KIRIBATI REPORT TO THE SUSTAINABLE DEVELOPMENT 2002 WORLD SUMMIT FOR

KIRIBATI NATIONAL REPORT TO THE WORLD SUMMIT ON SUSTAINABLE DEVELOPMENT

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Introduction

In pursuing sustainable development, one of the most essential factors that must be considered is the development of an environmental management framework that is socially and economically sustainable. An assessment of the progress made towards sustainable living conditions will essentially include the evaluation of a number of environmental initiatives, programmes and projects pertinent to sustainability. Equally important is the enumeration of the outcome of the many components and ingredients conducive to the sustainable use of resources.

This report reflects the achievements and constraints that have emerged in the course of implementing the Rio agreements, also popularly known as Agenda 21. The major part of the document represents the views of the National Multi Stakeholder Consultation Workshop attended by wide cross section of the community from different cultural, social, economic, religious, and educational backgrounds. Additionally, it depicts an awareness of problems that prevailed. The recommendations for a more effective environmental management framework were those suggested by the participants.

In essence this document is an outcome of a collaborative effort of the various contributors who have undertaken the task of researching into relevant information in order to provide a comprehensive document on the implementation of Agenda 21 agreement within the last decade.

Sustainable development should be a lingering concept in the minds of future generations regardless of ethnic, cultural, social, educational and spiritual backgrounds. It may as well be viewed as an issue that requires the persistent involvement of all the necessary technical, and professional spheres to substantiate its perfect and satisfying accomplishment and achievement, irrespective of the cost involved. This virtually means that it will not be sufficiently carried out at a national level. In fact it will be satisfactory implemented through global participation.

Achieving the aim of producing a plan for international action on environmental and developmental issues can only be possible through tangible national strategies that meet the challenges of mobilizing available resources in the right direction. With this view in mind the struggle to foster improved global economy ,which is a vital element in support of sustainable development can achieve a desired goal.

Acknowledgement.

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A C R O N Y M S

AMAK	---	Aia Maea Aine ni Kiribati (Women's Federation)
BTC	---	Betio Town Council
FSP	---	Foundation for the Peoples of the South Pacific
KCC	---	Kiribati Chamber of Commerce
MCIT	---	Ministry of Commerce Industry and Tourism
MESD	---	Ministry of Environment and Social Development
METT	---	Ministry of Training and Technology
MICT	---	Ministry of Information Communication and Transport
MHARD	---	Ministry of Home Affairs and Rural Development
MNRD	---	Ministry of Natural Resources and Development
MOH	---	Ministry of Health
NGO	---	Non-Government Organization
SAPHE	---	Sanitation Public Health and Environment Project
UNCED	---	United Nations Conference on Environment and Development
UNDP	---	United Nations Development Programme

Executive summary

(Neri Tiaeke)

1. Introduction

A prerequisite for attaining sustainable development is a comprehensive environmental management framework that is nationally adaptable and applicable. Essentially it must be an integrated national input by the various stakeholders, community groups, private and public sectors within the urban and rural populations.

The current recorded achievements since the Rio Conference constitutes the major part of this document in addition to the future national deliberations towards achieving sustainable development

2. Agriculture.

Agricultural development schemes are unfortunately encountering prevailing unfavorable environmental and climatic conditions not to mention the restricted land area and limited plant species. In an attempt to improve the economic status of the country, it is pertinent to develop agricultural arena.

2.1. Crop Production.

Research into identification of exotic and indigenous fruit trees with high yielding ability and suitability to Kiribati climate is on-going. The tendency is to cultivate and distribute fruit trees widely in Kiribati for local consumption.

2.2. Introduction of Agroforestry Section.

Agroforestry aims at identifying the value of trees and their contribution to subsistence living, besides assessing their economic and cultural significance. For this project, support is offered by overseas research organizations in terms of funding and technical advice.

2.3. Coconut Replanting and Rehabilitation Programme.

Promotion of copra production is executed through replanting and rehabilitating coconut trees. It involves offering of free gardening tools and chemical fertilizers. To date, 70%-80% of the total land mass is occupied by coconut trees. The three main producing islands (Kiritimati, Tabuaeran and Teraina) are included in the scheme.

2.4. Exotic and Native Crop Species.

Activities are propagated to increase the number of indigenous and exotic plants by establishing nurseries where these plants are cultivated, and made available for widespread distribution.

The scheme is supported financially by the Pacific Regional Agricultural Programme (PRAP). An important aspect of the project is home gardening.

Most of the major agricultural projects are currently financed by Regional or International Organizations such as the Food and Agricultural Organization (FAO), the International Coconut genetic Resources Network (COGENT). The Secretariat for the Pacific Community (SPC) and the South Pacific Regional Initiative on Forest Genetic Resources (SPRIG).

2.4.1. Breadfruit Varietal Collection.

The Exotic Breadfruit Varietal Collection was introduced in 1992 with the aim of identifying those varieties that will make harvesting of breadfruit trees continuous throughout the year. Of the 21 varieties obtained, only 12 varieties

survived in the nursery. Of the 12 varieties planted in the fields only 5 survived. These were distributed on Tarawa as well as to the outer islands nurseries.

2.4.2 Dwarf Coconut Collection.

Funded by COGENT, the project has for its objective conserving the hybrid dwarf coconut that are grown locally. The best cultivars would be conveyed to outer island nurseries from where they can be distributed to planters on the islands.

2.4.3. Pandanus Varietal Collection.

The new project which is jointly supported by FAO, SPRIG and SPC is aiming at establishing a pandanus varietal collection at the Central Nursery. Conserving the pandanus varieties which is culturally valued is an important objective of the scheme. On Kiritimati alone, 549 pandanus (screw pine) trees were planted and are flourishing well.

2.4.4. Exotic Fruit Trees.

Exotic plants namely lime, lemon, guava, Indian jujube, Sapodilla, custard apple, Native fig and introduced fig are introduced with the hope of a wide acceptance and distribution in Kiribati.

2.4.5. Nitrogen Fixation Trees. (NFTs).

These trees are known to improve soil fertility.They can also be used for firewood, stock feeds and building materials.

2.4.6. Vegetable Production.

Home grown vegetables are a source of health related elements. Vegetable gardens besides generating income is believed to be a useful constituent of a healthy diet.

2.4.7. Bamboo Collection.

Growing of bamboo plants is being initiated by growing seedlings from Australia. Ultimately 12 such plants are now ready to be dispersed to outer islands hoping to provide buildings materials, fishing rod, firewood and vital domestic implements.

2.5. Livestock Breeding Programme.

The focus of this programme is in the breeding and distribution of better livestock breeds as a step towards developing commercial livestock production.

2.5.1 Egg Production.

The best selected chicken layer for egg production were ordered from New Zealand to develop egg production in Kiribati.

2.5.2 Pig Production.

The introduced breed (Duroc and Berkshire) have been sold to farmers with a view to cross breed with local breed. By this, pork quality will be greatly improved.

2.5.3. Duck Production.

It is not commercially viable. Home consumption is the trend.

2.6. Staff Training and Promotion of Agricultural Programme.

Recruitment and training of staff is carried out locally by the Agricultural Division. Entry requirement is Form 6 as extension courses of 100 levels are also included in the training programme. Successful trainees can further there training at Tertiary Institutions. Additionally refreshers and other rudimentary training courses are conducted as required.

2.7. Information Link.

The Agriculture library is always open for research needs. International and regional documents are accessible in the library for information seekers.

2.8. Research and Technology.

It has been done by expatriate in the past. Research training is an urgent need for Division staff.

2.9. Resources.

Support has been rendered by Kiribati government apart from several international agencies for example the European Union (EU), FAO, SPC and the University of the South Pacific through IRETA.

2.10. MAIN CONSTRAINTS TO AGRICULTURAL DEVELOPMENT.

By virtue of Kiribati calcareous soil, agricultural extension programmes are very much jeopardized. It follows therefore that the focus of operation should be in the direction of agricultural development and research activities. The following factors should be considered along the line of agriculture improvement:-

- Low fertility of soil due to absence of growth elements.
- High pH of soil (alkaline).
- Low rainfall.
- Prolonged droughts.
- Intrusion of salt water resulting from rising sea level.

2.11. RECOMMENDATIONS:-

- A joint research by the Agriculture Division and other regional or international organization should be undertaken to identify and find solutions to the various constraints that hinder agriculture projects.
- The Report and outcome of such researches should be assessed on account of its viability in Kiribati situation.
- Composting methods must be further improved through research and studies.

- . .Traditional agricultural knowledge should be revitalized and incorporated into the process of agricultural development in Kiribati.

3. Fisheries Sustainable Development.

By virtue of its extensive and expansive exclusive economic zone of 3.5 square Kilometres, Kiribati is regarded as having immense marine fishery resources and extensive biological diversity.
The economic and social development is directly dependent on the marine resources that are available. The fisheries and marine resources not only provide protein source in the diet but also provide a source of income to the population in terms of items that can be produced for trade.

The level of seafood consumption ranks high by world standard being in the region of 565 grams per person per day in rural areas while a reduction is noticed in urban areas being 365 grams/person/day.

Varied climatic conditions affect marine life due to temperature variation in sea water. Not only the fisheries that are affected but also the living corals and fish habitat.

The movement of important fish species during spawning run depends largely on the availability of food, moon phases, and climatic variations. Sea level and temperature is known to have appreciable effect on coral. Adverse impacts can be damaging to the marine ecosystem.

3.1. Achievements.

The major achievements consist of the enactment of the Environment Act in 1999, the establishment of a conservation area in North Tarawa and the enhancement of marine resources in particular fish stock.

3.2. Institutional Processes.

The Kiribati Government is supporting sustainable development as stated in the National Development Strategy. Consequently there are future plans to simultaneously develop and improve the state of fisheries and the sustainable utilization of marine resources.

Surveys involving the collection of data on artisanal fisheries are presently conducted on all islands. Several ensuing surveys are to be undertaken to assess the status of marine resources including the species used for aquarium, sea cucumbers (beche de mer) giant clams and pearls.

3.3. MAIN CONSTRAINTS

Increase in population, open access to fisheries, limited fisheries data,weak law enforcement, slow public awareness programmes and insufficient funds for research are the main constraints that hinder progress towards sustainable development.

3.4. RECOMMENDATIONS:-

In order to maintain the fisheries at a sustainable level, it is imperative to efficiently manage and conserve the existing marine resources. The following are the recommended actions conducive to sustainable development of marine resources:

- Increasing or strengthening public awareness activities.
- Encouraging community based resource management.
- Maintaining marine stock enhancement programmes.
- Improving methods and procedures of data collection.
- Expanding existing by-laws to cover and regulate harvesting of marine resources.

4. Climate Change.

4.1. Institutional Framework.

The Kiribati government is conscious of the need for the socio-economic development and for a well managed environmental programme To substantiate this, the Ministry of Environment and Social Development was established to manage and to coordinate meaningful actions that are vital for the task.

A number of initial project that are funded by the United States of America, one of them was Monitoring of climate change. The national commitments on climate change and its related impacts were mentioned in the governments development strategies. The continuation of the programme was a study team comprising of persons from a number of ministries conduction studies pertaining to climate change topics. In addition, a permanent post of climate change officer is created within the Ministry of Environment and Social Development.

4.2. Coordination and Cooperation.

Policy formulation for climate change falls under the jurisdiction of the Minister for Environment and Social Development while the responsibility for supervising it handled by the Permanent Secretary. Most of the Climate Change activities are coordinated by the Environment and Conservation Division.

Regional and International assistance was offered through the regional and international conventions, workshops and seminars.

4.3. Capacity Building.

Formal as well as informal training and education of specialized personnel on climate change was undertaken by local and overseas institutions. Education of students in climate change topics was done in primary and secondary schools. Public awareness workshops were convened in community groups in various categories from government to private sectors.

Research opportunities were offered to those with the ability and intention of undergoing studies in any area as individual or as a group. The country study team is an example.

Resources for planning on climate change programme are utilized to the best advantage. A cooperative effort had made the task possible.

4.4. The Way Forward.

4.4.1. Overarching Constraints.

4.4.2. National Specific.

A sound financial foundation confirms the sustainability of climate change activities. In the event of failure, external aid would be sought through regional allotment of funds.

4.4.3. Regional and International.

Usually as regional programmes took a bigger portion of the financial share, national projects suffered the consequences and disadvantages. Specific national programmes were more beneficial than those done regionally.

4.4.4. Emerging Challenges.

The struggle to convince the communities to put more effort on climate change would continue. The pressure put on the community by the Environment Act should take effect in future.

5. WATER

5.1. SAPHE-project's Physical Components summary.

The main physical components of SAPHE are Water, Sewerage, and Solid Waste Disposal.

5.1.1. Water component covers the whole of South Tarawa

A. NEW WORK

- Water treatment Plant plus Storage Tank 400 m3.
- Mains Pipe-line from Bonriki to Teaoraereke.
- New Storage tanks and booster pumps-Temaiku, Nawerewere, Mackenzie point, Bangantebure, and Tebunia.

B. Rehabilitation of Old system
- Storage tanks
- Booster pumps and gallery pumps
- Betio distribution systems
- Replace valves on Teaoraereke and Betio pumps.

HOUSE CONNECTIONS

- Pilot project – approximately 320 connections at Nanikai, Betio, and at Bikenibeu on South Tarawa.
- Remaining connections 3,000 to be done when the main Construction Contract starts in the 2nd Quarter of 2002.

5.1.2 Sewerage component covers only villages that are connected to PUB's Sewer Lines.

A. NEW WORK
- Pipelines Bikenibeu & Betio
- Pressure pipe mains – Bikenibeu
- 5 Booster pump stations.

B. REHABILITATION
- 16 Booster pumps (wet-wells) including Hospital
- 3 Sewerage outfalls – Betio, Bairiki, Bikenibeu
- Gravity mains
- Salt water intake pump/pipe (Betio Bairiki, Bikenibeu)
- Sewer connections to house – 400 is envisaged.

C. HOUSE CONNECTIONS
- 400 plus some partial connections

5.1.3. Solid Waste components

A. NEW WORK
- Land fill at Nanikai
- Incinerate for TCH, Nawerewere Hospital.

B. REHABILITATION
- Betio land fill

C. EQUIPMENT TO BE PROCURED

- 2 bull dozers (TUC BTC)
- Transfer truck for TUC
- Collection sites at Public places, park
- 1 tractor & trailer for North Tarawa

It is recommended that any savings made under the Loans portfolios will be used for addition connections or any ad hoe public connections to be decided by Cabinet.

Socio-Economic Factors in the Construction of the Water Supply and Other Infrastructure (Environment)

Construction of the water supply infrastructure and of most components of the saltwater, sewage and solid waste management infrastructure will have minimal effects on the bio-physical environment. Measures to ensure that any negative effects that might occur are minimized and mitigated. Ownership of and access to. Land and compensation for vegetation clearance will be recurring issues that the SAPHE project team will need to address in advance of and in the course of construction works.

Management Report on all project-related Tasks for the period up to November 2001.

5.2. Groundwork preparations:

PMO is pleased to report that all the necessary tasks in relation to all components of the SAPHE project have been completed and are awaiting the green light signal (to go ahead) from the BANK or implementation by relevant PIUs.

5.3. Water Reserve protection:

This will be done through construction of road along the 50-metre setback from the high water mark or surrounding the Water Reserve Area at Bonriki. After road construction at Bonriki, Buota Water reserve should be next.

5.3.1. Milestones accomplished:

- After a series of meeting and consultations with MWE (PWD) the drawing and costs estimate the money $297,358.11 for the construction of the road was released to PWD under DW no.90/01.
- Committee of Water Reserve Management as proposed by Dr Paul Jones has not been formally established. Government has already approved such idea but action now awaits the commencement of CDPI stage two. PMO had sent to SPRM Vanuatu the signed MOU for the TA. It is now envisaged that the TA will commence in February 2002.

A. Pilot Project – As from last steering committee meeting in July 3 sites were approved: Betio, Nanikai, and Bikenibeu. Work on erection of tank stands started from beginning August.

Local contractors were mobilized to implement the tank stands activity with PUB being the Supervisor, The KHC the Contracting Authority and the PMO the paying Agent. About 360 Tanks supplied by Fylost of Australia arrived in Tarawa in late October. An ad hoc contract was started by PUB for fitting works on the tanks in early November. The installation of the tanks were carried out in November at Nanikai using the same Contractors that did the stands to pre-empt any potential hiccups resulting from conflict of interest.

5.3.2. Local Council's Capacity building for Solid Waste – Collection and dumping

BTC- had received one tractor & trailer plus $5,000 worth of outfits and tools for the use of Garbage collectors.
TUC had also received the same stuff as BTC.
ETC had received one tractor with trailer.

6. WASTE AND POLLUTION

6.1. Introduction.

Like its Pacific island neighbours, Kiribati is experiencing the growing problems attributed to uncontrolled waste disposal and pollution emerging from a myriads of sources. The intensity of the problem is increasingly felt in urban areas where there is a notable concentration of the population and increasing commercial and manufacturing establishments.

