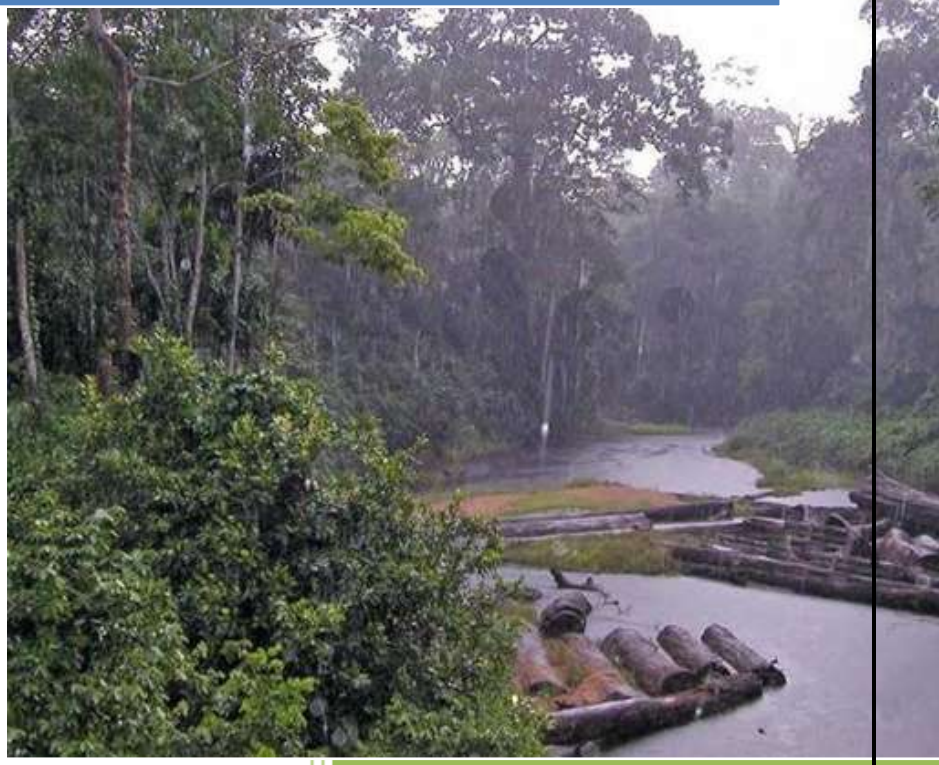
FEDERAL REPUBLIC OF NIGERIA

FEDERAL MINISTRY OF WATER RESOURCES

NIGERIAN INTEGRATED WATER RESOURCES MANAGEMENT COMMISSION

Niger South Integrated Water Resources Management & Water Efficiency Plans



FINAL REPORT: Volume 2

IWRM STRATEGIES AND WATER EFFICIENCY PLANS

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"If we do not act now, we will surely end up where we are headed"

An old Chinese proverb

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1 INTRODUCTION

1.1 GENERAL

The Federal Ministry of Water Resources through the Nigeria Integrated Water Resources Management Commission (NIWRMC) has commissioned PSE Consultants Ltd to prepare the IWRM strategies and water efficiency plans for the Niger South Catchment. The Niger South Catchment, also referred to as Hydrological Area 5 is made up of land areas of mainly Delta, Rivers, Bayelsa, parts of Edo, Anambra and Kogi States in. All the states are in southern Nigeria along the lower half of river Niger.

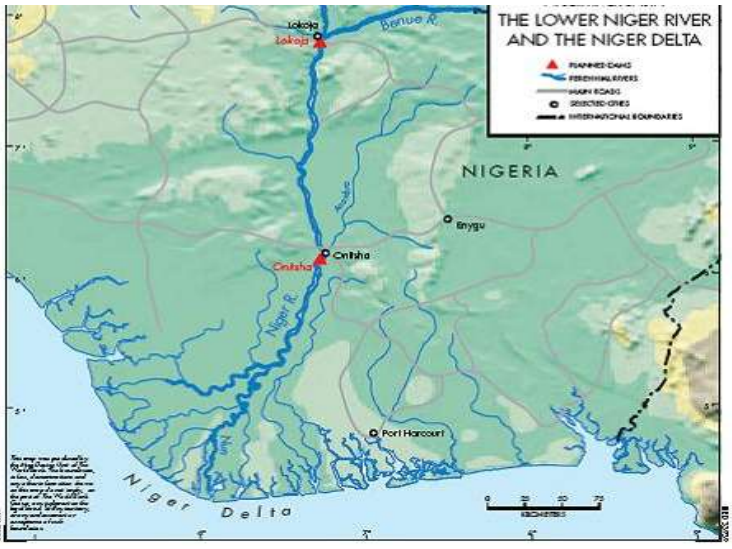
1.1.1 OVERVIEW OF NIGER RIVER BASIN IN NIGERIA

Nigeria is the final downstream country through which the Niger River flows, and contains 28.3 percent (424,500 square kilometers) of the Basin area. The Niger Basin extends across 20 of the 36 states of Nigeria and comprises two main rivers, the Niger and the Benue, and 20 tributaries. Of Nigeria's major rivers, more than half are in the Niger River Basin.

1.1.2 THE NIGER SOUTH CATCHMENT

The Lower Niger River and the Niger Delta hydrographic region of the Niger River Basin is approximately the Hydrologic Zone 5 in Nigeria (The Niger South Catchment-Figs 2 and3). States in the Niger South Catchment include Delta, Rivers, Bayelsa, parts of Edo, Anambra and Kogi States (Fig 1).

At Lokoja, the Niger River enters the Lower Niger River segment, which includes the Niger Delta. Also at Lokoja before reaching the Niger Delta, the Niger River is joined by its major tributary, the Benue River, which originates in the highlands of Cameroon's Adamawa Plateau.



From Lokoja, the Niger River takes a north to south direction for 200 kilometers; it receives only a few small tributaries, including the Anambra on the left bank, which drains a basin with significant rainfall. The Lower Niger flows for another 100 kilometers and the lower valley progressively transforms into the vast Niger Delta covering approximately 30,000 square kilometers, with no fewer than 30 outlets to the ocean (Figs 3 and 4). The main course of the Niger takes the name of Nun as it

crosses the Niger Delta and discharges to the Gulf of Guinea, 4,200 kilometers from its source in Guinea.

1.2 WATER RESOURCES IN NIGERIA

Nigeria has abundant water resources although they are unevenly distributed over the country. The highest annual precipitation of about 3,000 mm occurs in parts of the Niger south catchment in the Niger Delta and mangrove swamp areas of the south-east Nigeria, where rain falls for more than eight months a year. River Niger runs through the middle of the Niger south catchment. There is a progressive reduction in precipitation northwards with the most arid north-eastern Sahelian region receiving as little as 500 mm a year precipitation from about 3-4 months of rainfall. Nigeria must live with the water supplies it currently has and be prepared for less.

The water resources in the catchment is not being effectively utilized due to the lack of an effective holistic plan. Less than half of the population in the catchment have access to adequate potable water and less than 10,000 ha of irrigation is in use by the River basin development authorities.

1.3 THE NEED FOR IWRM IN NIGERIA

The quantity of water available is a finite resource and might possibly reduce in the future. Most studies of climate change suggest a change in available water over the coming decades due to global warming. Water demand would increase significantly in the future as a small percentage of people living in the country have adequate access to potable water. With increased development and increased investment in the water sector the percentage coverage is set to increase. When the percentage coverage increases and people become used to the availability, the per capita usage would increase as well. At the same time Nigeria wastes a significant proportion of the limited water available through both inefficient use of water and water losses.

