Nauru
Country Briefing Paper

Republic of Nauru

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High Level Consultation Meeting
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"From Vision to Action:
Towards Sustainable Water Resources Management
In the Pacific"

"Everything originated in water,
Everything is sustained by water"

Goethe

ACKNOWLEDGEMENT

Apart from various reports and articles written in recent past on the Water resource of Nauru, most of the current and updated information in this report was extracted and compiled from the Mission report of Dr. Ian Wallis of the World Health Organization. In collaboration with the Ministry of Heath and the Nauru Phosphate Corporation (NPC) Dr. Wallis visited Nauru from May to September 2001 to undertake a consultancy work in accordance with the following terms of reference:

1. Assess the present water supply arrangements, policies and procedures for providing potable water to the people of Nauru.
2. Assess existing systems for production, storage and delivery of water and provide recommendations for their improvement.
3. Determine future needs for a reliable backup supply of potable water in the event of a future water shortage.
4. Recommend various technical options for a reliable future water supply.
5. Formulate a plan of action in consultation with the relevant Ministries.
6. Begin drafting proposals for technical assistance from donor agencies and for possible bilateral support.
7. Submit a report at the end of the assignment.

In September 2001 a 2nd visit resulted in the successful formulation of the 1st draft of the Nauru Long Term Water Plan. A number of stakeholders were consulted including the successful outcome of a workshop held during the visit whereby it was decided to undertake further consultation with the government and the community of Nauru.

Other national, regional and international organizations that have provided Nauru with the required information on water resources included Nauru Rehabilitation Corporation, Nauru Phosphate Corporation, Department of Economic Development, the South Pacific Applied Geoscience Commission, South Pacific Regional Environment Programme, University of the South Pacific, World Health Organization, AusAID, ADB, GEF/UNDP, to name a few.

It is hoped that the relentless efforts provided by these organizations can now become a reality through action plans to sustain the water sector at the national, regional and international level. The government of the Republic of Nauru acknowledges and expressed its appreciation to all who have made these efforts to ensure that as a Small Island State the sustainable use and conservation of our water supply is adequate for all generations to come.

Introduction

All life would cease without water. Man is two-thirds water while the surface of the globe is seventh tenths water and yet men and animal still die of thirst, plants whither and desert increase. [1] For small islands they are especially vulnerable without water to a changing physical, technological and cultural environment. To understand more about the water situation in a small island state as Nauru it is best to provide a firsthand geographical account.

The Republic of Nauru is an isolated, uplifted limestone island located 41 km south of the equator at 0^o 32' S. latitude and 166^o 56' E. longitude. The total land area of Nauru is only 22 km^2 (2,200 ha). The island is surrounded by a fringing coral reef between 120 and 300 metres wide. The reef drops away sharply on the seaward edge, at an angle of about 40^o, to a depth of about 4000 metres. The land area consists of a narrow coastal plain or "Bottomside", ranging from 100 to 300m wide, which encircles a limestone escarpment rising some 30 m to a central plateau, known locally as "Topside".

The coastal plain is comprised of a zone of sandy or rocky beach on the seaward edge, a beach ridge or foredune, behind which are either relatively flat ground or, in some places, low-lying depressions or small lagoons filled by brackish water where the surface level is below the water table (freshwater lens). The most extensive system of these landlocked lagoons is found near the border of Ijuw and Anabar Districts. Scattered limestone outcrops or pinnacles can also be found on both the coastal plain and on the intertidal flats of the fringing reef, with particularly good examples in the Anibare Bay area.

The escarpment ranges in gradient from vertical cliffs to gradually-sloping areas of colluvial soil (deposits that accumulate on and at the base of slopes as a result of movement by gravity) interspersed with limestone outcrops and pinnacles.