A prospective and a positive solution to the problem or to prevent it is to formulate a national workable plan and strategies that can be implemented through a programme in a cost effective manner. The programme will require financial support by government.

Great concern is expressed in relation to the disposal of radio-active wastes being dumped in the sea in close proximity to Kiribati. The harmful effects of human exposure to radio active radiation have been experienced in many parts of the world and in particular the Pacific region.

Waste and pollution problems though may affect a particular location, or region it should be a global issue for a number of reasons, one of which is that eventually it will be a world wide problem.

The inevitable problems attributed to improper management of waste and pollution is a widespread experience in Kiribati. The situation is worsening in urbanized areas where there is a high population density and the obvious problem of overcrowding and pollution evolving from many sources.

6.2. Progress and Achievements.

Since waste and pollution problems are gaining high priority, government is making plans to immediately implement remedial programmes. National activities to implement the recommendations of the Rio declaration are undertaken by relevant government and non-governmental organizations the public and private sectors. Voluntary community

involvement in waste disposal and pollution related programmes are continuing and maintained.

Government agencies that are involved with the management of waste and pollution are making positive progress in the elimination and minimization of waste and pollution disastrous consequences.

Public awareness is progressing in many sections of the community both on outer islands and urban areas. This is done making use of workshops, public meetings, video shows, drama, radio and local newspaper and periodicals.

Raising public awareness on pollution and waste issues can enormously deter community's understanding of the ways in which waste can be used to a great advantage. Conversely the problems that can be created through the inefficient management of waste is explicitly illustrated during public awareness meetings and workshops. The rudimentary ideas about storage, minimizing, disposing and reuse of waste are the main topics of delivered lectures and discussions.

The establishment of the Ministry of Environment and Social Development to control, manage and monitor environmental issues was instituted by government with environment related mandates. The ministry has undergone profound improvement and development that it is capable of performing duties needed forprotecting biological diversity, environmental impact assessments, environment inspection, waste and pollution control, climate change assessment, and other environmental management duties.

The enactment of the Environmental Act in 1999 and the approval of the

Environment Regulations paved the way to a more efficient and effective control and management of environmental situations. Legal framework is a vital constituent of any process that that must be accomplished under any circumstance.

Waste disposal in rural areas is done by householders under Local councils supervision. Control and abatement of pollution arising from unsanitary waste disposal becomes the task of the Local councils.

In urbanized areas, the process for waste disposal is controlled by the urban councils. The waste collection and disposal service is operated by the Urban Councils. Monitoring is the responsibility of the Ministry of Environment and Ministry of Health. Pollution control measures are executed by the same ministries.

Waste disposal options are widely taught to communities via workshops and educational meetings or visits. Human excreta disposal methods are promoted by non governmental organizations and small community groups. Approved sanitary methods of excreta disposal such as septic tank privy, composting toilets are constantly promoted in villages and urban areas.

Kiribati observes the recommendations stipulated by the London Dumping Convention and other international agreements in relation to ocean dumping of wastes including dumping of toxic and radio active wastes.

Kiribati participation in regional and international meetings or workshops is considered as very important, hence at all times it is encouraged and fully supported. By the national government. Participation in international forums is a clear indication of the nation's willingness to be involved in international affairs and cooperation.

National reporting on waste and pollution control activities to regional and international bodies is a continuing task. Quarterly, monthly and annual reports are regularly submitted to various destinations. National reports are valuable documents showing progress, constraints and future plans for specific programmes that are currently in operation in a country.

6.3. Institutional Framework.

Although the bulk of responsibility is vested with the Ministry of Environment and Social Development, other ministries possessing relevant expertise or concerned with wastes and pollution are offering supportive services.

The Ministry of Natural Resources Development is assisting in this venture advising farmers on the accepted methods of growing and cultivating them using compost without causing or creating pollution and waste problems.

The Ministry of Health takes the responsibility of advising communities on the correct methods of disposing solid wastes and ways of preventing pollution. It is also undertaking quality monitoring of fresh and seawater.

Community education is carried out by several ministries in different areas of waste and pollution control and management.

6.4. Capacity Building.

Human resources development is an essential provision for a successful implementation of programmes. The staff of Ministries directly responsible for waste and pollution control are given opportunities leading to the improvement of skill and betterment of their service performances. This is achieved by means of offering training either locally or overseas. Aid donating agencies contribute towards financing such training.

6.5. Information.

The value of relevant information in respect of waste and pollution control is of utmost importance. Data and information is useful in decision making and planning of waste and pollution programme. Sources of information can be identified in Kiribati.

The collection of information is usually done by research and survey procedures. Correct methods of seeking information must be adopted if accurate and genuine information were to be obtained. Informations on waste and pollution are available from a number of

sources including public libraries, ministry information sections, university center, and the national statistics office.

The management of records and information is adequately maintained by trained personnel. They are readily available on request and adopting the right approach.

Research opportunities are available and encouraged by government and training institutions. The resources are also available including human resources and facilities.

The use of information for decision making is understood and therefore information is stored and updated so that it can be made available when needed.

6.6. THE WAY FORWARD.

6.6.1. Overarching Constraints.

6.6.2. National Specific

The following constraints were confronted in the process of managing and controlling waste and pollution:-

- The traditional method of waste disposal consisted of burning, burial and sea dumping.
- Insufficient financial support
- Lack of knowledge in modern waste disposal methods.
- Insufficient land resources
- Lack of essential material.
- Inadequate legislative provisions to regulate
- Insufficient equipment for operating controlled waste disposal system.

6.6.3. Regional / International

- Delay in the availability of funds for implementation of national projects due to a complex process of transferring funds.
- Priority consideration in respect of allocating funds
- Supervisory control of regional projects implemented in individual countries.
- Lack of equipment and coordination .
- Consultation is usually a long process due to inefficient communication links.

6.6.4. Emerging Challenges.

Qualified personnel are urgently required to mana ge and supervise waste and pollution control processes.

Developmental considerations should be afforded to the Environment and Conservation Division and other organizations that perform supportive tasks on waste and pollution programmes.

The Ministry of Environment and Social Development is embarking on the formulation of a strategic plan to develop and strengthen its capability to coordinate actions and performances in the area of sustainable development and indeed pollution control activities.

6.6.5. Recommendations:-

Strengthening and improvement of financial support by the national government.

Research programmes to be encouraged and fully supported by relevant agencies.

Expansion of the present Environment Act and Regulations to permit better control of pollution and waste management procedures.

(ECD pictures)

Remedial measures are taken by government to clear the area
(Pollution by bitumen.)

7. SUBSIDIARY ISSUES AFFECTING SUSTAINABLE DEVELOPMENT.

7.1. Energy.

Electricity is the major power supply in South Tarawa and Betio. As the price of petroleum is soaring, other sources of energy will in future be sought to increase the supply according to the demand.

Renewable energy is at present not to be relied upon to cater for the need of the population on South Tarawa. Efforts to develop and to increase its use will take quite sometime.

Solar energy for lighting and for operating electrical apparatus is promoted on the outer islands and to a lesser degree on South Tarawa by the Solar Energy Company. The question as to whether solar power will become a sustainable source of electricity or not remains to be decided. Other natural sources of energy can be resorted to after considerations have been made in the light of their damaging effect on the environment.

7.2. Weather.

Among the numerous commitments of the Meteorological Division is the collection, storage and management of weather data. Following the withdrawal of New Zealand Meteorological services, the Division is faced with the deterioration and shortage of equipment despite financial assistance from overseas donors.

The expansion of services to be executed by the division means the development of the Division in many respects including the provision of modern and sophisticated apparatus to monitor the weather conditions.
Instruments to record ozone, carbon dioxide, heat energy from the sun, rainfall, and radiation are among the material requirement of the Meteorological Division.

7.3. Natural Disaster.

When a natural phenomenon strikes a particular area causing devastating loss of lives and property and if the existing resources cannot cope to remedy the effects, and risks involved, that area is regarded as having a disaster.

Natural disasters that occurred in the past have been due to increase in sea level causing flooding and resulting damage to vegetation and property. Presumably it is not right to believe that other types of natural disasters would not occur since they have not been experienced for a long time. It is wise to be prepared to contain the consequences of these destructive natural force that can occur without warning. Fortunately, preliminary steps have been taken to draft a National Disaster Preparedness Plan.

7.4. The National Preparedness Plan.

The plan has been jointly prepared by almost all government ministries in addition to smaller voluntary organizations. The plan embodies the nature and composition of rescue operations. It stipulates the responsibilities of the organizations and groups to be involved in the initial invasion and aftermath of the natural disaster. Apparently the strategic plan presumably strives to mobilize available national resources to subdue if not to counteract the effect of the disaster. Communication links with foreign or overseas organizations can be immediately established in order to propagate information and disaster notification. The plan advocates disaster awareness and contingency planning systems.

7.5. Land and Population Issue.

Land is a resource that has been achieved through fierce fighting followed by shedding of blood and debility, .even to the point of death. Population growth is not parallel with the increase in natural resources.

It is therefore an appropriate step to devise plans that will address the increasing problem of over exploitation of natural resources as a result of population increase.

The population of Kiribati stands at 84494 according to last census, an increase of 6836 over the population in 1995.The figures indicate a sharp rise in population which should stir the planners to promulgate more convincing population policies. Resettlement scheme for the Northern Line Islands alleviates the problem to a certain degree but it might not entirely solve it. However, with government assurance that the task would be tackled immediately, the problem will not cause further worries.

7.6. Urbanization.

The concentration of the population in a given area exerts considerable pressure on the essential services and available resources. The accompanying traumatic consequences can be foreseen immaterial of their severity and the rate of their occurrence.

Urban drift of the nations population is an obvious dilemma. Resettlement scheme is considered to be the forerunner of a more prudent move in the intended direction.

SECTION 2: - THEMATIC PAPERS

1.0 Agriculture Sustainable Development

(Tianeti Ioane)

Introduction

Unfavorable environment and climatic factors such as small land mass, limited plant species existed in all the islands, low rainfall, prolong drought, low soil fertility, high infiltration rate soil, and high pH of the soil are considered to be the main constrained to any form of agricultural development programme in the Republic of Kiribati. Plant growth is often stunted due to nutrient deficiencies or toxicity, and alkalinity inherent to coralline soil (Raynor, 1992). Soil analysis show that Kiribati soil is limiting in most of the essential elements. Application of nutrients element such as iron (Fe), Manganese (Mn), copper (Cu), zinc (Zn), phosphorus (P) easily result in precipitation while potassium (K) and nitrogen (N) are easily lost by leaching (Small, 1972; Finlay, 1992' Reddy and Chase, 1992).

Until the end of the mining of phosphate on Ocean Island, The Republic of Kiribati has then relied mainly on export made from the limited land natural resources such as copra and local handicraft and as well as marine resources. Within this confined and challenging situation the Agricultural Division within the Ministry of Natural Resource Development has therefore geared its programme to encourage I-Kiribati to utilize the limited land resources sustainability to increase their wealth hence their standard of living would also improved.

1.1. Crop production

The Agriculture Division has in the past conducted and still continues to conduct research work to identify both indigenous and exotic fruit tree and root crops, vegetables, and NFTs species with high yield ability and well suited to Kiribati condition. The tested crop species viable for Kiribati condition are then cultivated, propagated and multiplied at the Central Nursery for distribution to the general public. Nurseries on outer islands are also supplied with planting materials where they propagated and multiplied for the same purpose.

1.2. Introduction of Agroforestry Section

The establishment of the Agroforestry Section within the Division of Agriculture and the activities implemented are based on more sustainable way to improve some of the traditional agricultural methods. The traditional agricultural methods such as clearing the land by cutting and burning some times left the ground bear for quite a long time is unsustainable and can result in soil destruction and also cause high loses to the limited plant species. The Section conduct research to identify crops which are considered to be of cultural and traditional importance and also promote both native exotic species of nitrogen fixation trees (NFTs) and tree outside forest (TOF). The contribution of NFTs and TOF to the subsistence need of I-Kiribati and as well as their cultural and economic importance cannot be overemphasize. One of the main tasks of this Section is to make contact with regional and international research organizations for their assistance and

support in terms of finance and technical advice on the introduction and economic values and uses of both native and exotic tree species that are well adapted to the local environment.

1.3. Coconut replanting and rehabilitation programme

This remains one of the main extension programmes of the Agriculture Division in the outer islands that aims to increase copra production through replanting and rehabilitation (Manate, 2000). Provision of free farm inputs such as fertilizers and tools to support the programme continued to be the major expense provided by the Kiribati Government amounted to a total of Aus$30,115.00. Approximately, over 70-80% of the total 810.0 sq. kilometers land mass is under coconuts. In the early sixties, replanting scheme was introduced to all the islands of the Kiribati Group, including Kiritimati. The Government of Kiribati see the important of coconut in the daily activity and subsistence need of the rural people and as a result, a total of Aus$40,000.00 was allocated for coconut rehabilitation and replanting scheme on Kiritimati and Tabuaeran. The scheme aimed to increase copra production whereby the country relied on most for foreign exchanged apart from what was received from the mining of phosphate on Banaba. Large area of land (old coconut plantation) were removed and replanted with selected young coconut seedlings. The programme gave initiatives to landowners by paying the landowner for doing the work. The noticeable problem with the scheme was that most new plantations do not produced good yield.

A new replanting scheme was introduced as a result of extensive research conducted to investigate the failure of the old replanting scheme. The scheme directed to landowners but emphasis was on small scale of land rather than large area. The initiative to landowners were provision of free tools and chemical fertilizers.

The rehabilitation programme was also introduced to improve the growth and production of the plantations that were planted in the 1970s coconut improvement scheme. Like the replanting scheme, landowners are provided with free planting equipments if they were interested in rehabilitating their plantations. Landowners are encouraged to mulch their plantations and discouraged from the practice of burning rubbish on their land. Chemical fertilizers and hand drills were given to landowners under close supervision of trained agricultural assistants (AA) posted on the islands.

1.4. Exotic and native crop species

Because of its smallness, and coupled with its harsh environment, the plant species found on the islands are very limited. Propagation to increase the population of these limited plant species is still the main objective of the Agriculture Division. Hence, the Central Nursery was established on South Tarawa and small nurseries are also established on all the islands to maintain, multiply and supply planting materials at affordable price to the general public. Plant a tree day programme runs every year was initiated by the Agricultural Division in collaboration with Pacific Regional Agricultural Programme (PRAP) and the main objective of the programme was to encourage I-Kiribati to plant fruit trees and other promoted crops (NFT and ornamental) around their homes. This would help them to realize the importance (source of fuel wood, building materials, medicine) of having trees around their homes.

The collection of some important native and exotic crop species have been made possible at the Central Nursery by the financial assistant from the Government of Kiribati and other international donors such as Secretariat of the Pacific Community (SPC), Food and Agriculture Organization (FAO), International Coconut Genetic Resources Network (COGENT), and South Pacific Regional Initiative on Forest Genetic Resources (SPRIG).

1.4.1. Breadfruit Varietal Collection

Exotic Breadfruit Varietal Collection was a project undertaken by the Agriculture Division in 1992, aiming to identifying breadfruit varieties that would fill the gaps in the local bearing season. A total of 193 root cuttings of 21 varieties were brought in from Hawaii's Kahanu Gardens. Of these, 57 cuttings of 12 varieties survived in the nursery. There twelve varieties were planted out in the field, however only five of the twelve varieties (momolega, roiha'h, pu'upu'u, afara, and yuley) survived. The five survived varieties were propagated and distributed to the public on South Tarawa and as well as the nurseries on outer islands.

1.4.2. Dwarf Coconut Collection

The coconut collection at the Central Nursery was a funded COGENT project with its main objective of conserving the hybrid dwarf coconut that are already existing in the country. These best cultivars in terms of tolerance to local climate condition and high yield from the dwarf coconut collection would be selected and distributed to the nurseries on outer islands for public use.

1.4.3. Pandanus Varietal Collection

The newly joint project by FAO, SPRIG, and SPC on pandanus resulted in the establishment of pandanus varietal collection at the Central Nursery in South Tarawa. The purpose of this project is to conserve the pandanus varieties that has strong cultural values and as well as food values. On Kiritimati alone a total of 549 pandanus were planted in an effort to increase the population of this high value tree.

1.4.4. Exotic Fruit Trees

Introduction of exotic plants (Lime, Lemon, Guava, Indian jujube, Sapodilla, Custard apple, Native fig, and introduced Fig,) and multiplication of the survived species at the Central Nursery for public use is the ongoing programme of the Division. The fruit trees are propagated and multiplied to meet public demand.

1.4.5. Nitrogen Fixation Trees (NFTs)

Poor soil productivity has resulted in low crop production and any attempt to improve crop production would be very costly and environmentally problematic (Beenna, 2001). Increase in population has posed greater pressure on the limited plant species in the country especially at urban areas of South Tarawa. The NFT species are still promoted to the public for their role in soil improvement, fuel wood, livestock feeds and building materials.

1.4.6. Vegetable production

Vegetable production was encouraged to the public for both income generate and as well as health promotion. There are number of individual farmers who are operating more less like commercial farmers but on small scales and as well as those who are producing for home consumption only.

