SUMMARY OF SOPAC WATER DEMAND MANAGEMENT AND CONSERVATION ACTIVITIES IN THE PACIFIC REGION

Paula Dawe
CUSO Volunteer

SOPAC Miscellaneous Report 442

September 2001

This work has been supported by SOPAC, the Republic of China, NZODA and the Canadian organization CUSO

TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

INTRODUCTION

Definition of Water Demand Management

Water Demand Management (WDM) is a holistic approach towards controlling water supply systems and making fully-informed decisions regarding that system. It involves the adoption of policies and investment by water utilities to achieve efficient water use by all members of the community. It includes preventative maintenance, setting up performance monitoring devices, zonation of the system into districts and pressure sub zones, community education campaigns and advisory services, cost-reflective pricing and customer metering, leakage detection and repair programmes, retro-fitting programmes and more.

Benefits from demand management are various, offering pluses to both customers and the water utility. These include financial benefits, protection of the environment, energy savings, better customer service and the reduction of wastewater flows.

History of donor funded WDM projects managed by SOPAC

In the past, SOPAC has managed and implemented 2 major water-demand management projects in the Pacific, one funded by the Republic of China (Taiwan) and the other by New Zealand Overseas Development Assistance (NZODA). The latter project included a regional meeting of 25 participants from 13 different countries on water demand management. Further objectives of the NZODA project were aimed at implementing the recommendations and conclusions of this regional meeting. Mainly this comprised technical assistance with the assessment of water losses, generation of electronic maps and inventories, generation of hydraulic network models, leak detection, addressing management problems and training.

Scope of this report

The purpose of this report is to:

1. Provide a chronological account of donor-funded SOPAC water demand management activities and of the WRU members of staff who performed the work in question.
2. Summarise work that was achieved as part of water demand management projects, and in which countries.
3. Link WDM activities with outputs such as databases, models, reports and recommendations for further work.
4. Extract recommendations for further work that was made from the numerous water-demand management reports.
5. Identify recommendations SOPAC or other organisations (if known) followed up on.
6. Identify where further work is required and what activities still need funding.

Proposals for the Republic of China and New Zealand ODA funded water-demand management projects can be found in Appendix A, along with a third phase WDM proposal that has yet to receive funding.

Budget for WDM activities

The following is a total budget line for water demand management activities funded as part of the Taiwan and New Zealand projects.

Phase 1	– Republic of China WDM Project – 1998	FJ$ 75,531.25	(US$ 50,000)
Phase 2	– NZ ODA WDM Project – 1999	FJ$ 111,925.11	(NZ$ 110,000)
Total		*FJ$ 187,456.36*	

Water Demand Management Activities

The following tables outline different water demand management activities that SOPAC has carried out since 1997.

Table 1. Documented SOPAC Water Demand Management Funded Activities Since 1997 and Corresponding Donors.

