of the Environment and various local bodies act in the capacity of integrating land-use permitting with water resource protection. The integration of the NRA, His Majesty's Pollution Inspectorate and the radio-activity control body is also currently under review.

In Israel an effective system of integration of national and local level management has developed through the establishment of Environmental Units which fall functionally under the municipalities. These units work according to Ministry guidelines in areas such as fuel tank installation and evaporation ponds and the redirection of problem substances. One of the aims of water management in Israel is to create national regulations which will become by-laws for local authorities through council decisions. In this way, many management functions can be delegated to local authorities.

An increasingly important aspect to the institutional management of water is the extent to which the catchment forms the basic management unit in groundwater management. The central function of basin authorities in Spain and Water Resource Management Boards in South Australia has been outlined above.

As explained in more detail below, in terms of the 1980 Arizona Groundwater Management Act, various levels of water management are provided for to respond to different groundwater conditions. The highest level of management, where groundwater overdraft is most severe, is applied to Active Management Areas (AMA's). The boundaries of these areas are generally defined by groundwater basins and sub-basins rather than by the political lines of cities, towns or counties. In fact the Code specifically provides that AMA's may not be smaller than natural,

hydrological basins except in the case of the regional aquifer system in northern Arizona. AMA's are generally declared by the Director of Water Resources but may be created upon petition and election of the voters living in a groundwater basin.

Although the general trend is towards centralised overall management, with policy development and the defining of norms and standards being carried out at national level, there is also a realisation that water resource development can only be sustainable if the key functions in this regard are devolved to the regions or areas where the water resources occur and are utilised. It would appear that policy development and research, subsidisation to facilitate implementation, supervision, intervention where necessary, training and the setting of national guidelines and standards are generally regarded as functions of the national department. Actual implementation, the granting of licenses and permits, the development of area specific management plans, inspection of facilities and enforcement are often delegated to local level. Water quality monitoring supervision is difficult to delegate since local regions are more subject to local politics and need the support and control of central government. The UK division between resource protector and resource developer is recommended as it allows clearer focus on the environmental management functions.

STRATEGIES TO ENSURE CO-OPERATION BETWEEN DIFFERENT GOVERNMENT DEPARTMENTS INVOLVED IN LAND USE MANAGEMENT AND ACTIVITIES WHICH IMPACT UPON GROUNDWATER RESOURCES

Traditionally in most states in Australia, water resource management, governed principally in terms of state water acts, was separated from general land use planning. More recently however, statutes such as the Victorian Planning and Environment Act 1987 and the New South Wales Environment Planning and Assessment Act 1979 created a comprehensive planning system, covering the use of waters at all levels of the system.

The South Australian Water Resources Bill states as its object, the integration of the administration of the Bill with other legislation dealing with natural resources. The Bill specifically requires water resources managers to liaise with other relevant bodies, such as soil conservation boards, to ensure that their management plans are consistent with the management plans of other bodies.

In the United Kingdom, the NRA is constituted as a statutory consultee under the respective Planning Acts by virtue of which it can influence planning decisions which may have an impact on the yield or quality of groundwater. The NRA is not a statutory consultee on all relevant planning matters but Planning Authorities are

encouraged by Government to consult the NRA in any event.

The New Zealand Resource Management Act of 1991 is unique in its attempted integration of the management of natural and physical resources. The Act creates a clear separation between policy and regulatory functions with the Ministry for the Environment having the responsibility for giving advice to government that integrated policy considerations on natural resources.

Apart from the examples mentioned above, specific regulatory provision is not made for the integration of water resource management with general resource management considerations in most of the legislation reviewed. The UK approach, to constitute the resource protector as a statutory consultee in terms of planning legislation and the New Zealand approach of integrated legislation are two approaches to the problem of insufficient co-ordination between departments involved in resource management.

METHODS USED TO CONTROL GROUNDWATER ABSTRACTION. THE OPERATION AND FUNCTIONING OF LICENCE PROCEDURES REGULATING GROUNDWATER ABSTRACTION

In most modern jurisdictions, the use of water, including underground water, requires an official permit or licence which does not confer a title to a supply of water in any specific quantity or of any specific quality. The use of water includes the withdrawal, conveyance to the surface or the diversion of groundwater. A permit or licence may be granted subject to the imposition of conditions, which may also be imposed in order to prevent or make good any effects which are detrimental to other persons. Permits and licences may also be granted subject to the reservation that at a later date measures may be prescribed for monitoring water use and its consequences, and to ensure an economical use of water in the interests of natural water resources.

A permit or licence may be refused or revoked in cases where the proposed use is likely to harm the common weal, and in particular where it would endanger the public water supply and where the harm or danger cannot be prevented by the imposition of conditions.

The Canadian legislation entrenches a prior appropriation doctrine which holds that licences authorising diversion of water from the same stream have precedence in law according to the respective priorities of the dates from which the licences take

precedence. Where authorisations have been issued on the same date, preference is ranked according to the respective purposes for which the water is authorised to be used.[32]

The Botswana Water Act creates a process for the application for a water right to a Water Apportionment Board. The board may declare that the water right attaches to specific land and the benefit accrues to the occupier or possessor of the land. The Act empowers the Minister to reduce the quantity of a water right if insufficient quantity exists in a particular area to satisfy all the rights granted. The Act further provides for the determination or diminution of water rights where the holder of a right has not made full beneficial use of the right or where diminution of the right is required for public purposes. In the latter case the right holder is entitled to compensation.

In terms of the Botswana Boreholes Act of 1956, anyone proposing to sink a borehole for purpose of abstracting water (certain shallow boreholes are excluded) must give notice of his intention to do so to the Director of the Geological Survey of Botswana. It is a requirement to keep samples of superficial deposits and strata passed through in the process of drilling. One is also required to keep a record of the progress of the work and to send the record to the Director within 10 days after completion or abandonment of the work. Provision is made for records to be treated as confidential.

Under the new South Australian Water Resources Bill, a range of activities are also controlled through a permit system, the most important for present purposes being the drilling, repairing and altering of wells. Licences, which in the case of the drilling or alteration of wells, are issued by the Minister, are subject to conditions of use which are specified in the relevant water plan. A commonly used licence condition is the irrigation and drainage management plan. This is an on-site water management plan prepared by the licensee, showing how the water will be used both efficiently and in an environmentally sensitive way.

The Bill specifically provides that a water licence or permit is required to drill, plug, backfill or seal a well or to repair, replace or alter the casing, lining or screen of a well. A schedule to the Bill specifies certain classes of wells for which a permit or authorisation is not required. Permits are also not required by owners of land on

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[32] The rankings are from highest to lowest rank : domestic, waterworks, mineral trading, irrigation, mining , industrial, power, hydraulicing, storage, conservation, fluing, conveying and land-improvement purposes. Licences issued authorizing the diversion of water from the same stream for the same purpose and on the same date have equal precedence.

which wells are situated subject to certain provisos.[33] The Bill further provides that only licensed well drillers may obtain such permits or authorisations. Well drillers licences are granted by the Minister on application by persons who hold the necessary qualifications which are prescribed by regulation. The Bill further provides that the owner or occupier of land on which a well is situated must ensure that the well (including the casing, lining, and screen of the well and the mechanism used to cap the well) is properly maintained. Where a well is in need of remedial work and the Minister is of the opinion that the defect resulted from the work of a licensed well driller he may require the driller to undertake the remedial work.