1.4.7. Bamboo Collection

A small trial on exotic species of bamboo was established at the Tanaea Nursery with the ultimate aim to distribute planting materials to the general public. A total of 20 seedlings (4 species x 5) were imported from Brisbane, Australia. Only 12 plant survived and are now ready for propagation and distributed to outer island nurseries and also for the

general public. The use of bamboo as an alternative for building and fishing gear and as well as grafting has to be promoted to the public so that the project would serve its purpose.

1.5. Livestock breeding programme

Activities of this section focuses on breeding and distribution of improved breeds of livestock (introduced chicken layers, pigs, and ducks) to support development of commercial livestock production and to improve local breeds of livestock through cross breeding.

1.5.1. Egg production

The Agriculture Division's aim is to provide the best breed of chicken layer for the local commercial egg producers. Selected chicken layers for egg production were ordered from New Zealand and were multiplied locally to meet the demand of local egg producers. It is quite expensive to bring into the country live poultry so the Agriculture Division buys eggs which are hatched locally.

1.5.2. Pig production

The few survived introduced breed (Duroc and Berkshire) were bred at the livestock unit then sold to the public to cross breed with the local breed. The purpose of this programme was to improve the quality of the meat of the local line of pigs. So far no commercial local pig producers in the country and this could be due to high cost of feed.

1.5.3. Duck production

So far no commercial local duck producers exist in the country. The few interested farmers raised small number of ducks for their local consumption.

1.6. Staff training and promotion of the programme

The Agriculture Division always conducted a training programme for new staff when there is a need for new agricultural assistant (AA) to fill in the vacant posts. The recruitment requires form six as a minimum entrance as the course undertaken are also Extension Courses of the 100 levels. It is anticipated that those who satisfy the criteria and complete the certificate would have a chance to further their training at tertiary level. In country training and other national workshops have offer some benefits to AA which in turn, they would communicate the technical skills to the public at their respected stations. A weekly radio programme is used to communicate the development the Agriculture Division has undertaken.

1.7. Information link

The Agriculture Division has a library where all information related to agricultural activities nationally, regionally and internationally are stored and always made availabel to the public upon request. The library has also collections of regional and international Scientific Journals and other publications related to agricultural activities which always made available to the public.

1.8. Research and technology

For the past years the Agriculture Division has relied heavily on expatriate to carry out research work related to agriculture due to lack of qualified and technical staff.

1.9. Resources

In terms of finance and technical staff, the Division has been well supported locally by the Kiribati Government and as well as regional and international agencies such as the European Union (EU), FAO , SPC and the University of the South Pacific through Institute for Research Extension and Training in Agriculture (IRETA).

1.10. Major constraints to agricultural development

Since Kiribati soil is derived mainly from calcareous reef materials, they have a number of important properties that hinder agricultural development (Beenna, 2001). Raynor (1992), and Hunter and Tuivavalagi (1998) confirmed that crop production in atoll soils like Kiribati are very poor and growth is often stunted due to high pH, poor physical properties, and low fertility of the soil. This problem can be made worse with other important factors such as poor or very low rainfall, intrusion of salt water, poor quality of water for crops, and prolong drought period. Agricultural activities and crop production are confined to the limited number of plant species available.

1.11. Recommendation

The Agricultural Division should collaborate with other regional and international research institutes to find solutions to the constraints that hinder the development of agriculture in Kiribati without exploiting other valuable resources and most importantly cause environmental destruction. What has been recommended by other researchers

should be tested for their viability in Kiribati soil condition. National agriculturalist should be encouraged to obtain high qualification so that research conducted are sound to the need of Kiribati. Research on the use of compost should be a priority for the Agriculture Division staff and those involved in any form of agricultural production. Traditional agricultural methods should be encouraged and intermarriage with introduced agricultural methods to increase and improve food crop production.

2.0 Fisheries Sustainable Development

(Tooti Tekinaiti.)

Background information

Kiribati is endowed with a vast exclusive economic zone that covers over 3.5 square kilometers and known to be rich in globally important fisheries resources (mainly pelagic resources), significant mineral resources including coral reeds and high marine biodiversity.

The fisheries and marine resources are considered to be of great importance to both the social and economic developments in the country. With limited land base, the fisheries resources provide not only the main protein source in the diet but also offer a source of income, recreational and security to the local populace and therefore the importance of the resources cannot be over-emphazied. In 1999, the marine sector has contributed about 14 percent of total gross domestic product (GDP). Seafood provides about three-quarter of animal protein in the national diet. The level of per capita seafood consumption is one of the highest in the world with average consumption of 565 grams/person/day in rural areas and 365 grams/person/day in South Tarawa.

In the past the immediate needs for coastal communities in the islands is to find food and income for their daily needs. These needs did not prove destructive to the coastal and marine resources. However, in recent years with the increase in population especially on South Tarawa coupled with the improved in fishing technologies, the use of the coastal and marine resources is now geared towards the need to stimulate economic activity. There is no doubt that these activities are increasing fishing pressure on the limited resources in future. The fisheries resources even though considered as renewable, are not infinite and therefore need to properly managed.

Kiribati is also very vulnerable to the impacts of climate change. Movement of the important fisheries in terms of their aggregation and spawning run depend on availability of food, phases of the moon including climatic factors. Corals that provide favorable habitats for fisheries is known to be susceptible to changes in seawater temperature and sea level. An increase in temperature (above 28 ° Celsius) is more likely to have adverse impacts not only on the health of corals but also on other important fisheries resources.

To exacerbate the problem the coastal marine resources are considered as open access fishery or as common property resources over which no individual has exclusive rights. Fishermen can fish any part of the lagoon without restrictions on the fishing efforts.

This report will cover main achievements on sustainable developments since 1992, institutional processes used for sustainable development initiatives, major constraints, and recommendations.

2.1. Achievements

Major achievements for the last 10 years includes the enactment of the Environment Act 1999, establishment of a conservation area on South Tarawa and enhancement programmes.

The Environment Act provides for the protection, improvement and conservation of the Environment of Kiribati. Environment Impact Assessment is an essential component of all development projects to ensure minimal degradation of the marine ecosystems.

A marine conservation area has also been established on South Tarawa. This area encompasses major spawning grounds for certain marine species like bonefish, goatfish, and giant claims. The purpose of this area is to enhance the survival and existence of marine flora and fauna. Plans are also underway to develop more conservation areas on outer islands, especially Kiritimati where there is heavy fishing pressure on the resources.

The development of aquaculture on some marine species (sea cucumbers and pearl oysters) of economic value have been investigated and enhancement programmes are being carried out. Growth rate, migration pattern and suitable habitat are still being assessed. There are plans to extend the enhancement programmes to other outer islands.

2.2 Institutional Processes Used for Sustainable Development Initiatives

Government is also conscious of the need to protect these resources and has tried to encourage sustainable developments through its National Development Strategies. The fisheries development vision for the next five years also encourages sustainable utilization of both the coastal and offshore resources.

Data collection and stock assessment surveys form an integral part of our fisheries programmes. Artisanal fisheries surveys are conducted for all islands, including South Tarawa, to monitor the rate of exploitation of the fisheries resources from time to time. Underwater visual census surveys are also mounted to assess the current status of the resources in terms of their distribution and abundance. Surveys have been done on commercially important fisheries species such as those species targeted by ornamental live reef fish, sea cucumbers (beche-de-mer), clams and pearl.

Aquaculture developments have also been encouraged not only for restocking purposes but also to try and diversify fishing activities and alleviate fishing pressure on the fisheries resources. Seaweed has emerged as another income generating activity for the outer islands and a lot of fishermen are currently involved in such venture.

Through the Biodiversity Project, consultation workshops have been conducted on a number of outer islands including South Tarawa and Kiritimati (Line Islands) educating not only local communities but also staff from the public and private sector on the importance of the marine resources including coral reef, seagrass beds and mangroves and the need to protect them. This is the first and important step towards educating all the stakeholders and the part that they should play towards sustainable use of the fisheries and marine resources.

In addition, there are existing laws and regulations that are in place for the protection of the marine resources. The Fisheries Ordinance (1977) which provides for the regulation and conservation of fisheries resources, Prohibited Areas Ordinance (1957) which permits designation of environmental conservation areas, Local Government Act (1984) which restricts activities that will cause destruction to natural resources and Environment Act (2000) which provides for the protection, improvement and conservation of the Environment of Kiribati. Environment Impact Assessment is an essential component of all development projects to ensure minimal degradation of the marine ecosystems.

Some Island Councils have by-laws prohibiting certain fishing methods with the view of either conserving existing stocks or ensuring more equitable benefits to all members of the community from the resources.

2.3. Main Constraints

Some of the main constraints in trying to achieve sustainable development are included as follows: increase in population, open access to fisheries, fisheries resources inventory, limited fisheries data to set fishing limits (Total Allowable Catch, MSY, MEY,), weak law enforcement, lack of public awareness programmes and lack of funds for research.

Government is placing high priority on the improve the living standard of its people and to foster economic developments from its available resources. Sustainable utilization of the marine resources is also being encouraged. There is a growing need to feed the increasing population (2000 census – 84,000) and the marine resources provide a cheap source of protein for the populace. Open access fishery system where there is no restrictions on fishing activities inside the lagoon further exacerbate the problem.

In addition, there is limited fisheries data available especially on the number of all fisheries and marine resources found in Kiribati (fisheries inventory). Biological parameters such as total allowable catch, maximum sustainable yields, maximum economic yields for the different fish stocks have also not been established. It is therefore important that baseline information and biological parameters are established to guide future policies and management decisions.

Furthermore, lack of manpower and funds to conduct research and public awareness programmes related to proper management and conservation measures are also seen as major drawbacks an effort to encourage sustainable utilization of the marine resources.

There is also a need to assist island councils to develop more stringent by-laws for proper conservation and management of the fisheries resources.

2.4. Recommendations

It is important that the condition of the fisheries and marine resources are maintained at sustainable levels to allow future generations to enjoy the same benefits that the fisheries resources can offer. With the increase in population and the need to foster economic developments, there is an urgent need to properly manage and conserve the mentioned resources. The following recommendations that will be taken when trying to encourage

sustainable utilization includes increasing public awareness programmes, community-based resource management, stock enhancement programmes, data collection, ongoing assessment surveys, and formulation of more stringent by-laws to control harvesting of resources.

Knowledge on coastal marine resources and marine related systems among coastal communities, private and public sectors is still lacking in Kiribati. There is a need to increase public awareness on the importance of these resources and the need to sustainably use them through consultation workshops not only with local communities but also with all the stakeholders involved. In addition, local communities who depend on these resources will be empowered or encouraged to take a more active role in managing their own resources in their villages while Fisheries Environment Divisions will assist in providing technical advice whenever needed. This practice seems to work well in our Pacific Island countries and a good approach for the future. A small country like Kiribati with limited financial resources cannot afford to do it without the participation of the local community. This approach will not only minimize conflicts between resources users, but it will also reflect the growing desire and confidence of the local interests to take a lead role and responsibility for the stewardship of their own resources.

There are plans to establish more conservation areas in the future especially in areas where there is high fishing pressure on the resources. The purpose of this area is to enhance the survival and existence of marine flora and fauna so it could replenish the surrounding areas. Prior to establishing these areas, a stock assessment survey should be conducted to identify main spawning and aggregation sites for important fisheries resources, especially those that are targeted for subsistence and commercial purposes including endangered species namely giant clams, turtles and others. Local communities will also be encouraged to take an active role in managing these areas. Financial assistance is needed to develop more conservation areas.

Stock enhancement programs through aqaculture are being investigated for two marine species. Aquaculture is important to ensure a stable supply of marine seedlings to the marine environment for restocking purposes. There are plans to continue and investigate the potential of culturing other marine species and to expand the reseeding programmes to other islands. Financial assistance support for culturing and restocking programmes will also be needed.

Data collection and on going stock assessment surveys will continue to form an integral part of our fisheries programmes. There is still a large gap in acquisition of baseline information on coral reefs and important fisheries due to limited funding for research. Information available are too general and there is a need to extend surveys to outer islands. In addition, monitoring of the fisheries, different fish stocks, fishing efforts and regularly established maximum sustainable yields or maximum economic yields for different fish stocks are necessary to provide information to guide future policies and management decisions.

There is also a need for strengthening capacity of human resources to enhance present skills and knowledge for proper conservation and management of the resources.

There is also a need to review the current Fisheries Act (1979) and assist Island Councils to develop more stringent regulations and by-laws for sustainable management of the coastal marine resources.

3.0 Climate Change

(Berenato Timon,Tabanteiti Rokoua,Nakibae Teuatabo)

Introduction

Climate Change is defined as the recent warming of the earth during the last century due to enhanced greenhouse effect. The greenhouse effect is the natural ability of the earth to retain heat from the greenhouse gases such as carbondioxide, methane, etc. Enhanced greenhouse effect is the over saturation of greenhouse gases resulting from uncontrolled emission of carbondioxide and other greenhouse gases into the atmosphere from industrialization uncontrolled deforestation. With this effect there has been a global warming and sea level rise during the last century. Using different scenarios and best guess it is estimated that there would be an increase of 1.5 – 3^{o}C in temperature and 15 – 98cm in sea level rise during the next 100 years. Climate Change means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.(United Nations Framework Convention on Climate Change1990)

Kiribati, in terms of climate change and sea level rise, is vulnerable naturally, culturally, institutionally, infrastructurally and economically. Also it is important to remember that vulnerability without humans is no vulnerability. Because there are people in Kiribati with a very rapid population growth its vulnerability is very high, exacerbated by global warming and sea level rise. This report discuss the realities of climate change, problems already experienced supported by proximal data, Kiribati's response to climate change and current and future achievements in the different sectors most vulnerable to climate change and sea level rise. These are the foreshore, agriculture, fisheries and water resource.

3.1. What really is climate change?

The technical explanation of climate change is very broad and dynamic. Its inclusion in this report will take more time and space. There is only room for brief explanations in order to have a fair understanding of what is happening and its impacts to I-Kiribati. Climate Change in reality is a natural phenomenon that has occurred for millions of years and for the last thousands and hundreds of years. There were short term changes (climate variability such as ENSO) and there were long term changes (ice age, etc.). These changes whether short or long have made significant impacts on the lives of I-Kiribati through generations and generations. Experience had made ancestral I-Kiribati adapted and hardened to the forces of climate changes. He had survived those forces with every means accessible to him. Climate change is still a reality, yet not only apparent but with more power and haste enhanced by the greed and selfishness of the few people (such as George W. Bush) and industrialized countries who treasure their comfort no matter what. I-Kiribati of today, softened by modernization and western development is caught midway, innocent of this mishap, yet to suffer the consequences of global warming and sea level rise. Would I-Kiribati of today be able to face this problem, and worst still is the question of, would there be Kiribati when all this has happened or all will be inundated?

3.2. Kiribati's Response to Climate Change

Kiribati is limited in responding to climate change. Identified by UNFCC there are three main categories of responses and these are mitigation, adaptation and sequestration. Mitigation is the cutting down of emissions in accordance with Kyoto Protocol and sequestration is the provision of sinks such as reforestation. Sequestration would be limited but again initiatives would be a positive trend considering our vast and diverse marine flora. Adaptation is lacking in all sectors yet much has been done, which are in line with the issues of climate change. There is much to be done with an anticipatory attitude and with a no regrets policy by individuals and government

3.3. Institutional Framework

In the early 1990s government recognized that it is critically important for the socio-economic development programmes to be sustainable. It recognized that more attention, than in the past, has to be given to the management of the environment. It accordingly established an Environment Unit within the Home Affairs ministry, and subsequently established a Ministry of Environment and Natural Resource Development when the Environment Unit, with the assistance the South Pacific Regional Environment Programme (SPREP) began to identify and assume specific environment programmes. A National Environmental Management Strategy (NEMS) was developed and adopted. This document identifies climate change as among the priority issues in view of the perception that as a low lying coral atolls, Kiribati is most vulnerable to the potential sea-level rise.

3.4. Current Achievements and Future Adaptations

Whether intentionally or not, any development in line with climate change would be considered as an adaptation to climate change. There are basically three adaptation options practical in Kiribati though with differing consequences. These are to protect, accommodate and to relocate, if worse comes to worse. These are applicable to all sectors. Protection ensures that climate change and sea level will not affect the environment. Accommodation is letting climate change and sea level rise take their course and we try to change our way of living to absorb the impacts. Relocation is when worse comes to worse and one has to change sites either further away from the shoreline or complete resettlement to another country. Kiribati adopts the Kyoto Protocol and other International Agreements on Climate Change.

3.5. Foreshore Sector

The foreshore sector includes the high water mark on the beach up to the edge of the reefs. A number of problems related to climate change have been experienced. These include coastal erosion, flooding from super tides and storm surges. This is more frequent during ENSO period. Kiribati, merely 1.5m above sea level on average, except for Banaba, is very vulnerable to sea level rise (Thaman and Tebano).