The raised central plateau or Topside consists of a matrix of coral-limestone pinnacles and limestone outcrops, between which lie extensive deposits of soil and high-

[1] Man and Environment, Arvill, R. 1971

grade tricalcic phosphate rock (Tyrer 1963, Viviani 1970) [2]. This area covers approximately 16,000 ha (over 70% of the island) and has been the focus of phosphate mining for over 80 years. Relative elevations on Topside vary generally between 20 and 45m above sea level, with occasional pinnacle outcrops reaching elevation of 50 to a maximum of 70m above sea level. The topography remaining after completion of primary phosphate mining is a pinnacle and pit relief varying between 2 and 10 metres from the top of the pinnacles to the bottom of the pits. The highest point on the island is Command Ridge in the west at an elevation of 71m above sea level.

Buada Lagoon, a landlocked, slightly brackish, freshwater lake, and its associated fertile depression (about 12 ha in area), is located in the low-lying southwest-central portion of the island at an elevation of about 5 m above sea level.

Apart from Buada Lagoon, there are no surface freshwater resources on Nauru, although there are a few brackish ponds near the base of the escarpment, especially on the northeast of the island in Ijuw and Anabar Districts, and an underground lake in Moqua Cave in the southeast (Viviani 1970). The only significant permanent freshwater resource is groundwater in the form of a "lens" of often slightly brackish freshwater, hydrostatically "floating" on higher density saltwater beneath it. The height of the freshwater lens above sea level and the level of salinity vary in relation to the elevation, geology, texture and shape of the island, and with the amount of water use and rainfall.

A Hydrological study of Nauru was undertaken for the Commission of Inquiry in 1988 (Jacobson and Hill 1988). This indicated that groundwater exists in the form of a layer (head) averaging 4 to 5 m thick (above sea level), with the lens being particularly well-developed in the north-central and south-central parts of the island. Beneath the upper layer or head the water becomes increasingly brackish with depth until it meets salt water at 80 m below sea level. Replenishment or recharge of the freshwater lens is dependent on rainfall. A first approximation of the average groundwater recharge for Nauru is 800 mm per year (based on the following figures: rainfall (2000 mm) - evapotranspiration (1200 mm) = groundwater recharge (800 mm).

[2] National Environment Management Strategy, 1999

Groundwater on the bottomside is tapped by several hundred wells, about one-third of which exceed the W.H.O. recommended limit of 1500 mg/l Total Dissolved Solids. Groundwater under the topside area has been mathematically modelled, with the result that a sustainable bore field could comprise 4 bores at 1 km centres producing 1 litre/second and 4 bores at 1 km centres producing 2 l/second. Alternatively, bores could be spaced closer together but produce less water flow.

Jacobson and Hill (1988) also concluded that the collection and storage of rainwater should be a top priority. Long term potential threats to the quality of the groundwater resource included contamination by cadmium, rubbish dump leachate and sewage. The brackish ground water from wells used as an alternative supply has high coliforms and high dissolved solids and the brackish ground water is not suitable as a potable supply. It was also found that increased extraction of ground water from wells around the perimeter of the island could lead to sea water intrusion as well as threatening the supply of freshwater to the roots of coastal plants.

Rainfall

Nauru is located in the dry belt of the equatorial oceanic zone, with diurnal temperatures ranging from 26^{o}C to 35^{o}C, and nocturnal temperatures between 22^{o}C and 28^{o}C. Annual rainfall is extremely variable, averaging 2126 mm per year (data from 77 years between 1916 and 1993) with a range of 280 to 4590 mm. Monthly rainfall data available for the period 1977 to 1993 indicate a range of 0 to 746 mm, with 62 months out of 204 months (for which data were available) having less than 100 mm of rain. Rain tends to be more frequent during the months of December to April (data from Davey 1966 and NPC Analytical Laboratory Reports). Prolonged droughts are common (approx. every 9 years) and place severe stress on even the most hardy coastal strand species, lead to the death of non-coastal exotics (such as breadfruit), and severely restrict the production of even coconut palms. For example, in 1917 and 1918, when only 465 and 483 mm of rain fell, "thousands of coconuts and other fruit trees died" (Griffiths 1923).

Until a comprehensive hydrological study is undertaken it is not known whether the ground water lens beneath topside can supply water reliably or not particularly during prolonged

droughts. The wind direction during the drier months from May to November is generally from the easterly sector at speeds of 5 to 10 knots, and during the wetter months from December to April is generally from the westerly sector at speeds of 10 to 18 knots. During squally weather wind speeds of up to 30 to 35 knots have been recorded. Nauru does not experience tropical cyclones.

