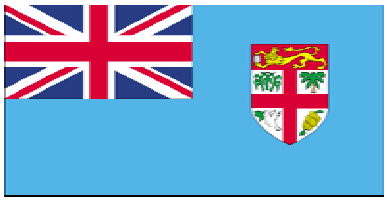
Sustainable Integrated Water Resources and Wastewater Management in Pacific Island Countries

National Integrated Water Resource Management Diagnostic Report

Fiji Islands



Published Date: November 2007

Draft SOPAC Miscellaneous Report 637

GEF Hotspot Analysis Diagnostic Report, Fiji Islands, March 2007

TABLE OF CONTENTS

LIST OF FIGURES

ACRONYMS

ADB	Asian Development Bank
AusAID	Australian Agency for International Development
ENSO	El Niño-Southern Oscillation
FEA	Fiji Energy Authority
FMS	Fiji Metrological Service
FWA	Fiji Water Authority (*proposed*)
GEF	Global Environment Facility
IWP	International Waters Programme
IWRM	Integrated water resources management
LWRM	Land and Water Resources Management Division, Ministry of Agriculture
MRD	Mineral Resources Department
NGO	Non-government organisation
NZAid	New Zealand Agency for International Development
PWD	Public Works Department
SOPAC	South Pacific Geoscience Commission
SPREP	South Pacific Regional Environment Programme
UNDP	United Nations Development Programme
USP	University of the South Pacific
WB	World Bank

EXECUTIVE SUMMARY

This report identifies the present status of Integrated Water Resources Management (IWRM) in the Fiji Islands and barriers to the more effective implementation of IWRM. Because water performs so many important functions for society, the responsibility for water is always spread among different organisations, public and private, and is located among several government ministries. IWRM is both a set of mechanisms and a process. IWRM implies several ways to managing, which are:

- *Integration of planning and execution of programmes* undertaken by various government ministries and organisations;
- *An adaptive approach* that takes into account the natural variability of water resources as well as the changes in development and society that affect and are affected by water – seeing IWRM as a process;
- The involvement of society at all levels in water management decisions.

IWRM is defined as '*a process that promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems*' (United Nations Food and Agriculture Organisation). IWRM implies an integrated approach, linking and consistently managing all sectoral activities that have a relation to water and it equally implies a that the complexity of water resources demands a consultative approach to decision-making.

The implementation of IWRM in Fiji requires a number of features to be developed simultaneously. Barriers to IWRM presently include:

- *Lack of detailed policy and strategy* to which the government is committed, including clarification of national IWRM objectives;
- *Inadequacy of legislation;*
- *Lack of robust coordination* arrangements at national level, with adequate supporting resources;
- *Lack of ministerial and departmental responsibility* for IWRM or water management and the resources to undertake the activities required;
- *Lack of formal responsibility* for the major water resources data fields and a rationalised data collection programme to support for long-term IWRM objectives and the data sharing and coordination mechanisms to allow comparable data to be used for investigation and planning;
- *Inadequate planning mechanisms* and in some cases powers to ensure the control of

activities for the purposes of water allocation and water body protection;

- *A serious deficit of technical* and scientifically qualified staff in the government service;
- *Less than ideal levels of understanding* in the population, particularly some rural populations, of the need to conserve water and use appropriate waste disposal methods.

The key capacity building requirements are considered to be:

- Active policy development on key water management issues;
- Continuation with legislative changes already commenced;
- Establishment of much improved linkages between sectors, both formal and information, including at the local and watershed planning scale;
- Technical and human resources capacity building and the identification of sources of finance.
- Serious consideration of the long-term sustainability of water services and schemes and means to ensure they will continue to deliver (or be improved to deliver) the essential services required (in particular reliable and safe water supply);
- Proactive approaches to water protection and responses to water threats and vulnerabilities by planning between crises and learning from disasters that have already occurred;
- Education and understanding about water and its protection by urban and rural people to be promoted more actively

1. INTRODUCTION

This report identifies the present status of Integrated Water Resources Management (IWRM) in the Fiji Islands and barriers to the more effective implementation of IWRM. Because water performs so many important functions for society, the responsibility for water is always spread among different organisations, public and private, and is located among several government ministries. IWRM is both a set of mechanisms and a process. IWRM implies several ways to managing, which are:

- *Integration of planning and execution of programmes* undertaken by various government ministries and organisations;
- *An adaptive approach* that takes into account the natural variability of water resources as well as the changes in development and society that affect and are affected by water – seeing IWRM as a process;
- The involvement of society at all levels in water management decisions.

IWRM is defined as '*a process that promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems*' (United Nations Food and Agriculture Organisation). IWRM implies an integrated approach, linking and consistently managing all sectoral activities that have a relation to water and it equally implies a that the complexity of water resources demands a consultative approach to decision-making.

2. COUNTRY BACKGROUND

Fiji is an independent island republic in the South Pacific, situated between latitudes 15° South and 21° South and straddling the 180th meridian from 177° West to 175° East. The 320 or so islands form a complex group of high islands of volcanic origin, with barrier reefs, atolls, sand cays and raised coral islands. The two largest islands, Viti Levu (10,386 sq.km) and Vanua Levu (5,535 sq.km), together comprise 87% of the total land area. Two smaller islands, Taveuni (435 sq.km) and Kadavu (408 sq.km), account for a further 4.6% of the land area, and most of the remaining islands are very small. Less than a hundred of the islands are inhabited, most of the population being concentrated in the towns, villages and lowlands of the two larger land masses. The annual population growth is 2% and the population density is 39 inhabitants per sq.km. Suva, the capital city, is located on a peninsula near the southeastern corner of Viti Levu.

Fiji has an equable maritime climate, a consequence of its high topography and prevailing winds, the Southeast Trades. The west coast of Viti Levu is in a rain shadow, and thus experiences a distinct dry season. Maxima and minima temperatures for Suva are 30°C and 20.5°C respectively. The dry season extends from May to October, and the wet season from November to April. Mean relative humidities are 80% and 75% at 0800 hrs and 1400 hrs respectively on the east coast, and about 10% lower on the west coast. Relative humidities as low as 40% can occur during the dry season.

Both Viti Levu and Vanua Levu have mountainous interiors, with peaks rising to 1,323 m and 1,032 m respectively. The uplands of both islands were formerly covered in tropical rainforest, but much of this has now been replaced with secondary forest and grassland on the lower slopes. Farm land occupies most flattish lowland, and large areas on both islands are under cultivation for sugar cane. Mangrove forest occurs widely along the coastline and at river mouths. Coral cays tend to be dominated by palms, pandanus and casuarinas.

The large number of islands, their differing geological origins, the large size of some of the islands, the varying climates and their isolation from other islands have all contributed to provide Fiji with a large number of different ecosystems and habitat types with a very rich diversity of flora and fauna. Many species are endemic. There are about 1,500 native species of vascular plants, of which 40-50% are endemic. All 26 palm species are endemic. There are 39 species of butterfly (including seven endemics), 27 species of reptiles and amphibians (including eight endemics) and about 120 species of birds (including 22 endemics) (Dahl, 1986; Pratt *et al.*, 1987). Dahl (1980 & 1986) has given a brief account of the natural ecosystems of the islands, and has reviewed their importance for nature conservation. UNEP/IUCN (1988) provide a general account of the coral reef systems

and the reef resources, and also give detailed information on seven of the most important reef systems.

The archipelago of the Fiji Islands comprises more than 300 islands, of which only one third are inhabited. The two largest islands are Viti Levu and Vanaua Levu. The land area is 18,333 km^2 while the territorial area (land and sea) is 1.3 million km^2. The population o Fiji is 824,300 (2002 estimate). The two major urban areas are located in Nadi and its peri-urban area and the Suva-Nausori corridor, both of whish are located on Viti Levu.

Some data related to population growth and life expectancy are (World Bank, 2005):

Population growth (annual %)		0.82
Population, total (millions)	0.85	
Life expectancy at birth, total (years)	68.15	
Mortality rate, infant (per 1,000 live births)	16.00	

Data on water-related Millennium Development Goals for Fij is:

Improved sanitation facilities (% of population with access)	72.	
Improved water source (% of population with access)		47.
Nationally protected areas (% of total land area)		no data

The following environmental issues were identified in the Issues Paper on Sustainable Development prepared for the Parliament of Fiji (1998):

- deforestation;
- land degradation;
- impacts of climatic change such as global warming and rising sea level;
- waste disposal;
- inland water pollution;
- depletion of coastal and marine resources;
- loss of biodiversity;
- loss of aquatic fish;
- loss of coral;
- depletion of energy resources;
- high population growth;
- rural and urban migration; and
- natural disasters such as floods, droughts, cyclones, tidal waves and earthquakes.

The paper argued that deforestation results in:

- land degradation;

- loss of biodiversity;
- sedimentation of inland and marine waters;
- soil erosion;
- air pollution;
- depletion of energy/resources.
- land slides; and
- increased food hazards.

In all island countries of the Pacific, the handling of waste disposal has become a difficult task due to:

- lack of adequate lands for disposal sites;
- lack of technical know how to improve collection efficiency;
- industrial activities yielding non-cycling industrial wastes; and
- high population growth resulting in the discharge of large scale domestic waste products.

Water-related issues, both freshwater and marine, are prominent among the listed environmental issues.

3. WATER RESOURCES MANAGEMENT

3.1 Classification of issues

Water management involves many types of activity and sectoral responsibilities. For this reason, IWRM issues are broken down into readily understood categories. The two main categories used in this report are water resources issues and water services issues.