3.5.1. Current Achievements

A current hard structural adaptation option is the building of sea walls which is regulated and controlled by the Foreshore and Land Reclamation Act, Laws of Kiribati Act 1989. This has been privately initiated for private property and government for government property. It is an expensive means of adaptation especially for Kiribati which has a high coastal area consisting of fragmented and scattered islands. A more practical and cheap option would be a systematic replanting of mangroves and coastal vegetation to control coastal erosion. Other achievements include establishment of Ministry of Environment & Social Development to control environmental issues. Marine zone past achievements on legislation includes, Foreshore and Land Reclamation Act, Laws of Kiribati Act 1989, Harbors Ordinance, Kiribati Ports Authority Act 1990 and Marine Zones (Declaration) Act 1983.

Establishment of Environment Act 1999 in particular the area, " Powers concerning discharge of waste or pollutant and creation of pollution' Section 43(1)(2). This empowers Environmental Inspectors to issue stop notice or a pollution abatement notice in writing to a person in breach of a license, in dispersing, destroy, dispose of or otherwise deal with the waste. Section 43(2) entails a fine for the polluter. This lacks enforcement by the Division or public awareness. A fine on the spot should be more effective for individuals at the community level (Adoption of *Polluter Pays principle*) causing such careless disposal of waste on land or at sea.

3.5.2. Future Achievement

A concern is raised as to the state of health of Kiribati corals. It is believed that an increasingly careless disposal of waste in the sea is slowly causing destruction to our corals. Pollution is increasing due to rapid population growth and this is a major concern to our coral. Coral is the livelihood of I-Kiribati. I-Kiribati lives revolve and depend on the healthiness of coral. It is protection to the immense ocean waves. It is bread and butter to I-Kiribati. An already unhealthy stressed coral will not be able to withstand the brutal impacts of global warming and sea level rise. All the different forces of government and non-government organization need to come together to tackle the roots of pollution and so ensuring the healthiness of our coral. It is when such is achieved that the impacts of global warming and sea level rise could be minimized

3.6. Agricultural Sector

The agricultural sector is very important in dealing with climate change issues. A strategic anticipatory adaptation approach needs to be taken seriously. A number of things that may affect the agricultural sector include increase of insect pests, increase in salinity due to prolonged droughts and increase in sea level, increase in wetlands and higher precipitation during rainy seasons. Food production will be very much affected so there is a need to activate resources that are suited to these kind of conditions

3.6.1. Current Achievements

The agricultural sector has included the following projects, which are consistent with climate change adaptation strategies. These include establishment of a coconut dwarf

gene bank, the most important pandanus to I-Kiribati gene bank and the best breadfruit for all different seasons gene bank. Increase in temperature and sea level rise will definitely affect the water lens as well as the vegetation. If it is likely that water salinity will increase then these projects would be most fitting. Pandanus is the only tree that has been seen to withstand water stress from prolonged droughts. Next is the coconut tree which is abundant through out Kiribati but the dwarf type is considered to be ideal for coconut production and toddy cutting for the modern I-Kiribati and breadfruit especially a variety called 'te bukiraro'. Planting of bamboo is also encouraged as a substitute for house building and therefore saving the pandanus trees. Much has to be done in this area since these projects are still in their early developmental stages/phases.

3.6.2. Future Achievements

With a likely increase in precipitation it is important that the agricultural division focus on plants that are adapted to high soil moisture to prevent heavy run off and increased soil and coastal erosion. There is a need to regenerate traditional plants to ensure there is diversity and sufficient food supply. Salt tolerant trees, such as te kaina, (*Pandanus tectorius),* te bero *(ficus tinctoria) and* Te boi *(Portulaca oleracea)* need to be systematically planted so that the impacts of climate change and sea level rise will be minimal to food supplies. There is also a need to encourage the use of sea vegetables as substitute to terrestrial vegetables which are more vulnerable to climate change and sea level rise, especially prolonged droughts.

3.7. Fisheries Sector

A number of achievements and issues in this sector are related to the foreshore sector so to avoid repetition, what has already been discussed in the foreshore sector will not be discussed here. As a matter of fact Fisheries Sector is a very big sector in terms of size. Most islands have a protected lagoon with a number of table reef islets with no lagoons but with fringing reefs and reef slopes which are very important to the people subsistence way of living. Kiribati EEZ is over 3.55 million square kilometers (Thaman and Tebano1994) so there is quite a lot with fisheries.

3.7.1. Current Achievements

In the fisheries sector a number of activities have been implemented consistent with climate change adaptation strategies. Artificial propagation has been successful on a number of marine animals but most important are berchedemer and trochus. These marine animals will help enrich the marine protein provision so those current ones under stress will not deplete. More important is the implementation of the Fisheries Act which prohibits the exportation of coral. Coral is the very source of life to I-Kiribati (see foreshore sector 4.22) Exportation of coral will be disastrous to Kiribati which is built on coral.

3.7.2. Future Achievements

One important adaptation that needs implementation is the controlling of any kind of trade, domestic or international on any wild life, especially marine. Over exploitation is always a problem when people become money minded in trade. They would not give any

concern for any retarding resources but would take as much as possible to trade to the point of extinction. A world convention on controlling trade on wild life has been going since 1975 which is called Convention on International Trade in Endangered Species (Traffic, 2002). Kiribati intends to become signatory to the convention as soon as all procedures to become party have been completed. This will enable Kiribati to control trade on any of CITES species Appendix I, II, and III, and therefore be able to protect a species dear to I-Kiribati, coral.

3.8. Water Resource

Water resource is a major topic to be discussed in detail in this sector. Hence, the concern is on the issue of sea level rise affecting, ground water which is the only water resource for an I-Kiribati. As mentioned in the SAPHE project end of year report 31 December, 2001, drinking water is obtained only from the Public Utilities Board's reticulated water supply derived from underground water, as well as private wells and rainwater. Water pollution is a major concern that needs to be addressed as it requires a very long time to clear impurities.

Taking South Tarawa with a 2000 census population of 53,000 or 62,000 by 2010 as an example, the increasing population has caused the decline of per capita daily water supply. The per capita daily water supply is 45 litres, however as estimated around 200% leakage occurs during the transmission process, giving a more accurate figure of 37 litres/person/day. This is estimated that the per capita water supply will fall to 24-28 litters/person/day. As also indicated in the report for case studies on three districts in South Tarawa namely Bikenibeu, Teaoraeke and Betio previously used local groundwater, thus has become unfit for human consumption because of water pollution caused by percolation of industrial wastewater down to the underground lenses plus increased salt concentration resulting from excessive pumping of well water by landowners, and prolonged drought of the late 1980's to the early 1990's.

South Tarawa has existing wells (freshwater lenses) as water reserves at Bonriki and Buota village, the last remaining sources of ground water for the many lives of I-Kiribati working and living in the capital island.

Much is needed to be done to preserve our last remaining sources of groundwater. Although, measures are being undertaken as in the SAPHE project, nothing is based on counter measures for the acknowledged sea level rise now experienced in Kiribati. The Housing Corporation on a separate note, is currently put in place a new design of raised floor housings with rainwater catchments, more to suit the intense heat of Kiribati climate rather than a measure to counteract warnings against global warming and sea level rise causing salinity of underground water.

3.8.1. Current Achievements

The current existence of the SAPHE project now addressing the preservation and protection of water reserves and also providing desalination. The establishment of a 10 Year Master Plan by the Public Works Department in line with the Public Utilities Board and the Housing Corporation.

The SAPHE project is currently piloting projects in three areas established to test the effectiveness and customer acceptance of constant flow of arrangements to individual houses. Each household should be able to have a connection to a flow-restricting device which allows a flow catchment into tanks of say 300 to 500 litre capacity.

The Ministry of Environment in its department of Environment and Conservation division has drafted a Climate Change National Implementation Strategy (NIS) 2002 – 2007 and chapter 6, 6.7, pp 39 on Water resource and management discussed in detail current achievements. The Ministry of Works and Energy has the overall responsibility of water supply. The Water Engineering Section was established under the Ministry in 1986 to coordinate activities on water projects in the outer islands. The activities concentrate on investigating alternatives for water supply schemes, preparing designs and estimates including project documentation for seeking funding assistance. It remains a body that oversees the on going water projects on outer islands and lately has been delegated a task of proposing overall policy on water resources in the country including water supply schemes on South Tarawa and Kiritimati. The Public Utilities Board (PUB) is a statutory body which the responsible authority for maintaining and manages water supply schemes in South Tarawa and Kiritimati.

3.8.2. Future Achievements

The SAPHE project Manager is currently drafting a *Water Resources Management Bill* for submission to the Ministry of Works and Energy for endorsement. It will await the approval of Cabinet for reading in the Maneaba Ni Maungatabu. Hopefully, this will be a major achievement in the legal aspect of preservation and protection of our limited underground water resources.

3.9. Capacity building

Some of the activities under section 2 (Coordination and Cooperation) above are capacity building for Kiribati government officials. These include a formal training course on the vulnerability assessment and informal training through cooperation in specific project activities. In addition there were ad hoc short training courses on particular works required under the UNFCCC as was the case with the greenhouse gases inventory.

In primary schools and in particular for secondary schools optional subjects include climate change topics. Students from secondary schools normally seek tutorial assistance from the staff of the Environment and Conservation Division. This fact may indicate the need for more inputs from climate change issues to the curriculum development, and for more teachers to be better acquainted with the issues.

Public awareness raising, education, and training need to be structured and pursued. More effort and resources are required; the design and implementation should be done through regional collaboration but to be based on national needs and priorities.

3.9.1. Education and training

Climate change to a certain extent is included in the school curriculum. In the primary it is part of Environmental Science where it us extensively taught. In the secondary it is a

small topic taught at forms 1-3 Social Science and forms 4-5 Geography. More in-depth teaching of the science on climate change and global warming is necessary to ensure that students acquire a sound understanding of global warming and sea level rise in order to be able to have an anticipatory adaptational insight for its impact.

3.9.2. Communication and awareness

Public awareness on global warming and sea level rise is an issue in Kiribati. A number of people are convinced that there is in fact global warming and sea level-rise but most are still reluctant to accept this basic scientific fact. Even well educated people in high government still do not believe in enhanced climate change and sea level rise. Problems with religious beliefs are hindrances that are at times become barriers to realities of life and this is very strong in Kiribati. Kiribati is more than ninety percent Christians who believe that God will look after His people. Booklets on climate change have been freely distributed to the public and schools so that people may realize what Climate Change is and what its implications are for Kiribati.

3.9.3. Human Resource Development

Kiribati and most Small Island Pacific Countries lack human resources to deal with the negative and positive impacts of climate change. Expatriate Consultants were the only means of data collection and distribution and this is expensive for poor countries like Kiribati. There is a need to train locals who would be able to help their governments in preparation and planning for global warming and sea level rise. A university postgraduate certificate programme on climate change emerged in 1998 in New Zealand at Otago, Waikato University in collaboration with the University of the South Pacific. The programme also included lay students who gained a certificate of participation at the end of the course. The programme later moved in 1999 to The University of the South Pacific in Fiji. Kiribati has been fortunate to be represented at both universities. This has become a part of the University of the South Pacific programme.

3.9.4. Information

Government ministries and their technical departments collect and keep data relevant to their services and functions including planning. There is, however, no readily available information on the types of data, their source departments, and on requirements for making them available to other users. The exception is the Meteorological Department that monitors the weather, thus maintaining data on the climate.

For climate change, the types of data that will be required in methodologies and tools for vulnerability assessment and for greenhouse gases inventorying need to be identified, and their availability be ascertained. Systematic observations of critical ecosystems need to be established where these do not exist, and data from these observations need to be properly managed. An appropriate management system for these data needs to be established, and gaps identified.

3.9.5. Research and Technology

Fortunately, an Australian SEAFRAME has already been established in Kiribati and it is believed that Kiribati can have the latest report on sea level rise/fall at a touch of a button.

Section 2 (Coordination and Cooperation) above contains information on some research that were done, and the mode of cooperation between international researchers and Kiribati nationals. Kiribati Initial National Communication to the UNFCCC Conference of the Parties and its National Implementation Strategy (in final process stage) identify areas where research work are to be required.

3.9.6. Resources

Kiribati government is already making available its own limited resources towards planning for climate change. It was from the concern about climate change and the potential sea-level that the Environment Unit, a one-person unit then, was first established. The work of the Climate Change Study Team represents a proportion of Kiribati man power resource allocated to climate change response. Moreover, recently a restructuring of the Environment and Conservation Division of the Ministry of Environment and Social Development incorporates changes that will further increase Kiribati inputs towards a response to climate change.

3.9.7. Coordination

The Minister has the overall responsibility for policies related to climate change, whilst the Permanent Secretary has the responsibility to supervise the implementation of such policies. Coordination of, and cooperation in the implementation of policies and activities on climate change are in practice and more often carried out by the Environment and Conservation Division.

At the technical level, inter ministerial coordination and cooperation is done through the Climate Change Study Team, its meetings and other meetings and workshops on issues and themes on climate change but which are all project related. Representatives from stakeholders including local government councils and communities are normally invited to workshops as a way to involve them in the project activities, including their planning.

Regional coordination and cooperation are achieved through consultative meetings and workshops in built into regional climate change projects to which Kiribati participates. This was the case with the Pacific Islands Climate Change Assistance Programmes. The executing agency for this project is the SPREP. SPREP is pursuing continuation programmes to assist countries to implement ongoing commitments under the UNFCCC, regional as well as countries own initiatives in planning responses to climate change and sea level rise.

3.10. Forward Component

3.10.1. National Specific

Government services and socio economic development programmes need human financial resources that are available. Resources to meet requirements of identified response measures to climate change are additional to which Kiribati can not afford to provide. This should be understood within the context of Kiribati as being poorly resource-endowed and fragmented atolls, and a least developed country.

Availability of national resources for a response measure of climate change is a function of the government's perception of the short term sustainability of financial resources and of its understanding of climate change issues. Public support for any climate change activity depends on their awareness of issues on climate change. These lead to a minimal support to climate change activities contrary to the fact that Kiribati will be most vulnerable to climate change.

Inadequate capability to implement fully the UNFCCC, to undertake research to further our understanding of the vulnerability of our atolls needs to be addressed. Also there is a need to identify and proceed with "soft" and/or "hard" options to adapt to the impacts of, and/or mitigate climate change. Dependency on regional and international scientists to undertake such research is acutely sensed when identified research needs have to await availability of the experts. In some cases, research work undertaken did not involve the training of Kiribati government technical personnel, and collaboration between the scientists, government personnel, and local communities.

3.10.2. Regional/International

Emphasis of regional programmes is on common needs among member island countries, and therefore other national needs that are not shared by other countries of the region are often not addressed.

Regional projects are very specific in their objectives and activities, leaving no flexibility to address national needs that are less related to the objectives.

3.10.3. Emerging challenges

Mainstreaming climate change issues into government development planning process is desired. The Environment Act 1999 requires that projects undergo an environmental impact assessment thus providing an opportunity for the Environment and Conservation to take into consideration the potential impacts of climate change and sea-level rise when assessing the environmental sustainability of the project and its immediate surrounding.

A number of possible projects were identified in the Initial National Communication and the National Implementation Strategy. The challenge is to develop more detailed planning for priority projects and to be able to attract

external funding for them. This requires a capability that is limited or not existing within the establishment responsible for climate change planning.

3.10.4. New Initiatives and Commitments

Preparatory work for a Second National Communication should start soon. The work can include collection of data that are required for a greenhouse gases inventory, collection of relevant information on options to mitigate climate change, data on adaptation, and review of the Initial National Communication.

Coastal Zone Management is urgently needed. This is a multi-sectoral management effort but a principal agency is the Land Management Division with which collaboration with the Climate Change Unit (to be established) should be developed.

A National Plan of Action for climate change should be developed and to use information in the Initial National Communication and the National Implementation Strategy.

3.10.5. Future Needs

A framework is required to integrate climate change considerations into the national development planning process. The important institution in such a framework is a section or unit in the Environment and Conservation Division to be fully engaged in climate change planning. A mechanism to cater for the multidisciplinary nature of climate change issues could be in the form of the existing Climate Change Study Team and, to provide for regular reporting system to policy makers, a high level policy and steering committee could be required. The Study Team will remain a technical committee, immediately supervising the project implementation.

3.10.6. Special Proposals

On adaptation, it is recommended that a pilot project targeting a specific community be started. The aim is to pursue sustainable development approach but with lead sectors/areas that are most vulnerable to climate change adverse impacts. A well thought out institutional framework that provides for coordination among government relevant agencies and of their inputs to the project is desired. Further it should set out a coordination and cooperation mechanism between these agencies and the local community(ies). This framework will be an essential component of any pilot project.

The community has to be selected, and consultations with them is essential and with government agencies whose inputs are to be required.

Ideas, and activities for a pilot project should be taken from the Initial National Communication and the National Implementation Strategy. The proposal will have to be tailored into smaller scales and targeting the selected community and village(s).

More efforts is required for capacity building, education, training and developing endogenous capacity to undertake research in collaboration with international scientists and research programmes.