Desalination Plant

A modern desalination plant has been commissioned by NPC, using the waste heat generated from the power station. This is the island's current supply of water which is delivered in tank-trucks to individual household and other storage tanks via road transport. Storage facilities for potable water are restricted to household and institutional storage tanks, because the extreme porosity of the soil and bedrock rules out the easy construction of dams or reservoirs.

The plant supplies 950t/d of high quality potable water and the rest came from rainwater and brackish well water. Based on NPC available records for the dry period of 1998/2001 a total of 950t/d was supplied to residential, institutions, hotels and other buildings and settlements. When the plant is not in operation due to maintenance, which could take 1-2 weeks twice a year, the island faces a severe water shortage.

Current Situation

Last year in 2001, through the Ministry of Health, Nauru requested the WHO for technical assistance to provide advice to government agencies in order for government to make informed decision on a plan for future water supply. At that time the island was facing a critical water shortage particularly as there had been a three year drought since 1998 and there was very little stored water and the desalination plant had constantly stopped operation for sometime to undergo emergency repair. It was at this time also that the government had informed the public and the international community that there was a national emergency crisis on water shortage and technical assistance was urgently required.

In May 2001 the World Health Organization undertook its 1st phase of the consultancy process with various government departments and institutions and the following assessment was reported: [3]

1. Present potable water is supplied through the operation of the NPC desalination plant in conjunction with the power station. Additional potable water is captured by houses that have gutters and rainwater storage tanks in good operating condition.

2. The total water demand in Nauru was estimated to be 1,500 t/d of potable water and 1,000 t/d of non-potable water. The present supply of potable water by the desalination plant and rainwater collection can meet this demand in wet years but not in low rainfall years or at times when the plant is not in operation.

3. An emergency backup supply of potable water is required during periodic droughts, which from rainfall records, occurs about every nine years. A storage volume of 30,000t is recommended, sufficient for 20 days.

4. The existing desalination plant can produce 950 t/d of potable water. However it was estimated that an additional 550 t/d is required to meet the total demand of 1,500t/d. The potential supply options that were identified are
    - ?? Additional desalination plant;
    - ?? Collection and storage of rainwater; and
    - ?? Extraction from the fresh surface layer of the ground water.

    Conservation of water is a crucial issue that needs to be tackled with any of the options or combinations of all.

5. There is little information available on the safe yield or quality of the ground water but estimates developed indicated that the yield may be up to 850t/d in most years. However in a prolonged drought the safe yield would be less and could even be below 500t/d. Hence groundwater is not yet confirmed as a reliable long

[3] WHO Mission report to Nauru on Water Plan, Dr. I. Wallis

term potable water source.

6. In September 2001, the 2nd phase of the WHO consultancy was to organize and conduct a national workshop based on the 1st phase of the state of the water situation report in order to develop a National Water Plan. The list of those in attendance as well as those who were consulted is appended as Annex 1. The first draft of the National Water Plan has been successfully developed but yet to be reviewed and commented on by the participants prior to submission to the government for endorsement.

VISIONS, ISSUES AND CONSTRAINTS

7. Much of the water shortage in Nauru is due to, or accentuated by, faulty management. Unless effective action is taken soon to conserve water and improve water supplies the years ahead will soon be dominated by recurring droughts. Nauru's national vision towards a sustainable water resource management is still in its developmental stage but based on the outcome of the national workshop on the Long Term Water Plan for Nauru that was held on 28th September 2001 it was found that there are pertinent issues that would need to be addressed.

8. ISSUES AND CONSTRAINTS

?? Nauru is facing economic difficulty and with the increased diesel costs to maintain and operate the power station it is becoming extremely difficult to produce the expected water supply on a daily basis.
?? With the lack of good soil and available water supply planting of food crops after the rehabilitation of the mined out areas would be a problem and it would be necessary to look into the use of effluent from sewage treatment or grey water for use in agriculture.
?? Contamination of brackish ground water by waste water from household cesspit is an issue of concern and the need to replace the cesspit with appropriate septic tanks with properly designed infiltration beds.