The quantity of water used for irrigation is not up to the expected level at the present time. But the limited water used in irrigation is not applied efficiently.

The above shows that the problem in Niger south is not a resources problem but a management problem and it is a problem which can be solved through applying the principles of Integrated Water Resources Management (IWRM).

It is well accepted that there is a lot of room for improvement in the management of the water resources of Nigeria. The limited capacity in state water agencies and river basins in the area of water resources management is also a concern.

Currently IWRM is not being practiced in Nigeria in the true sense of it. We have a number of water projects scattered all over the country with no holistic plan. Many of them are dysfunctional and abandoned. Many of the boreholes do not have a clear ownership structure. IWRM offers a process of turning these around to being integrated, properly managed and efficiently operated.

There are many consequences of a fragmented, sectorally driven and poorly managed water resources management system. A few to highlight are:

- Apparent localised water shortages where the actual total resource is sufficient.
- Low efficiency in Irrigation water use.
- Vast amounts of money spent constructing boreholes all over the country in a chaotic manner by all tiers of governments and funding agencies, sometimes duplicating locations and there are always further plans to build additional boreholes in every budget every year.
- Limited attention paid to water quality issues

Clearly, it is evident that the existing approach to water resources management in Nigeria is not working. An integrated approach, in which the catchment is managed holistically, with the participation of all stakeholders and ensuring environmental sustainability, would resolve many of the above problems.

There is a well understood link between economic and social development and the effectiveness of water management. The continued social and economic development of Nigeria depends on having access to good quality water. Financing improvements in water resources management is not a cost but an investment in the future. Establishing and *implementing* an IWRM is therefore a pressing issue.

1.4 THE HIGHLIGHTS OF THE PLAN

This document sets out modalities for implementing an Integrated Water Resources Management and Water Efficiency Plan for the Niger South catchment in southern Nigeria. The plan would only be usefully if it is followed up by well trained professional water managers and other specialists to implement a real, functional IWRM. With appropriate commitment and effort it is reasonable to estimate that it will take 5 to 6 years to properly implement the IWRM. The objective of this document is to get the process of IWRM started, to define the steps which are most crucial, most immediate. It is expected that the document would be continuously updated with feedback from the field and stakeholders.

The Plan defines what steps and actions are needed at the national level to support effective and integrated water resources management at the river basin level, where hands-on management is done.

The Plan is about water governance. Its focus is on how to get management structures working better. It is about how to achieve integration.

1.5 WHAT IS INTEGRATED WATER RESOURCES MANAGEMENT?

Integrated Water Resources Management is the term given to what is now considered best practice in water management. Specific definitions have evolved since the Dublin Principles were first put forward. At the Rio Conference later in the same year, six basic principles of IWRM were presented and they provide a good founding in what is meant by IWRM:

1. The catchment is the correct administrative unit for managing water.
2. Water resources and the land which forms the river basin area must be integrated, in other words, planned and managed together.
3. Social, economic and environmental factors must be integrated within water resources planning and management.
4. Surface water and groundwater and the ecosystems through which they flow must be integrated within water resources planning and management.
5. Public participation is necessary for effective water resources decision making.
6. Transparency and accountability in water management decision making are necessary features of sound water resources planning and management.

However, IWRM is not intended as a strict set of rules that would apply around the world, but rather a flexible approach based on the above principles which can be adapted to the needs of the individual country.

Implementing IWRM primarily means integrating government policies with each other, with the impact on water resources in mind. This means economic and social development policies, agricultural policies, industrial policies, health and social welfare policies, etc. A few examples pertinent to Nigeria are:

- Integrating and coordinating the execution of water infrastructure in the country. It is impossible to have an IWRM when all tiers of government and the private sector are working individually in trying to meet their water needs.
- Integrating agricultural policies with environmental policies – it is essentially impossible to improve water quality in rivers or to restore and maintain wetlands and other water bodies in irrigated agricultural areas where drainage is not effectively dealt with and water is overused.
- Integrating agricultural policies with water management policies – there are many ways to reduce and rationalise water use in agriculture. All require good coordination between the irrigation service providers, agricultural extension and water resources managers.
- Integrating water management with environmental management to ensure water quality in rivers and lakes are actually managed.
- Integrating surface water management and groundwater management to improve conjunctive use of surface and groundwater which could have a very beneficial effect on irrigation water use and access to domestic water.
- Integrating water use with water resource availability.
- integrating environment with industrial policies to reduce pollution – it makes little economic or environmental sense to allow industries to pollute water bodies, only to have to clean the water up again to use it for other purposes downstream.

- Integrating environment and municipal water and waste management policies – as for industry above, it makes little sense to pollute here then clean up there; it is better and cheaper not to pollute in the first place.
- Integrating poverty reduction policies with water policies – ensuring clean, safe and sufficient water supplies to all people is a prerequisite to economic and social development at every level.

Nigeria needs to implement the principles and practice of IWRM because of the severe environmental, economic and financial consequences that the current fragmented approach to water management has had on the country.

1.6 WHAT IS WATER EFFICIENCY

Water efficiency is simply a term to express the use of water in the least wasteful way; in other words, maximising water's potential. The Global Water Partnership (GWP) refers to two different aspects of water efficiency: technical efficiency and allocative efficiency.

Technical efficiency refers to the use of water in an area or sub-sector while minimising waste. Technically, this requires demand management interventions.

Example: The present Domestic water supply requirement in the Niger south catchment is estimated to be about 5 MCM per day. Most water agencies in Nigeria operate with more than 50% losses and unaccounted for water. If the agencies meet this requirement, a drive to reduce pipe leaks and other losses by 30% would result in water saving of 0.6MCM per day or 219 MCM a year.

Allocative efficiency refers mainly to economics, allocating water to the highest value water users. Naturally this assumes that environmental and social needs are met prior to restructuring allocations on the basis of economy. Considering the present situation of the country and the fact that there is an adequate water resource in the catchment (if properly applied), this aspect of water efficiency would not be considered in this study.

1.7 KEY OBJECTIVES OF IWRM FOR THE NIGER SOUTH CATCHMENT

The key objectives for the IWRM and Water Efficiency Plans are:

- Ensure Adequate Water Supplies for All.
- Ensure the Maintenance of a Good Environment and Healthy Ecology
- Improve water governance through policy and institutional reforms;
- Enhance knowledge of current and future water uses
- Build the Foundation for Improving Water Use Efficiency

The overall goal of the IWRM and is to

..."achieve a coherent implementation of water resources development, with a long-term vision, that would benefit all stakeholders in an environmentally sustainable manner".

2 STAGES OF THE PROCESS

2.1 THE FIRST STEPS IN THE PROCESS

2.1.1 FINALISE AND ADOPT A NATIONAL IWRM AND WE PLAN

The most logical first step in developing IWRM and water efficiency (WE) Plan for a hydrological area in the country is the creation and adoption of a National IWRM and WE Plan. The plans for the various hydrological Areas should follow from there, although the IWRM and WE Plans should be run from the catchment level. One of the main reasons why the national IWRM should come first is that some laws may need to be passed at the national level to enable the implementation of the plans.

Although the National IWRM and WE plan in not in place for the whole country, we would proceed to present this IWRM and WE plan for the Niger south catchment assuming that the provisions would be compatible or applicable to the National IWRM and WE plan when adopted.

2.1.2 INCREASE THE AUTHORITY OF THE NATIONAL INTEGRATED WATER RESOURCES MANAGEMENT COMMISSION

This is a very important step as all other steps and the overall implementation of IWRM in Nigeria depends on it. With the recent passing of the enabling law for the commission (which is now waiting for the president's accent) an important first step has been put in place. This needs to be followed up by adequate funding and implementation of the relevant provisions.