Water resources issues are those matters that deal with the availability of water in nature, its abundance and quality, extremes (flooding and drought) and its interactions with the natural environment. In the case of Fiji the impact of freshwater on the marine environment is important.

Water service issues are those matters that deal with supplying water for all the economic and social purposes of the nation and disposing of such water safely and without unreasonably damaging the natural environment.

There are overlaps between these two categories, but the major responsibilities of organisations can be assigned to one or other category.

Fiji's islands exhibit considerable differences in their geographical characteristics. The large islands are mountainous and have significant permanent surface water sources, while there are many small islands, both inhabited and uninhabited, which have little or no permanent surface water and rely on groundwater and rainwater only. The water management issues for the large islands and small islands can vary significantly.

3.2 Types of freshwater

3.2.1 Surface water

Surface water is used as the main source of supply for all major towns on the larger islands of Fiji (ie islands with higher elevation), as well as industrial and irrigation uses. However a combination of surface water and groundwater is used to supply the smaller settlements not supplied by the major water utility.

Fiji has numerous small islands, some of which are low in elevation and also inhabited. Surface water availability is a problem in some islands, which rely exclusively on groundwater and may or may not attempt to use rainwater. Rainwater harvesting using roof systems is widespread in Fiji but the psychology of rural people may fail to take into account the possibility of extreme climate events and drought when there is relatively abundant water for most of the time (for instance providing small capacity storage instead of larger capacity).

Some conflicts have occurred over surface water availability. In particular, there are conflicts

between water for irrigation and water for other purposes in one or two cases (eg Sigatoka River). The conflicts arise in part because there is no coordinating mechanism to ensure that water use for one sector (ie agriculture and irrigation) is recognised and that other sectors (ie town water supply, tourism or industrial water demand) do not adversely affect an existing development by other sectors. Solutions require a coordinating function which allocates water and where rules for taking water are determined and applied by an expert arbiter. Such rules should include measures for dealing with low flow and drought conditions, where priorities need to be allocated among various conflicting water users.

3.2.2 Groundwater

Groundwater occurs on both the large islands and small low-lying islands, but the groundwater issues and challenges in these different physical environments differ. Groundwater is found in superficial and medium-depth strata on the larger islands of Viti Levu and Vanua Levu and some large islands, in either fractured rock or sedimentary formations.

Significant groundwater deposits, such as the Nadi Valley coastal aquifer, on the large islands are available and are under pressure for devleopment.

Groundwater resources on small islands play a very different role. There are cases in Fiji of islands with superficial groundwater lenses in sandbeds or coral formations, which lie on marine water and can be readily exhausted. The fragility of superficial groundwater lenses means that they need to be carefully managed.

3.3 Types of Freshwater use

3.3.1 Nature of water services

Water services in Fiji have been identified in the following sectoral areas:

- *Urban water supply and sanitation*, which has been the responsibility of the Public Works Department but which is to be transferred to the Fiji Water Authority;
- *Irrigation*, which is the responsibility of the Ministry of Agriculture;
- *Major hydropower,* which is the responsibility of the Fiji Energy Authority (FEA), the national commercial energy provider;
- *Rural water supply and sanitation*, to be undertaken by the Fiji Water Authority and managed by local communities (at village level) when constructed;
- *Urban drainage*, municipal responsibility, although Public Works Department has been the

constructing agent for major drainage schemes;

- *Flood control,* Ministry of Agriculture, to the extent that it is undertaken – in limited areas.

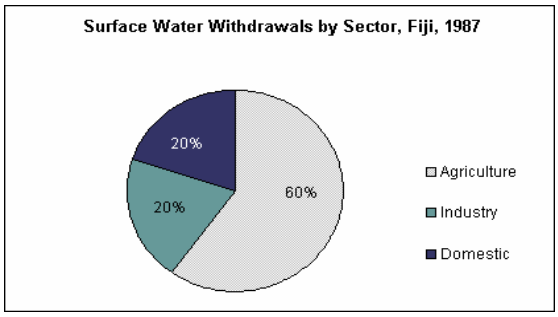


Figure 1: Surface water withdrawals by sector, Fiji, 1987

Water withdrawals by sector are estimated to be (World Resources Institute, 2006) as shown in the figure opposite.

There are no special coordinating arrangements to ensure that the development and use of water resources by sectors and agencies are consistent, and no agency has the responsibility for ensuring such consistency. Although the EIA under Town and Country Planning procedures identifies environmental impacts, there is no ongoing mechanism, except for the studies involved in EIA, to guarantee that such activities as water abstraction are consistent not only with environmental objectives but that one water user does not adversely affect the water available to others.

3.3.2 Urban water supply

A single agency provides water supply in the cities and towns of Fiji. The Government is in the process of separating the water supply and sanitation functions from the Public Works Department which has been operating them and creating a separate utility, the Fiji Water Authority, under the Public Enterprise Act of 1996. The water supply became a political issue because of water 'cuts' resulting not so much from inadequate sources but from failures of the supply system. Problems for water supply have been:

- Lack of cost-recovery mechanisms or even a plan to move in that direction;
- Inefficient operation and water distribution networks, which have not been well maintained;
- Inadequate capital investment for scheme augmentations;
- Inadequate training and capacity of staff;

- Illegal connections which cannot be readily dealt with;
- Lack of customer focus.

As a result, and with assistance from various donors over a period of time (most recently the Asian Development Bank), a plan has been developed to create a commercially-oriented water supply utility, the Fiji Water Authority, which will operate as a public enterprise in a more effective manner. Legislation, a proposed Fiji Water Authority Act, is being prepared. The Fiji Energy Authority can provide a model in some respects.

The move to establish the Fiji Water Authority has highlighted legal and policy issues, which include the need to develop an effective control scheme for the protection of drinking water catchments and the need to provide legal certainty for the right to take water from water sources.

Separation of water supply from the Public Works Department raises the question whether some of the relevant PWD functions such as the hydrology section, should be transferred to the Authority or retained elsewhere.

3.3.3 Sanitation and wastewater

The Public works Department has been responsible for sanitation in towns of Fiji and that responsibility will be transferred to the Fiji Water Authority. Only part of the water supply areas are provided with sewerage. Other areas make local waste disposal arrangements. It is intended that the Fiji Water Authority provide sewerage in all towns in Fiji, as is presently the responsibility of the Public Works Department.

3.3.4 Urban and rural drainage

Urban drainage is the responsibility of municipal authorities, although urban drains can interact with sewers in rainfall events. Public Works Department may take responsibility for constructing major drains and maintaining them. Rural drainage is undertaken by the Ministry of Agriculture.

The condition and capacity of urban drainage is a key contributor to local ‘flash’ flooding which causes frequent problems in urban areas. Additionally, the quality of drainage outflow may be causing periodic or more persistent problems in the coastal zone or in rivers, though limited research into the impact of drainage on water quality has been undertaken.

3.3.5 Works for flood mitigation

Flood works have been constructed by the Ministry of Agriculture and by the Public Works Department, but there is no national mandate as such for flood control or mitigation. LWRM undertakes flood mitigation work under its general charter. Flood control works have been constructed alongside the lower reaches of the Nadi River and the Nadi catchment programme,

conducted by the Ministry of Agriculture, which includes the construction of dams which are designed to have a joint flood mitigation and irrigation function.

The plans developed by the Ministry of Agriculture for the Nadi catchment are unique. Elsewhere, a planned flood management approach has not been taken, because responsibility for flood management has not been assigned to an agency or funds provided for such a programme.

3.3.6 Rural water supply

Installation of rural water supply schemes has been a rural development responsibility, but may be given, as a social obligation, to the new Fiji Water Authority. The operation and management or rural water supply is undertaken by village authorities for the most part. There appear to be mixed results, with some villages managing their water supply adequately while problems occur in other areas. Funds and expertise to maintain such schemes are believed to be constraints on maintaining a safe supply.

The national budget provided the following funds for 2007 ($ Fiji): Rural Water Supply Programme, $2,000,000; Minor Public Water Supplies, $500,000; Self Help Rural Water Supply Schemes, $1,200,000; Borehole Subsidies, $250,000 and Maintenance Training for Rural Water Supply Operators, $50,000.

The following chart shows assessed reliance on various sources of water at the time of the 1996 drought (source: The Socio-Economic Impact of the 1997-98 ENSO Event: UNU)

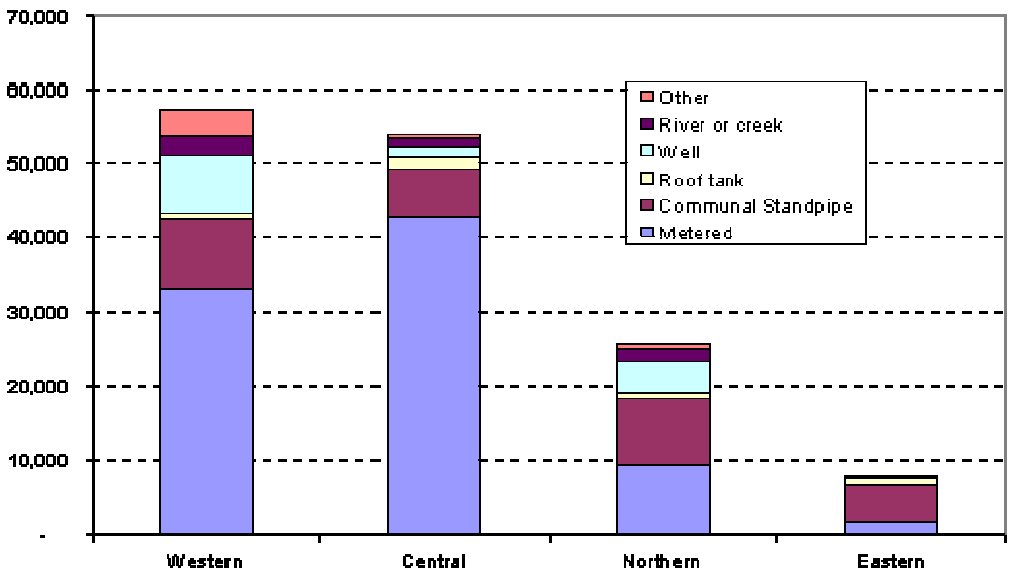


Figure 2: reliance on various sources of water at the time of the 1996 drought (source: The Socio-Economic Impact of the 1997-98 ENSO Event: UNU)

3.3.7 Groundwater development

The development of wells and bores for groundwater extraction is not regulated in Fiji. The Mineral Resources Department and private drillers construct bores, but there are no standards or certification for bore drilling, nor do bores need to be registered or information required to be provided to the government.