4.0 Water Supply

(An extract from SAPHE PROJECT)

Introduction

The aim of this report is to present the facts about the SAPHE project and to report on activities through the eyes of Project Management Office from its inception on 25th September until 31st December 2001.

The Project was approved on 8th December 1998; the Project became effective on 15th September 1999. The overall objective of the US$10.2 millions worth of project is to improve the health and well-being of the people of South Tarawa through a sustained program of physical and institutional improvements in water supply, sanitation services, solid waste disposal and environment conservation.

SAPHE's consultants and specialists in the course of one year have submitted quite a lot of Reports with their recommendations on actions to be taken at Project Implementing Units level and also at Project Management Office level.

At the turn of the first year of operation of the project, the Project Management Office is proud of its achievement as rated by ADB Review Missions of June and of September respectively to be fully satisfactory as regards progress in implementation and fully satisfactory as regards progress in achievement of objectives.

The next sections of the report will dwell on presenting the facts plus shelving some concerns relative to the project's socio-cultural matrix.

4.1. Water Resources

South Tarawa has a population of 38,000 squeezed into small residential areas. Drinking water is obtained from the Public Utilities Board's reticulated water supply derived from groundwater, as well as private wells and rainwater. People in the three districts of Bikenibeu, Teaoraereke and Betio in South Tarawa previously used local groundwater, however, this became unfit for human consumption because of water pollution caused by percolation of industrial wastewater down to the groundwater lenses plus increased salt concentration resulting from excessive pumping of well water by landowners, and prolonged drought of the late 1980's to the early 1990's etc,

Usable groundwater is currently pumped from a number of wells in the reserved areas of Bonriki and Buota. The amount of such groundwater is around 1,500 m^3, and this is supplied to more or less all the districts of South Tarawa after being sent to Bonriki Water Plant for injection with chlorine for disinfecting. In addition to this, 200 m3/day of living water is supplied from three desalination plants at Nawerewere hospital, Otintaai and at Betio.

Accordingly, the total amount of water supply in South Tarawa is 1,600 m3/day. Per capita daily water supply is 45 liters, however, since it is estimated that around 200 % of

leakage loss occurs in the transmission process, the actual amount of water supply is 37 liters/person/day.

Moreover, the per capita daily water supply declines as the population increases. Population is displaying dramatic increase in South Tarawa and, based on the population census carried out at the end of 2000, it is forecast that the population of may increase to 53,000 or 62,000 by 2010 if all other socio-economic variables remain constant. In this case, per capita water supply will fall to a fairly tight figure of 24-28 liters/person/day. In order to secure satisfactory water supply for citizens, it is important to adopt countermeasures such as the development of new water resources, effective use of rainwater, preservation of water quality and prevention of excessive pumping of existing water resources in Bonriki and Buota, and so forth.

In particular, existing wells (freshwater lenses) in Bonriki and Buota are the last remaining sources of groundwater in South Tarawa, and it is necessary to ensure that they are well protected and conserved for sustainable and perpetual use.

We must never forget the problems of water pollution caused by high salt concentration and industrial wastewater in the freshwater lenses of Bikenibeu, Teaoraereke and Betio. Once the groundwater becomes polluted, it requires a very long time for it to become clean once again.

In consideration of the above background, measures for the preservation of freshwater lenses water quality in Bonriki and Betio are described in the following paragraphs.

4.2. Preservation of Water Quality in Wells (Freshwater Lenses) in Bonriki and Buota from the influences of bacteria.

There are 20 or so freshwater lenses in Bonriki and Buota. Both districts cover an area of 382 acres (155 ha), and population here increased by 36% over five years from 1,843 in 1995 (11.9 people/ha) to 2,513 in 2000 (16.2 people/ha). Population density in Bonriki and Buota in 2000 was 15.7 people/ha and 17.4 people/ha respectively.

According to the Royds Report of 1996, it is reported that two types of bacteria exist in the local groundwater, i.e. coliform and sulphide oxidizing bacteria beggiotoa. Moreover, from public water supply reticulation pipes, thermo tolerant coliform was detected.

4.2.1. Causes of Water Pollution

Judging from detected microorganisms, causes of pollution of freshwater lenses can be found in the lifestyle activities of local residents. This cause and effect relationship can be explained in the following way.

Since the aquifer of freshwater lenses is located at the shallow depth, it is thought that various harmful substances and bacteria contained in human and livestock urine and excrement, domestic waste products, fertilizer and agricultural chemicals, human burials, detergent and withered leaves, etc, are unable to quickly infiltrate the aquifer by percolation and rainwater runoff. At times of heavy rainfall, it is thought that this water

enters private wells owned by citizens and that sediment and polluted and non-polluted substances alike are carried into the freshwater lenses.

These substances produce new materials via processes of chemical degradation and fusion with existing substances in the water. In turn, the newly produced substances contribute to change in water quality by playing a part in the generation and multiplication of bacteria.

4.2.2. Coliform

Coliform permanently exists in the human large intestine. A certain group of coliform causes infections in the intestine, and this is known as pathogenic coliform. Pathoghenic coliform is divided into four groups, and each group causes distinctive symptoms following infection. The WHO standard for drinking water is 0/100 ml, and adequate disinfecting is required to achieve compliance with this.

Infections bacteria in human feces include campylobacter, yersinia enterocolitiga and legionella in addition to colirom. When the population of such bacteria in drinking water reaches a certain level, this leads to mass outbreaks of diarrhoea and organ damage, etc. and can even result in large numbers of human fatalities. Human and animal urine and feces also contain protozoa and viruses, some of which are pathogenic microorganisms that lead to infections in humans and animals alike. Therefore, there are cases of human organ damage arising from the urine and feces of animals. Chlorine alone is not enough to sterilize and eradicate these bacteria, therefore, ultra violet rays and equipment such as ultra-filters, etc. are necessary and these lead to expensive equipment and maintenance costs.

4.2.3. Beggiotoa

Beggiotoa occurs in well water that contains hydrogen sulfide generated by the decomposition of sulfur-carrying proteins.

There is nothing in particular to report concerning human health damage caused by beggiotoa, however, this is an indicator of pollution advance. This bacteria leads to corrosion when it attaches to metal pipes, etc.

4.2.4. Counter-measures and Summary.

Pollution of water sources in Bonriki and Buota has not reached serious levels yet, however, when one considers the current conditions and future prospects of water resources in South Tarawa the lasting utilization of these water sources is something that should be strived for.

Agreement has been reached between the Kiribati Government and Asian Development Bank to make protection measures of these water sources under a project component of the loan contract for the SAPHE Project.

These measures aim to protect water resources by limiting the inflow of various pollutants in line with population increase and daily lifestyles in the target areas. Specific methods for implementing these measures are relocation of citizens from the central parts of these water resource areas, establishment of residential zones 50 metres away from high water marks, promotion of relocation to such zones, and prohibition of destructive entry to water resource areas.

These counter-measures shall only be implemented in Bonriki, which has an abundant groundwater flow. Judging from analysis findings of current water quality in Bonriki, since water resources in Bonriki have only been affected by domestic solid waste products, it is thought that implementation of the said measures can lead to improvement in a relatively short time. This is because there is no need to consider chemical compounds contained in factory waste liquids, which can adversely affect human health even in small quantities.

However, if waste products continue to be disposed in water resource areas there will be little hope for improvement of the water quality. For the sake of protecting water resources in Bonriki, it is important that people of South Tarawa refrain from entering and disposing of waste in water resource areas.

4.2.5. Rental payments on the Bonriki and Buota Water Reserves

As reported, the Lands Management Division, on behalf of the Government, currently makes an annual land rental payment at a commercial rate of $1504 to the Bonriki and Buota landowners and their appointed family representatives in January each year (see Table 1.). There are many distributions with each plot and the number of payees far exceeds the number of plots. The total amount paid to landowners on both reserves in 2001 was $413,482 representing 26% of Government's annual amount paid to landowners for leased lands in both South Tarawa and outer islands. This annual rental amount is reviewed every five years via legislative provision, the last review being 1999. The previous rate for the earlier five-year period (1995-99) was $638 and was increased substantially to $1504 during a land valuation review in 1999 and implemented in 2000. The rate of $1504 paid to reserve landowners is the same rate paid for land used for commercial purposes by Government elsewhere in South Tarawa. The previous lower rate of $638 was approximately 60% of the then residential rate. This major increase in rent was seen by Government as a move to reflect a more representative value of the land and importantly, to appease the lingering concerns of the Bonriki and Buota residents regarding adequate compensation payments. The payments are made on-site in the Bonriki and Buota village **maneaba's** following announcement of payment times and date on the local Radio Kiribati.

Table 1: Rental Payments on the Bonriki and Buota Water Reserve, 2001

Indicator	**Bonriki Water Reserve**	**Buota Water Reserve**
Number of landowners/agents paid	**619**	**244**
Number of registered plots in water reserve	**104**	**74**
Total amount paid in 2001: $413,482	**$249,013**	**$164,469**

4.3. Groundwater development

It goes without saying that for the next five years (2002 – 2006) Government is obligated to pay $2,067,410 and for the ten years (2002 – 2011) Government would pay the land-rents of $4,134,820. The amount of payments would further skyrocket when the water reserves development programme extend to Abatao and Tabiteuea in North Tarawa or to other villages.

Tony Falkland report 1992 gave a summary of preliminary sustainable yield estimates for each of the lands in North Tarawa as presented below:

Abatao	250m3/day
Tabiteuea	300m3/day
Tabiang	150m3/day
Marenanuka	250m3/day
Abaokoro	50m3/day
Taborio	2200m3/day
Taratai	600m3/day
Tebangaroi	150m3/day
Nuatabu	150m3/day
Tearinibai	250m3/day
Buariki	1500m3/day
TOTAL	3850m3/day

In addition, there is the potential for additional fresh groundwater to develop from artificially built island which could be located at a convenient location within the lagoon somewhere to the west of Buota or Abatao. It would be a wise and logical move for Government to invest its money on developing this idea. It is known that freshwater lenses will gradually develop on 'new' islands given sufficient time. This has been found to be true in the Maldives where fresh groundwater has shown after a few years. Essentially the time taken to develop a lens is the time required for groundwater recharge from rainwater to displace seawater from under the island (approximately 5-10 years under average recharge conditions). This option has a number of potential advantages- it would be government land, it could be developed in a way to protect and conserve freshwater (ie no buildings in centre- only around the edges.). The cost of this proposal would not be cheap, but would be more practicable than bring water from the very north of North Tarawa. It is about time that Government officials start to pay serious attention to recommendations made by Hydro geologists and to be firmly committed to any actions leading thereupon.

4.4. Kiribati SAPHE Project – Water Supply Components

The following are the components of the SAPHE water supply works:

1. Construction at the existing treatment facility of a water treatment plant with a design capacity of 2050 cubic metres per day comprising:
   1.1 Aeration facility

1.2 400 cubic metre reservoir
1.3 Pump station
1.4 Control building and chlorination
1.5 Stand-by generator

2. Construction of a 225 millimetre diameter PVC pipeline from Bonriki to Teaoraereke approximately 18,340 metres long laid in trench along the shoulder of the main road.
3. Five new elevated storage tanks and two new booster pumps
4. Rehabilitation of existing water system facilities
   4.1 Two elevated storage tanks, five low level tanks and six booster pumps
   4.2 Replacement of 40 existing 100 millimetre valves, installation of 30 new 100 millimetre valves and replacement of 1,000 metres of 100 millimetre piping in the Betio distribution system
5 House Connections
   5.1 Pilot trials of restricted constant flow connections with on-site storage in two residential areas each with about 100 houses
   5.2 Subject to the success of the trials, full implementation of the constant flow connections to all water supply customers

Components 1 to 4 inclusive are expected to be included in the main contract to go out to international bidders. It is proposed that Component 5 be carried out by PUB with technical assistance provided by the SAPHE project.

4.5. Description of Water Supply Components

4.5.1. Water Treatment Plant

The water treatment works will be located at the existing water treatment site at Bonriki. The treatment plant receives water from groundwater galleries at Bonriki and Buota. The current water production capacity of the galleries is limited to approximately 1400 cubic metres per day.

The treatment facility will be designed and built to accommodate a flow of 2050 cubic metres per day but initially the plant will only treat the current production capacity of the galleries. The work involves the provision of:

- an aeration facility to remove hydrogen sulphide from the raw water;
- a 400 cubic metre storage tank;
- a new pumping station to deliver water from Bonriki to Betio;
- upgrading of the existing building and chlorination facilities; and
- a replacement generator for stand-by power supply.

The aeration facility will be a commercially available fibre glass cooling tower with an appropriate filling block. An electrically driven fan will provide positive airflow. The aerator will receive raw water from the galleries and deliver it to the new reservoir. The aerator will be located on top of the roof of the new pumping station.

The 400 cubic metre reservoir will be a prefabricated steel panel tank. The tank will be provided with an appropriate protective coating, roofing, access ladders, water level indicator and good ventilation.

The pumping station will draw water from the new reservoir and deliver it into Bonriki to Betio pipeline. The pumping station building will be a concrete block structure with a reinforced concrete roof and will house three 7.5 kW pumps and associated electrical and control equipment.

The existing chlorinator will be replaced with a new unit that will automatically control dosage rates to match pump flows.

The existing building will be upgraded and extended to provide operator amenities.

A new stand-by 65kVA diesel driven generator will be supplied within a separate new building to replace the existing generator.

4.5.2. Pipeline from Bonriki to Teaoraereke

A new 225 millimetre diameter transmission pipeline will be constructed from Bonriki to Teaoraereke to replace the existing 155 millimetre pipeline. The pipeline is approximately 18,340 metres in length and will be laid in a trench in the shoulder of the main road. The pipeline will be constructed of PVC pipe and provided with sluice valves, air valves and scours. Along the pipeline connections will be provided to seven existing reservoirs and five new reservoirs.

Between Temaiku and Teaoraereke the existing 155 millimetre pipeline will be retained and used as part of the reticulation system. Connections will be provided between the 155 millimetre pipe and existing reticulation pipes. The existing 155 millimetre pipeline along the Temaiku causeway will be disconnected and disused.

4.5.3. Elevated Storage Tanks and Booster Pumps

Five new 22 cubic metre elevated storage tanks will be constructed at locations along the new pipeline. Booster pumps will be installed at two of the new reservoirs.

4.5.4. Existing Water System Rehabilitation

Two existing elevated concrete reservoirs and 5 low level concrete reservoirs that are leaking will be repaired. Six existing booster pumps and associated pipes, fittings and electrical and control equipment will be replaced. Ten existing elevated concrete reservoirs will be fitted with water level indicators.

All 100-millimetre valves (approximately forty) in the Betio water reticulation system will be replaced and an additional thirty 100-millimetre valves will be inserted. Provision has been made to renew up to 1,000 metres of 100-millimetre pipe in the Betio reticulation system.

The six sluice valves along the existing 225-millimetre pipeline from Teaoraereke to Betio will be replaced

4.5.5. House Connections under Pilot project

Three pilot areas will be established to test the effectiveness and customer acceptance of constant flow arrangements to individual houses. Each household will have a connection with a flow-restricting device that allows a constant flow of water into a tank of 300 or 500 litre capacity. No meters will be needed as flows at each connection can be readily checked with a small measuring flask. Different sized flow restrictions will be provided according to household water needs and monthly charges will be set accordingly.

The pilot areas need to have an isolated supply direct from a reservoir. To obtain representative results, pilot areas will be located in a densely populated area and a moderately populated area. The densely populated area will be a portion of Betio or Bairiki that currently does not receive adequate water. Nanikai is suggested for the moderately populated area. Each pilot area would contain approximately 100 houses.

The pilot areas will be monitored for a period of at least three months to gauge customer acceptance and technical performance. Based on the results of the pilot test, the constant flow system will be modified as necessary and extended to serve all other areas in South Tarawa.

4.6. Criteria for connection to PUB water reticulation system under the project

1. The consumer should be connected to the PUB water supply system after paying the $20.00 connection fee.

2. The consumer should have an updated account with PUB. That is he/she should pay the $10.00 water charge on a monthly basis.

3. Consumers who do not have their water account updated will not be covered under the SAPHE pilot project. It is important that all accounts are settled prior commencement of the Pilot study in October, 2001.

4. The consumer is responsible for digging the pipe trench from the 50 mm pipe to his/her premises.

4.7. Solid Waste

Solid waste disposal is a major problem and the present unsatisfactory situation creates hazards by, for example, contaminating the coastal zone (ocean and lagoon) and groundwater lenses, and providing breeding places for mosquitoes, flies and rats, well as restricting land use options. The waste generated in South Tarawa was estimated in 1996 to be about 6,500 tonnes per year, of which 83% was residential. About 75% of this is organic waste (mainly dried fronds and leaves) which is compostable. A further 10% is scrap metal, largely aluminium cans (beer and soft drinks). The rest is cardboard, paper, plastics, glass, fabrics and food tins.

The 1996 studies indicated that about 75% of the total is collected by the two Councils who are responsible for the disposal of the waste. At present domestic and other solid

wastes are left by the side of the main road in heaps for up to a week or more before it is collected by Council employees. The rubbish is disposed of at a small number of surface dumps along the both the ocean and lagoon shorelines. At most dumps the rubbish gets spread by wave erosion over large areas of the shoreline because there are no barriers to contain the rubbish. The largest dump at Red Beach on Betio is now contained by a seawall.