The UK's Water Resources Act 1991, also provides for a licence system as a means of restricting abstraction from any water source including underground strata. It provides that no person shall begin to construct or extend any well, borehole or other work by which water may be abstracted from underground strata without a licence and in accordance with its conditions. Provision is also made for notices with respect to borings not requiring licences. Anyone who proposes to construct a well, borehole or other work to prevent interference with the operation of underground works, is required to notify the NRA of his intention before he begins to construct. To apply for an abstraction licence in respect of underground water, one must either be an occupier of the land comprising the underground strata or have a right of access to the land. The management of abstraction control is made easier in the UK by virtue of the fact that groundwater is not used extensively for irrigation.

The prohibition against use without a licence in most jurisdictions does not apply in the case of water required for an individual's reasonable domestic needs or for stock watering provided that the use does not have an adverse effect on the environment. This is generally either measured volumetrically or in terms of an abstraction rate. In the UK a licence is required 'unless the abstraction is such that the quantity of water abstracted from the strata ... exceeds twenty cubic metres, in aggregate, in any period of 24 hours'.

In Spain, the granting of an administrative concession is required for the use of groundwater which exceeds a specified annual volume or which exists in areas declared as over-exploited or in danger of over-exploitation by the relevant drainage basin authority. All new works designed for the purpose of abstracting groundwater require such a concession. Concessions are granted taking into

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[33] Permits are not required by owners of land or employees or sharefarmers of the owner to drill, repair, replace or make any alterations to the casing, lining or screen or a well or to plug, backfill or seal a well if the well gives access to underground water the surface of which is at atmospheric pressure and the salinity of which exceeds 1800 milligrams per litre and the work is carried out solely for the purpose of maintenance...(s20)

account the joint rational exploitation of surface and underground resources. The rate of abstraction is controlled, in the case of new boreholes, by water meters and in the case of old boreholes, by means of pump specifications. Control is achieved through a basin police with about one policeman per 1000Km.

It is generally agreed that Arizona has the most comprehensive groundwater management legislation in the United States. While subscribing to the broad doctrine of reasonable use, which applies to surface water, the 1980 Arizona Groundwater Management Code establishes three levels of water management to respond to different groundwater conditions. The lowest level of management includes general provisions that apply state-wide. The next level of management applies to Irrigation Non-Expansion Areas. The highest level of management, with the most extensive provisions, is applied to Active Management Areas (AMA's) where groundwater overdraft is most severe.

Within an AMA a person must have a groundwater right or permit in order to pump groundwater, unless the person is withdrawing groundwater from an exempt well. An exempt well is a well with a maximum pump capacity of 35 gallons per minute. Exempt wells may be used to withdraw groundwater only for non-irrigation purposes and are generally used for domestic purposes. A permit or right is required to withdraw water from any well with a pump capacity greater than 35 gallons per minute. These include grandfathered rights, service area rights and withdrawal permits.

Grandfathered rights include irrigation grandfathered rights, Type 1 non-irrigation grandfathered rights and Type 2 non-irrigation grandfathered rights. An irrigation grandfathered right is the right to use groundwater to irrigate specific acres of land which must have been irrigated with groundwater between 1975 and 1980. Land without an irrigation grandfathered right may not be irrigated with groundwater. The right does not specify how much groundwater can be pumped; that amount varies over time according to a formula established in management plans drawn by the Department of Water Resources for each AMA. An irrigation grandfathered right may not be sold apart from the associated land. A Type 1 right is associated with land permanently retired from farming and converted to a non-irrigation use. This right, like an irrigation grandfathered right may be sold or leased only with the land. A maximum amount of groundwater that may be pumped each year is attached to the right. Groundwater withdrawn under a Type 2 right can generally be used for any non-irrigation purpose. The right is based on historical pumping of groundwater for a non-irrigation use and equals the maximum amount pumped in any one year between 1975 and 1980. Type 2 rights may be sold separately from the land or well.

Most Arizonans receive domestic water through service area rights. These rights allow cities, towns, private water companies and irrigation districts to withdraw groundwater to serve their customers.

Finally, withdrawal permits are required for new withdrawals of groundwater for non-irrigation uses within AMA's. The Code provides for seven kinds of permits including : mine dewatering permits, mineral extraction and metallurgical processing permits, general industrial use permits, poor quality groundwater withdrawal permits, temporary permits for generation of electricity, temporary dewatering permits and drainage permits. There are no permits for irrigation uses because irrigation other than grandfathered irrigation is not permitted. Each type of permit or right is subject to certain conditions, particularly on the quantity and purpose of the groundwater use. Every permit or right, except a right based on an exempt well, is subject to the conservation requirements in the management plans for each AMA.

As far as the registration of drillers is concerned, the Code requires the owners of existing wells to register their wells with the Department of Water Resources and provide information about the well's location, depth, size and pumping capacity. Wells may be constructed and modified only by licensed well drillers. A person may drill a well on his own land without having a contractors licence, but he must first obtain a single well license from the Department. Wells must be constructed according to standards promulgated by the Director. Well logs, as well as pump test, water level and equipment reports must be submitted to the Director. Anyone wishing to construct a new well must file either a notice of intent to drill or an application for a well drilling permit. The type of filing necessary depends upon the type of well being constructed and the location of the well (whether it is within or outside an AMA).

In all jurisdictions reviewed the use of all water, including groundwater is made subject to the obtaining of a permit or licence. It is in the criteria for allocating licenses and the uses and works that may be undertaken without a licence that differences between the approaches taken begin to emerge. In the more advanced jurisdictions, all wells are required to be registered while in more developing countries, with limited administrative capacity, only new wells require registration. Generally the right to abstract attaches to a specific area of land with the benefit accruing to the occupier of the land or a person with lawful access to the land. Once again in more advanced countries a licence is required not only to drill a new well but to alter or repair a well whereas in less developed countries a license is only required to drill a new well. Different approaches to wells not requiring licences are also evident. In all jurisdictions use of water for domestic and stock watering purposes are exempt but what constitutes domestic use may be measured volumetrically or in terms of abstraction rates or in some cases by the depth of the well. Exemptions or special licence considerations are also generally applied to owners of land on which wells are situated. In most jurisdictions, a regional water plan determines the allocation criteria, granting licences in areas where groundwater resources are not imperilled in terms of quantity or quality.

STRATEGIES TO ENSURE EFFECTIVE INFORMATION FLOW BETWEEN DIFFERENT GROUNDWATER MANAGEMENT INSTITUTIONS

The lack of hydrological data in many countries, particularly developing countries is a major obstacle to groundwater resources evaluation. This problem becomes more and more acute as the use of available surface water resources are exceeded. The need for conjunctive use of both surface and groundwater is often recognised but utilisation is hampered by a lack of hydrological information and the cost associated with its collection. This problem has, to an extent been addressed in Botswana's water legislation. It requires drillers to obtain licences and 'data submission is made part of the renewal conditions, so the onus is on the driller to submit the required data'.[34] The granting of a water right to abstract the water from a borehole is made subject to borehole registration which is similarly dependent on the provision of hydrological information. Registration can be refused if information is inadequate. A form of 'internal audit' is ensured by the provision which makes the borehole owner responsible for maintenance of the borehole. It thus clearly becomes in the borehole owner's interest to ensure that the driller completes his registration certificate (which requires fairly detailed information) accurately.