The Mineral Resources Department provides technical advice to (i) the Department of Planning to assess groundwater aspect of development proposals, and (ii) private developers who wish to know what groundwater is available and assess the impacts of exploiting it.

The key political groundwater management issue in Fiji has been the abstraction of groundwater for bottling and export by Fiji Water. There have been conflicts over the potential of other bottling enterprises to affect the groundwater taken by Fiji Water. A further issue was the protection of the quality of the water in the aquifer and the need to impose measures for its protection through a planning instrument that limited development and activities such as waste disposal.

3.3.8 Major issues and concerns

3.3.8.1 Availability and use of groundwater. On the larger islands, groundwater use is primarily for rural water supply and to augment some town water supplies. In recent years some industries have begun to exploit groundwater.

One commercial use of groundwater has attained considerable political and public attention – namely water bottling for export currently developed in the Yaqara valley (see discussion below). The example of Fiji Water has motivated many landowners to wish to consider the same type of enterprise, although the up-front investment may not be available.

Groundwater is an important and even critical resource on small islands which are without significant surface water resources. However, shallow groundwater lenses, which are fed directly by rainwater, may be disrupted easily if over-exploited. Good information is needed to provide understanding among local communities about the danger of over-pumping such groundwater reserves. Rainwater harvesting should be considered a necessary adjunct to groundwater use on islands which have no permanent or significant surface water sources.

3.3.8.2 Surface water quality. A report on regional freshwater issues (SPREP, Falkland 2002) identifies a number of water quality issues for surface water in the region. The following (taken from Flakland, 2002) are considered relevant to Fiji.

Water quality degradation has arisen from:

- Discharges of untreated wastewater with associated pathogenic organisms into streams, rivers and coastal estuaries. These discharges occur from outfalls (point source pollution)

and from more diffuse flows from on-site sanitation systems within urban areas of surface water catchments. The rapid urbanisation process, mentioned previously, is putting great pressure on both surface water (and groundwater) supply catchments used for urban and nearby rural water supplies. A study of water quality in the Ba River and estuary, Fiji (Anderson et al, 1999) found it to be seriously contaminated, with the dominant source of faecal contamination being Ba Town;

- Direct faecal contamination of catchments and streams from animals (e.g. cattle, pigs). Runoff of waste matter from commercial piggeries and from less formalised urban and village pigpens is a major source of pollution in some PICs (UNEP, 2000);
- Solid waste disposal sites close to streams or elsewhere in catchments where runoff can readily transport pollutants to watercourses;
- Soil erosion resulting from exposure of soil, leading to increased sediment discharges, high turbidity and colour problems, due to extensive or inappropriate clearing of native forest as part of logging operations or for agriculture; poorly designed or constructed unsealed roads and unplanned development activities and fire used to clear undesired weeds in farming and forestry areas;
- The erosional effects of tropical forest clearing for agriculture and urbanisation, of road construction and other activities in surface water catchments. Steep island topography, causes floods, landslides and sometimes major losses of vegetation and significant soil erosion;
- Runoff from agricultural land containing nutrients (from fertilisers) and sometimes toxic agro-chemicals (pesticides and herbicides);
- Persistent organic pollutants (POPs) which are a threat in some PICs due to their high toxicity, persistence in the environment, and ability to be transported long distance;
- Discharges or accidental spillages of toxic chemicals from mining sites into streams and rivers.

The quality of water in the major rivers and streams of Fiji is believed to be reasonable, although data are not organised or coordinated. It is likely that local pollution of streams results from the manner in which domestic and agricultural waste is disposed. There is little data on the impacts, if any of agricultural chemicals on surface water resources, although anecdotally and as shown by studies in some locations there are potential problems.

The responsibility for the control of point sources of pollution lies with the Ministry of Environment, which is developing a wastewater licensing scheme. Both public and private polluters are to be

regulated by the scheme.

Responsibility for managing diffuse sources of pollution is less clear, although the Ministry of Agriculture has been developing policy for catchment management. Legislation does not provide for regulation of catchment activities and even if it did, it would be very difficult, of not impossible, to enforce. Therefore a consultative and educational approach is vital.

The common problem of accountability resting at a practical level with numerous sectors applies to catchment management in Fiji. Although there is a catchment management plan and policy, agencies in general do not actively follow it because they lack funds or staff and it is marginal to their main functions.

3.3.8.3 Groundwater quality. Very little data is available for the assessment of groundwater quality. The key problems are believed to be occurring, or potentially occurring, in smaller islands, where local waste disposal has the potential to pollute groundwater, but groundwater contamination is of concern on larger islands also, for instance potential for pollution of groundwater used for high quality purposes (drinking water, water for bottling, high technology processing). The solutions must involve improved public awareness and education as well as adequate facilities, and establishing well-accepted local management and accountability is also critical for sustainable management.

Control measures are being considered to limit groundwater pollution potential. The high profile case is the Yaqara valley, where it is proposed that buffer zones be established to protect water sources used for bottling and other potential future uses. Buffer zones would be protected by the declaration of protection areas where certain activities could be proscribed, including agriculture and industry. The mechanism for applying such zones has not been implemented yet.

3.3.8.4 Wetlands. Fiji does not possess extensive wetland areas that rely on surface water. The larger islands have mountainous interiors and floodplains exist but are limited in area, mostly having been developed. There are important ecosystems along the coastlines of the larger islands.

Groundwater may be a more important resource for sustaining natural ecosystems on small and low islands, as well as for productive vegetation such as coconut trees.

Wetland oversight and protection is the responsibility of the Ministry of Environment, but further work is necessary to investigate, classify and plan for the protection of the wetlands of Fiji.

3.3.8.5 Water related disasters. Fiji has experienced both drought and flooding. Drought results form el Niño climate conditions, and may be severe as in 1986. Flooding tends to affect local areas rather than major catchments and floodplains, but the progressive removal of forest cover may cause flood peaking to become more extreme in the future. Added to that, if development is allowed to proceed in areas subject to relatively frequent flooding, the damage to property and the

economy will increase.

Fiji has a flood and disaster warning body, DISMAC, which has a disaster warning and response responsibility.

3.3.8.6 Drought. Drought is a serious issue for Fiji. In the six years preceding the 1997-98 El Niño event, Fiji had faced two previous droughts, in 1992 and 1996. The drought of 1998 resulted in conditions that threatened half of Fiji's sugar cane crop, and the survival of 270,000 people. One half of the country had no significant rainfall for more than seven months and food was distributed by the government to 105,000 people. Under 'normal' climatic conditions, people in the large islands do not expect water scarcity and the key problem is the adequacy of supply infrastructure.

Drought mitigation measures have included sinking local wells for drinking water and for agriculture. There is not significant dam storage for water users other than urban water supplies and hydropower. However, drought has affected the sugar cane industry and when combined with the effects of tropical cyclones, the industry, which has been a major contributor to the national economy, has suffered serious losses.

The comment was made (The Socio-Economic Impact of the 1997-98 ENSO Event, United Nations University)) that roof catchment systems with a communal standpipe are very popular in rural Fiji. So high is the country's annual rainfall that installed storage tanks are normally small without thoughts for long periods of zero rainfall. A lot of guttering exists only to channel rainwater to waste. A large number of rural people were affected by inadequate water-tank storage in the 18-month drought of 1997-98. Particularly schools in drought-affected areas were badly impacted with the shortage of essential water for health and hygiene.

3.3.8.7 Control of protected water catchments. There is a need, in some areas, to exercise a relatively high level of protection of the land surrounding water sources. Two general levels of protection can be identified: (i) broad catchment areas where some special measures are imposed to limit such activities as logging, or to ensure agriculture is undertaken appropriately, and (ii) special areas, normally more restricted in area, which may require a much higher level of protection and possibly total exclusion. This is sometimes a requirement for the protection of drinking water sources.

Action is required in Fiji to improve the mechanisms for controlling activities in protected catchments. A recent court decision to compensate the landholders in the Monsavu Catchment which drains into the dam owned by the Fiji Energy Authority, has set a precedent for compensation to be granted to land owners whose commercial activities are restricted (in this case mainly logging and forest exploitation). In the Monosavu case, logging is prohibited upstream of the dam and the compensation recognises the losses suffered by the native land owners.

The Fiji Water Authority has a need to protect a number of its water sources, and legislation (Water Supply Act) provides a general mechanism for such protection, but in practice, protection has been weak because (i) resources (funds and staff) have not available for protection and (ii) the legal mechanisms have been weak. As a result, and in light of the potential for native land owner claims, protection for drinking water sources is expected to be a critical water management issue in the future.