2.1.3 PREPARE AND ADOPT A WATER RESOURCES MASTER PLAN FOR THE CATCHMENT

To check the fragmented and haphazard mode of construction of water schemes in the country by all tiers of government, a comprehensive water resources master plan should be developed that make provision for how every city, town and community in the catchment would be provided with adequate water supply and sanitation. The master plan would be preceded by a comprehensive baseline study. The plan would also make provisions for all water related activities including, irrigation, livestock, fisheries, industry, tourism, wildlife, recreation and the environment. With this master plan in place any tier of government federal, state or local

government that wants to carry out a water resources investment would execute the part of the plan that concerns it. In that way all arms of government would be working towards the same goal. The complete plan must not be completed all at ones but could be done in stages. Even after the completion of the plan it should be subject to constant changes and modifications. The goal here is not to produce a fixed, restrictive document that would restrict or stifle development but a mechanism that would ensure that we have a holistic focus.

No arm of government would be permitted to work outside this plan. If there is a cogent reason for a water resources investment not covered in the plan the new requirement should be added into the plan and the overall effects and ramifications to the whole IWRM plan considered before such approval is given.

2.1.4 ESTABLISH AND DEVELOP HYDROLOGICAL AREA COUNCILS (HAC)

With the successful setting up of the National Integrated Water Resources Management Commission (NIWRMC), there is a need to setup "hydrological area councils" HACs for each catchment so that the stakeholders can be managed better. Having one council for the whole country would be too big and the aim of effective stakeholder participation would not be full achieved. Having a HAC for hydrological area would be preferred as each hydrological area has slightly different issues and challenges, it would be better for a fewer set of people to come together to work towards the same specific target. This concept is also in line with the Rio Conference principles which emphasised that the catchment is the correct administrative unit for managing water.

The inclusion of all stakeholders at the catchment level and carrying them along in the implementation of the IWRM and WE plans is very important in ensuring the overall success of the program. In order to involve them in the decisions and ensure their buy in, they need to be integrated at the highest decision making body, hence the need for the creation of a Hydrological Area Councils (HAC). The HAC would be made up of all stake holders in the Hydrological Area (HA) such as representatives of IWRM related organisations (both public and private sectors), nongovernmental organisations, consultants, contractors, private sector participants and the water users' representatives. Also it is imperative that tertiary educational institutions are integrated formally as a body and not as currently practiced where individual lecturers are invited in their personal capacities. The point of this is to ensure that the benefits and information coming from the participation is channelled back formally to the whole institution for the benefit of all not to create isolated towers of knowledge. The HACs are the key to effective and sustainable water management into the future. They would ensure stakeholders participation and buy-in in decisions that would be made in the catchment. The full HACs should meet twice a year in the initial stages of the implementation of the plans. The frequency can decrease with time as the implementation of the plans take off. The HACs would constitute an action committee made up of fewer people selected by the full body to take quick decisions when needed on behalf of the group.

2.1.5 OVERCOME FRAGMENTATION

Water resources management is important to practically all sectors of the economy and the society. As a result there are many ministries, departments, local administration bodies, which

are involved in water in some way. The key to integrating water resources management is not that all functions must be housed within one organisation but rather to overcome the fragmentation that keeps the various organisations communicating, coordinating and cooperating. However, the responsibility for the overall management of the water resource, including its use and protection, which means water quality and watershed protection, must be with one organisation. The ideal body for this role is the NIWRMC. The NIWRMC must therefore be able to count on other organisations contributing through monitoring, assessment, licensing, etc. This, in turn, means that IWRMC should be empowered to regulate all water resources activities in all parts of the country for all tiers of Government and the private sector.

2.1.6 ESTABLISHMENT OF A COMPREHENSIVE GIS DATABASE OF ALL WATER RELATED INFRASTRUCTURE

This should be a comprehensive list of all water related infrastructure indicating their status, area and populations served. This data would include functional, dysfunctional or abandoned as well as planed schemes for the future. It is particularly important to include dysfunctional ones because out of sight is out of mind. All parameters of the infrastructure would be included in the list. There should be continuous communication between the NIWRMC and the responsible agency to find out plans to repair broken down facilities. This data needs to be continuously updated at least every quarter by the relevant agencies. The NIWRMC should arrange physical inspection of these schemes every year to ensure that the reported information matches what is on the ground. The database could be housed at the premises of the NIWRMC or at a private data centre. The information should be available online.

2.1.7 ESTABLISH THE NATIONAL WATER INFORMATION CENTRE

Good management cannot be done without good information. Good water information should be developed and housed in the integrated water management commission office in Abuja. It should be accessible online and made available to all organisations contributing data to it and all stakeholders free of charge. This information centre should have all relevant information including hydrologic, metrological, environmental, land use, population, water demand, agricultural information, all relevant laws and required training information.

Development of the National Water Information Centre (NWIC) within the NIWRMC is as an immediate need. Considering Nigeria's stage of development it is important that there would be a one stop shop for all information relating to water resources. All stakeholders would link up to the commissions data bases to access and update data. The NWIC will therefore become a link or connection between the ministries, departments and other organisations which will monitor, analyse and present information in the databases. It is imperative that there is a National legislation requiring anybody (both private and governmental) collecting water resources information to make a copy available to the NIWRMC free of charge within a set time period of collecting it. As a first step the government should direct all governmental agencies to send all their relevant data to the NIWRMC immediately. In the absence of this directive the NIWRMC would not make any meaningful headway in assembling the required data for function effectively.

The most effective means of data collection is at the river basins, state water boards and the local government level. Officers in those organisations would be trained and given a financial

incentive to make contributions to the database. It would not be prudent or desirable for the NIWRMC to attempt to have staff in all locations in the country. A water resources consultancy firm should be maintained to supervise and ensure that the information centre is running correctly. The consultant should oversee the running of the hardware as well as making sure that the required information is collected and the database updated on time and correctly. They would also assist the setting up of facilities and training of personnel at the various agencies in the Local Government Areas, State Governments and federal level that would assist in the data collection. This would also assist in the awareness of IWRM principles at all levels of government and enhance participation.

The key is for the federal Government to ensure free access to all data by all stakeholders. At present, government organisations do not have access to the information of other government organisations, not to talk of the general public having access. There needs to be some immediate steps taken to rectify this situation. Information systems need to be freely accessible, well designed, properly staffed and adequately funded.

2.1.8 ESTABLISHMENT OF A LICENSING REGIME FOR USE OF WATER INFRASTRUCTURE

There is a need for the establishment of a licensing regime for use of water infrastructure. This would help implement or manage the catchment master plan mentioned above. The licensing regime is one of the implied provisions of the draft bill that has been passed by the national assembly awaiting the presidential accent.

Before a user undertakes a project that would use water resource, the user has to apply and obtain a licence from the NIWRMC. The point of the license we are proposing is to give the commission an advance warning of the development and an opportunity to engage with the user to find out how best to use the available water resources in the area bearing in mind the catchment master plan and the needs of the users in the vicinity. The user would be required to report back to the commission when the project is completed. For best results the license should not be a money making venture / revenue stream for the commission or become a hurdle for would-be investors but an opportunity to integrate the development of water resources and capture all developments. If it becomes a hurdle there would be large scale avoidance and the objective would not be met.

Considering the stage of Nigeria's development and the fact that we need a lot of investments in the development of water infrastructure at the present time it is very imperative that the *license issuance should not become a hindrance to investment or growth of the sector*; a revenue generation avenue for the government or cause undue delays to planned projects.