Rubbish is also dumped at many uncontrolled locations, usually on the upper beach and commonly (at the request of landowners) behind seawalls along the lagoon constructed to create new land for building on which extends out beyond the present shoreline. Residents also dump rubbish in similar locations or burn or bury it on private land. Suitable potential landfill sites are few and all are along the shoreline.
Of the 25% which is not collected, much of the leaf litter is mulched or composted by being placed in babai (taro-growing) pits and around the bases of trees, especially breadfruit trees. The remainder is dumped at small uncontrolled locations, usually on the upper beach, or is burned and/or buried on private land.

The preliminary results of the SAPHE Project social survey (a sample of 565 households) indicates that much less than 75% of the solid waste is being collected by the Councils. The survey results suggest as little as 25% is collected, with similar amounts, if not more, being disposed of in the householder's own yard and at the beach.

Medical wastes, which are potentially especially hazardous, are either burned using kerosene in 200 litre drums at the hospital (the incinerator is not functioning), or is collected by Council staff and disposed of in a dump.

There are about 1,500 tonnes of scrap metal in the form of vehicle bodies, heavy machinery and sections of steel. Options for disposing of this scrap metal discussed have included recycling it for sale overseas, dumping it in deep ocean locations and using it to construct artificial reefs in the lagoon.

Graham *et al.* (1999) described several stockpiles of waste chemicals and contaminated sites found on South Tarawa which will require removal and/or management by methods such as site remediation and removal and disposal of hazardous materials in off-island treatment facilities.

4.8. SAPHE-project's Physical Components summary

The main physical components of SAPHE are Water, Sewerage, and Solid Waste Disposal.

4.8.1. Water component covers the whole of South Tarawa

A. New Work

- Water treatment Plant plus Storage Tank 400 m3.
- Mains Pipe-line from Bonriki to Teaoraereke
- New Storage tanks and booster pumps –Temaiku,, Nawerewere, Mackenzie point, Bangantebure, and Tebunia

B. Rehabilitation of Old system
- Storage tanks
- Booster pumps and gallery pumps
- Betio distribution systems
- Replace valves on Teaoraereke and Betio pumps.

C. House connections
- Pilot projects - approximately 320 connections at Nanikai, Betio, and at Bikenibeu on South Tarawa.
- Remaining connections 3,000 to be done when the main Construction Contract starts in the 2nd Quarter of 2002

4.8.2. Sewerage component covers only villages that are connected to PUB's Sewer Lines.

A. New Work
- Pipelines Bikenibeu & Betio
- Pressure pipe mains – Bikenibeu
- Booster pump stations.

B. Rehabilitation
- 16 Booster pumps (wet-wells) including Hospital
- 3 Sewerage outfalls – Betio, Bairiki, Bikenibeu
- Gravity mains
- Salt water intake pump/pipe (Betio Bairiki, Bikenibeu)
- Sewer connections to houses – 400 is envisaged.

C. House Connections
- 400 plus some partial connections

4.8.3. Solid Waste components

A. New work
- Land fill at Nanikai
- Incinerat for TCH, Nawerewere Hospital

B. Rehabilitation
- Betio land fill

C. Equipment to be procured
- 2 bull dozers (TUC BTC)
- Transfer truck for TUC
- Collection sites at Public places, park
- 1 tractor &trailer for North Tarawa

It is recommended that any savings made under the Loans portfolios will be used for additional connections or any ad hoc public connections to be decided by Cabinet.

4.9. Socio-Economic Factors in the Construction of the Water Supply and Other Infrastructure (Environment)

Construction of the water supply infrastructure and of most components of the saltwater, sewage and solid waste management infrastructure will have minimal effects on the bio-physical environment. Measures to ensure that any negative effects that might occur are minimised and mitigated.

Ownership of and access to. land, and compensation for vegetation clearance will be recurring issues that the SAPHE project team will need to address in advance of and in the course of construction works.

4.9.1. Land Ownership and land Access

Some land will be crossed by underground infrastructure such as pipelines and after construction work is finished this land can revert to its former use. Other localised areas of land will be required permanently for above ground infrastructure such as water storage tanks, pumping stations and solid waste processing facilities (e.g. waste transfer stations and landfills).
Land occupation arrangements in South Tarawa include (Kingston Morrison 1996, Chapter 5):

- I-Kiribati owned land, i.e. customary land
- Government owned land (small areas only)
- Government leased land, 99 year leases
- Land sub-leased from Government, 25 year leases
- Customary land leased by others (including Missions and individuals)
- Communal land

As described by Kingston Morrison (1996), customary land ownership in Kiribati adopts the principle of family ownership, whereby land is passed on through the family members. The governing legislation for customary land is the Native Lands Ordinance CAP 61. Family land will generally have a number of owners; these owners do not have exclusive rights to any particular part of the land but have undivided shares or interests in the whole of the land, although they may be allocated specific house plots. All pass down from the original land owner and are held during one's lifetime. Custom has established that land will pass to both male and female kin and to their kin. Original land boundaries stretch from ocean to lagoon, and generally encompass narrow strips of land. There is a tendency for land owners to allocate house plots to others outside the immediate land-holding family by way of informal agreement. These arrangements are supposed to be approved by the Magistrates Court, but more often than not they are never recorded. The system of customary land ownership and land registration makes it difficult to deal with land owners and/or occupants. Communal land exists within the village area of each main village. Most of it is leased from Government and housing on it is invariably unplanned, congested and comprises illegal structures.
As discussed by Kingston Morrison (1995, Chapter 5), the Government of Kiribati prefers to acquire the land it needs for public works (and housing) through agreement with the land owners rather than by compulsory acquisition either absolutely or by lease

under the State Acquisition of Lands Ordinance CAP 95B. It also prefers leasing rather than outright purchase of land. There is a requirement to pay compensation and if compensation is not agreed to the matter may be referred to the High Court for determination. Leasing is governed by the Native Lands Leases regulations. No lease or sub-lease can be granted for a longer period than 99 years without the approval of the Minister.

The Public Utilities Ordinance CAP 83 may also apply to the SAPHE project. Under this ordinance the PUB has power to undertake various actions to facilitate the supply of electricity, water and sewerage facilities. Government, through the PUB, can lay such utilities on or under any road over of through any land, provided any damage done is made good and any appropriate compensation is paid.

The SAPHE project has set in process the following steps to ensure that access to land required by the project is obtained.

The SAPHE Project is offering loans amounting to $1500 to householders for the construction of latrines and wells.

A. The Public Utilities Board will be responsible for negotiating the required access to land for the water supply, saltwater reticulation and sewage system infrastructure. This process should have already commenced by late 2000. Which authority will be responsible for negotiating access to land required for the proposed landfills and solid waste transfer stations should be the two town Councils (BTC and TUC).

B. The Lands Management Division (LMD) of the Ministry of Home Affairs will assist in identifying the parcels of land to which access is required and the owners of those parcels. For Betio, Bairiki and parts of Bikenibeu the LMD GIS has land parcel boundaries plotted (including for customary land), with cross-reference to the names of their owners. For the rest of South Tarawa buildings are plotted, along with land boundaries for some land parcels owned by government and institutions. For customary land, no land parcel boundaries are plotted. LMD has lists of the names of landowners in each village area, but no information about the locations of the land parcels they own. It is not even possible for LMD to identify the owners of those buildings plotted on the GIS which are on customary land.

C The SAPHE project had recruited three Community Liaison Officers to facilitate the consultation process in relation to land acquisition and access. It is about time that the efforts of such officers are consolidated and focussed around the project.

It is anticipated that any additional customary land required for the SAPHE project would be acquired largely if not entirely by leasing arrangements without the need for compulsory land acquisition. Furthermore, the amounts of such land are likely to be very small and to total no more than a few hectare. In these circumstances, an ADB Land Acquisition and Resettlement Plan will not be required.

4.9.2. Vegetation Clearance Compensation

When carrying out activities which cause the destruction of economic trees the Government normally pays compensation according to a Schedule of Rates for trees, crops and buildings maintained by LMD. The schedule specifies rates for major economic trees such as coconut, pandanus, breadfruit and Te bero trees according to their age and whether or not they are bearing fruit. Compensation is also payable for banana, pawpaw and vegetable crops. The schedule approved by Cabinet in 1992 is still in force and recent payments have been made in accordance with it. LMD would assist the SAPHE project and other involved parties such as the PUB and Councils in negotiations with landowners for compensation. (Table)

Table give the price list for various crops released from LMD:

Crops	Prize
Coconut	
1. Fruit Bearing	$50.00
2. Non Bearing	$25.00
Breadfruit	
1. Fruit Bearing	$120.00
2. Non Bearing	$ 60.00
Pandanus	
1. Fruit Bearing	$23.00
2. Non Bearing	$12.00
Pawpaw	
1. Fruit Bearing	$12.00
2. Non Bearing	$ 2.50

Source: Land Management Division 2001.

In addition to paying due cash compensation, it is the intention of the SAPHE project to provide compensatory planting of trees where feasible at the rate of two trees for every tree lost.

4.9.3. Compensation for Other Improvements

The Government would also pay compensation for any damage to or destruction of any improvements made to the land, especially buildings. It is anticipated that very few buildings will be impacted.

4.9.4. Relocation and Resettlement Issues

Apart from relocation/resettlement issues associated with continued use of the Bonriki and Buota water reserves discussed further in Section 2.4 below, few if any households or businesses will be required to relocate as a result of the land requirements of the SAPHE project. None of these few relocations would be involuntary.

Our Environmental Specialist advised that neither an ADB Land Acquisition and Resettlement Plan nor a resettlement plan as prescribed under section 11 (c) of the *Environment Act* 1999 is warranted for the SAPHE project.

5.0 Waste and Pollution

(Tongatapu Malua, Teririko Anre, Neri Tiaeke)

Introduction.

Like other Pacific Island Nations, Kiribati is not immune to the increasing problems associated with waste and pollution. The situation in rural areas is not so critical as compared to what can be felt in urban areas. The nature of waste found on outer islands is largely of organic matter derived from plants and trees, food scraps, decaying twigs, fish bones and discarded household sweepings. On the other hand urban waste consists usually of biodegradable as well as non-biodegradable matter. Pollution attributed to unsanitary disposal of wastes in rural environment is insignificant apart from creating unsightly appearance of areas where they exist. In an urban setting, pollution, regardless of its origin and severity is a complex problem. Due to population concentration in urbanized areas, pollution occurrences are generally on a larger scale sometimes to the point where they will be conveniently categorized as natural disasters.

Waste and pollution problems are liberated from a variety of root causes, notably increase in population, urbanization, changing life style, to mention just a few. Regardless of the precautions taken to curtail these situations, invariably the problem has escalated or progressed to such an extent that it will warrant a national or regional cooperative effort to overcome it. With these facts in mind it is imperative to embark on the promulgation of national plans that will among other thing establish an organization with a mandate to manage waste disposal and related pollution problems. Pollution from various sources is increasingly becoming a critical issue demanding immense commitment on the part of national governments towards its prevention or management, including Kiribati. Air, land, and ocean pollution by organic, inorganic and radio-active substance have created much concern in every sphere of the globe. Recent disturbing disasters involving human exposure and pollution from radioactive wastes and explosions are so significant that they have resulted in great loss of human lives. Human exposure to radiation and its consequent detrimental effects contribute enormously to a high incidence of cancer cases in many parts of the world. Pollution is among the major existing problems that must be solved globally.

5.1. Progress and Achievement

Waste disposal and pollution related problems are being increasingly considered to be of high priority, so much so that a national endeavor to counteract its effects are vigorously pursued. The progress of this venture has been quite encouraging and should ensure satisfactory results. National waste disposal and pollution strategic planning has evolved some remedial procedures that must be followed in order to contain these problems in a cost effective manner. Within the period of ten years since the Rio Conference, much has been achieved in the area of waste and pollution control.

5. 1.1. Public Awareness and Education.

Raising community's awareness on the issue is of prime importance as a preliminary step in the struggle against pollution control. Public awareness activities are conducted by trained personnel of government ministries, non-governmental organizations, and church groups. The programmes are designed and planned to cover a large proportion of the population. The assessed coverage is 34% to 40% in urban areas while 40% to 50% is for the rural areas. The topics that are generally communicated during the workshop sessions are on the types of wastes, the various methods of disposal, ways of minimizing waste by recycling, reuse, volume reduction, use of biodegradable materials instead of those that are non-biodegradable as in the case of plastic shopping bags, rubber tyres and plastic wrappers to minimize the quantity of waste.

Awareness- raising and education have been conducted for commercial and trading enterprises to stress the important point of importing goods and items that will not create waste and pollution problems. The importation and sale of old or second hand vehicles and machinery from Asian countries raises great concern and therefore, traders are made conscious of the problems that may arise from the accumulation of discarded and deteriorating vehicles. Pollution created by discharged noxious gases from inefficient internal combustion engines is critically emphasized.

Mention must be made of educational activities in schools and village maneabas (meeting houses). This type of developing useful knowledge and understanding of environmental pollution can be of considerable use. Progressive actions are concentrated on the development of schools curricula to encourage the teaching of environmental subjects in Primary as well as in Secondary schools.

5.1.2. The Establishment of the Ministry of Environment and Social Development

The creation of the Ministry of Environment to manage the environment was a stepping stone to a national management and control capability of environmental situations. Furthermore, instituting the Environment Division within this ministry consolidates the ability of the nation to skillfully handle problems of environmental concern. Environmental audit, environmental impact assessment, conservation of biodiversity, climate change assessment and pollution control are among the many services that can be offered in terms of control mechanism by the Division.

5.1.3. The Enactment of Environment Act and Regulations.

The enactment of Environment Law in 1999 and its enforcement on 21st March provides for the protection, improvement and conservation of the environment. The approval of subsidiary regulations and in particular, the section dealing with pollution has paved the way to a legal manipulation of environmental and performance of environmental oriented tasks. The advantages of legal backing of action that are gravely needed in the attempts to maintain pleasant environmental conditions are manifold. Acts and regulations are most useful when dealing with situations that are difficult to handle. It is the last resort when all other means fail.

Pollution is defined to include contamination of air, land and sea by noxious substances as to make them:

- Unsuitable for human habitation
- Harm human health
- Offensive to human senses
- Degraded so as to be incapable to support fauna and flora
- Harmfully affected in a way that can in turn have a detrimental effect on underground water lens.

The Act and the Regulation cover the pollution control of land by discharge of wastes from manufacturing or industrial premises. The control of air pollution is covered under the Environment Act and Regulations. The discretion, however, remains with the environment inspectors who should have the capability of determining the occurrence of pollution, sampling and identifying pollutants in the air besides conducting investigations leading to their elimination and if necessary to institute legal proceedings.

The Act and the Regulations somehow provide adequate provisions for the legal control of waste and pollution. There is much room for expansion to handle other spheres specifically in the field of pollution abatement and control. New laws that fit into the existing traditional parameter should be introduced. This approach will facilitate the enforcement procedures. Any legal instrument should be established in consultation with cultural practices and beliefs.

5.1.4. Waste Disposal

The current method employed for household waste from kitchens and surrounding yards especially in urban environment is that of controlled collection system operated by Town Councils. They system involves regular collection of household wastes (placed in receptacles along the access roads) by vehicles manned by laborers and transported to designated dumping areas (refuse tips) where the waste is compacted and covered with a layer of covering material (soil). Waste disposal sites are generally located near the shores to facilitate land reclamation.

Individual households not served by the system dispose their refuse by burial, incineration or composting. Other sanitary means of waste disposal are in the process of being promoted through organized promotional programmes. Composting of refuse to recondition the soil is vigorously promoted by Agriculture Division.

Methods of minimizing wastes using minimization principles are being taught in workshops conducted for the purpose. Recycling of aluminum containers can be done by recycling enterprises which export crushed cans before shipping them overseas.

Special disposal methods will, in the course of time be devised for toxic waste such as batteries, cleaning fluids, waste oil and materials containing heavy metals and corrosive chemicals.

Human waste disposal methods are currently being improved through public education and toilet construction schemes on outer islands and urban areas.

5.1.5. Ocean Dumping of Waste.

The detrimental effects of indiscriminate dumping of waste in the sea or ocean cannot be overemphasized. Many undesirable events involving marine creatures have occurred as a result of dumping wastes in the sea.

In an attempt to fulfill international requirement Kiribati is adopting the London Dumping Convention and ideally observes the agreement stipulated by other International bodies.

Attempts are being mounted towards monitoring and guarding against dumping of toxic and radioactive wastes in Kiribati waters. Regional commitment and cooperative involvement in safeguarding against ocean dumping of hazardous wastes is being sought to successfully accomplish the task. Lately, it has been possible to verify the presence of persistent organic pollutants with the assistance of regional organizations, the South Pacific Regional Environment Programme, for example. Areas where POPs are identified will cleared during the next phase of this programme.