3.3.8.8 Measures to Manage IWRM. There are two important types of island in Fiji – large islands with mountainous or hilly terrain, and small low-lying islands with limited surface water resources. In the latter case, groundwater resources may be very vulnerable to over-exploitation and contamination and rainwater harvesting should be promoted much more actively. Issues for large islands differ considerably from those on small islands and include flooding, inter-user conflict, urban water services and more extensive and intense sources of pollution (industrial, urban drainage, sewage).

Lack of coordination and responsibility for coordination at various levels, including national and river basin or sub-basin. An area where coordination and the application of consistent policy is important is in lower floodplains where local government, national infrastructure development and nationally-controlled water schemes (irrigation, town water supply and power generation) interacts to contribute to flood impacts.

3.4 Island Vulnerability

3.4.1 Types of disasters

The two major types of disasters are flood and drought, both of which affect the Fiji Islands. In addition there is vulnerability related to (i) possible sea level change and (ii) under-sea instability leading to storm surges and coastal flooding and erosion.

3.4.2 Flooding

Floods have occurred in Fiji in some catchments (notably the Nadi catchment) at frequencies of ten years or more. Local and frequent flooding (return period of up to 2 years) resulting mainly from inadequate drainage infrastructure in cities and towns, is a more frequent and widespread problem.

Upland catchment degradation, leading to more flash flooding, and more extreme high and low flow events is believed to be a problem in certain developing catchments on larger islands. The Nadi River catchment being the prime example. That catchment is likely to experience increased damage to property and buildings because of the location and nature of development in the lower parts of the catchment, in addition to exacerbation of upland vegetation and quality.

Responsibility for flood works and other measure related to flooding (such as river dredging) has been undertaken by the Ministry of Agriculture (Land and Water Resources Management Division).

3.4.3 Riverine health

Sand and gravel is extracted from some rivers, with the possibility of erosion and deterioration of river banks, channels and beds. The problems are considered moderate at this time and the situation will depend on whether extraction of materials from river channels is prohibited or limited in the future, as has been discussed. This issue affects the larger islands.

Material extraction is approved by the Director of Lands but technical advice is provided by LWRM.

3.4.4 Freshwater-marine interface

The coastal zone is of very great importance to Fiji because it is important for the natural environment and in turn, inshore fishing and tourism. The condition of reefs and marine fish stocks can be affected by freshwater withdrawals but more particularly by deterioration in the quality of water and the outflow of silt into the marine zone. A second potential source of damage to the marine environment is the disposal of wastewater, which may be generated by untreated urban sewage, urban drainage, industrial discharges and sewage from tourist developments.

No agency is currently specifically responsible for ensuring that development on land and riverine health is consistent with maintaining a healthy marine zone around the islands. The issue is most important for the larger islands, although it would be unwise to give the impression that small islands should not be concerned about the disposal of their wastes to the sea.

3.4.5 Major Issues and Concerns

Issues and concerns include:

- The apparent increase in the frequency and severity of coastal flooding on large islands with consequent loss of life and damage to property, which results from both upland catchment changes (degradation) as well as inapropriate downstream development;
- The occurrence of inland flash floods which have caused loss of life and property;
- The danger of storm surges and marine-based coastal flooding, leading to erosion, loss of land value and property damage;
- Periodic drought resulting from major cyclical climatic developments, primarily el nino effects, with the potential for disastrous impacts on domestic water supplies and agriculture in the northern and western areas of the two major islands and also affecting smaller islands;

3.5 Awareness of water resources

3.5.1 Types of awareness

3.5.2 Major issues and concerns

3.5.3 Measures to manage - IWRM

3.6 Technology

3.6.1 Types of supply systems

Urban water supply is provided by the Water Supply Division of the Public works Department, although the Government appears close to deciding to create a Fiji Water Authority to undertake that function. PWD is responsible for water supply within all the formally defined urban areas of Fiji. It constructs and operates all water supply infrastructure, including water supply reservoirs, water treatment plants water distribution networks and associated supply reservoirs.

PWD also constructs major drainage lines, but local government is responsible for minor drains. Coordination between the two schemes is not always ideal.

Domestic water supply outside urban areas is designed, constructed and part funded through PWD with technical evaluation from MRD for groundwater sources and facilities (bores and bore drilling). Management and operation of domestic water supply schemes outside urban areas is the responsibility of the local community that benefits from the scheme.

3.6.2 Types of sanitation systems

3.6.3 Major issues and concerns

4. INFORMATION, DATA AND TECHNICAL CAPACITY

Information is an important key to effective water management because the availability, behaviour, impacts and qualities of water need to be understood. The flow in surface water bodies is subject not only to climatic factors such as rainfall, but geology, vegetation and the impacts of development. Ideally the short term and long term patterns of flow in rivers need to be understood and modelled to identify what changes will occur if, for example, a dam is constructed or water is diverted.

Similarly, groundwater occurrence and behaviour needs to be understood. Although groundwater moves more slowly, in most cases (least of all in fractured rock) it does move and shallow aquifers are recharged by rain and other sources such as streamflow and drainage flow. There is commonly interaction between river flow and adjacent groundwater.

There is also a critical need for data on the quality of water. Very many parameters may be measured, but data collection is costly and is normally only undertaken if (i) a project development application requires water quality to be understood, (ii) for health reasons, samples are collected at certain locations, (iii) research projects which collect data in limited areas for a period of time, (iv) some monitoring information

Currently, the Public Works Department has been the organisation with the majority of the streamflow data collection network, although the Ministry of Agriculture has been collecting data in the zone of tidal influence. Together their data bases would provide a comprehensive foundation for streamflow on the larger islands. However, the public works data has been collected for the purposes of measuring flow where urban water schemes exist, and the data collected by the Ministry of Agriculture, has related to irrigation and flooding.

The Mineral Resources Department has been collecting groundwater data, although much data collected by private drillers is not included in its database. Nevertheless, a reasonable data base is available. (refer to figure 2 below)

Data on water quality is more scattered. Data collected for health reasons is mainly included in discrete reports, not put into a database. Individual research and investigation projects have collected data for the purposes of those projects. The wastewater discharge permit programme of the Ministry of environment will require data on discharge to be collected routinely and that may allow assessment of the relevant water bodies. Some organisations (formerly Public Works Department) have monitored their wastewater discharges in the past.

What Fiji requires is a comprehensive data collection responsibility in the areas of:

- Surface water data (streamflow);

- Groundwater data;
- Water quality monitoring.

It is not necessary or practical for a single organisation to collect and store all the data or even to be responsible for all data in a single data set. More importantly, an agency should be accountable for ensuring that the data is collected, that the data is useful for IWRM purposes and other long term purposes, and that it is available and conforms to data standards. It would be logical for an agency with water management responsibility to be responsible for surface water data and groundwater data, while the Ministry of Environment was responsible for water quality and environmental data. Ideally, there should be database linking at some time, so that quantity and quality information can be evaluated together in a meaningful way.

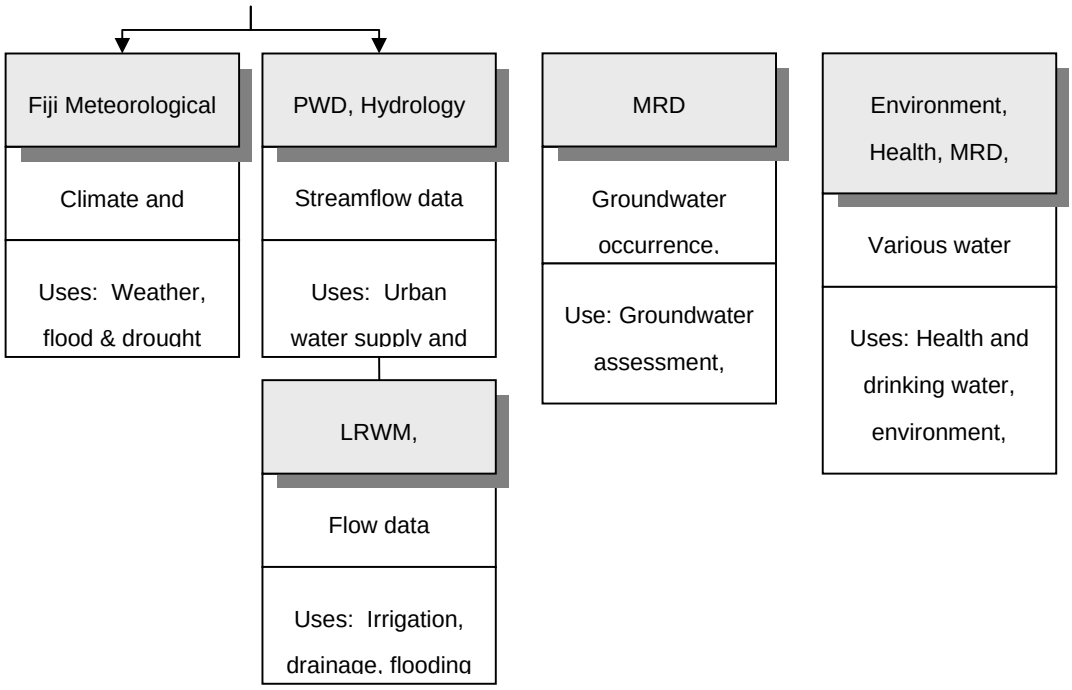


Figure 3: Key water resources data sets and current responsibility

4.1 Measures to manage - IWRM

4.1.1 Management of shallow aquifers

As noted earlier, populated islands without permanent surface water supply may rely on shallow aquifers for their main source of freshwater. Potential difficulties are (i) the possibility of over-extraction, as a freshwater lenses may rests directly on sea water and, if pumped out may not be

readily replenished, and (ii) pollution from the unwise disposal of wastes. In either case, the water resource may be damaged beyond the point where it is useable as a drinking water source. There are circumstances where water has to be taken by tanker to outlying islands when local sources are inadequate.