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There should be two kinds of licensing; a license to start development and a second license to start operations. The license to start development should be time bound i.e there should be a time limit within which the project construction should have started and competed, otherwise the licence becomes null and void and a new application would be

required.

For public sector projects the commission should encourage or insist that the catchment water resources master plan should be followed. Where this is not possible for cogent reasons the proposed project should be integrated into the catchment master and the overall implication studied. As earlier mentioned the master plan is not intended to be a fixed or rigid document but to be constantly updated and subject to continuous improvement.

For public sector projects, there should be a clear ownership structure. This means that there should be a clear legal entity (private or public) that would be responsible to the operation and maintenance (O&M) of the project in a sustainable way. They should also have to accept responsibility to ensure that the scheme is operating at a minimum of 70% of its installed capacity at all times subject to demand. The entity should be known as the legally responsible organisation (LRO) for the scheme. This legal entity if different from the agency building the project should attach a written statement to the application accepting responsibility for the (O&M) of the scheme and indicating exactly how the finished scheme would be operated and maintained in a sustainable way. This should include estimates of how much it would cost to run and service the finished scheme and how the funds would be sourced over time.

The case of the promoter of the project proposing that the competed project would be turned over to some as yet un-constituted water user association (WUA) is not acceptable. The use of WUAs to operate and maintain projects (which in itself a good idea in some circumstances) has been abused in this country and has been used as an excuse not to make adequate provision for operation and maintenance. For a WUA to be accepted as a LRO it has to be properly constituted and registered as a legal entity with clear owners, who would be fully aware of their responsibly as LRO.

Regulation should be put in place for clear strict sanctions on LROs that do not live up to their responsibilities.

For privately funded projects, <u>for private use,</u> where the development would not cause undue stress to the water resources or water quality in the area, the license should be promptly issued. This is different from the type of license issued to a private sector participant water supply company intending to render water supply services to a town or community. This should have a more stringent requirement and may even be put up for public biding or auction.

For both privately funded and public funded projects, information of the proposed development project should be entered in the database as a planed project. When the project is completed and the license to start operations is issued the project would be updated in the data based as completed.

All application should be accompanied with a clearly viable and sustainable (economic and environmentally) full lifecycle operation and maintenance plan for the development. This requirement would help to reduce the occurrence of abandoned competed projects in the country.

A threshold should be set over which an environmental impact assessment would be required before the license is issued.

The commission should set the size of project over which a visit of the commission or one of its consultants to the proposed or completed site is necessary.

2.1.9 ENCOURAGE PRIVATE SECTOR PARTICIPATION IN THE UTILISATION OF THE WATER RESOURCES

The NIWRMC should take concrete steps to encourage and invite private sector participation in the water resources sector industry. The role of government and the private sector in development is clear and it is no longer a subject for debate.

The private sector should be involved in all aspects of IWRM. This should include;

- Provision of water supply to towns and cities,
- Management of the operations of dams and irrigation schemes,
- Monitoring of water quality,
- Collection of water resources data and information
- Management of data centres for IWRM related information
- Development and operation of a unified information systems
- Monitoring and evaluation regime for projects
- Surface and ground water monitoring

There should be clear rules and guidelines regulating their involvement. Also the government should consider special incentives and tax breaks to encourage them.

Nothing stops the type of revolution we have witnessed in the communication industry from being replicated in the water resources sector.

For the private sector to succeed in the water resources industry there must be clear consistent rules that encourage competition and reward improvement and innovation by the private sector participants.

With privatisation, clear consistent rules and open competition amongst the players in the communication industry the number of telephone lines has risen from 400,000 to 50,000,000 lines and the prices are slowly coming down to the original Nitel prices. In the process thousands of jobs have been created in a sustainable way.

2.1.10 ADOPTION OF RESULT BASED BUDGETING AND PLANNING FOR WATER RELATED INFRASTRUCTURE

The present situation in which a local government chairman or government official realizing that funds are available would decide to apply it to sinking a borehole is not ideal. This decision sometimes is made without any engineering or water resources professional's input. The next thing: bids are called and the contract to execute the "project" is awarded. After a few months or years the contractor would complete the construction and the promoter of the project would come and drink a glass of water from the site. Job done! The Project is regarded to have been completed successfully irrespective of the fact that the scheme may end up not meeting the aspiration of the population and there is no sustainable way to operate and maintain the "project".

Government should stop ordering the construction of boreholes and any water infrastructure and start requesting specific targets in a community be met. It would be the responsibility of the professionals to determine the best way to achieve the target. The governments target could be "to reduce the time spent fetching water for 45% of the population in a given community to a min of 30 minutes within 6 months" so that at the end of the project execution if the set target is not met then the project has failed and the professional would be held responsible. Merely constructing a borehole should not be a success condition by itself but a means to an end.

2.1.11 PRIVATIZE OR OUTRIGHT SELLING OF WATER INFRASTRUCTURE THAT HAS BEEN ABANDONED FOR MORE THAN FOUR (4) YEARS TO THE PRIVATE SECTOR IN A TRANSPARENT MANNER.

With the aid of the inventory of water related infrastructure and the feedback mechanism to be put in place. NIWRMC should monitor schemes that are dysfunctional or producing at very low capacity. If schemes remain dormant for an extended period of time discussions would be opened as to the options e.g. assistance, privatisation or outright sale. A lot of the nation's resources are tied down in abandoned water projects all over the country and a lot more are being built and abandoned every year. The country can recover a lot of money and a lot of time by putting these assets back into use. In some cases the faults are not of a very serious nature and the masses end up suffering needlessly.

In situations where public water schemes have been dysfunctional for more than four years the facility should be handed over to the private sector (in clear and transparent process) to rehabilitate and run.

2.1.12 ESTABLISHMENT OF A MONITORING AND EVALUATION REGIME FOR PROJECTS.

The NIWRMC should adopt the procedure of

a. Agreeing on what to monitor and evaluate
b. Create a baseline study
c. Selecting key indicators to monitor outcomes
d. Review of baseline data indicators
e. Set up a Monitoring and Evaluation Framework
f. Setup an information dissemination framework

Result based monitoring and evaluation needs a clear set of goals, outcomes and targets. At the onset it is pertinent to clarify the difference between these terms.

Goals are the *higher-order objectives to which a development intervention is intended to contribute* usually at the national level. Goals are generally long term. Such as the project objectives outlined in that the National level.

Outcome is *the likely or achieved short-term and medium-term effects of an intervention's outputs*.

Targets are the more short-term results that an intervention is to achieve.

In carrying out a monitoring and evaluation assignment an important key step is agreeing on the out comes with all stakeholders to ensure a buy-in at the early stage of the project. This should be done with the HACs.

In a government programme such as the IWRM there is a clear need for a multi-level set of goals, outcomes and targets. There should be a set of long term goals at the national level. In addition to these goals, a set of outcomes and targets, which usually have intermediate to short term time frames are needed at the hydrological Area (HA) and scheme level. Progress needs to be monitored at all levels of the programme to provide feedback on areas of success and areas that needs to be improved upon.

The overall goals of the IWRM project should be clearly defined at the HA level as all catchments do not have the same problems.

A major constraint we have identified in carrying out water resources interventions is the absence of clear targets and outcomes in each of the individual schemes on which success can be measured at individual scheme level defined from the onset of the project. This would help every stakeholder know clearly what there are trying to achieve. Any indicator developed would only be relevant when measured against an objective.