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[34] M Sekwale, Hydrogeological data collection, storage, retrieval and water law in Botswana, Challenges in African Hydrology and Water Resources, 1984

Groundwater information is managed in the United States in terms of the National Water System of the US Geological Survey (USGS).The information system was developed by consulting several user groups' lists of requirements (groundwater, surface water, water quality, sediment, National Data exchange, spatial data and water use). Data entry and data storage remain at state level and standardisation and quality control is achieved through the common system and the many built in reference tables. Information may remain confidential by keeping it separate in multiple databases however the policy of the USGS is to allow public access to the data base.

In Arizona, all groundwater withdrawals in Active Management Areas and in Irrigation Non-Expansion Areas, except withdrawals from exempt domestic wells must be measured by an approved device and the quantities of groundwater withdrawn must be reported annually. This reporting procedure forms the basis of the ' pump tax' or groundwater withdrawal fee applicable to all persons withdrawing groundwater in AMA's. A new groundwater quality database is presently being developed for Arizona to support water quality assessment. In terms of the Act all data must be available to the public.

Israel is embarking on a programme of mapping pollution sites, which includes the type of source and the process that can cause pollution. Agreement has also been reached by institutions such as Health, Environment the Water Commissioner and Water Companies to create a national water quality information centre and national laboratory to share water quality information.

The importance of information retrieval is clearly realised in all jurisdictions assessed. It is generally implemented through licence conditions and duties are imposed on the driller and owner of the borehole to submit information. The 'internal audit' approach followed in Botswana appears to be an effective method of ensuring that information is available when boreholes are drilled. Systems for involving drillers or owners of boreholes in the continuing provision of groundwater information are not apparent from the legislation surveyed.

METHODS USED TO PROTECT GROUNDWATER QUALITY

As stated above, this topic forms the subject matter of a separate task team. This part of the report is thus limited to an examination of the principal legislative and institutional differences in approach to groundwater pollution control. The practice followed in the United Kingdom and Australia demonstrate some of the major aspects.

In Australia water pollution control is mainly based in independent acts outside the general water legislation. This generally also means that pollution prevention is administered by authorities' other than those administering the use and management of water resources. An exception is the Northern Territory Water Act of 1996 where a water pollution prevention system consisting of a general ban, State quality standards, a licence system and monitoring is an integral part of the general water legislation.

In New South Wales, in terms of the Clean Waters Act 1970, water resources are classified according to their existing and future uses and 'assimilative' capacities. The original idea of classifying all water resources was not practical however, and hence there is only a classification system for a minority of state waters. The Act places a general ban on polluting subject to a licence and applies equally to all waters and specifically provides in the definition of 'pollute' for pollution caused by the 'percolation into any water' of any contaminant. The Act is a sector specific pollution prevention act, implying that integrated pollution control has not been achieved. This is mitigated however by the provisions of the Pollution Control Act which establishes a co-ordinated framework for a licence procedure. In terms of this Act one may apply for a discharge licence into any media.

Administrative integration of pollution control in New South Wales has been provided for by the establishment of an Environment Protection Authority (EPA) in terms of the Protection of the Environment Administration Act. One function of the EPA is to prepare substantive integration of the existing licensing and discharge provisions in various pollution control enactment's. In respect of water quality management a classification scheme is under preparation which establishes water quality criteria and a set of water quality goals.

In the United Kingdom, overall responsibility for the monitoring and protection of groundwater quality and the conservation of its use for water resources has been entrusted to the National Rivers Authority (NRA) in terms of the Water Resources Act of 1991. The powers of the NRA are set out in the Act. In respect of groundwater quality, the NRA must, inter alia, achieve statutory quality objectives for groundwater and control discharges to groundwater through a discharge consent process. In addition the NRA also controls discharges from prescribed industrial processes and controls waste disposal to land.

The NRA inherited various groundwater protection policies from the Water Authorities. These policies evolved to meet specific groundwater protection problems and lacked any national co-ordination. In 1992 the NRA published a national policy for the protection of groundwater. A key objective of the policy was to devise a framework that covered all types of threats to groundwater. Central to the policy are the concepts of vulnerability and risk. The policy sets out a system

for the classification of groundwater vulnerability and a system for defining and demarcating groundwater source protection zones. The classification of groundwater vulnerability is based upon the key variables of the nature of overlying soil cover, the presence and nature of Drift, the nature of strata and the depth to the water table (thickness of the unsaturated zone). Source protection zones are determined by the travel time of potential pollutants and source catchment areas. The aim of the NRA is to produce a set of vulnerability maps that cover the country (53 maps at a scale of 1:100 000). In addition to vulnerability mapping, the NRA also proposes to map important Source Protection Zones. These are divided into 3 categories : Zone 1 Inner source protection, Zone 2 Outer source protection and Zone 3 Source catchment. Vulnerability maps and the definition of source protection zones provide the method in terms of which the NRA's policy is implemented. Through the development of 'acceptability matrices' all activities or developments are linked to groundwater resource vulnerability and source protection zones so that more stringent controls or protection measures will be sought in situations of greater risk.

This policy is provided for, in general terms, by the Water Resources Act , which provides for the determination of statutory water quality objectives. Provision is made for a system of classifying the quality of various controlled water resources. The classifications essentially prescribe the purposes for which the water resources are suitable or substances or concentrations of substances that are to be present in or absent from the water resources. Quality standards for rivers and for groundwater are being developed.

In most jurisdictions examined, no legal separation exists between the pollution control legislation that applies to surface and groundwater. The principal distinction is between jurisdictions that incorporate pollution prevention measures and enforcement agencies within water related legislation specifically and those that have separate pollution legislation and a separate pollution Inspectorate which operates independently of the water legislation.

INSTITUTIONAL STRUCTURES FOR THE RESOLUTION OF CONFLICT BETWEEN COMPETING USERS AND CONFLICT MANAGEMENT IN THE LICENSING PROCESS

It is clear that some form of public participation in the licensing system is crucial. Most statutes allow either for objections to be lodged or for more expansive notice and comment procedures. In Germany and British Columbia, before granting a licence, the relevant authority must hear objections from affected persons. In British Columbia the authority may decide that a hearing is warranted, whereas the

German legislation provides that licences will be granted only if the detrimental effects are prevented or made good by the imposition of conditions. Where this is not possible, the licence may nevertheless be granted, subject to the affected person being granted compensation. An affected person who was unable to foresee any detrimental effects before the grant of a licence may request that conditions be imposed ex post facto.

In Alberta, extensive provisions for public notification of applications, and objections thereto, are incorporated in the Act. Similarly, the New Zealand legislation provides that notice of the application must be served on persons who are likely to be directly affected by the application, including adjacent owners and occupiers of land. Decisions must be taken in accordance with plans and policies. Affected individuals may appeal to the Planning Tribunal.

In South Australia a special Environment, Resources and Development Court has been established to hear appeals on a wide range of environmental topics. In terms of the new Bill appeals lie to this court in respect of licence irregularities including the refusal to grant a licence or permit and one may apply to the court to prevent a breach of the Act. Similarly in New South Wales and Queensland, a Land and Environment Court has been created and vested with collective competence for general and administrative jurisdiction in the fields of environment, planning natural resources and land use.

In all jurisdictions reviewed, provision is made for appeals against decisions concerning the granting, revocation or refusal to grant licences or permits. The major distinction concerns whether the appeal institution is constituted at a central level or at a regional or catchment level and whether the tribunal should be specifically formed to deal with water or natural resource related matters or should simply be an extension of the state civil or criminal justice system.