Possible solutions include (i) the need to consider joint use of rainwater and groundwater, (ii) the development of rules to limit extraction to sustainable levels, (iii) education about waste disposal and appropriate facilities. A draft policy has been developed for discussion, covering these issues. It is considered that a multi-faceted approach needs to be taken for small communities, which includes all the points above and also to institute local management arrangement in which the village communities agree to assign various responsibilities to maintain the schemes and comply with water management rules.

4.1.2 Rural and small island water supply

The provision of water supply for rural settlements poses different challenges from those that face the urban Fiji Water Authority. While funding can be a constraint to providing a reliable and safe water supply, there is a problem of scheme sustainability once the water supply is installed. The two main problems are:

- *Lack of responsibility*, technical skills and resources to maintain the schemes after installation,
- *Lack of understanding* of the impacts of waste disposal on the quality of water being used for a drinking water supply.

There are programmes in Fiji, some conduced by NGOs, aimed at educating rural people about water quality (since local people usually assume there is no problem if the water seems to be clear). Broader understanding is needed, accompanied by appropriate facilities.

There is also a funding and resources shortfall, since a considerable proportion of the rural population do not presently have a reliable and safe water supply.

4.2 Related natural resources

The management of natural resources has an impact on water resources. Management of vegetation, forests and agriculture, taken as a whole, have an impact on the hydrological characteristics of catchments and streamflow. The main consideration in Fiji is the logging and clearing of forested areas, thereby altering the hydrology, causing streamflow events to become more extreme and the removal of vegetation may cause soil erosion and the deterioration of stream channels.

The health of natural vegetation, forests and impacts directly on rivers and groundwater may also

be affected. The recharge characteristics of aquifers in Fiji, including shallow groundwater lenses in small and low islands, need further study.

Agriculture may also affect the quality of water in rivers and streams. The use of agricultural chemicals is believed to impact on water bodies, but few data are available.

4.3 Environmental management

The Environment Act was introduced in Fiji recently. The Ministry of Environment is still in the process of developing programmes and policies and has limited resources. As noted earlier, the wastewater permit system is in the process of being developed and applied. The environmental legislation is intended to apply to the government administration as a whole and activities which unreasonably affect the environment are proscribed. The administration of the Town and Country Planning Act now involves environmental impact assessments (EIA) to be made for significant development proposals and the technical review of EIA reports may be drawn from various agencies, including MRD for groundwater and LWRM for surface water aspects and the Ministry of Environment as to water quality.

The active on-ground protection of environmental features such as wetlands and water bodies with special environmental significance is often beyond the resources of the Ministry of Environment and therefore arrangements need to be established whereby local authorities become more involved in environmental management and protection. Such involvement may also mean education in environmental awareness.

5. INSTITUTIONAL AND LEGAL STATUS OF IWRM

5.1 Water legislation

The Fiji Islands were provided with legislation by the colonial government, most of which has needed to be modernised since the colonial era.

The legislation of Fiji currently covers various water services, but does not deal explicitly with IWRM. There is legislation covering urban water supply (Water Supply Act), irrigation (Irrigation Act), use of water by mining enterprises (Minerals Act), and the taking of water from rivers and streams (Rivers and Streams Act). The Rivers and Streams Act, originally a colonial ordinance, provides for the Lands administration to approve water abstraction from rivers and also allows traditional activities to be conducted by native Fijians in small streams. Importantly, the Act contains provisions that imply the right to water resources to be in the power of the government.

The Environment Management Act, of 2000, further introduced protection powers relating to water quality (both freshwater and marine) and the protection of features of environmental importance.

It is important that a clear understanding be established as to the powers of the government to control and allocate water and its power to protect water resources, because native land owners are arguing for their own right to determine how water is allocated.

Recent legal developments have been (i) drafting of new legislation to establish the Fiji Water Authority which will supply water to all towns in the country, (ii) draft amendments to the Minerals Act, which (a) establish a requirement to obtain a permit to extract groundwater (and to install bores and wells) within declared areas, and (b) to limit polluting activities in declared areas, for the purpose of protecting the quality of groundwater. These drafts have been given cabinet approval to proceed, although they have not been through the parliamentary process.

In addition, some drafting has been undertaken for a possible water resources statute which provides that the government has the power to allocate water and undertake related activities. The proposal (undertaken under the European Union Program for Water Governance) is at the proposal stage and does not yet have government approval to proceed.

5.2 Organisation and coordination

The government administration of Fiji does not identify water resources management as such. No minister is responsible for water resources, although ministers have responsibility for water supply, irrigation, power generation, agriculture and environment. Coordination is provided by the national water committee, an ad hoc committee established by Cabinet in 2001 and comprising the heads of

the key water resources agencies of the government.

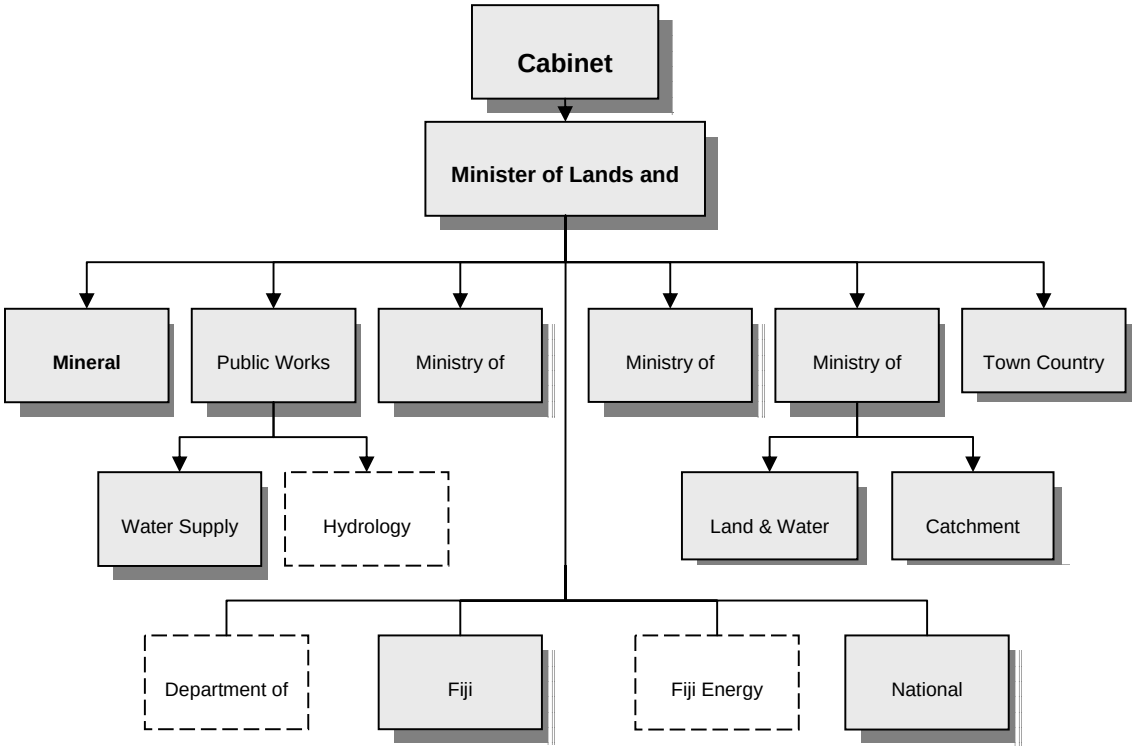


Figure 4: National Water Committee member agencies

Note the agencies or units in boxes not filled in are not formally members of the committee, but have important water related roles.

5.3 Sectoral water-related responsibilities

The organisations responsible for sectoral management are responsible for providing services or regulating activities within their sectors. The key organisations are:

- *Mineral Resources Department: 'effectively responsible for the groundwater resources of the nation; including its monitoring and protection from abuse and contamination'* undertaking resource investigations, Borehole Drilling and Groundwater Monitoring, though monitoring is not conducted on a consistent nation-wide basis, but according to project finding from time to time
- *Ministry of Agriculture*, Land and Water Management Division: irrigation development and operation, rural drainage, land reclamation, flood control works and flood management measures on a catchment basis, estuarine dredging and flow gauging, technical

assessment for riverine excavation;

- *Public Works Department/Fiji Water Authority*: provision of water supply and sewerage in all urban centres, river flow gauging, based on urban water supply information needs;
- *Department of Lands:* administration of the *Rivers and Streams Act*, involving approval of authorisations to take water from rivers, although the function appears not to be actively exercised; approval of riverine excavation (based on technical evaluation provided by LWRM);
- *Ministry of Local Government:* provision of rural water supply and sanitation schemes;
- *Fiji Energy Authority:* operation and management of dams for hydropower generation, and regulation of upstream catchments;
- *Ministry of Environment*: environmental protection and management in general, technical appraisal of EIA reports, state of environment reporting, data collection (mainly water quality and environment), wastewater discharge permits and monitoring;
- *DISMAC*: disaster warning and response, for flood, drought and other disasters;
- *Fiji Meteorological Service*: collection and analysis of climate and rainfall data, climatic forecasting.

Related responsibilities are:

- *Town and Country Planning*: development plans for urban areas, approval of development proposals, which must comply with EIA guidelines;
- *Ministry of Agriculture*: catchment management policy and programmes in rural areas;
- *Ministry of Health:* monitoring and investigation of water quality for sources of drinking water;

5.4 Water resources management

There is no actively developed water resources management (WRM) or IWRM function in the government administration of Fiji. However, there are two agencies with some assigned responsibility.