?? There is a concern with the potential pollution of the fresh ground water at topside including the intensive temporary housing provided for the refugees. Grey water (from showers, laundries and kitchen areas) are collected and pumped on the ground adjacent to the camps and into crevices well below the elevation of the camp.

?? The current discharge of the sewage and septic contaminants from holding tanks, cesspits and other pollutants onto the coastal reef without treatment is a concern about the environmental damage resulting from the discharge of the wastes.

?? Most of the household water tanks are badly in need of repair due to corrosives from sea water. The lack or reduced of household income to maintain and/or purchase new water tanks has been a constant burden for most families.

?? Nearly half of the household gutters are in need of repair and maintenance for water collection during the wet season.

9. OBJECTIVES

During the consultative process the following objectives were generally agreed based on the above issues:

?? To provide safe potable water to the residence of Nauru.

?? To ensure water is accessible to all and that the water supply is sustainable in perpetuity.

?? To provide an adequate amount of water for the needs of all residents;

?? To ensure there is efficient distribution of water.

?? To ensure there is a reliable water supply even during prolonged droughts.

?? To safeguard the environment and ecology of Nauru

?? To ensure there is potable water supply affordable to all residents.

?? To make best use of existing resources, facilities and skills.

?? To conserve resources and energy.

?? To provide a culturally acceptable water system.

10. ACTIONS ALREADY UNDERTAKEN

?? Consultation meetings with various stakeholders to draft a National Strategy for Long Term Water Supply for Nauru.
?? Public Awareness through the media on water conservation;
?? Data collection on water quantity/quality, water use, charges, distribution and other relevant information for inclusion into the GIS.
?? Installation of a 950t/d multi-effect desalination plant using waste heat from the diesel power plant and a 120t/d desalinator at the Menen hotel.

11. FUTURE ACTIONS

At the national level the following activities have been proposed which are subject to the available technology transfer, expertise and funding.

?? Finalize the draft Water Plan for 2002 including action plans to implement the various components of the Plan.
?? Advise arrangement of an underground gallery which would allow extraction of water from the ground water lens without the risk of over pumping.
?? Install ground water monitoring wells at various locations at suspected land fill sites for leachate migration.
?? Conduct a thorough study of ground water to establish the safe yield during droughts, water quality and safe yield of brackish ground water around the perimeter of the island.
?? Provide drinking water coolers at schools as part of the healthy island campaign.
?? Clean, line and seal existing tanks for emergency water storage.
?? Feasibility study to replace the existing desalination plant at the end of its service life with one using renewal energy.
?? Consider the installation of a waste and sewage treatment plant.
?? Establish a water conservation program in schools as well as for public awareness.
?? Seek donor or bilateral funding assistance in the equipment purchases to implement the water strategy.

?? Provide a feasibility study for a possible rainwater collection system for the airport.
?? Examine household scale desalination systems as well as repair the roof gutters and water tanks.
?? Generate funds for water activities to be self-sufficient through realistic water charges.

At the regional level the following actions would be required

?? Provide technical assistance and advice on the best available appropriate technology for expanding water supply and distribution system with respect to the Nauru Water Plan.
?? Facilitate with regional training workshops on water resource management and awareness including provision of materials, illustrations, information on water.
?? Assistance with some of the national action plans to implement the Long term National strategy for Water Supply such as water conservation, water charges and funding, existing desalination plant, new desalination plant, rainwater collection at households, rainwater collection at airport, water storage, ground water development study, monitoring and data collection, waste water and contamination prevention scheme, etc.