5.1.6. Participation at Regional and International Conferences and Workshops.

As one of the media for the exchange of experiences, feelings and opinions there are quite a number of regional and international conferences and workshops in which Kiribati has actively participated. The advantages of participating n these views exchanging and sharing gatherings are significant and precious to the country concerned. Apart from gaining international recognition, attendance's at international meetings reveal the true manifestation of national commitment and interest in world affairs.

5.1.7. National Reports.

The great demand for country reports by Regional and International organizations is not unusual. In the event of convening International Conferences and World Summits, country reports containing progress in environmental management programmes contributes to a great part of the conferences agenda. Kiribati national reports on a variety of environmental topics have been prepared and presented on a number of occasions Reports, when well prepared are a powerful tool for presenting the actual situation of a subject in question. In many cases several country reports are compiled to produce a larger or cumbersome report that may represent information about regional activities.

This country report is a brief account of what has been achieved over a decade of implementing the agreements endorsed during a world conference in Rio de Janeiro in 1992. A reporting system becomes vital and fulfill its intended purpose as long as it is effectively managed.

5.2. Institutional Framework.

Notwithstanding the responsibility vested upon the Ministry of Environment to deal with environmental tasks, other government and non-governmental organizations accept a

certain responsible involvement in environmental management. It is an accepted fact that sustaining the environment is the concern of individual person who is conscious of the importance of a clean and wholesome environment in relation to the well being of people.

Several government administrative organizations exercise some form of commitment to the effective performance of functions related to environmental control. The immediate drawback that has been encountered is the overlap of functions when precise or specific responsibilities are not clearly defined.

Beginning with conservation of biodiversity, environment Impact Assessment, Waste and Pollution Control, Environment inspection, and overall management of environmental conditions, the Ministry of Environment and Social Development is solely responsible. The functional framework within the Ministry is designed in such a manner as to implement and discharge appropriate services in the most efficient and cost effective way.

Since a great deal of the expertise and professional know how is available in other ministries, it is desirable to utilize these resources to the best advantage; an example of this is the Ministry of Natural Resources which is allotted with the function of developing agricultural and fisheries programmes implying the restoration of marine stocks and terrestrial resources. Development of initiatives and their management in these fields of expertise is aptly persued. The policy is that specific personnel are allocated relevant responsibilities or duties that are consistent to their area of specialty.

Complaints related to pollution and waste disposal are lodged with the environment inspectors who will mount an investigation to assess the status of the complaint and devise appropriate actions to remedy the situation. One of the actions that can be taken is to advise the offender of the remedial works to be performed giving sufficient time for the task. Non compliance with the recommended actions will warrant the issue of a stop notice to stop all development until appropriate measures have been put in place to alleviate any further problems.

The task of controlling and managing pollution and nuisances associated with waste is vested with the Ministry of Environment. Policies dealing with persecution following violation of Environment laws are formulated and implemented by the small Ministry Involving communities in policy and planning formulation has been known to be quite effective when need arises for the involvement of community groups in implementation programmes.

5.2.1. Implementation.

Projects or initiative implementation is achieved through the unified efforts of a number or organizations and community bodies, under close supervision of competent personnel.

The majority of waste and pollution control programmes are planned and implemented by the staff of the Ministry of Environment and Social Development with assistance offered by smaller organizations. The involvement of subsidiary organizations considered as complementary or supportive to environmental control processes.

Implementations strategies are formulated using management techniques and tools. The incorporation of cultural, economical and social understanding of cultural norms and values are seemingly vital.

The financial component of the project is to be treated as a fundamental issue to be considered. The maintenance of pollution control cannot be undertaken unless a stable fiscal foundation is established. It is therefore an avenue worth exploring in the event of planning. Fortunately in most cases regional and international organizations generously contributed in this respect apart from providing consultation services and other in-kind assistance.

Minor Environmental programmes are carried out by Island Councils through women or youth groups organized by religious denominations. Replenishment of endangered species of plants and trees and the promotion of traditional methods of sustainable harvesting of natural resources are constantly taught during workshops and promotional meetings.

Voluntary work is usually the norm for executing environmental oriented initiatives. This type of communal engagement has been successfully initiated in other programmes. Catalyzing this movement is a properly designed community based promotional and awareness-raising actions. Incentives do not in any way have a long term effect hence they are not encouraged. Community involvement in a clean-up organized initiatives are seen as complimentary to the normal schedule adopted by the urban councils. Clearing of vacant lands can be done through this community involvement activity.

5.2.2. Legislative and Policy Platform.

Waste management and control is supported by legislative framework in such a way that activities related to waste and pollution control take place under prevailing difficult times. The need for application of laws arises when stringent actions are essential in order to evade conditions which may cause environmental damage. Laws are made handy as guidelines and they should only be used to as a means to handle complicated issues.
Policies guide actions in a manner so that they can be performed in a systematic way. Policy formulation is conveniently done on a political level. The most prominent policy which is kept in mind is that wastes should be stored, conveyed and disposed of in a manner that will not create immediate appreciable nuisances. The nuisances referred to are smell, fly breeding, water and air pollution including unsightly appearance. A prospective policy is perhaps one dealing with minimizing waste as far as practicable by means of processes such as reuse, recycle, reducing the bulk at the source and, by crushing or mechanical compaction at the dump site.

5.2.3. Administrative Authority.

Waste disposal in urban areas is administered by Urban Councils. The storage, collection, conveyance and ultimate disposal of domestic and commercial waste is regularly done by a team of council workers under supervision of a competent overseer. A nominal annual fee is payable by householders who compulsorily use the service. The

overall management of the operation is in the capable hands of the Ministry of Home Affairs and the Ministry of Environment.

5.2.4. Cooperation and Participation.

Eventhough the administrative responsibility is vested in the Urban councils, there are regions of operation that the council cannot undertake with available internal resources. To ensure the adequacy of such a service, assistance is offered by organizations in terms of manpower, equipment and expert consultation. The Ministry of Environment and the Ministry of Health are the main actors in this situation.

5.3. Capacity Building.

The development of human resources' knowledge and skill in the various areas of responsibility is a crucial component of waste management and pollution control scheme. Training of the Environment and Conservation Division staff is an ongoing process. The positive impact on the services performed is encouraging and commendable. The same programme is being instituted in other organizations with the aim of upgrading the capability of personnel who are constantly engaged in waste and pollution surveillance work.

Training opportunities are sought both within the country and overseas. Local training institutions are being established and manned by qualified technical and professional people to afford the necessary training of the work force.

5.3.1. Education and Training.

Supervisory training courses are offered at the Tarawa Technical Institute for supervisors of garbage collection services and those engaged in pollution control and abatement fields. Training requirements are identified and conveyed to training centres for planning and accomplishment. On the job training of workers engaged in waste collection can be done on a daily basis during working hours.

5.4. Information.

The value of genuine information with regard to managerial processes cannot be overemphasized. Information is an ingredient that is in great demand for the sake of decision making and policy formulation.

5.4.1. Collection

For the assessment of progress and other management activities, collection of valid information is a painstaking task. In spite of its usefulness it has to be done if rightful decisions are to be achieved. Acquiring information is possible by conducting researches or seeking information from other available local and overseas sources. The collection of information has been done on a number of occasions by uncountable number of people, organizations and research groups. Research surveys with the purpose of collecting information on waste and waste disposal have been carried out in the past.

5.4.2. Management

Information management framework for pollution and waste control programmes need development considerations in terms of manpower, equipment, and facilities. Although the level of managerial control of information is for the time being adequate, it requires immediate strengthening to cope with the pressing need to develop pollution control measures.

5.4.3. Availability

A vital ingredient of information management is that concerned with the dispersal of information when and where needed. The channels of communication within the information management framework has to be followed in order to acquire the necessary data and information. The procedure, though appears to be complex it can be simplified considerably through reorganization and improvement of the system. This task will be successfully addressed in a inter organizational effort.

5.4.4. Use for Decision Making

Primarily, information is used for decision making. Subsidiary uses of information are also to be accounted for. An important issue related to this is the quality of information, as regards its accuracy and the manner which it is acquired.

5.5. Research & Technology

Collecting data, processing it to give information and utilizing information to make logical conclusions, is what is required to develop and improve the manner in which pollution and waste disposal activities are performed.

5.5.1.Resources

A great deal of resources to institute research work has been realized and the demand for research undertakings is so great.

Human resource accounts for the first and foremost requirement among others such as time, equipment, financial, skill, and facilities.

5.5.2. Technology

Pollution and waste control lacks modern technology. The method employed in waste disposal systems is consistent with the financial resources of the implementing authorities, namely the urban councils. The waste disposal systems employ simple, durable machinery in order to minimize the capital cost of the operation. The waste disposal sites are managed and operated without suitable machinery. The system for waste disposal is operated using simple technology.
Pollution preventative measures are done in the absence of modern technology. The use of development control by the Environmental Impact Assessment section has a lot to contribute to the prevention of pollution attributable to development activities.

5.6 The Way Forward.

5.6.1. Overarching Constraints.

Progress is hindered in a variety of ways some of which are easy to overcome while others are not. Some of the constraints are listed as follows :-

- Cultural norms and practices whereby waste is to be discarded in a manner that will cause its disappearance, for example by burial or burning.
- Insufficient financial support.
- Shortage of essential manpower.
- Lack of essential skills and expertise.
- Insufficient land for waste disposal sites (refuse tips)
- Lack of resources (e.g. covering material for the waste dump.)
- Inadequate legislative framework to substantiate implementation and prosecution procedures.
- Lack of individual responsibility.
- Insufficient educational and awareness- raising in communities.
- Mismanagement of funds and misuse of equipment and facilities.
- Lack of vital resources e.g. sand for covering material in rubbish dumps.
- Inadequate supply of instrument and apparatus for sampling and testing of pollutants in air, water and soil.
- Limited legislative enforcement policies to regulate all aspects of waste disposal and pollution control.

5.6.2. National Specific.

- . Changing the traditional method of disposing wastes is a painstaking task that embodies constant and early age education of the community. It would in some respect entail education of this topic in primary schools and most probably in secondary schools.

- Notwithstanding the fact that traditional methods of refuse disposal are obstacles, public education on the best and most appropriate waste and pollution prevention methods have been launched through different channels.

- . The development of waste management options have to be made to keep abreast with the problems connected with the increasing amount of wastes and pollution as a result of urbanization and increasing population.

- . Providing the essential equipment for monitoring and detecting pollution is not comparatively considered as immediate need.

- Waste related problems do not attain high recognition in the minds of planners and decision makers. Pollution is regarded as a minor problem with insignificant detrimental consequences because of insufficient information to testify its critical entity.

5.6.3. Regional / International.

Regional waste and pollution projects are not allotted equal amounts for each country. Financial allocations are assessed after a number of considerations. In situations where insufficient funds have been allocated for a certain project, failure is often experienced.

Regional and International programmes are generally not effectively supervised because of traveling distances the supervisor has to travel to project areas.

Great expenses are incurred in order to cover the cost of travel, accommodation, allowances, and other incidental expenses.
Each country has different priority pattern and therefore the magnitude of involvement can also differ. In this situation regional programmes do not gain full national commitment and consequently do not achieve great success.

5.7. Recommendations.

. A well structured and designed national strategic plan for the implementation of waste disposal and pollution prevention and management programme should be drafted in consultation with the various actors and stakeholders including government ministries, private organizations and other community groups. A communal participation in this venture should be facilitated by means of a national workshop or other measures appropriate to the prevailing conditions. In the process, cultural representation and church denomination participation should be part of the task.

- . Financial commitment by the national government and other aid donors should be assured.
- . Human resources development in the field of waste and pollution management should be considered a priority.
- . Training of manpower must be afforded in management skills and financial control.
- . Studies should be mounted to discover ways of providing extra space for landfill sites. Land reclamation connected with waste disposal activities can be looked at as an alternative to inland controlled tipping sites.
- . Expansion of the present Environment Act and Regulations will provide for a thorough and more comprehensive control of waste and pollution.
- . Individual responsibility must be encouraged via educational programmes in individual homes.
- Programmes on public awareness should be strengthened and improved considering the provision of adequate funding and recruitment of extra manpower.

- Sufficient equipment should be provided and maintenance funds allocated in order to substantiate an attempt to maintain pollution monitoring schedule. Updating and expansion of Ordinances and Regulations that in one way or another cover some aspects of pollution and waste disposal for example, the Public Health Ordinance and Regulations.

6.0 Other Elements of Sustainable Development.

(Teakamatang Eritai)

6. Energy

This report is very much environmentally oriented revealing the actual struggle for the cheap form of energy supply.that can be provided for socio economic development. This means that the current high landed cost of petroleum and gas is posing unnecessary problems. Developments especially in the transport sectors and electricity generation are becoming unprofitable and uneconomical to maintain.

Renewable energy cannot provide the essential demand for power generation on South Tarawa and therefore it may well be viable to start introducing other forms of energy that can be produced using natural forces. Still diesel driven power generators dominate the power source because it is cheaper and locals have acquired the technical skills. For outer islands renewable energy is more practicable but to the extent of household basic consumption such as lighting and radio.One other noticeable change is that oil will be completely depleted within the next 40 years from now according to reliable sources.

On the other hand, going green is the best option but this is explicitly significant only in future say about more than 20 or 30 years from now based on the available energy resources that could be harnessed and the current renewable energy system innovations available in the world, lest we will not be underprivileged and deprived of the necessary developments before then.

6.1. Weather:

Though the Meteorological Service in Kiribati is accumulating climatic data there are gaps in the current observation facilities available. Since the withdrawal of the New Zealand Meteorological Service it has been very difficult to replace or get new instruments required for climate monitoring. The instruments currently in use are old and most of them need replacements. Donors provide technical assistance in terms of some instruments but once they break the recipient then struggles to get replacements. Sustainability is guaranteed if spares or parts are provided alongside the instruments themselves as technical repairs could be carried out locally.

To boost the capability of the meteorological services ability in monitoring climate additional sensors that monitor other parameters are required. Such sensors or instruments include Ozone, carbon dioxide, heat energy from the sun.. Rainfall recording and other weather data must be recorded by the meteorological Division.

Furthermore, the smaller and poorer island states are struggling to maintain instruments in running order. Kiribati Meteorological Service depends heavily on outside monetary support in the procurement of appropriate apparatus to effectively perform its primary task..

6.2. Natural Disaster:

"If an island is affected so badly by a hazard or unforseen situation, and the lives and/or safety of people, property and livelihood continue to be at risk, and they are unable to cope with their own resources, it is deemed to have suffered a disaster," defined the official source at The Ministry of Home Affairs and Rural Development. Washing away of coastlines of low and tiny islands by tidal waves can result in the destruction of human lives. This is true in some of the Pacific Island Countries including Kiribati, as their coral soils are not so compacted compared with other volcanic Pacific Islands. Their beaches are easily removed or washed away by the action of the sea.. Sometimes the sands are transported by coastal processes and may reshape or form other atolls. In December 2001 till early 2002 great westerly winds hit many islands of Kiribati causing channeling in some places. During such time solidly constructed causeway in Tarawa, Dai Nippon, was struck and partly damaged while others were flooded.
Factors contributing to coastal erosion categorized as natural disaster includes;

- poorly designed or constructed sea walls and causeways,
- reef blasting for boat channel construction,
- removing of beach and coral reef for any construction work etc.,
- removing of mangroves and coastal seaweed.

The protection of capital assets such as land and buildings from erosion will need to be weighed accordingly against the high costs of such protection. This is a significant concern in South Tarawa where more than one third of the population and greatest concentration of capital assets are situated.

There were copious of constraints identified to positively attack number of natural hazards as today better achievements had been encroaching toward them viz.; drought, epidemic, fire, coastal erosion, strong westerly wind, land and lagoon or ocean pollution, major accident (aircraft crash), tsunami and loss at sea.

Actually, they are minimized while the Agricultural Division together with The Foundation of The People of The South Pacific (FSP) and many others are promoting, maintaining and improving successive techniques on farming. The patrol boat (Te Anoai) donated from the Government of Australia and other boats just built from abroad for Kiribati are assisting in evacuating victims of the sea.

The brand new and well-equipped hospital with its Nursing School located at Nawerewere donated and constructed by Japan through Dai Nippon Construction or well-trained local therapists from overseas institutions, wider extension of education through Junior Secondary Schools built by Australia and the Government of Kiribati and in addition fire trucks to the Fire Department all help alleviating such hazards.

Paving the run-way and renovations of the Bonriki International Airport by The People of The Republic of China, the new reclaimed wharf with all its premises and machinery at the main Seaport at Betio constructed by Dai Nippon from Japan, a new plane designed and built from the United States of America serving the islands, improvements of a sole Fishing Company of Kiribati (Te Mautari) on Tarawa and on the outer islands funded by the Government of Japan also reduces such constraints.

For the elimination of future constraints, a proposed National Disaster Management Plan which was prepared by the Police Department and National Disaster Council in 1991 had been replaced and currently reorganized by The Ministry of Home Affairs and Rural Development since 1993. The Task Force was established to urgently assist affected areas at any time. Such council has been renamed The National Disaster Management Council.