A de facto water management responsibility has been assigned to the Mineral Resources Department, as the agency with expertise in groundwater, which also heads the national water committee and was responsible for developing the national water policy draft. MRD, however, does not have resources to devote to water management and therefore its role is minimal. MRD was

responsible for developing the national water policy document for the government's consideration in 2005.

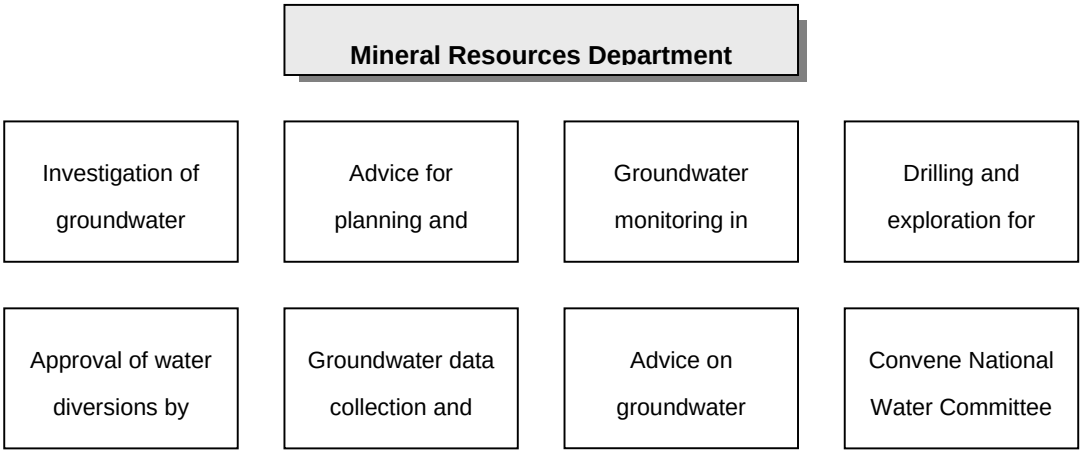


Figure 5: Water related responsibilities undertaken by MRD

LWRM of the Ministry of Agriculture has been assigned the '*overall management of Fiji's land and water resources . . in an environmentally sustainable manner'* although it does not have the legislation to undertake that function. Its activities in surface water are more extensive in scope than those of any other agency (see above). Land management is a focus of the Ministry which has the catchment management function.

Both groundwater and surface water need to be managed jointly and there should be a general water management responsibility covering both, assigned to a department or ministry, which could be attached to an existing agency or could from a separate administrative unit. The creation of the water management function, with water allocation as its base, is not a light matter for a government to determine, particularly in light of limits to available funds and staff in Fiji.

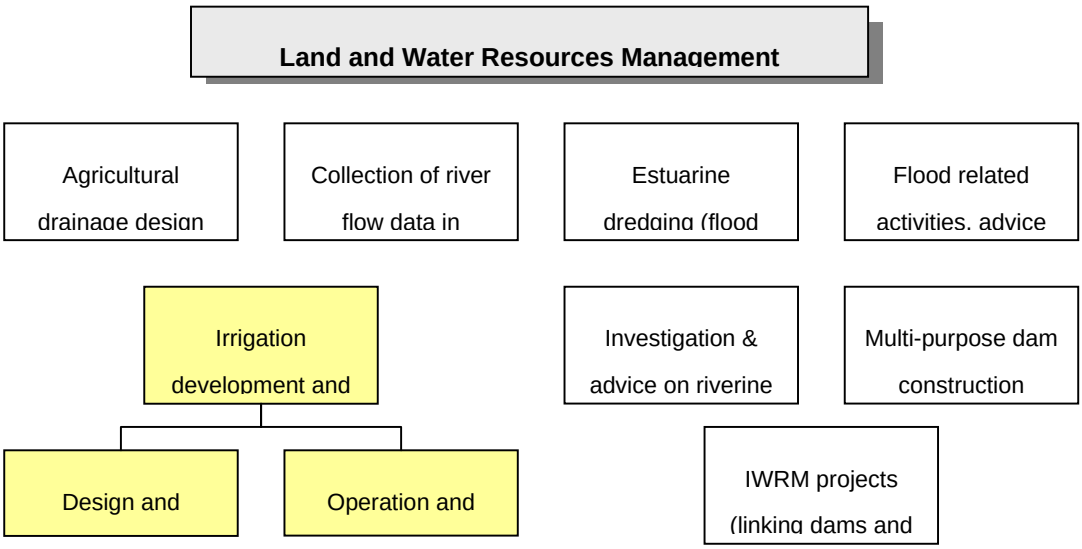


Figure 6: Water related responsibilities undertaken by LWRM

Figure indicates two types of function, namely irrigation development and operation, which is a water using activity, and the other functions which deal with surface water resources and elements of management. The data collected by LWRM is complemented by data collected by the Hydrology unit of PWD, which undertakes river gauging upstream of areas of tidal influence. When combined, the data covers the surface water resources of the larger islands.

5.5 Coordination

Coordination on water resources is provided in Fiji mainly through the National Water Committee (see Figure). However, the committee is ad hoc (meeting only when required) and has no dedicated resources. The membership of the committee is confined to government officials. Proposals supported by the committee are put to higher levels by the Director of MRD, though the Minister of Lands and Mineral Resources. The Minister does not have a formal water management responsibility, nor does any other minister.

5.6 Consultation and participation

IWRM requires decision-making to be consultative and where appropriate, participatory. At present the coordination of advice to the government is limited to officials in the administration who make up the national water committee. However, Fiji has well-developed consultation processes which

involve district commissioners and also the bodies representing native land interests. In practice, the Great Council of Chiefs will normally be consulted on any important policy issue that could affect land, and water is considered to be such an issue.

Some water issues need to be resolved at a national level while others should be decided more locally. In general, the latter type of issue involves the provision of services for rural communities, whether in large island hinterlands or on small islands. The importance of ensuring the sustainability of rural schemes (water supply and sanitation) and the protection of local water bodies (such as shallow groundwater lenses) may have been underestimated. Without the agreement and support of local people, responsibility for maintaining and protecting schemes and water resources may not succeed in the long term.

For regional and urban water initiatives, apart from land ownership negotiations, there are the normal development planning procedures which allow public comment on development proposals. However, the urban population may not have other means to comment on public policy (most consultation occurs through the district and related channels).

5.7 Recent initiatives

The government has made a number of IWRM related initiatives in the past five years. They are:

- Creation of the National Water Committee, a coordinating committee of officials to meet under the chairing of MRD;
- Development of a draft national water policy which has been accepted subject to consultation, which has not yet taken place;
- Commitments to consider new water resources legislation and national coordinating arrangements (as stated in the draft policy which reflects earlier cabinet decisions).

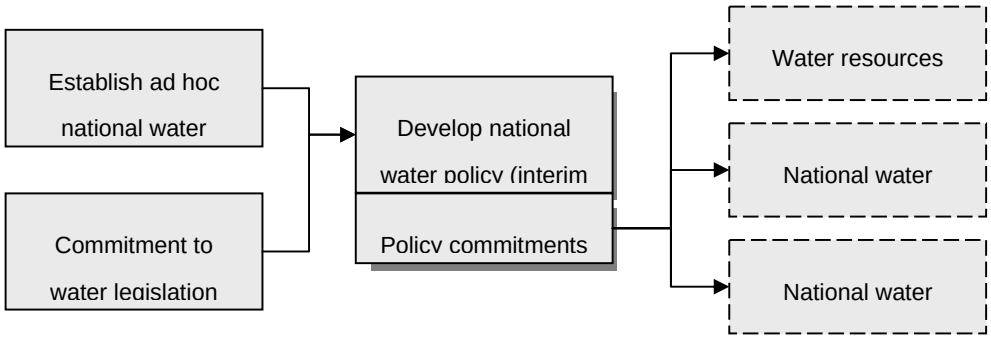


Figure 7: Sequences of water management decisions by Fiji Government

These initiatives indicate that the government is considering strengthening IWRM, but decisions so far have been preliminary and action has not yet been taken to establish more effective arrangements.

5.8 Gaps and overlaps

The major gap is the lack of an active water resources management responsibility in the government. IWRM or water resources are not assigned to a minister.

A current gap is the lack of an active water allocation function. Surface water has not been the subject of major conflict, but various symptoms of likely conflict in the future are present.

Although a coordinating committee of officials has been created, it is an ad hoc committee without dedicated resources. It meets when issues arise and when reform proposals require consideration. A more active coordinating group is needed, which has representatives of the most important interest groups as well as some experts, to advise the government and comment on reform proposals, as well as to monitor the status of IWRM and the key problems and report to the government.

6. PUBLIC AWARENESS

There are a variety of needs for improved public awareness about freshwater in Fiji. General environmental awareness needs to be improved and the Ministry of Environment is aware of that need.

Awareness needs differ in urban areas and in rural areas. Predominant cultural attitudes in rural areas include the idea that water is inexhaustible, although people remember times of drought, and a failure to understand how water is likely to become polluted (it looks clear, so there's not a problem). Some NGOs and major donors are undertaking awareness programmes, for example to inform villagers that phosphates may be present in their water supply. Most important for rural areas is awareness of:

- The limits to groundwater as a resource, particularly in cases where it may be over-exploited;
- The need to conserve water, even when it appears to be abundant;
- The nature and causes of drinking water pollution and the importance of good waste disposal practices.