	Report or Activity	Author	Date	Donor
1	Demand Management and Conservation Workshop in Oslo Norway (PR246)	Ed Burke	April 1997	UNDP
2	Water Demand Management and Conservation in the Pacific Region (MR252)	Ed Burke	June 1997	UNDP
3	Demand Management and Conservation Investigations on the Island 'Eua, Tonga- Demand Management Project (PR 251, TR264)	Ed Burke	Feb 1998, Aug 1998	Taiwan
4	Demand Management and Conservation Investigations in Funafuti, Tuvalu (PR254, TR269)	Ed Burke	Feb 1998, Nov 1998	Taiwan
5	Workshop on Numerical Modelling of Water Distribution Networks (MR287)	Harald Schölzel	May 1998	SOPAC
6	Demand Management and Conservation Project Field Investigations Solomon Islands Water Authority (MR284)	Ed Burke and Harald Schölzel	May 1998	Taiwan
7	Water Pricing and Demand Management and Conservation Workshop (TR260, MR292)	Ed Burke	July 1998	UN ESCAP
8	Demand Management and Conservation Project Field Investigation in South Tarawa, Kiribati (MR302)	Ed Burke	Oct 1998	Taiwan
9	SOPAC Water Demand Management Workshop (MR345)	Harald Schölzel and Rhonda Bower	June 1999	NZODA
10	A Technical Appraisal of the Auki Water Supply System Malaita Island, Solomon Islands (TR261)	Harald Schölzel	Aug 1999	Taiwan
11	Hydraulic Modelling of the Nuku'alofa Water Supply System, Kingdom of Tonga (TR273)	Harald Schölzel	Aug 1999	SOPAC
12	Rural Water Supply and Water Demand Management, Vanuatu (MR351)	Harald Schölzel	Sept 1999	NZODA
13	Water Demand Management as a Tool to Mitigate Drought Impacts in Rural water Supply Systems- Kandavu, Fiji (MR353)	Harald Schölzel	Sept 1999	NZODA
14	Hydraulic Network Modelling of the Rarotonga Water Supply System, Cook Islands (TR296)	Paula Dawe and Harald Schölzel	Jan 2000	NZODA
15	Pipe Detection Surveys and Creation of a Water Utility GIS, Niue (TR311)	Paula Dawe	March 2000	NZODA
16	SOPAC Projects Newsletter 14 – World Water Day 2000: Water for the 21st Century	Rhonda Bower	June 2000	NZODA
17	Report of Visit to Samoa (PR293)	Marc Overmars, Paula Dawe, Rhonda Bower	April 2001	NZODA

UNDP – United Nations Development Programme
Taiwan – Government of the Republic of China
SOPAC – SOPAC regular budget
ESCAP – UN Economic and Social Commission for Asia and the Pacific
NZODA – New Zealand Overseas Development Agency

Table 2. Tasks Achieved and Recommendations Made as a Result of SOPAC Water Demand Management Activities.

(Bullets in italics – recommendations addressed by SOPAC or other organisations)

	Country or Scope	Achieved	Recommendations
1	International Conference	▪ Presentation on WDM in the Pacific given to an international audience. ▪ Strategies were developed.	▪ *Member countries should pursue WDM and conservation through: legislation, public education and awareness programmes, technical measures.*
2	Regional	▪ Regional statistics on major freshwater sources in each country. ▪ Regional statistics on utility operation data – metered, tariffs, UFW, leak detection, conservation programmes.	▪ *Data on amount of water supplied and consumed.* ▪ Data on surface/ground water catchments. ▪ *Installation of bulk and individual water meters.* ▪ *Introduction of user pay systems.* ▪ *Leak detection and rehabilitation programmes.* ▪ *Public awareness and education programmes.* ▪ Legislation to protect water supply catchments.
3	Tonga	▪ Performed flow and water-quality measurements on the island of 'Eua, Tonga. ▪ Reviewed 'Eua distribution system and made recommendations on WDM measures to reduce water losses and improve system.	▪ *Carry out minimum night-time flow measurements and step tests.* ▪ Repair all leaks – system and customer side (ie. taps, toilets). ▪ *Create public awareness.* ▪ *Install water meters.* ▪ *Provide training to TWB staff.* ▪ Protection of water source areas. ▪ Explore alternative water sources- rainwater, groundwater.
4	Tuvalu	▪ Review of existing rainwater catchment systems and water sector practices in Tuvalu.	▪ *Review and update the draft Tuvalu Water and Sanitation plan- design standards, water rationing procedures, user-pay systems, water saving devices, plumbing standards, composting toilets, building codes and material specs, operational and maintenance procedures for rainwater systems.* ▪ Seek government approval for plan. ▪ Maximise roof catchment areas and optimise storage. ▪ Regular maintenance of rain catchment systems.
5	Fiji	▪ Conducted 3 day workshop covering hydraulic theory, developing numeric models, working with GIS.	▪ PWD should run a refresher course in basic hydraulics and flow metering. ▪ *PWD needs to invest in a hydraulic modelling software, and allocate resources to the task of modelling their system.* ▪ *SOPAC should assist PWD in using GPS and GIS tech to design or upgrade water supply systems.*
6	Solomon Islands	▪ Training of SIWA staff in hydraulic principles and step tests. ▪ Assessment of the Auki water supply, collection of flow meter data including peak and night time flows.	▪ *Continue training in hydraulic design and modelling of water supply systems for SIWA staff.* ▪ Upgrade inefficient supply systems. ▪ Continue step tests in areas of suspected high UFW.