STRATEGIES TO ENSURE PROTECTION OF THE RESOURCE ITSELF

The notion of an ecological reserve, developed in the Water Law Review Principles has its origin in river system thinking. Although it is difficult to define a reserve for groundwater on its own and in isolation from the rest of the hydrological cycle, such a reserve can have special meaning for groundwater, because of its special characteristics and the nature of its occurrence and local importance.[35]

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[35] E Braune The resource base in the case of groundwater, discussion document 1997

Regulations published in terms of the Spanish Water Act of 1985 define a procedure for the declaration of underground water resources in a particular area to be over-exploited or in danger of being over-exploited. In such a case the relevant Drainage Basin Authority must establish comprehensive rules for all kinds of uses in order to achieve more rational exploitation of the resource and make the necessary revision to the respective hydrological plan. An aquifer is deemed to be over-exploited or in danger of over-exploitation when the water uses generated by the aquifer are in danger of immediate extinction as a result of the annual withdrawals exceeding, or being very close to, the average volume of renewable annual resources, or withdrawals that cause serious degradation to the water quality. An aquifer shall also be declared to be in danger of over-exploitation when the quantity of withdrawals carried out, in terms of the renewable resources of the aquifer, results in the continuation of the danger for the uses of the aquifer in the long term.

In a later evaluation of this definition it was apparently[36] felt that either all the causes that might endanger the uses should be listed or they should all be removed from the definition and the decision left to the Basin Authority.

Once an aquifer has been declared to be over-exploited or in danger of over-exploitation other measures to manage the over-exploitation are brought to bear including the setting of rules for further exploitation, extraction planning as the mechanism to correct, or at least minimise, the undesirable effects related to over-exploitation, assessment of the exploitation of an aquifer in terms of all the benefits which are harnessed from exploiting the resource, including economic, social, ecological environmental and political and other practices such as conjunctive use, artificial recharge and supplementing or combining water from different sources.[37]

Other legislation is less specific in its protection of the resource itself.

The German legislation provides for the establishment of water-protection areas where it is necessary to protect certain waters against detrimental practices, in the interests of the existing or any future public-water supply and to recharge groundwater. Within these areas certain activities may be prohibited or permitted only to a limited extent. If an order amounts to expropriation, compensation will be paid. Where an order limits agricultural or silvicultural use of land, reasonable compensation will be paid to make up for the economic disadvantage. This section specifically allows recourse to the courts in matters of dispute.

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[36] E Braune The resource base in the case of groundwater, discussion document 1997

[37] Ibid

In New Zealand, where water is outstanding as a habitat for terrestrial or aquatic organisms, as a fishery, for its wild, scenic, scientific and ecological values, or for recreation, historical, spiritual, or cultural purposes, a water-conservation order may provide for the preservation of that water in its natural state.

One of principal objects of the new South Australian Water Bill is to safeguard ecosystems, including the biological diversity of ecosystems which produce and are associated with water resources. The Bill also subscribes to a precautionary approach to the assessment of risks of impacts arising from the use and management of water resources. In developing water allocation plans, water resources management boards are specifically required to assess the quantity of water needed by the ecosystems that depend on the water resource. This enables the board to assess how much water is available for consumptive use.

Interestingly, numerous Australian urban water supply acts also provide for environmental factors, though mainly as part of a wider context. The objects of the New South Wales Water Supply Authorities Act for example include 'ensuring that the water and related resources within the area of an Authority are allocated and used in ways which are consistent with environmental requirements'. In exercising its functions an Authority may have regard to factors including 'the necessity for integrated catchment management and planning of land use and the use of water resources and the conservation of natural resources'.

In the United Kingdom, one of the specific functions of the National Rivers Authority (NRA) is to manage groundwater so that it does not prevent the maintenance of acceptable flows in rivers. The Water Resources Act contains provisions for determining and considering minimum acceptable flows or volumes of inland waters. Although inland waters do not include groundwater, provision is made for related groundwater considerations to be taken into account in determining such flow or volume. In determining the flow or volume, the extent to which rights to abstract groundwater may be affected must be considered. Provision for environmental flow requirements is not explicitly made in the provision however, although the NRA is given a fairly wide discretion to consider other factors it deems appropriate in determining the flow or volume.

The cornerstone of the Arizona Groundwater Management Act is conservation. As explained above, in Arizona Active Management Areas (AMA's) are established in areas where groundwater supplies are imperilled. AMA's include 80% of Arizona's population and 70% of the state's groundwater overdraft. The primary management goal within AMA's is to achieve safe yield by 2025, defined as a long term balance between the annual amount of groundwater withdrawn in the AMA and the annual amount of natural and artificial recharge. To reach the goals established for each AMA, the Groundwater Management Code directs the Department of Water

Resources to develop and implement water conservation requirements for agricultural, municipal and industrial water users in five consecutive periods over 45 years from 1980. With each consecutive period, the management plans contain more rigorous water conservation and management requirements. The management plan for each management period is subject to public notice, hearing and appeal. The plans include provisions for aspects such as an assessment of groundwater quality in the AMA's which includes a groundwater quality management programme and a programme for augmentation of the water supply in each AMA which include specific programmes for artificial recharge. If during the third management period, satisfactory progress has not been made towards safe yield, the Director may levy a pump tax to be used for the purchase and permanent retirement of grandfathered rights. (see above) Purchase and retirement under this programme will not be for the purpose of transferring grandfathered water uses to new uses. The water rights purchased will be permanently extinguished and those demands on the groundwater basin eliminated.

Increasingly, the notion of sustainable yield of water resources generally and groundwater specifically, is being incorporated in water legislation abroad. The Spanish legislation with its definition and management procedure for aquifer over-exploitation is possibly the most innovative in this regard. Ultimately however, measures to provide for the 'ecological reserve' no matter how strict their definitions are, depend upon a subjective assessment or value judgement of the trade-offs that require to be made in determining the desired state of the resource

OBSERVATIONS

Having analysed groundwater regimes in numerous countries the following similarities emerge. It is clear that the legislation is informed by the necessity to conserve and distribute the resource in the public interest. In most jurisdictions, the hydrological cycle is recognised in the statutory definitions of 'water'. No distinction is made between the legal status of surface and groundwater. Property in the national water resources vests in the State and is allocated according to a licensing system. The New Zealand, German and Canadian statutes provide for public participation in the licensing procedure, while the German legislation advocates the use of alternative dispute resolution mechanisms to resolve conflict. In some cases where licences are revoked, the licensee is statutorily entitled to compensation. The licences pass with the land to the successor in title.

In spite of the vesting of title in the State, certain rights to use water are saved by the legislation. Landowners rights to use as much water as they used prior to the

enactment of the legislation is saved. The effect of this is that only unappropriated water is available for redistribution by the State. The right to use water for domestic purposes, defined in various ways, without requiring a licence is protected.

There is also a clear trend to delegate water management functions to lower levels of government with some jurisdictions recognising the catchment as the basic unit in water resources management. Equally important is the realisation in many countries of the importance of integrated management of all natural resources and the co-ordination of management functions between all departments involved in resource management. This is particularly evident in the New Zealand legislation.

The necessity of effective information retrieval systems is embodied in most modern groundwater legislation as are provisions for ensuring sustainable use of the resource.