In urban areas, public awareness is needed for:

- Domestic and residential water saving;
- Commercial and industrial processing and efficiency of water use;
- Awareness of water pollution.

Government programmes

NGO programmes

Live and Learn is a regional Pacific NGO undertaking education and awareness programmes in the region, including Fiji.

7. CRITICAL RELATED ISSUES

7.1 Land tenure and legal control of water

In the Fiji Islands, the traditional culture and way of life involve communities at village scale, who are inter-related and belong to a village hierarchy. Native land, which comprises the majority of land in Fiji, is owned communally by nominated landowners. Native land is inalienable (may not be sold) and ownership attracts various benefits considered to relate to traditional life before the modern era. Native land owners have the right to lease land to enterprises, but there is now a debate about water and whether it should be treated in a similar fashion to land.

There is a danger that the need for the government to have the legal power and capacity to ensure water is available for public purposes will be forgotten in the discussion about the rights of native land owners. Because water is mobile and its management must be configured on catchment (drainage basin) boundaries, it would be problematic if native land owners had a controlling power that allowed them to allocate it without regard to downstream impacts. In the larger valleys on the main islands, there will be numerous native land holdings and management will be

This issue can only be resolved by considerable discussion and debate, but it is highly desirable that appropriate legislation be enacted to replace the Rivers and Streams Act, which clearly give the government the ability to ensure water for public use and essential services. Legislation does not currently cover groundwater (except for the draft proposals in the Minerals Act), and groundwater needs to be under the control of the government in the same way.

7.2 Technical capacity

Fiji, in common with other Pacific countries, has a problem retaining people with technical and scientific qualifications and experience. Well qualified people frequently leave the country for greener pastures overseas. With a population of around 800,000, Fiji has limited qualified personnel in many technical areas. For example, there is only one qualified geologist with experience in groundwater in Fiji, and in fact in the region. Recent political instability has not assisted.

The University of the South Pacific is located in Fiji, so Fiji is better off than some neighbouring countries, but obtaining and retaining people with necessary capacity remains a challenge.

Some areas in which capacity would be desirable are:

- *Hydro-geology* – given the number of small island communities relying on shallow groundwater and the need to asses such limited water reserves;

- *Hydrologic modelling* – there is no capacity at present (as distinct form hydrographic expertise, flow gauging) and international consultants are required to undertake assessments and modelling of such
- *Environmental modelling and assessment of ecosystems* in the areas of limnology, wetland management and protection,
- *Estuarine and coastal zone modelling and assessment* – to identify the impacts of freshwater outflows into the marine zone.

Some skills are more abundant, such as data management (although there is scope for improvement) and GIS (a number of organisations are developing and using GIS mapping systems).

Solutions require creative approaches because until now, it has been difficult to retain qualified staff in many areas. It is demoralising to invest in high level qualifications and then see the qualified person leave.

7.3 Finance

Water sector financing in Fiji lacks long term sustainability in a number of areas. In summary, sources of finance for water services are as follows:

Urban water supply

The Public Works Department is funded by Government from central Treasury sources and water charges collected by the Department are returned to Treasury. Thus there is no direct link between funds raised and the operating costs of the water supply. Finds recovered from water fees are estimated to be less than the cost of operation and certainly would not cover the cost of major maintenance or replacement. A difficulty is that the water distribution networks in many towns are seriously degraded and require significant investment to make improvements.

Urban sanitation

The same conditions apply as for urban water supply, except that charges are not levied for sewerage or drainage as such.

Urban drainage

All urban drainage costs are met from national or local government sources, except in the limited cases where developers are required to install and maintain drainage lines within or flowing from their developments.

Rural water supply and sanitation schemes

Schemes are installed by PWD and other agencies, at Government cost, but ongoing operation and maintenance is a local responsibility. Funding, to the extent it is found, comes from local communities and from sources they can obtain, which may include NGO or other donor programmes from time to time.

Irrigation

The government constructs and operates irrigation schemes. Irrigation farmers do not pay water fees for the water they receive. Long-term maintenance and the condition of the schemes remains a responsibility of the Government, administered by LWRM.

Water resources information

Various information schemes receive ongoing government funding. These are:

- *FMS activities,* which are also funded by international donors as part of the regional climate information centre;
- *PWD Hydrology* which has operated the surface water flow gauging facilities;
- *Estuarine water level monitoring by LWRM*;
- *Collection of groundwater data by MRD* in the course of drilling and groundwater investigation, which is archived by the Department;

Other data is collected but not managed as part of a coordinate database, such as water quality data related to health (Department of Health) and environment data (Ministry of Environment).

Water management functions

Water resources management initiatives have been funded though various national government ministries and department in the course of their normal activities and thought special programmes and projects. These include catchment management pilots. However, it is notable that the National Water Committee, for coordinating inter-ministry water-related activities, does not receive dedicated funding but relies on MRD for its support.

Summary

The contribution of water users and the private sector to water services is minimal and the government remains responsible for the bulk of both services and management costs. Some developers may be required to contribute to measures associated with their projects, such as environmental or water-related programmes or works. An example is the protection of groundwater in areas where water bottling is undertaken commercially, but even in that case, the government appears to be undertaking to bear most of the cost of protection measures if they were introduced.

Contributions by developers would be relatively uncoordinated and affect local areas only. Alternate funding for water management-related activity comes from donors and NGOs. NGO funds are mainly oriented to studies, education programmes and local community pilots for improved water management behaviours. In some cases NGOs have attempted to promote protection programmes, such as wetland protection in coastal areas.

7.4 Linkages

7.4.1 Landuse and agriculture

Conferrable attention has been paid to water in association with landuse and agriculture. The Ministry of Agriculture has been tackling the linkages in two areas: (i) land conservation and catchment management, and (ii) water resources management related programmes.

The Land Resources Division of the Ministry undertook an extensive policy development programme which led to the recent adoption of a Land Conservation Policy. The policy includes numerous proposals for the amelioration and protection of natural vegetation and the sustainable use of productive land, a number of which are aimed at protecting the quality of water resources. In addition, some intensive monitoring and participatory programmes with farmers and other land users.

Limitations of the linkages are firstly that although legislation for land conservation exists, it has not been usefully enforced because (a) the provisions are general and difficult to enforce and (b) the resources are not available. Secondly, the policy relies on voluntary participation by rural land owners and users, and although it has resulted in changes to the approach for State forestry, the role of participation of private landowners remains patchy because of limited resources. Finally, catchment managment programmes have been applied in detail in some catchments such as the Rewa River, but these have been limited in geographical scale due to the resource issue. However, they may be used as models for other areas if finance becomes available.

Catchment management is also a focus of LWRM, which has been putting resources into the Nadi catchment as one of the most important watershed areas and to developed linkages between upland and estuarine areas. The key elements of the catchment plan for the Nadi River basin are (i) the design and construction of flood mitigation dams in the middle reaches which may also be used for irrigation, (ii) river channel amelioration on the floodplain and estuary, including channel clearing and dredging, and (iii) flood-related programmes which include initial flood level and flood prone area identification with a view to undertaking more extensive drainage and flood routing work in the future. There are not strong links yet between work which might be undertaken for the upper

catchment area and the LWRM programme. The upper catchment of the Nadi River is subject to significant population and development pressure and is believed to be degrading at present.

7.4.2 Habitats and ecosystems

Work on habitats and ecosystem in the context of water resources is at an early stage. Ecosystem awareness such as the value of wetland preservation, is not widespread in rural areas, nor even the urban population. To date there are no major programmes for

The wetlands of Fiji can be broadly divided into five main categories: mangrove forests, peat bogs, rivers, lakes and reservoirs.

7.4.3 Health and hygiene

In rural areas there is a close connection between waste disposal (liquid and solid) water quality and health. The Ministry of Health is keenly aware of the potential for waterborne diseases to occur in situations such as the aftermath of flooding in settled areas and previous outbreaks of disease have led to awareness of the dangers. There was considered to be a risk of waterborne diseases such as Leptospirosis, diarrhoea, dysentery and typhoid; following the floods in February/March 2007, the Ministry of Health raised alerts for typhoid, dengue fever and Leptospirosis. Warnings and instructions are issued by the Ministry when circumstances occur which appear likely to cause a water-related health threat. More recently (2007), cases of typhoid have brought attention

While some education programmes have been developed on water quality awareness and health, the Minstry of Health has provided information on some aspects of water contamination and health, but has not water issues as a central priority. Various donor projects have touched on water and health.

I outlying areas, PWD must take into consideration the safety of local water supply schemes it constructs, as the quality of water at source and within the schemes can affect the health of the local population. PWD conducts water quality testing of drinking supplies for its own schemes and others.

7.4.4 Watershed and coastal management

Comments have been made earlier on watershed management. The relationship of the coast and its management to marine values be becoming more evident, in particular the need to protect coral reefs from degradation. Studies of coastal wetlands have been undertaken (eg Wetlands International) to illustrate the connection between coastal land and water quality and marine life.

Marine resources tend to be managed quite separately from freshwater resources, and although awareness of the connection and importance is increasing, there are no formal linkages. Marine

resources are the concern of fisheries and environment agencies, with interest from the perspectives of tourism. However, the impact of the quality and quantity of freshwater entering the sea has not been the focus of attention until now.

7.5 Stakeholder engagement

The key issue for stakeholder engagement is the participation and cooperation of native land owners and rural communities in programmes for water resources management. Without an understanding of the need for programmes to protect water resources from pollution and degradation, it is unlikely that rural communities will willingly cooperate

Stakeholder engagement in development proposals is catered for in the planning legislation but nevertheless, the Government finds itself facing difficulties with conflicts in which communities and landholders usually play a prominent part. Intensive engagement mechanisms sometimes appear necessary, but resources and willingness on the part of authorities may not always be present.