These targets would have to be developed through a participatory and consultative process involving all stakeholders to ensure that each group concerns are incorporated. To achieve this, the following would have to be done:

1. Identify specific stakeholder representatives
2. Identify major concerns of stakeholder Groups
3. Translate problems into statement of possible outcome and improvements
4. Disaggregate the selected outcomes to capture key desired targets.

Examples of a clear target for a water supply project are:

- Reduce the time spent by children fetching water for 25% of the population by 40% in one year.
- Reduce the cost of a litter of water for 60% of the household living 1 mile radius of the scheme by 50% in six months.

Examples of a clear target for a sanitation project are:

- Reduce the quantity of solid waste entering local rivers and water bodies, 10 miles radius of the project by 90% with one year.
- To meet set environmental standards in a given area within 10 months

These targets should incorporate all the relevant aspects of IWRM including, Surface water, Ground water, Land use, Agricultural, Environmental issues and other relevant IWRM issues that need to be integrated into the M&E programme. These targets should vary from site to site depending on the nature of the intervention or what needs to be monitored.

It is very important to monitor and evaluate the progress of IWRM implementation. An annual progress report should be prepared highlighting the progress for the past year relative to targets and detailing successes and failures and the reasons behind them. An updated plan for the following year should also be prepared incorporating lessons learned from previous years.

2.1.13 TRAINING OF PROFESSIONAL WATER RESOURCES MANAGERS AND SPECIALISTS IN RIVER BASINS AND SWAS

A key component in improving governance in water management is to ensure that the organisations charged with managing water have the human capital to do so. There are several ministries, departments and organisations in the three theirs of government charged with (or that may be charged with) various aspects of managing or monitoring the water resources of the country that do not have the capacity to discharge the function effectively due to poor human resource development.

The main reason for this has been the lack of training or the existence of a continuous human development program in most government institutions today. At the same time, the world has been undergoing rapid improvements in water management methods and approaches (including the development of IWRM). Many public institutions cannot keep up.

It is pertinent that this human capital is developed to international standards to achieve standard results. It would be very necessary to bring in relevant experts to train existing staff in all tiers of government that would participate in the IWRM programme not just the commission staff.

The staff of the commission that demonstrate excellence should be sent for further training, which should include short courses and post graduate programmes in relevant specialist areas.

The commission should ensure that they have some key specialist at the onset of the implementation stage. If there are no staff with the required skills, short term consultants can be engaged to fill the gap. They would help implement the initial stages. The required staff include but not limited to:

- legal specialist – with knowledge of the legal and institutional aspect of the IWRN plan.
- environmental specialist – with knowledge of environmental and ecological water needs to coordinate with Ministry of Environment and drive the environmental component of the IWRM Plan.
- water quality specialist – with experience and training in water quality monitoring and assessment to drive the improvement of water quality
- agricultural specialist – with knowledge in agricultural water needs and water efficiency
- industry and domestic water use specialist – with knowledge of industrial water use and municipal / rural domestic water use.

2.2 BUILD CAPACITY IN SURFACE AND GROUND WATER MONITORING

2.2.1 ORGANISATION OF SURFACE WATER MONITORING

Surface water monitoring in Nigeria is carried out mainly by the inland waterways, which is under the Federal Ministry of Transport. They have gauging stations in major navigable rivers especially along the river Niger. Most smaller rivers and streams are not gauged. There is need to empower an agency that would establish of Hydrological stations in all rivers in the country.

2.2.2 BUILD CAPACITY IN GROUNDWATER MANAGEMENT

There should be a system of regular observations, assessments and forecasts of groundwater conditions to provide information necessary to ensure the rational use and protection of groundwater.

The main tasks are:

- Groundwater observation
- Assessment of groundwater status
- Forecasting groundwater status
- Maintenance of an information base on quantity and quality of groundwater
- Provision of information and recommendations for decision making
- Assessment of actions on prevention of pollution and environmental improvement of groundwater

2.3 BUILD CAPACITY IN WATER QUALITY MONITORING

The Ministry of Environmental is charged with the responsibility of monitoring water quality in the country. Currently, routine monitoring of the water quality of the rivers is not carried out in the Country and there is no water quality monitoring framework for this purpose. Also there is limited information on which to base decisions on improving and managing water quality.

Some River Basins have laboratories but these are not used to monitor and protect the quality of water in water bodies.

The following water quality monitoring activities should be developed:

• ambient water quality monitoring in rivers and other water bodies

• monitoring quality of industrial discharges

• monitoring of water quality at intakes of water treatment plants

• monitoring of groundwater quality

These monitoring could be done by different responsible agencies such as ministry of environment or state water agencies as these information are needed by different agencies for different things such as monitoring discharge consent by ministry of environment or for water

treatment as in the case of state water agencies but the information gathered through these activities should be incorporated into the IWRM database to be developed. This would help in actually managing and improving water quality in the river basin.

Monitoring for effective water quality management takes three forms:

Ambient monitoring

Ambient monitoring is characterised by sampling at selected sites on a regular basis for a minimum of parameters to monitor the background or ambient water quality. In some cases this can be as few as three parameters depending on the known water quality and river basin activities.

Surveillance monitoring

Surveillance monitoring is carried out in addition to ambient monitoring when specific problems are identified or suspected. This can be done at any location on an ad hoc basis depending on the suspected problem or the type of water quality concern. Surveillance monitoring is typically used when anomalies are identified through ambient monitoring.

Forensic monitoring

Forensic monitoring is employed to determine sources of pollution or other water quality events, usually in conjunction with ambient and surveillance monitoring. Field testing laboratory kits are very useful in forensic monitoring because of their easy portability.

While some river basin authority have laboratories at the moment, there is need to strengthen existing ones and build new ones for those that do not have. Also private participants should be encouraged to set up independent laboratories by giving selected companies long term contracts to carry out monitoring of selected water bodies.

The NIWRMC should commission consultants to prepare a strategy for the improvement of water quality for each of it hydrological areas.

2.4 IMPROVE LAND MANAGEMENT FOR IWRM

2.4.1 INTEGRATING LAND AND WATER MANAGEMENT

The water bodies of a river basin are intimately connected with the land of the river basin or watershed. The hydrology, water quality and overall health of the river are completely dependent of the health of the watershed. In order to protect the water bodies the land on which it is based must be properly managed

Land management takes several forms:

• the impact on the watershed of decisions on land development

Every change to the watershed has an effect on the quantity and/or quality of the water in the rivers and lakes and the aquifers. Even where a single decision for change may have a relatively small effect, the cumulative impact of several changes may be significant.

• management of solid waste disposal

Unregulated disposal of solid waste is a massive problem in pollution of the watershed as a whole specifically in contamination of both surface water and groundwater. Toxins in solid waste seep in the subsoils and enter rivers and lakes as part of surface and sub-surface runoff or percolate to groundwater.

• management of waste water disposal from industry and municipalities

Wastewater disposal in Nigeria is not managed. Most municipal waste water, which includes disease causing human waste as well as chemical disposal from smaller industries is dumped directly into rivers and water bodies with no treatment whatsoever.

• management of quarry and mine drainage

Disposal of mine and quarry waste is usually done with water. Mine and quarry waste often contains heavy metals and other toxins which end up in groundwater and surface water.

• management of forests

The cutting down of forests radically alters the hydrology of the basin usually resulting in reduced water retention in the soils, greater initial runoff and lower base flows. This means higher flood risk and flood damage potential, greater soil erosion and reduced access to water during the dry periods of the year.

• management of agriculture, especially irrigated agriculture

Agriculture is hard on land and that is especially true for irrigated agriculture. Agriculture is also the largest source of non-point pollution. Managing agricultural land is of the greatest importance to avoid damaging land.