PART 5

RECOMMENDATIONS TO THE DRAFTING TEAM CONCERNING THE PROTECTION AND UTILISATION OF GROUNDWATER IN A NEW WATER CODE :

SELECTION OF THE MOST APPROPRIATE OPTIONS FOR ADDRESSING SOUTH AFRICA'S GROUNDWATER MANAGEMENT PROBLEMS

INTRODUCTION

As stated in the introduction to this report, it is understood that the development of broad enabling legislation, which gives effect to the legislative policy enshrined in the Water Law Principles, is the focus of this stage of the Water Law Review process. Detailed regulations, specifying the precise methodology to be adopted for the implementation of practical water resource management approaches, are to be formulated at a later stage. Accordingly, this part of the report aims to provide the drafting team with a recommended legislative approach to an enabling rather than a regulatory framework, for the protection and utilisation of groundwater in South Africa. The recommendation gives effect to what the task team considers to be the most appropriate practical management option for equitable and sustainable management of the resource.

As evident from the Preamble and the recognition accorded to the hydrological cycle in the Water Law Principles, the fundamental approach of this task team is that surface water management and groundwater management should be integrated as far as possible. From a legal drafting perspective this entails integrating the legislative approach to both sources and providing for separate management, resource allocation or protection regimes only where absolutely necessary.

The recommendations contained in this part of the report therefore, draw a distinction between what should be included in general provisions of the new water Code, which apply to all water resources and specific features, unique to groundwater, that should be dealt with in a separate chapter in the new Code.

To assist the drafting team, the sources of the legislative approach suggested will be provided where they are based on legislative regimes operative in foreign jurisdictions.

In proposing an integrated legislative framework, this part of the report deviates from the structure of parts 3 and 4. It is submitted that the development of

appropriate management options and corresponding legislative approaches to each of the topics discussed in the parts referred to, will further perpetuate legislative and management fragmentation. Accordingly, this part of the report describes a management and a legislative approach to utilisation management, which consists essentially of a licensing and permit system, and resource protection which is achieved through a differentiated protection strategy. Institutional and other aspects to these inter-related topics are then incorporated under these broad headings.

GROUNDWATER UTILISATION MANAGEMENT

The general approach

In legal terms, utilisation management is concerned with the regulation of the right to use groundwater. In essence, as mentioned above, the approach of the groundwater policy task team is that surface water management and groundwater management, including abstraction control, should be integrated as far as possible. This stems from their inter-connectedness in the hydrological cycle and is necessary to provide for optimal use of water resources, which is often only possible through conjunctive use of surface and groundwater. The integration of groundwater quantity management and quality management is also necessary due to the fact that both forms of management have the objective of maintaining the resource base through sustainable utilisation. For the sake of clarity, groundwater quality management is dealt with below under the heading of resource protection.

Integrated management is best achieved by combining surface and groundwater management institutions (discussed below) and by unifying the allocation mechanism applicable to the two sources. This is not to say that no distinctions may be drawn between the two sources for the purpose of implementing abstraction control, which take cognisance of the unique features of both sources. Whilst it is regarded as fundamental that allocation should always take place within the context of the hydrological unit, taking all the resources within that unit into account, utilisation management approaches will differ from unit to unit and also between surface and groundwater resources depending on the resources and demand characteristics in the unit and the resource base that requires protection.

To complicate matters, groundwater occurrence in South Africa is highly localised and of limited yield over large parts of the country. There is also a dearth of reliable hydrological information about the resource in many areas. For this reason, different utilisation management approaches and priorities need to apply to different sources of groundwater. A uniform system of regulating groundwater use is accordingly, neither necessary nor practical.

A three tiered management approach is accordingly proposed to regulate the use of groundwater :

- Registration of all new boreholes, controlled by a permit system.
- Control over 'high' abstractions by the granting of abstraction licences which apply uniformally to all water resources, yet allow for differentiated regulation depending on the particular characteristics of the resource and the utilisation management approaches and priorities which apply in the circumstances.
- Control over a number of 'high' abstractions by the restrictive granting of abstraction licences as provided for above.

There is a fourth 'tier' to the groundwater utilisation management strategy that demands consideration. This concerns the regulation of activities which represent the most significant threat to the groundwater resources of the country. Since this is integral to the groundwater protection strategy discussed later in this part, this aspect will also be dealt with under that heading despite the recognition that these activities constitute a 'use' of groundwater and thus should be dealt with as part of utilisation management.

The insistence on a uniform allocation system stems from the principle of integrated management and is further necessary to provide for conjunctive use which may be obtained by granting only one licence for all water abstraction.

OBSTACLES TO A UNIFORM ALLOCATION SYSTEM : THE LEGAL STATUS OF WATER

The legal categorisation of all water, including groundwater, as res communes, in which no right of property attaches, has been settled by the Water Law Principles and follows strong international precedent.

As demonstrated in the international survey in Part 4, the all-encompassing definition of water does not mean that no distinctions may be drawn between resource management approaches applicable to surface or groundwater, which take cognisance of the unique features of both sources.

RECOMMENDATIONS CONCERNING THE LEGAL STATUS OF WATER

To ensure that groundwater is included in the legal categorisation of all water as res communes, requires the definition of 'water' in the Code to make specific mention of groundwater. An all inclusive definition of water, that may be instructive, is used in the New Zealand Resource Management Act 1991 where 'water' is defined as 'water in all its physical forms whether flowing or not and whether over or under the ground'. It includes fresh, coastal and geothermal water, but does not include any water in any form while in any pipe, thank or cistern.

To draw distinctions between resource management approaches that take cognisance of the unique features of surface and groundwater, requires clear, separate definitions of the two sources. The South Australian Water Resources Bill contains a useful definition of underground water as 'water occurring naturally below ground level or water pumped, diverted or released into a well for storage underground'. This is distinguished from surface water defined as 'water running over land [except in a watercourse (including rivers etc.)] after having fallen as rain or hail or having precipitated in any other manner' or the abovementioned water 'that has been collected in a dam or reservoir'.

BOREHOLE REGISTRATION

The registration of boreholes is primarily designed to facilitate groundwater data collection for local, regional and national water resources planning and management. As groundwater resources reach their exploitation potential, sustainable utilisation depends more and more on reliable information.

If properly utilised, registration of boreholes also achieves an initial level of control of groundwater abstraction. It is a common feature of many foreign water law systems and is generally coupled with the requirement to provide information on aspects such as :

- location
- depth
- depth where water reached

- rest water table
- geological log
- borehole construction
- pumping test
- water quality

It is proposed that provision be made in new water legislation for the registration of boreholes and the furnishing of information to local water resource management boards. Due to the magnitude of the task, the initial focus should be only on the registration of new boreholes, but provision should be made for eventual registration of existing boreholes. Information should be stored on a data bank operated by the local board and if necessary facilitated and supported by a higher level water management authority. This would allow for the early identification of potential conflict over the available resources or other information which may necessitate more stringent protection measures to be imposed. Local data bases should be linked with regional and national information systems for the monitoring of groundwater development trends and for higher level resource assessments.

It is also suggested, that in certain proclaimed areas, where groundwater resources are particularly important or vulnerable to over-exploitation, notice of an intention to drill a borehole should be required before drilling commences. To obtain the necessary authorisation land owners could be required to pay a deposit which is only refundable upon satisfactory furnishing of borehole information. This would provide additional protection and regulation of sensitive or vulnerable groundwater resources.

By virtue of the anticipated difficulty in obtaining compliance with such registration procedures from land owners, it is proposed that the onus to register boreholes be placed on the driller. Land owners may be encouraged to ensure that all boreholes are registered by making abstraction licences (dealt with below) conditional upon borehole registration, as is done in Botswana.