The National Disaster Management Plan is effective by virtue of the 1993 National Disaster Act. The Ministry of Home Affairs and Rural Development has the overall responsibility for an effective national disaster management strategy covering prevention, mitigation, preparedness, emergency operations, relief and rehabilitation. Such responsibilities are in no way absolve other government agencies of their responsibilities for disaster management activities peculiar to their everyday role, but under the new organization, coordination is to be effected between the appropriate agencies through the National Disaster Management Council and its related bodies.

The National Disaster Management Council Working Group consist senior level officer representing the following agencies;

- Senior Assistant Secretary (MHARD) - chairperson
- Superintendent of Police - Vice chairman
- Senior Economist (MFEP)
- Mineral Officer (MNRD)
- Environmental Officer (MESD)
- Director of Health (MHFP)
- Civil Engineer Public Works Division (MWE)
- Water Engineer Water Unit (MWE)
- Senior Education Officer (METT)
- Marine Superintendent (MICT)
- Chairperson Kiribati Association of NGO's
- Secretary General Kiribati Red Cross Society.

The NGOs will elect five representatives to the National Disaster Council one each from the Red Cross, Scouts, Girl Guides, Kiribati Council of Churches and Kiribati Association of NGO's (KANGO) who will report back to all NGOs.

Ministries of the Government of Kiribati with other private sectors and NGO's are agencies of the National Disaster Management Council with respective responsibilities. Below are some of the ministries and private sectors with their specified and required roles as gathered from *National Disaster Management Plan 2002*;

- The Ministry of Finance and Economic Planning is responsible for preparing efficient financial guidelines and procedures for the National Disaster Council and for Ministries in times of disaster, securing funds to supplement the Disaster Fund when a disaster occurs, maintaining accounting for and reporting on the Disaster Fund and meeting charges for using of commercial resources used in emergency and relief operations.

- The Ministry of Works and Energy is responsible for mitigation - building codes to be publicized, organizing land transport for disaster relief operations, maintaining and restoring power and water supplies, provide emergency power to hospital, radio station, National and Island Operational Centers, coordination of the clean up operation needed after a disaster and arranging surveys for damaged structures and demolition when there is danger to the general public.
- The Ministry of Health and Family Planning is responsible for conducting health education awareness to the public by doing workshops and voicing it out through Radio and newspaper, making arrangements for the treatment and hospitalization of injured and sick disaster victims, registration of dead and injured victims as well as supervision of burials.
- The Ministry of Education Training and Technology is responsible for disaster awareness to be included in the school curricula and providing suitable school buildings as emergency disaster relief centres.
- The Ministry of Foreign Affairs is responsible for seeking and coordinating overseas aid as directed by the Beretitenti through the Cabinet, providing the Cabinet with information on overseas offers of assistance and on the details of assistance being provided, and coordinating all measures and information concerning foreign nationals affected by the disaster.
- The Ministry of Information Communication and Transport is responsible for providing warning of storms, strong winds etc, likely to cause disaster, maintaining and restoring telecommunications service within Kiribati and with the outside world, providing emergency communications for Emergency Operations Centers and portable communications to other response agencies as required, and organizing land, sea and air transport for disaster relief operations.
- The Kiribati Broadcasting and Publication is responsible for broadcasting warnings of forecast conditions that may cause disasters, arranging to remain open and broadcasting throughout any threat period, broadcasting public information in the post-disaster period, and staff for the Public Information Unit at the National Emergency Operations Centers.
- The Ministry of Environment and Social Development is responsible for provision of weather forecasts and warnings to the public, coordinating the provision of emergency food supplies and aid in kind from within the country and arranging surveys of damaged crops and assessing recovery potentials.
- The Ministry of Natural Resources and Development is responsible for arranging surveys of affected crops and animals due to insect pests and diseases and prevention measures, providing relevant information on plant and animal pests and disease and prevention measures, providing relevant information on plant and animal husbandry related to Kiribati conditions, relevant information on marine pollution and prevention measures and relevant information on coastal erosion plus its causes and prevention measures.
- The Ministry of Labor Employment and Cooperatives is responsible for advising Island Cooperative Societies to provide assistance to Island Disaster Committee in the provision of transport and to provide assistance in the provision of food supplies to the victims.

- The Police Force is responsible for providing first aid, food, water and shelter, support in the management and operation of emergency centers, gathering information and reporting, cleaning up, pastoral care and counseling of victims, advocacy, seeking overseas assistance through international NGO's channels such as World Council of Churches, International Federation of Red Cross and Red Crescent Societies.

During emergencies, the National Emergency Operations Center will be activated to coordinate the activities of disaster monitoring, warning and immediate post-disaster response including emergency relief work. The center at the Police Headquarters, Betio or, at the Telecommunication Headquarters will consist of an Operation Unit to display locations of the disaster area, personnel, officers from relevant agencies etc., a Conference Room; a Communication Unit with radio communications circuits to disaster affected area(s) and deployed manpower, telex and facsimile with international access etc., a Public Information Unit for collection and provision of disaster information for the public and the media or coordination and cooperation with the media and etc.

There are 4 Stages of Counter-Disaster Operations with their respective responsibilities viz;

- Preparedness: This consists of measures which are maintained continuously, so that response to any disaster situation can be made effectively; maintaining the viability of plans and resources, developing necessary levels of public awareness and carrying out training. The chairperson of such council (NDMC) is responsible for the overall direction of the necessary preparedness measures.
- Watch: Whenever signals are introduced which indicates that there are NDMPs to be carried out soon by the members of the council - who had been on the alert as been told as their role wherever they are, they are to avail themselves to whatever directives until the watch is ended.
- Standby: This consists of all council members to draw closer to any means of communication so the chairman may contact them at any time needed in case he needs to call a meeting for any existing threat.
- Operations: This only activated if the disaster event is eminent or a plane crash has occurred. Emergency operations included in this stage and varies in duration, and it is advised that it be kept shorter as possible so it returns to its normal schedule as soon as possible.

6.3. Post Disaster Review

The post-disaster review will cover the following aspects:

- status of plans and preparedness pre-disaster
- effectiveness of communications
- origins, transmission, receipt, processing dissemination and action regarding
- activation and effectiveness of NEOC.
- effectiveness of operations carried out
- emergency feeding, shelter and welfare arrangements.
- External support

- assessment of public awareness programs
- training lessons
- initial recovery indicators.

The National Disaster Management Plan has a wider scope of plan as it addresses disaster mitigation and rehabilitation after disasters, establishes the mechanism for International assistance and Damage Assessment and detail organizational roles and responsibilities. It also provides greater autonomy for Island Disaster Officers (the Clerks to the 22 islands with Island Councils) allowing them maximum flexibility in activating emergency operations and the selection and composition of their own Disaster Management Councils. In the case of Kiritimati Island the Assistant Secretary within the Ministry of Lines and Phoenix Group. It is in the best interest of the nation that maximum use be made of all Agencies, including Provincial and Advisory Councils and the Non-Governmental Organizations.

However, the above appropriate assistance is still inactive because of the unavailability of designated machinery to assist carry out the task at the time such hazards and disasters or emergencies take place. Hopefully, the Disaster Fund will meet all operational costs regardless what and would ensmoothen to recover whatever disaster or damages introduced; but doubtful that the physical machinery is pre-insufficient and would hamper the Disaster Working Management Council Working Committee and Working Group. Actually, money together with the work force without any designated and appropriate machinery to repair what the disaster has done will not accomplish the goal of the Disaster Task Force.

Therefore, it is highly recommended that appropriate machinery must be added to The Ministry of Works and Energy through its division Kiribati Plant and Vehicle Unit to alleviate the demands of the public at large in regard to such machinery. Sometimes the present machinery is hired for extended periods at time for some urgent needs of the government and therefore can not make it to its assigned purposes as expected. A number of the needed machinery listed below are locally repairable by local;

- loader (Komatsu Wheel loader. Model WA180-3)
- backhoe (Komatsu Wheel Hydrolic Excavator. Model BW100-3)
- cement mixer (Concrete Mixer powered by 9hp lompartini air cool diesel engine. Model 15LD315)
- tipper truck (7 tonnes)

6.4. Land and Population:

Land is valuable in Kiribati since our ancestor acquired them by brutal fighting and shedding of blood. In addition, the population of Kiribati is rapidly growing while the lands is diminishing. The land plots are getting smaller in size as it is reshuffled among family members.

The Kiribati census in the year 2000 reveals that the population was 84,494 and in 1995 it was 77,658. This gives an increase of 6,836 or about 13% within five years, or more than 1,368 people each added to the population of Kiribati within such period. Foreseeing a tiny island floating in the pacific basin with its coast washed out little by little by nature

and with a tremendous growth of population, the future for the I-Kiribati is bleak. This is compounded by the evacuation of families from their lands by government, leaving many with no place to go. Kiribati and its neighbor island countries must send their signals (SOS) before it is too late to beg for mercy while seeing themselves with such condition.

One of the main factors that must be kept in mind is the impact of population growth and rapid urbanization on the environment. One third of the population of Kiribati, 36, 717 living on South Tarawa create conditions leading to overcrowding, unemployment, poverty, child labour and housing shortages. Child abuse is highly identified as one of the worst problems connected to urban living .This has been shown in the record kept by The Ministry of Health and Family Planning. four child abuses were recorded in the year 2001 and ten within the first four months of 2002. These social problems are most evident on Betio, an Urban center in Kiribati with its shops, bars, restaurants and other attractions. Tarawa, has a population density of about 7,000 people per square kilometer in 2002 while 6,194 in 1995.

Therefore, the Government of Kiribati may need to consider population growth as an issue of major concern. With the current rate of population growth, population policies focusing on fertility reduction through family planning might be regarded as top priority as well as continued population resettlement to the less populated areas of Kiribati.

On the other hand, there is a need to improve the awareness, knowledge, acceptability, accessibility, availability and degree of satisfaction of family planning methods and services especially amongst young men and women of childbearing age and adolescents, in order to raise the level of contraceptive usage. This would involve widespread information and counseling services through schools, radio, booklets, newspaper, community and health workers etc.

The urbanization of South Tarawa with its distribution imbalance has led to increasing pressure on the environment to absolve the impact of a rising population, and the lack of suitable land have led to illegal land settlements that have encroached onto water reserves and resulted in contamination of the groundwater by animal and human waste. Accommodating the estimated rise population is clearly a difficult task when considering the lack of available land due to finite supply, land fragmentation, land tenure arrangements and etc. Similarly, the pressure of the population on the fish and marine stocks of the lagoon and in combination with reduced recruitment because of causeway construction and channel reef blasting are adversely affecting the capacity of the resource to supply food for the rising population. The more the population in Kiribati is the more the problems to the environment.

The population of Kiribati has steadily increased since 1930s when the first census was conducted. With a population of just 30,000 people in 1931, almost 52,000 people in 1973, and 77,658 people in 1995, and 84,494 people in 2000, the Kiribati people may tripled in 70 years.

More than 36% of the population of Kiribati lived in South Tarawa in 1995. Its population has increased rapid ly, from 21,393 in 1985 to 25,380 in 1990 to 28,350 in 1995 and to 36,717 this year, 2000. In 1995 the population declined in seven of the Gilbert Groups (viz., Marakei, Maiana, Kuria, Beru, Onotoa, Tamana, and Arorae). These same islands continue to decline during the 2000 Census, plus another ten (Banaba, Makin, Butaritari, Abaiang, North Tarawa, Abemama, Aranuka, Tabnorth, Tabsouth and Nikunau) which are overpopulating South Tarawa.

The small population size of many outer islands makes the establishment of services of any kind expensive and cost-ineffective. Health service can only be delivered at a very basic level (dispensaries, etc.), and is not of the same quality as that in the urban center of e.g. South Tarawa. Provisions need to be put in place to allow transport to South Tarawa's main hospital for all medical emergencies.

Lifetime migration from the outer islands to South Tarawa is very high. The reason might be lack of schooling and employment opportunities on the outer islands; and a higher living standard, the availability and accessibility of services such as medical and educational institutions, entertainment facilities and, of course, a wider range of employment opportunities in South Tarawa

If the Government wishes to stop or reverse this trend, at least some of the disadvantages of living on the outer islands have to be eased by improving the above mentioned services. Such trend assisted by the Junior Secondary Schools, the Village Bank and etc, launched out to the outer islands.

A population's level of formal education is a key indicator of the development and quality of life . Education is a factor in the development of well being through its links with demographic, as well as economic and social factors. There is a close and complex relationship among education, fertility, morbidity, mortality and mobility. When mothers are better educated, they tend to have fewer children, and their children's health status improve. This will improve their survival rate as well.

School attendance is compulsory in Kiribati from grade 1 until grade 9 (ages 6 to 15) to complete primary education. In 1995, there were 85 primary schools and 10 schools for secondary education. Furthermore, there is the Tarawa Teachers College, the Tarawa Technical Institute, the Marine Training School (MTC) and the Kiribati Nursing School.

Overcrowded living conditions not only mean more stress on the environment but also - and perhaps more importantly - more mental stress for the people themselves. In this regard the Kiribati Government may wish to continue with its resettlement program, especially if it is well received by the people of South Tarawa.

In 1989, the government set up a resettlement program of people from South Tarawa to two islands in the Northern Line Islands Group (Teeraina and Tabuaeran). The impact of this program can be seen from their high growth rates between 1985 and 1990 (Teeraina 451 people in 1985 and 936 in 1990, Tabuaeran 445 in 1985 and 1,309 in 1990). This program was established in order to ease the population pressure in the Gilberts Group. This program, however, has been abolished as the government has decided to reserve these 2 islands for the development of tourism these days future.

Copra cutters just sent to Orona Island under a new Economic Development Project are harvesting existing resources to strengthen the economic base of this country. Environmental conditions will continue to deteriorate on Betio, and to be pessimistic, South Tarawa..Unless steps are taken to curb these approaching situations, Kiribati as a whole, will in future be affected by the consequences of inefficient planning. Long term planning is the answer and the immediate solution to the problem.. The Ministry of Environment and Social Development together with other ministries and community groups are still conscious of their responsibilities in maintaining and promoting the importance of the environment in Kiribati. They also investigate priority ranges at large measures.

Appendix 1

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Bibliography

1. Adams C.R.1977. Appraising Information Needs of Decision Makers. Jossey-Bass Inc. San Francisco. USA

2. Beenna, T.I. 1992 *Soil fertility evaluation of Aranuka soil of the Republic of Kiribati* USPSOA, Alafua Campus, Apia, Samoa

3. Burns.T. et al.2000. *Management of Persistent Organic Pollutants*. SPREP Apia, Samoa.

.4.. Ching. M. (ed) 1994. *Pacific Regional Programme*. UNDP, Suva , Fiji.

5, Connel. J. and Lea.J. 1993. *Planning the Future Melanesian Cities in 2010.* Australian National university. Australia

6 Hunter, D.J. and Tuivalangi, N. S. 1998. *Effect of Organic Matter and Frequent Fertilizer Application on Tomato Production.* JOSPA. USPSOA, IRETA Alafua Campus. Apia, Samoa

7. International Maritime Organization, *Final Act of Intergovernmental Conference on the Convention on the Dumping of Waste at Sea.*. IMO.

8. Izmerov. N. 1971. *Control of Air Pollution in the USSR.* W.H.O, Geneva. Switzerland

9. John Campbell and Neil De Wet, 1999. Incorporating Climate Change Adaptation into Development Activities, SPREP

10. Leatherman, S.P(ed)1997. *Island States at Risk*. Florida International University of Florida, USA.

11. Miles.G. 1998. *Pacific Islands Environment Outlook* Earthscan Publication Ltd.

12. Ministry of Environment, 2000. *Environmental Act*, Kiribati Government.

13. Pulea, M.& Farrier, D.1994. *Environmental Legislation Review*. SPREP, Apia, Samoa.

14. Raynor,B. 1992. *Multi-purpose Trees for Atolls*. USPSOA, IRETA, Alafua Campus, Apia, Samoa.

15. SPREP 1999 *Action Strategy for Nature Conservation*. SPREP Apia Samoa.

16. SPREP, 1999. *Guidelines for Municipal Solid Waste Management Planning in Small Pacific Island States.* SPREP, Apia Samoa.

17. Tenang, M. 2000. *Annual Report*. Agriculture Division, MNRD

18. UNEP,1994, *The Pollution of Lakes and Reservoir*. UNEP Nairobi Kenya Africa.

19. U.S Environmental Protection Agency. 1975, Manual of Individual Water Supply Systems , EPA, Washington D. C , U.S. A.

20. Wagner, E. and Lanoix. J. 1958. *Excreta disposal for Rural Areas and Small Communities.* World Health Organization, Geneva, Switzerland.

21. Watson R. T et al 1998. The Regional Impact of Climate Change – Summary for Policy Makers: An Assessment of Vulnerability, Cambridge University Press

22. W.H.O, 1987, *Nuclear Power Accidental Releases*. W.H.O , Geneva. Switzerland.

23. Wilson, C. K1994. *Kiribati: State of the Environment Report*. SPREP, Apia Samoa