Also of importance are:

- Management of the impact of the infrastructure and activities of the oil and gas industry, especially oil spill on land (this is very relevant in the Niger Delta).
- Management of soil and water in rain-fed agriculture to reduce on-farm erosion and runoff which could lead to gully erosion; and siltation of water sources.
- Management or regulation of land use to reduce uncoordinated land development.

2.5 MANAGEMENT OF WILD LIFE AND CONSERVATION OF BIODIVERSITY

Nigeria is rife with examples of unsustainable exploitation of many animal and plant species, both legally and illegally, but it is difficult to find hard data. Most rural Nigerians depend to some degree on food items and other products they can extract from the wild. As the population increases, so does the rate of extraction of key species. In addition, other species have an economic value and are overexploited for financial gain. Few controls are in place to make these activities sustainable over the long term. Illegal logging of timber is a problem. One other problem receiving international attention in Nigeria is the “bushmeat” trade. In most natural habitats in Nigeria, edible-sized animals have all but disappeared. Great apes, monkeys, duikers, rodents, birds, turtles, etc. are all hunted and consumed wherever they occur.

2.6 MANAGEMENT OF EXOTIC AQUATIC SPECIES

2.6.1 MANAGEMENT OF WATER HYACINTH

Water Hyacinth is an invasive species that was introduced into Africa as an ornamental plant, and which thrives in polluted environments. Water Hyacinth has the capability to completely clog the waterways in which it grows, making it nearly impossible to navigate fishing boats. In recent years it has found its way into the Niger River, choking out both sunlight and oxygen to the marine organisms that live there. When a species such as Water Hyacinth makes its way into the ecosystem, it competes with native plants for sunlight, diminishing energy resources within the marine environment. With the loss of energy some populations will not be able to survive, or their numbers may drop beyond a point of no return, creating a threatened environment. Added to the loss of energy, water hyacinth also takes up and depletes the water of oxygen which is essential to the livelihood of all marine organisms.

2.6.2 MANAGEMENT OF NYPA PALM

In coastal areas, the Nypa palm (Nypa fruticans) introduced from Southeast Asia is also a problem. In areas where mangroves have been cut and otherwise disturbed, Nypa palm is the first to re-grow, thus out-competing the mangroves. Mangroves have an extensive root structure that provides sheltered habitats for many species of fish, mollusks and crustaceans, and the fallen leaves continually replenish the soil. In areas where mangroves have been replaced by Nypa palms, these nurturing features are lost to the ecosystem.

2.7 MANAGEMENT OF EROSION AND FLOOD

The lead agency at the Federal level responsible for the control of erosion and flooding in the country is the Department of Erosion, Flood and Coastal Zone Management of the Federal Ministry of Environment. Recently the Federal Government of Nigeria initiated the preparation of the erosion and watershed management project (NEWMAP), which is also domiciled in the Department of Erosion, Flood and Coastal Zone Management. The project will be supported with financing from the World Bank. At the State level, erosion and flood control/management is the responsibility of the State Ministries of Environment.

Erosion and flooding in the Niger South Catchment is very pervasive and requires inclusive stakeholder participation for effective control and management. Erosion and flooding problems in the Catchment can be managed proactively by concerted effort involving a wide spectrum of stakeholders - relevant government agencies (Federal, State and Local), community based organizations, the town unions, corporate organizations (through Corporate Social Responsibility), etc.

The present arrangement, where the Federal and State Ministries of Agriculture are the lead agencies responsible for erosion and flood control at the Federal and State levels respectively, should be allowed to continue. However, there is need for an effective synergy between the Federal Ministry of Environment and the NIWRMC. The NIWRMC should participate actively on the issue of erosion and flood control not only in the Catchment, but

in the whole country, from policy formulation to implementation at both Federal and State levels. The Federal and State ministries of agriculture should also be key stakeholders because of the widespread impact of agriculture on erosion.

2.8 IMPROVING INFORMATION MANAGEMENT

To improve information management It is necessary to simultaneously carryout the following steps:

• improve and rebuild the monitoring network

• improve access to information among the various organisations

• strengthen all organisations in information management

• rebuild capacity in the key water management organisations so they have the ability to use information

• improve the information management systems

2.8.1 MAIN OBJECTIVES IN IMPROVING INFORMATION MANAGEMENT

The main objectives of improving the processes of the management and sharing of information and the development of an information infrastructure in the water sector are the following:

• to promote dissemination of information on current and future conditions in water resources and the environment in river basins

• to improve public awareness and public participation in decision making

• to promote transparency in the decision making process

• to support the development of the various monitoring systems

•to ensure availability of and access to information in national, regional and sectoral information systems and data bases

2.8.2 BUILD INFORMATION CAPACITY IN RIVER RELATED GOVERNMENT AGENCIES

All organisations involved in the water sector need capacity building in the areas of monitoring and information management.

The first step is to carry out an assessment of the needs for new and modern equipment, along with appropriate software, which will provide the relevant agencies with the needed infrastructure.

Because there are so many organisations involved in water use and water management it is necessary to establish a unified information space (UIS) to which all information users will contribute and access. The IWRMC is a good focal point for this assignment.

2.8.3 MAIN OBJECTIVES IN IMPROVING INFORMATION MANAGEMENT

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• to promote transparency in the decision making process

• to support the development of the various monitoring systems

• to ensure availability of and access to information in national, regional and sectoral information systems and data bases

2.8.4 IDENTIFICATION OF INFORMATION NEEDS

While every organization should have a general understanding of the information it needs for its own use, where there is a gap is the different organizations having a clear view of what other agencies need and the extent of the interrelationship and linkages. There should be training on information needs. As earlier stated it is important to ensure that every organization makes its information freely available to other organisations

The identification of demand for information needs to be made at the National level but there may be some modifications at each HA level if required. Collaboration between the various agencies would be important in this regard. Various forums should be organised among the relevant agencies and water users to identify what information is available, where it is lacking and what monitoring needs to take place to gather this information, and which organisation should be made responsible for the monitoring. The following list provides initial ideas on aspects to consider in identifying information needs:

• development of a list of users of information and a list of suppliers (monitors) of information

• ensuring organisations which are charged with monitoring, especially of water infrastructure, are doing so

• analysis of water use and economics in the HA (which may be done through questionnaire surveys) to compile a realistic data set of water demand

• determine the difference between information used for policy formulation and that used for day-to-day operational

2.8.5 ESTABLISH AND MAINTAIN A UIS AT RIVER BASIN LEVEL

A Unified Information System (UIS) is simply a means of ensuring that information coming from all river basins is in the same format and data collected in the same way so that comparisons can be made from one river basin to another. While this is simple in theory it does require considerable documentation and establishment of methodology.

Priority measures:

• design the GIS database for UIS, including the design of the overall GIS structure, according to the procedures agreed for the UIS

• data entry to the database with information on water objects and water management systems and hydraulic structures entered at the time of the inventory described below

• clarification of the river basin boundaries using modern geo-information technologies and entering of information into UIS. The result will be officially approved boundaries for river basins.

• inventory of water bodies, water management systems and hydraulic structures within river basins

2.9 IMPROVING EDUCATION AND PUBLIC AWARENESS

Presently there is very limited capacity in the country in the field of water resources management.

Two basic things need to be due to bring the capacity to acceptable standard.

• strengthen the level of knowledge in water management organisations through foreign training of existing staff

• build capacity in the Nigerian education system so that future graduated would be adequately equipped to work in the water resources field.