A system of licensing drillers is also proposed, a condition of which will be the mandatory registration of all holes drilled and the furnishing of borehole data. A code of minimum practice, and appropriate qualification and training of drillers should be integral to the procedure for the obtaining of drillers' licences which would facilitate the attainment of professional standards in the groundwater industry in South Africa.

Recommendations concerning borehole registration

As mentioned above, the institutional structure proposed for the registration of boreholes and the retrieval of information is local water resource management boards which may be aquifer based or catchment based and which operate within a framework of regional and national water resource management institutions. This is dealt with in more detail below under the heading 'Institutions for groundwater utilisation management'.

As far as the registration requirements are concerned, it is recommended that legislation should require drillers to register and furnish prescribed information about new boreholes that they drill, to local water resource management boards. Registration may be refused if information supplied is inadequate. A time period within which such registration must take place must be prescribed. The legislation should provide for the promulgation of standards according to which boreholes must be constructed. Only licensed drillers, who satisfy certain qualification criteria set out in regulations, may construct or modify boreholes. The granting of abstraction licences should be made subject to borehole registration.

Legislation should grant the relevant authority the power to require registration of all boreholes, in certain areas, where additional information is required.

Provision should be made to exempt owners of land who intend to drill a borehole to provide for domestic or stock watering purposes on their own land, from the general requirement that only licensed drillers may drill boreholes.

As stated above, it is also suggested, that in certain proclaimed areas, where groundwater resources are particularly important or vulnerable to over-exploitation, notice of an intention to drill a borehole should be required before drilling commences. To obtain the necessary authorisation land owners should be required to pay a deposit which is only refundable upon satisfactory furnishing of borehole information. This would provide additional protection and regulation of sensitive or vulnerable groundwater resources.

It is clearly necessary to provide for the registration of boreholes, as a management aspect unique to groundwater, in a separate chapter in the new Water Code

ABSTRACTION LICENCES

Given the localised nature and limited yield of groundwater resources over large parts of the country and the lack of knowledge concerning the resource as mentioned above, it is proposed to regulate the use of groundwater through abstraction licences. These will be required for abstractions above a certain determined yield, depending on the particular characteristics of the resource and the utilisation management approaches and priorities which apply in the circumstances. It is important to stress that it is envisaged that abstraction licences will apply to the utilisation of all water resources. Differences may however, exist in the application of the licence procedure : the level below which a licence is not required may vary between surface and groundwater sources or even between different groundwater sources.

In accordance with the general trend internationally, it is proposed that the general prohibition against the use of water (including underground water) without a licence, should not apply in the case of water required for domestic needs or for stock watering. This should be determined by the local water resource management board and should be measured volumetrically and may differ from area to area. This exemption may not apply where the use is very concentrated, such as in urban areas or intensive rural settlements, where it may be necessary to regulate all water utilisation in order to protect a particularly vulnerable resource, such as a sole source aquifer.

Due to the localised nature of groundwater resources, provision should also be made for the determination of abstraction levels, which may exceed those required for domestic or stock watering purposes, yet for which licences are not required. This would allow for regulation of only high abstractions which may be necessary to cater for lack of administrative enforcement capacity or to provide for situations where control is unnecessary because of the relative abundance of resources.

The final level of control over groundwater utilisation proposed, applies in areas where there are a large number of high abstractions and some form of conflict resolution institution is required to regulate licence allocation. No changes in the licensing procedure are envisaged in this 'management scenario', but the establishment of a separate institution is required. This is accordingly dealt with under 'Institutions for groundwater utilisation management' below.

Licences to abstract groundwater should be granted for a specified volume of water that may be abstracted although the purpose for which the water may be used may be attached to the licence as a condition. Abstraction volumes authorised by licences must take conjunctive use considerations into account.

Licences may clearly be granted subject to the imposition of conditions. Licences to abstract groundwater should be granted subject to the reservation that at a later date measures may be prescribed for monitoring water use and to ensure that the resource is being utilised economically. Provision should also be made for the amendment of licence conditions depending on the state of the aquifer.

A specific issue that requires attention is the granting of licences to local authorities who depend on groundwater resources to provide water services to their consumers. As in the case of surface water abstractions, it is envisaged that a form of service area rights, as used in Arizona, are granted to cater for such 'collective licence applications'.

Finally there is the question of existing rights to groundwater and the constitutionality of their diminution which may result where licences are not granted for existing uses. Since this is the subject of extensive research by a separate legal team, this report does not attempt to deal in any detail with the topic. It is suggested however, once again as in the case of surface water, that provision should be made for the registration of existing abstractions, in cases where abstraction licences would be required, in terms of which licences may be granted provided such use accords with the relevant water plan.

Recommendations concerning abstraction licences

It is proposed that a single licensing system should apply to the use of all water. This is achieved by defining the use of water, for which a licence is required, as including the withdrawal, conveyance to the surface or the diversion of groundwater. Once groundwater is included in the general licensing system, it is necessary to provide for differentiated utilisation management to take cognisance of resource differences. This is achieved by providing for the declaration of levels of abstraction below which licences are not required. It is important to allow for the variation of these levels to take account of differences in administrative capacity in different regions and for areas where resources are more abundant.

Licences for the abstraction of any water resources should not confer a title to a supply of water in any specific quantity or quality. Licences should be made subject to conditions, such as specific volumes that may be abstracted and the purpose for which the water may be used. Refusal or revocation must be provided for where the proposed use is likely to harm the public interest or the resource base or where the harm or danger cannot be prevented by the imposition of conditions. If constitutionally possible, the Code should provide for diminution of abstraction licences, where the holder of a licence has not made full beneficial use of the licence or where diminution of the licence is required for public purposes.

The Code should also specify who may apply for an abstraction licence. To apply for an abstraction licence in respect of groundwater, one must either be an occupier of the land comprising the groundwater or have a right of access to the land. Service area rights, as applied in the Arizona Groundwater Management Code, may need to be included to provide abstraction rights to local authorities who depend on groundwater resources to provide water services to their consumers.

It must be specified that the prohibition against use without a licence does not apply in the case of water required for domestic purposes or for the watering of stock provided that the use does not have an adverse affect on the resource base. This should be determined by the local water resource management board and the level of use exempted should be measured volumetrically and may differ from area to area.

Licences should be granted by local water resource management boards in accordance with allocation criteria specified in the relevant local water plan, which would, inter alia, determine where groundwater resources are imperilled. More restrictive allocation criteria may be applied in proclaimed areas but these are dealt with more fully under 'Resource protection' below. It is important to stress that despite the fact that distinctions are drawn between surface and groundwater in the implementation of abstraction control, allocation criteria such as equity or efficiency of use or even the prioritisation of certain uses above others, need not distinguish between the nature of the source.

As far existing rights are concerned, as mentioned above, it is suggested that, as in the case of surface water, provision be made for the registration of existing abstractions, in cases where abstraction licences would be required, in terms of which licences may be granted provided such use accords with the relevant water plan.

INSTITUTIONS FOR GROUNDWATER UTILISATION MANAGEMENT

As stated frequently above, in recognition of the hydrological link between surface and groundwater, the approach of the groundwater task team, is that separation between the institutional structures responsible for the management of the two sources is generally unnecessary. However, due to the localised nature of groundwater resources in South Africa, in certain areas specific institutions may be necessary, to afford protection or to facilitate allocation of certain important or vulnerable groundwater resources.