Catchment programmes have shown that structures need to be developed at more than one level in order to ensure that the participating groups are brought into the programme as willing participants. For example, the catchment management programme for the Rewa River involves a two-tier structure (managing committee and lower level technical committee) to involve all the relevant participants and it was deemed successful by the Ministry of Agriculture.

7.6 Other IWRM programmes

SPREP is a regional organisation established by the governments and administrations of the Pacific region to look after its environment. It has grown from a small programme attached to the South Pacific Commission (SPC) in the 1980s into the Pacific region's major intergovernmental organisation charged with protecting and managing the environment and natural resources. It is based in Apia, Samoa, with over 70 staff. SPREP has two major programmes as follows:

Island ecosystems Programme focus

1.1 Terrestrial island ecosystems

1.2 Coastal and marine ecosystems

1.3 Species of special interest

1.4 People and institutions

Pacific Futures programme focus

2.1 Managing multilateral environmental agreements and regional coordination mechanisms

2.2. Environment monitoring and reporting

2.3. Climate change and atmosphere

2.4. Waste management and pollution control

2.5. Environmental planning

Fiji International Waters Project (IWP)

The objective of the Fiji International Waters Project Fiji (IWPFJ) is to identify cost-effective ways to strengthen the management of solid and liquid waste in Fiji's rural communities. It is managed by the Ministry of Local Government, Housing, Squatter Settlement and Environment in collaboration with the Pacific Regional Environment Programme (SPREP).

The IWP is working with the villages of Vunisinu and Nalase located one hour north of Suva in the province of Rewa. These villages have a combined population of just over 200 people. The pilot project is intended to promote increased community involvement and responsibility for community-based waste reduction. It is hoped that the pilot community could model effective waste management systems for similar rural, coastal communities. It is also hoped that the practical lessons from the IWP will assist in the development and implementation of solid & liquid waste management strategies for Fiji's rural communities.

7.7 Capacity development and barrier removal

7.7.1 Introduction

Barriers to IWRM in Fiji fall into several categories. It was found useful, in the investigation under the European Union Programme for Water Governance (PfWG) for Fiji at national level, to consider water resources management in the following categories or 'building blocks':

- Policy
- Legislation
- Coordination and organisation
- Information and data
- Water resources planning
- Technical capacity
- Public awareness

The barriers to IWRM implementation are discussed below and summarised at the end of this section.

7.7.2 Policy and IWRM

During the past ten years, political attention has been paid to water resources management issues for the following reasons:

- Conflict or perceived conflict over access to groundwater for commercial purposes;
- The need for water (mainly groundwater) for the development of high technology industrial and commercial areas;
- The need for groundwater protection
- Water supply utility failure, leading to a restructure of the national urban water supply;
- The impacts of drought;
- The debate over native land owners' rights to water.

Other issues, not necessarily attracting serious attention at the political level include: the need to improve water supply in small islands, local pollution of drinking water sources, lack of

The Government of Fiji has not formally adopted a national water policy dealing with the comprehensive set of issues. An initial policy draft has been prepared for consultation but consultation has not yet taken place, for lack of resources.

A comprehensive policy and strategy is needed to assign priorities for the strengthening of IWRM in the next five to ten years.

7.7.3 Legislation

Although legislation covers water sector activities and related areas such as environmental management, town and country planning, agricultural development, forestry and mineral resources, the legislation dealing with the allocation of water (Rivers and Stream Act) requires updating to include measures for its implementation and enforcement. The current legislation lacks clear objectives for water allocation, which should include sustainable levels of development/abstraction and equitable water sharing, providing for essential services and public utility supplies, and promoting the national economy.

There need to be various powers that would enable the government administration to prioritise water access and

Additionally, a legislative basis for national water resources coordination is desirable.

7.7.4 Coordination

Fiji lacks a coordinating mechanism capable of reflecting the key private and public interests in water and advising the government on important IWRM policies, plans and programmes. Although a National Water Committee has been established, there is a need for a higher level body. It is also necessary to provide support for any national coordinating body. A deficiency in the current arrangements is the lack of dedicated support for the committee, which has limited capacity to develop strategies and proposals.

7.7.5 Organisation

The chief organisational limitation in Fiji for IWRM is the absence of defined responsibility for water resources, as distinct from water supply and sanitation. Although the environmental portfolio deals with a number of water resource-related issues, it does not include water allocation or the control of the diversion and extraction of water. Informal responsibility for water resources now rest with MRD, although that department's expertise is limited to groundwater, and the department does not have a structure or resources that reflect water management or IWRM.

Responsibility for water resources should be identified and developed at the following levels:

- *Ministerial:* a portfolio should include water resources or IWRM;
- *Departmental*: a department should be responsible for water resources and should possess the structure, staff and resources to undertake water management functions.

7.7.6 Information and data

Although various water data are collected for the large islands of Fiji, no comprehensive survey of water management data needs has been undertaken. Small island information requirements are not part of the major databases, which are:

- *The hydrology division of the Public Works Department*, which has collected streamflow data, mainly for the purposes of urban water supply;
- *The Land and Water Resources Management Division of the Ministry of Agriculture (LWRM)*, which has collected river flow and level data in the tidal reaches of rivers on the large is;
- *The Fiji Meteorology Service (FMS*), which collects climate and rainfall data for the whole of the Fiji Islands;
- *The Mineral Resources Department* which has collected and retained data on groundwater over the years from drilling operations and investigations for various purposes;
- *The Ministry of Environment*, which collects and collates environmental data and monitors

wastewater discharges.

In addition to the above, there are other organisations which collect data but do not have databases, such as:

- *The Department of Health*, which conducts investigations as required into cases of drinking water contamination which may include sampling of water sources;
- *Academic institutions such as the University of the South Pacific*, which conduct research into water resources.

Two major elements are lacking in data management for water resources, and other aspects of data management can be strengthened. The elements that need to be introduced are:

- *Assigning responsibility for data in various data fields*: responsibility can be assigned to more than one organisation, but overall responsibility for any particular set of data (such as surface water quantity or groundwater quantity) should be specifically given to the most appropriate organisation;
- *Developing data sharing and data standards* which allow data collected by various organisations to be shared and compared (therefore developed to compatible standards)

A third requirement is to undertake a survey of data needs for long term water resources management, planning and regulation.

Fiji needs a medium term programme (five years) to develop its water resource information capacity. The need for comparable data on water quantity and quality is increasing as the impacts of development on the aquatic environment need to be assessed.

7.7.7 Planning and water resources

Fiji has an urban and rural development planning system which satisfies the requirement for shaping development. However, planning capacities are needed in other areas, most of which would involve some regulation of activities or control.

The key examples are:

- Planning for water allocation and setting rules governing priority among watrer users for times of water scarcity;
- Plans for floodplain control, which may be added to or included in Town and Country Planning legislation;
- Possible plans for catchment protection accompanied by powers more suited to control of activities than current legislation (Water Supply Act).

Such planning requires technical capacity in modelling.

7.7.8 Technical capacity

Technical capacity is a critical constraint on improved water management in Fiji. The lack of qualified and experienced staff in key technical areas could be limitation on the ability of the government to undertake investigations and studies and to oversee activities such as water abstraction. Some skills may be imparted through training courses, including course specially designed for particular purpose, but other qualifications require formal course of study at university degree level. Hydrogeology is a pertinent example.

Without the capacity to understand both national and local water resources, decision-making cannot be soundly based. There is a need to understand surface water and groundwater not only on the large islands but on small islands also. There is also a need to better understand the freshwater-marine interface.

7.7.9 Public information and awareness

Although public information and awareness about IWRM-related issues is beginning to be promulgated in programmes such as water saving in urban areas, there are many other areas where better understanding of water management is important. In particular, in rural areas, there needs to be general awareness of the need for water conservation and the dangers of pollution.

Most agencies with water-related responsibilities produce some information about water for public education and awareness, from technical pamphlets to awareness-raising brochures.

7.8.0 Introducing an integrated approach to barrier removal

The implementation of IWRM in Fiji requires a number of features to be developed simultaneously. Barriers to IWRM presently include:

- Lack of detailed policy and strategy to which the government is committed, including clarification of national IWRM objectives;
- Inadequacy of legislation;
- Lack of robust coordination arrangements at national level, with adequate supporting resources;
- Lack of ministerial and departmental responsibility for IWRM or water management and the resources to undertake the activities required;
- Lack of formal responsibility for the major water resources data fields and a rationalised data collection programme to support for long-term IWRM objectives and the data sharing

and coordination mechanisms to allow comparable data to be used for investigation and planning;

- Inadequate planning mechanisms and in some cases powers to ensure the control of activities for the purposes of water allocation and water body protection;
- A serious deficit of technical and scientifically qualified staff in the government service;
- Less than ideal levels of understanding in the population, particularly some rural populations, of the need to conserve water and use appropriate waste disposal methods.

The key capacity building requirements are considered to be:

- Active policy development on key water management issues;
- Continuation with legislative changes already commenced;
- Establishment of much improved linkages between sectors, both formal and information, including at the local and watershed planning scale;
- Technical and human resources capacity building and the identification of sources of finance.
- Serious consideration of the long-term sustainability of water services and schemes and means to ensure they will continue to deliver (or be improved to deliver) the essential services required (in particular reliable and safe water supply);
- Proactive approaches to water protection and responses to water threats and vulnerabilities by planning between crises and learning from disasters that have already occurred;
- Education and understanding about water and its protection by urban and rural people to be promoted more actively