At the international level the following actions would be expected:

?? Funding from donor agencies to be available either at bi-lateral or multilateral level for multi-purpose water supply development projects.
?? More involvement of international agencies and UN support for the water problems of small island states.
?? International Cooperation is required and a call for Action by the international community especially the developed countries to assist the plight of small island states that they are more vulnerable to climate change in the wake of increasing seasonal droughts and desertification.
?? That long term programme for research by should be undertaken to

12. MEANS OF IMPLEMENTATION AND RESPONSIBILITIES

For Nauru the overall management for the supply of water resources would normally be provided by the following institutions in accordance to their respective roles:

?? The Nauru Phosphate Corporation (NPC) for the establishment and maintenance of the desalination plant and reticulated system including sewage treatment;
?? The Nauru Works & Community Services for the distribution of the water supply to all Nauruan residents and facilities including maintenance of household gutters and sewage collection and disposal;
?? The Department of Health for quality check of the water supply and sanitation;
?? The Departments of Education for devising an educational program for the school curriculum on water conservation and public awareness;
?? The Nauru Rehabilitation Corporation and NPC for data collection and surveys to be undertaken on water wells and underground water quality and aquifers.
?? The Department of Economic Development for coordination of activities with different stakeholders on water management and conservation including undertaking feasibility studies for water supply options with regional and international organizations.

At the regional and International level, SOPAC, SPC, World Health Organization, ADB, GEF, WMO, AusAID, and other relevant organisations could assist with the technical and funding assistance. Policies for the conservation, supply and wise use of water are required at all levels- be it national, regional and international but as long as effective measures are in place for their implementation.

13. CONCLUSION

In concluding Nauru, including other small island states, continually faces critical water shortage. With the global trends for unpredictable climate change and periodic droughts as well as a rising population growth and higher living standards, Nauru's dependence on its only desalination plant will not meet the expected water demand during the critical low rainfall years. The purity and quality now expected of water are higher and its range of uses for hygiene and for sanitation increases daily.

Much of the shortage was due to faulty management. Unless effective action is soon taken to conserve and improve water supplies the island will still face future droughts. This has been evident when it faced a water shortage crisis and had to declare a national emergency due to the 3 year drought experienced in 1998/2001. Every drought period had resulted in ill-health; hygiene problem, hunger and thirst, unproductive work performance and an unhealthy environment.

There is a need to install a backup desalinator or other available options as outlined in this paper. The alternative options available are either to do one or all of the following possibilities:

- ?? Since the present desalination plant can only provide 950t/d then subject to funding it might be possible to look at installing another desalinator using renewable energy or another appropriate technology albeit this option would be quite costly in view of running costs for operation.
- ?? Collection and storing of rainwater by encouraging householders through community education and government assistance with repairing of gutters, water tanks and plumbing maintenance as well as through public awareness from the media.
- ?? Carry out a comprehensive groundwater study to extract fresh water from the ground water especially during droughts and to continue using brackish water for household chores.

Long term solution to the shortage of water is required. People should be educated and informed about the importance of water and the need for its wise use. Without such awareness it will be difficult to deal with the complexities of the water problem that is involved.

It is the right of every man, woman and child to have access to a clean and safe water.

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Annex 1

LIST OF PERSONS CONSULTED AT THE WORKSHOP

?? Dr. Ludwig Keke, Consultant Director of Medical Services
?? Dr. Godfrey Waidabu, Director of Public Health & Medical Services
?? Mr. Vincent Scotty, Acting Executive Officer, Department of Health
?? Mr. Joseph Cain, Secretary for Economic Development
?? Mr. Bill McDonald, Supervisor Desalination Plant, Nauru Phosphate Corporation
?? Dr. Vincent Keane, Chief Medical Officer, IMO
?? Mr. Mathew Batsiua, Chief Secretary
?? Ms. Julie Olsson, Director for Culture & Tourism
?? Ms. Charmaine Scotty, Department of Womens Affairs
?? Mrs. Juanita Dick, Womens representative
?? Mrs. Cindy Kephas, Womens representative
?? Mr. Anthony Garabwan, Secretary for Works & Community Services
?? Mr. Simon Luperia, Secretary for Justice
?? Mr. Callistus Cain, Chief Secretary Department
?? Mr. Roxen Agadio, Environment Officer, Department of Economic Development
?? Mr. Phil Battery, Vivendi Water
?? Ms. Stella Thoma, Department of Fisheries & Marine Resources
?? Mr. Ian Mckay, Private sector
?? Dr. Ian Wallis, World Health Organisation