In line with international trends, water resource management clearly requires a centralised authority for its overall management. This is essential in the case of groundwater :

- by virtue of the fact that South Africa does not have abundant groundwater resources and because of the strategic importance of groundwater in many parts of the country;
- to provide norms and standards, to develop national plans for prioritising implementation, resourcing and integrated management; and,
- to allow for planned institutional development, capacity building and support to achieve sustainable management of local groundwater resources, at the lowest competent level.

The recommendation of the groundwater task team is that sustainable water resources development, allocation, protection and operation requires devolution of key functions to the lowest competent level, where the resources occur and are utilised. This should be undertaken within hydrological unit boundaries, taking cognisance of all the resources within the unit. It is envisaged that all catchments and large sub-catchments have catchment management boards, responsible for all water resource management, including groundwater management, within their catchment areas. In the South African context, such boards may consist of representatives from local authorities whose areas of jurisdiction share catchment boundaries. In certain catchments or sub-catchments, where groundwater resources are extensively utilised or are in danger of over-exploitation, further devolution to aquifer based institutions, is proposed where sufficient capacity exists.[38] These local institutions were referred to above as the institution responsible for implementing the highest level of control over groundwater utilisation. They are proposed in areas where there are a large number of high abstractions and some form of conflict resolution institution is required to regulate licence allocation.

These local boards should be responsible for the compilation of water resources management plans for their respective catchments which together make up and subscribe to a national water resources management plan. The boards should also be tasked with the actual implementation of the plans, the granting of licences and permits, inspection of facilities and enforcement. The institutional structure recommended is thus largely based on the Spanish example.

A vital role of local water resource management boards is the facilitation of hydrological data collection primarily through involvement in the borehole registration procedure. As stated above, it is envisaged that information be stored on a data bank operated by the local board and if necessary facilitated and supported by a higher level water management authority. Local data bases should be linked with regional and national information systems operated by the respective regional or national authorities.

Recommendations concerning institutions for groundwater utilisation management

Many of the task teams recommendations are referred to above. Given that the essence of the proposal is that surface and groundwater institutions should be integrated, it is only necessary to deal with institutions required to manage aspects

[38] An example of this structure is the Uitenhage Subterranean Government Water Control Area which exists within the Swartskop River catchment over which a higher level catchment management is exercised.

of groundwater utilisation that do not apply to surface water utilisation management.

Although groundwater basins do not always coincide with surface water catchment areas, the task team recommends that in the South African context, institutions responsible for all water resource management, at the local level, should be structured according to catchment boundaries. Given the political reality of local and provincial government in South Africa which is structured on political rather than physical boundaries, methods to ensure co-ordination between authorities that share catchments, must be provided for in the Water Code. The development of a national water plan and water plans for each basin, to which local and regional institutions must subscribe, as in the Spanish legislation, could facilitate such co-operation.

Of vital importance to effective water resource management generally and groundwater management specifically, is the integration of water resource decisions with general land use planning decisions. Although it is not possible to implement the approach of the United Kingdom in terms of the water law review process per se, the approach is nevertheless considered instructive. In the United Kingdom, the national water resource management authority is constituted as a statutory consultee under planning legislation in terms of which it can influence planning decisions which may have an impact on the yield or quality of groundwater. Although such an approach may not be possible at this stage, legislation should be developed to encourage planning authorities to consult the Department of Water Affairs on matters which impact upon water resources.

Sustainable water resource management requires devolution of key functions to the lowest competent level, where the resources occur and are utilised. In the case of groundwater management, aquifer-based institutions may be required where groundwater resources are extensively utilised or are in danger of over-exploitation. It is proposed that these institutions are constituted as conflict resolution institutions to resolve conflicts that may occur in the licensing process. It is suggested that, wherever possible, conflict should be resolved in the catchment or aquifer context, which will allow for participation of all interested and affected users.

Apart from the duty to formulate catchment or sub-catchment water plans, it is envisaged that local water resource management institutions should be responsible for the administration and actual implementation of the plans and specifically the granting of licenses or permits to utilise groundwater in accordance with the plans. The importance of the local institutions in hydrological information retrieval has already been dealt with above.

To realise the goal of devolved water resource management, the lack of knowledge and experience at local level, particularly concerning groundwater, may necessitate the use of the private sector, to provide for the transition of management functions from national to local institutions. The new Water Code should accordingly provide a mechanism for the involvement of the private sector in this regard.

GROUNDWATER RESOURCE PROTECTION

The general approach

Although this part of the report has separated groundwater utilisation management from groundwater resource protection, this is for convenience only and the interconnection between quantity and quality management must be stressed. This interconnection may be demonstrated by considering the broad purpose of abstraction, or quantity, control. In essence it is twofold. On the one hand abstraction control aims to provide a mechanism for the equitable allocation of a scarce resource. On the other hand, abstraction control aims to protect the resource from unsustainable over-exploitation. Both objectives underpin the licensing process described in detail above. Resource protection demands essentially determine in what areas and for what purposes abstraction licences should be granted.

Despite possible differences at the strategy and operational level, groundwater quality management objectives should be in line with surface water quality objectives, such as the concept of fitness for use, optimal management of all resources to obtain the maximum net benefit and the polluter pays principle. This said however, it must be understood that groundwater has unique characteristics, distinct from surface water, which must be considered when designing groundwater quality management strategies. These include the fact that groundwater flow is very slow with the effect that pollution impacts may be delayed, the fact that groundwater has only a limited assimilative capacity, contamination of groundwater is invisible and difficult to monitor and rehabilitation of contaminated groundwater is difficult and costly.

Notwithstanding the fact that groundwater requires special considerations because of its general vulnerability to impacts of use and abuse, it is vital that it be brought into the mainstream of water resources management to obtain the benefits of integrated management.

THE NEED FOR A DIFFERENTIATED PROTECTION POLICY

Note : Since the development of a groundwater quality management policy and strategy is the subject of a separate task team dealing with water quality generally, only a broad outline of the approach will be presented in this report. The emphasis will be on giving legal content to the implementation of the approach.

The starting point of a groundwater protection stately is that groundwater resources should be used within their capacity for renewal, both in terms of quantity and quality. This approach is also embedded in the notion of the ecological reserve, developed in the Water Law Principles. This concept has its origin in river system thinking. Although it is difficult to define a reserve for groundwater on its own and in isolation from the rest of the hydrological cycle, such a reserve can have special meaning for groundwater, because of its special characteristics and the nature of its occurrence and local importance.[39]

It is widely recognised therefore, that not all groundwater resources require to be protected to the same degree. For this reason a differentiated approach to the protection of groundwater quality is proposed. This means in practice, that the relative stringency and acceptable risk levels for impact minimisation measures which will be required for potentially polluting sources will depend on the nature of the affected resource.[40] The approach will be based on classification of the country's groundwater resources in terms of their relative importance and vulnerability.

Proclamation of Special Management Areas

To implement a differentiated protection strategy, provision must be made for the proclamation of certain areas which are in danger of over-exploitation or require special protection measures because of their relative importance or their vulnerability. The classification system referred to above thus forms the basis upon which areas are proclaimed. These areas could include all water resources within the area, particular surface water resources, particular groundwater sources or even specific boreholes. The purpose of proclaiming particular resources, is that although licences to utilise water will be required in all areas, including unproclaimed areas, within proclaimed areas, special protection measures may be enforced including the restriction of licences to use water or the imposition of special conditions to be attached to such licences.