2.9.1 EDUCATION SPECIFIC TO WATER MANAGEMENT

At present in Niger south catchment there are many higher institutions. The NIWRMC should actively encourage them to develop courses in water resources such as hydrometry, hydrogeology, hydraulics, engineering hydrology and discharge regulation, reconnaissance of groundwater, protection of water resources, water supply and sewerage systems, use of water energy, hydropower units, irrigation, hydraulic structures, operation of water facilities, regulation of river courses, improvement of quality of natural water, waste water treatment, water economy and etc. These courses cover all sectors of human activity in water and environment: agriculture, industry, communal services sector, etc. These are all necessary for the education of water management professionals. The NIWRMC include in its own budget funds that would be disbursed to selected universities for the development or setup of these courses.

One of the problems in water education is that the university curricula are out of date. Mostly, it remains purely technical. The approach to water management has progressed rapidly around the world in the last two decades. Areas which need to be introduced or enhanced include the integrated nature of water management, a stronger involvement with ecological aspects, the importance of society and the emphasis of good governance.

It is necessary to engage the universities to tackle the constraints to water management education and make the required changes.

In addition, it is necessary to increase environmental and water education in schools from the primary school level to develop a culture of environmental and water issues awareness. This leads to an improved public understanding of water issues which creates a better informed public as well as inspires young people to become the water managers of the future. The commission should in partnership with ministry of education publish relevant books aim at primary and secondary school children audience that would educate and stimulate their interest in the environment and water issues.

2.9.2 INCREASE PUBLIC AWARENESS OF WATER MANAGEMENT ISSUES

The level of general public understanding of water issues in Nigeria is very low. As the public is an important force in improving water management, it is important that there is a good understanding of the issues and of the place in the management and decision making process of civil society. Public Awareness also stimulates social activity in public concerns like water and its management which is valuable to drive improvements.

Public Awareness (PA) programmes or campaigns may have several modes, as described below:

Marketing Mode

• Working with the mass

• Distributing press releases and organising press conferences –

• Sponsoring competitions for journalists

• National water day festivals – In addition to World Water Day, many countries hold national water days to promote water conservation and other issues. These are typically festive occasions with theatrical performances, concerts, exhibitions, etc. organised for public enjoyment, but with a message.

Educational Mode

• Using websites

• Education of public officials, decision-makers, authorities, agencies

• Targeting adults

• Targeting youth

• Targeting children

Local or Social mode

• Involving civil society into the decision making process

• Integrating NGOs – NGOs can be very beneficial to reaching the general public on issues such as water and environment.

The most effective campaigns combine elements of each of the modes described above.

3 WATER USE EFFICIENCY

3.1 WATER USE IN NIGERIA

The present domestic water use per capita in Nigeria of about 47 l/c/d is very low. This can be argued to be an efficient use of water per capita on the face of it, given that more developed countries use as much as 250 l/c/p. this figure does not tell the whole story. This reduced rate of water consumption is as a result of sections of the population not being able to meet their basic need for water. In applying the principles of IWRM we intend to increase the per capita use of water in the country to such a level the basic needs of the population are met without allowing avoidable waste of the water resources.

At the moment we have the twin problem of limited supply of water coupled with very low efficiency of use for the limited available water. The limited water is not as a result of shortage of water sources but the result of inadequate investment in water supply, poor management of the available schemes and lack of planning.

Similarly irrigation water use is very poor in the catchment with an installed capacity of 19,700 Ha in all the river basin authorities in the catchment, of this amount 4,260 Ha is actually being irrigated at present. Also the limited area being irrigated is not done efficiently. If this is not checked when the capacities are increased it would have a consequent effect on the environment and water sources. The inefficient use of water in irrigation results in:

- reduced yields from irrigated agriculture
- costs due to reduced crop yields and unnecessary investments
- significant problems of drainage water disposal
- damage to water quality in the rivers and groundwater

3.2 FUTURE WATER DEMANDS AND RESOURCE PROTECTION NEEDS

In addition to the direct costs of poor water use, the future water needs and the future water resources must be carefully considered and planned for. Precise forecasting of the water resources is always difficult. Water resource is a finite resource, at the same time, with the government efforts to improve water availability and the growing Nigerian population, water demands will certainly grow. It is imperative that we start increasing our water use efficiency.

Considering the fixed quantity of available water sources and water use set to increase, water resources managers will need to deal with the following issues in the short and long term:

- If there is to be expansion of irrigated agriculture there will need to be a concurrent reduction in water consumption per unit area.
- With an increase in industrial activity there will be a consequent increase in industrial pollution unless legislation is passed and enforced to control it.

• There will be increasing water demands in the domestic sub-sector due to the attempts by government to achieve the MDGs for water supply and sanitation. This implies more people improved access to water supply. Per capita consumption will rise as well as the number of people served.

• With a change in water management practice to IWRM there will be a greater demand for environmental flows in rivers.

• Overuse of water for irrigation damages soils and reduces the future potential for agricultural expansion. Improving water use efficiency not only save water, it saves soil.

• Watershed protection needs to be addressed to ensure water is environmentally safe and ecologies healthy. Solid waste management needs to be better managed.

The above issue highlights the need for water efficiency improvements.

3.3 WATER USE EFFICIENCY ACROSS THE WATER SECTOR

Water efficiency improvements can be made in most subsectors of water use (industry, domestic, irrigated agriculture, etc.). However, from a water resources point of view the greatest saving are to be had through irrigated agriculture because of the potential larger share of water consumption.

The water consumed in the catchment by subsector, is shown in table below;

Year	Population	Per capita (l/c/day)	Domestic (m3/day)	Industrial (m3/day)	Agricultural (m3/day)	Total Demand (m3/day)
2011	18,801,705	80	1,504,136	150,414	1,037,854	2,692,404
2012	19,365,756	80	1,549,261	154,926	1,068,990	2,773,176
2013	19,946,729	80	1,595,738	159,574	1,101,059	2,856,372
2014	20,545,131	80	1,643,610	164,361	1,134,091	2,942,063
2015	21,161,485	85	1,798,726	179,873	1,241,121	3,219,720
2016	21,796,329	90	1,961,670	196,167	1,353,552	3,511,389
2017	22,450,219	95	2,132,771	213,277	1,471,612	3,817,660
2018	23,123,726	100	2,312,373	231,237	1,595,537	4,139,147
2019	23,817,438	105	2,500,831	250,083	1,725,573	4,476,487
2020	24,531,961	110	2,698,516	269,852	1,861,976	4,830,343
2021	25,267,919	115	2,905,811	290,581	2,005,009	5,201,401
2022	26,025,957	120	3,123,115	312,311	2,154,949	5,590,376
2023	26,806,736	125	3,350,842	335,084	2,312,081	5,998,007
2024	27,610,938	130	3,589,422	358,942	2,476,701	6,425,065
2025	28,439,266	135	3,839,301	383,930	2,649,118	6,872,349
2026	29,292,444	140	4,100,942	410,094	2,829,650	7,340,686
2027	30,171,217	145	4,374,827	437,483	3,018,630	7,830,939
2028	31,076,354	150	4,661,453	466,145	3,216,403	8,344,001
2029	32,008,644	155	4,961,340	496,134	3,423,325	8,880,798
2030	32,968,904	160	5,275,025	527,502	3,639,767	9,442,294
2031	33,957,971	165	5,603,065	560,307	3,866,115	10,029,487

There is need to bring together all users and managers of water at all levels to work together to achieve WE plans. This should be coordinated by the IWRMC at the national level.