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[39] E Braune The resource base in the case of groundwater, discussion document 1997

[40] Policy and strategy for management of groundwater quality in the RSA, DWAF 1996

In addition to the proclamation of special management areas, land use zoning should also be considered for the protection of important groundwater sources. Individual aquifer protection decisions should be based on a formalised system of environmental impact assessment for all significant impact including mining, waste disposal and intensive agricultural practices.

Regulation of activities which represent the most significant threat to the groundwater resources of the country

Taking cognisance of limited administrative capacity, regulatory controls will be focused on the abovementioned activities. These include :

- De-watering of groundwater resources
- Disturbance and damage to aquifers, specifically by mining
- Waste disposal from the urban, commercial farming, industrial and mining sectors
- Diffuse sources of pollution associated with urban and rural development specifically around wellheads
- Underground storage tanks

It is proposed that a system of withdrawal permits, similar to that used in Arizona, is established to regulate the utilisation of groundwater by the activities mentioned above. It is suggested that such activities should only be allowed if the proponent has exhausted all reasonable options to avoid the impact and where the rights of other water users will not be affected.

Recommendations concerning the implementation of a differentiated protection strategy

Integration of groundwater quantity and quality management is implicit in the operation of a licensing system. Both quantity and quality objectives are achieved if the allocation criteria for the granting or refusal of licences is made subject to resource protection strategies as in the case of proclaimed areas.

Surface and groundwater quality objectives may be integrated by creating the possibility of proclaiming all water resources within an area, particular surface water resources, particular groundwater sources or even specific boreholes. Restrictions would then be applicable to all resources within the proclaimed area, thus integrating quality objectives.

Whilst integration of surface and groundwater objectives is desirable, the distinct features of both sources must be taken into account in implementation. In particular groundwater quality strategies require to be more proactive than surface water strategies by virtue of the fact that contamination of groundwater is invisible and difficult to monitor and rehabilitation is difficult and costly.

As stated above, the purpose of proclaiming particular resources, is that although licences to utilise water will be required in all areas, including unproclaimed areas, within proclaimed areas, special protection measures may be enforced. Concepts such as safe yield may be useful criteria for deciding when licences should be granted, particularly in proclaimed areas. Safe yield, is defined in the Arizona Groundwater Management Code as a long term balance between the annual amount of groundwater withdrawn ... and the annual amount of natural and artificial recharge. If by granting the licence the former amount will exceed the latter amount, clearly a licence should not be granted. This system however, requires extensive hydrological information before it can be accurately enforced. In the absence of such detailed information, it is recommended that a precautionary approach be provided for in regard to the granting of licences or permits to utilise groundwater.

As far as providing for the proclamation of special management areas is concerned, the Spanish Water Act may be particularly instructive. As mentioned earlier in this report, regulations published in terms of the Act define a procedure for the declaration of underground water resources in a particular area to be over-exploited or in danger of being over-exploited. In such a case the relevant Drainage Basin Authority (catchment or aquifer based water resource management board in the South African context) must establish comprehensive rules for all kinds of uses in order to achieve more rational exploitation of the resource and make the necessary revision to the respective hydrological plan.

Once an aquifer has been declared to be over-exploited or in danger of over-exploitation other measures to manage the over-exploitation are brought to bear including the setting of rules for further exploitation. It is recommended that comparable provisions be provided for in the new Water Code.

Recommendations concerning institutional requirements for groundwater resource protection

Given the objective of integrating both surface and groundwater management and quantity and quality management, little needs to be added to what has already been stated.

The role of catchment or aquifer based water resource management boards in proclaimed areas is illustrated above with reference to the Spanish experience.

As aspect that requires consideration however, is whether water quality monitoring supervision should be similarly devolved to local water resource management boards. There is a perception that this function should possibly be retained at a higher level which is less subject to local politics and better able to obtain the support and control of a central government authority.

To the extent that it is possible, it is accordingly recommended that water quality monitoring and control functions should not be devolved entirely to local level.

The importance of ensuring co-operation between different government departments involved in land use management and activities which impact upon groundwater resources has been stressed throughout this document. It is particularly important in groundwater resource protection management. Once again, concepts such as the statutory consultee notion in the United Kingdom should be investigated in this regard.

PART 6

PREAMBLE TO GROUNDWATER CHAPTER IN NEW WATER CODE

Groundwater is a strategic resource in South Africa on two accounts. It occurs widely; even in the drier two thirds of the country where surface water is limited, and the use of local groundwater sources is a cost-effective method of meeting essential domestic water needs.

Groundwater is particularly vulnerable to poor management. This is because of its 'invisible' nature, the often delay before over-exploitation manifests itself and its limited self-purification capacity. Once groundwater becomes polluted, it is difficult, if not impossible, to rehabilitate. The major reasons for its poor management are ignorance and lack of information regarding its occurrence and the importance of its protection.

In the past, groundwater has been neglected in South Africa, both in terms of its effective utilisation and its proper protection.

The specific inclusion of groundwater considerations in all water resource management is thus necessary in the new Code to ensure the sustainable utilisation of this resource for the benefit of all the inhabitants of the country.

When considering water as a resource, no distinction should be made between surface water and groundwater. They are closely related in the hydrological cycle and should both be subordinated to the public interest and be managed in an integrated way to obtain maximum beneficial use.

Groundwater resources, both in quality and yield, are put at risk by a wide range of human activities. These should be managed to ensure the sustainable utilisation of the resource.

Key criteria for the management of groundwater and the allocation of its use should be beneficial use, economic efficiency, equity and protection of the resource base. These are in fact the same criteria that govern the management and utilisation of all water resources.

The resource base of groundwater must be protected against irreversible damage. The groundwater resource base includes its quality, storage for future use and the aquifer matrix integrity and stability. The essential contributions to springflow, river base flow, evaporative demands of vegetation and other environmental features are also dependent upon the presence or level of the groundwater table.

In South Africa's situation of widespread and highly localised groundwater occurrence and use, it will be physically and economically impossible to protect all groundwater resources to the same degree. For effective and focused intervention, a differentiated protection approach is necessary, based on the vulnerability and importance, both regionally as well as locally, of aquifers.

To avoid unnecessary risks to groundwater resources, requires knowledge-based management. However, obtaining such knowledge in the case of groundwater is an incremental process, necessitating a precautionary approach to all groundwater management decisions. Strategies and actions should be pro-active, planned and preventative, wherever possible, rather than reactive.

Because of its localised occurrence and vulnerability to a large variety of local impacts, groundwater cannot be managed and protected successfully unless management responsibility is devolved to the lowest competent level. Since the basic hydrological unit in water resource management, including groundwater, is the catchment, management institutions should be structured according to catchment, or sub-catchment boundaries.

This will require essential new functions for government : namely, awareness creation about the need for groundwater protection; capacity building and support for all sectors where groundwater management has to be undertaken; auditing and control; and action in those instances where regulatory initiatives by other authorities fail or are not yet in place.

Of vital importance is the need to ensure co-operation between different government departments involved in land use management and activities which impact upon groundwater resources.

In a situation of widespread local development by many new role-players, special efforts must be made to achieve increased efficiency and optimal development. A leading role by the private sector will be essential in the transitional period supported and supplemented by regulations, where necessary.

It is believed that the new approach of local level management and the participation of all sectors and the general public in the planning and implementation process will create the stimulus and correct environment for sustainable management of our vital groundwater resources.