3.4 WATER EFFICIENCY FOR ENVIRONMENT AND ECOLOGY

There is need for increased awareness of environmental water needs and adequate provision made for it. Adequate steps need to be taken to study the requirement for each river and tributary. Environmental or ecological flow regimes should be determined for each river and tributary as dictated by the geography and hydrology of the catchment. These should be carried out for each sub-river basin. Calculating environmental flows is a complex task requiring many different specialists in ecology, biology, hydrology, etc. the current method used is that a certain percentage (usually 15 to 30%) of existing flows is allowed for live flow when a river is to be used for example in dam construction. This method is arbitrary and needs to be improved.

3.5 IMPROVE WE IN THE DOMESTIC SUBSECTOR

In the domestic subsector there is a lot of room for improving water use efficiency. With the current high percentage of losses and unaccounted for water, in the state water agencies (SWA), that area seems to be a good place to start. These losses in an urban water delivery system are a significant cost burden to the service provider. There is need for improvements and extension of urban water supply and sanitation systems.

SWA as the service providers should begin a programme of loss reduction. Leakage reductions lead to reduced problems in service interruptions and an improvement in water quality.

Also there is a need to look into the use of more water efficient appliances. The savings from these would not be as much as the savings from minimizing losses but it would help. The best way is to target new installation. The public should be made aware of the benefits of having water efficient appliances installed in homes and public buildings. Regulation should be put in place requiring all new water appliances to be water efficient.

Improvements in efficiency in the domestic sector can also be made through a public awareness campaign directed at water conservation in the home. Such PA campaigns are relatively inexpensive to plan and implement. They should be combined with greater water education in the schools

3.6 IMPROVE WE IN THE INDUSTRIAL SUBSECTOR

In the industrial subsector water savings would be generated through treating and recycling of water. In some cases this could be taken as far as an almost closed system, resulting in very little water consumption. Secondly industries can improve water use efficiency through decreasing pollution of the water resource.

Reducing water consumption can be done through appropriate water charges.

With regard to reducing water pollution as an efficiency measure, international experience has shown that the most effective approach is through a combination of incentives for installing water treatment facilities (usually through tax breaks) and instituting and enforcing the

'polluter pays' principle. The 'polluter pays' principle consists of instituting charges or fines to the industry for discharging pollutants into water bodies at a level which is both discouraging and related to the actual cost of the damage it does.

3.7 IMPROVE WE IN THE IRRIGATED AGRICULTURE SUBSECTOR

Currently the water use for Irrigated agriculture is much less than the optimum. With projections that irrigated area would increase as a higher percentage of the irrigation potentials of the catchment is used. It is imperative that more efficient methods of irrigation are adopted.

There are several reasons for the very poor water use, all of which have to do with governance and management, so the solutions lie there as well.

Mechanisms for increasing efficiency of water use include:

• Improvement of the irrigation infrastructure

• Adequate water pricing and tariffs

• adopting improved irrigation technology

• instituting farmer education and agricultural extension

The above measures are interlinked and the most appropriate approach is to combine them in a coordinated effort to improve the efficiency of water use in irrigation.

3.8 IMPROVE WATER PRICING AND TARIFFS

The most successful way to improve overall WE is adequate pricing of water to be used my all consumers. People are less likely to waste a resource that they are paying for.

The continuing view that farmers are too poor to pay for the water that they use for irrigation holds back the rehabilitation and improvement of their irrigation infrastructure to the point where it does not work properly. Most farmers will pay for irrigation service if the service is good, meaning that it delivers the right amount of water at the right time in a way that is both hydraulically and financially efficient.

The continuation of the current policy of low or no water tariffs and low collection rates creates a downward spiral of farmers refusing to pay for the service which continues to deteriorate, strengthening farmers' refusal to pay. It is necessary to reverse the trend.

Farmers should not be expected to cover the costs of rehabilitation, but the tariffs should rise slowly over time to a level which will fully support recurrent costs and improvement costs.

Increasing water tariffs must be gradual and directly linked to improved service (meaning the right amount of water, when and where it is needed). Improved service must also lead to better crop yields and financial returns which rely not just on irrigation improvement but improvement across the agricultural sector. This will require increased agricultural extension, training of farmers and other agricultural inputs on the part of the government.

Water tariffs, whether in agriculture, industry or the domestic sector should not be seen as, or applied as, a means of generating revenue. They must be approached as:

1. a means of supporting water services to ensure services are sustainably, funded, able to do their jobs effectively and plan for the future
2. a means of promoting efficiency in water allocation and water use

Therefore the first step in establishing adequate tariff structure is for the federal government to make a policy decision on changing it. Following the policy decision an analysis is needed on how to reform the tariff structure. A full economic and financial assessment needs to be done on farmer incomes and the impact of irrigation, leading to determining what farmers can reasonably afford for water charges.

There will likely be need for some form of subsidies to the farmers and these will need to be given careful consideration. There are few, if any, countries in the world which do not subsidise agriculture, and subsidies are usually fairly substantial. There is no reason why Nigeria should be any different. However, the subsidies must be strategically placed – 'smart' subsidies aimed at very specific goals and targets. It is generally considered unwise to subsidise water use because it promotes the idea that water is free or cheap and that overusing it is acceptable. Hence the poor water use efficiency. *In summary we recommend that farmers should be subsidized but they should pay a sustainable price for the water they use.*

Given the current low quantity of irrigated area and deteriorated state of the existing irrigation systems, government should finance rehabilitation of existing systems and building of new ones. This would certainly be classified as a subsidy but it has very specific purposes. The steps to be taken may include:

- rehabilitate existing irrigation systems to improve efficiency.
- modernise existing irrigation delivery systems where possible
- build new irrigation systems to improve utilisation of available resource
- all new irrigation infrastructure would employ up to date efficient irrigation methods
- take steps to reduce the environmental degradation
- stopping the degradation of soils in agricultural areas and loss of arable land

3.9 IMPROVE FARM APPLICATION METHODS MODERN IRRIGATION TECHNOLOGIES

Advanced technology such as drip and sprinkler irrigation can improve water use efficiency but are expensive and are more difficult to use effectively. Nigerian government should encourage more studies in the most appropriate application method before a final decision is reached on a method to use.

Land levelling

Land levelling is seen by many as a good way to reduce water use per hectare. The initial cost of implementation is high but costs may be offset by the resulting reduction in water use and drainage volumes, which in turn will reduce the costs of drainage and disposal of saline water. Considering the high initial cost it is an option that is best decided on a project by project basis.

Farmer Training

It is well understood in much of the world of irrigation that farmer training must accompany changes in irrigation method. It has been demonstrated that irrigation methods and application rates improved only when farmer training was included in the process.

Technical interventions in irrigations can only have a positive impact if they coincide with farmer training.

3.9.1 INSTITUTING THE MANAGEMENT OF WATER QUALITY

Water Quality Management in Nigeria

Water quality monitoring has to be taken more seriously in Nigeria. There is insufficient information on which to base decisions on improving and managing water quality. The ministry of environment is responsible for the management of water quality issues.

Formalise Responsibility for Water Quality Management

From an IWRM perspective the ministry of environment does not currently have the capacity to handle that function at the moment. The river basins should be given the responsibility of monitoring all water bodies in their domain. The management of water quantity and water quality must be integrated and the best way to do that is to manage them within the same organisation.

Ensure Coordination between Water Quality Managers and Water Users

To integrate the management of water quantity and quality it is necessary for the managers of both to be coordinated with all organisations that use or potentially pollute water as well as organisations that protect water and who use and may damage watershed conditions affecting water quality.

These relationships between agencies must be formalised in order to work effectively.

4 IMPLEMENTATION FRAMEWORK

The IWRM/WE implementation has been outlined in the schedule attached hereunder.