7	Cook Islands	▪ 3 day workshop looking at water sector issues in the Cook Islands, WDM and conservation methods and practices. ▪ Development of a national water resources policy and strategy.	▪ To proceed with the development of the national water resources policy and strategy, eventually acquiring government approval. ▪ *To implement items identified in the water resources policy and strategy.*
8	Kiribati	▪ Reviewed existing water supply system and collected flow meter data.	▪ Develop drought index for South Tarawa. ▪ *Continue with provision of technical advice.*
9	Regional *See country specific action plans and assessment questionnaires in Appendix B* (Task Profile- RT 1999.05)	▪ 6-day workshop bringing together water utility people from the region. ▪ Presentation of country papers. ▪ Introduction to WDM theory and practice. ▪ Step test exercise. ▪ Assessment of country needs/ development of country action plans.	▪ *Assessment of water losses.* ▪ *Generation of electronic maps and inventories.* ▪ *Generation of hydraulic network models.* ▪ *Leak detection.* ▪ *Management issues.* ▪ *On the job training and training. attachments at SOPAC.*
10	Solomon Islands	▪ Review and analysis of the Auki, SI water supply system and collection of flowmeter data.	▪ recommended improvements to the current operation and rehabilitation of the Auki, SI water supply system. ▪ *Hydraulic modelling of the system be performed as part of a training attachment to SOPAC for the design engineer.* ▪ Collection of population data including growth and consumption. ▪ Water conservation and leak detection measures should be carried out in the area.
11	Tonga (Task Profile TO 1999.37 & TO 1999.32)	▪ Revised key design parameters for revaluation of the 1992 Masterplan. ▪ Developed a model of the Nuku'alofa water distribution system. ▪ Trained TWB engineers on hydraulic modelling.	▪ *Continued calibration of the model is required.* ▪ *Nuku'alofa water supply system needs to be upgraded following the 1992 Masterplan, with a few changes.*
12	Vanuatu (Task Profile VU 1999.01)	▪ Assessment of the Mele/Mele-Maat water supply system, including flow measurements and development of a network model.	▪ *SOPAC provide training in hydraulics for members of the RWSS.* ▪ Data should be transferred to a customised GIS. ▪ The RWSS should implement a demand responsive approach when working on community projects. ▪ *RWSS should purchase essential water supply system monitoring equipment.* ▪ Different institutional arrangements and building standards need to be adopted.
13	Fiji (Task Profile FJ 1998.40)	▪ Assessment and analysis of the Tiliva and Lagalevu village water supplies in Kadavu.	▪ Upgrades to the intakes for the Tiliva village water supply need to be performed. ▪ Connection of an additional source to the Tiliva system. ▪ Upgrades to the Lagalevu system including reconnecting an intake and pipe replacement. ▪ Generating community awareness on conservation practices and consequences of excessive use on downstream users.

14	Cook Islands (Task Profile CK 1999.01)	▪ A network model of the Turangi section of the Rarotonga water supply. ▪ Hydraulic training for one member of the Water Works staff. ▪ In depth demand analysis for Rarotonga.	▪ More accurate demand data needs to be collected. ▪ Further calibration of the Turangi model is needed. ▪ *Further training in hydraulics and hydraulic modelling for staff of Water Works.* ▪ Models for the other water supply zones in Rarotonga should be developed. ▪ *Greater public awareness of water conservation needs to be raised.* ▪ Introducing user pay systems to the Cook Islands.
15	Niue (Task Profile NU 1999.01)	▪ GIS of water utility assets in Niue created. ▪ Completion of 5-village pipe-detection surveys. ▪ Collection of water quality and demand data.	▪ *Continue the pipe detection surveys in the remaining villages and input data into the asset GIS.* ▪ *Training in MapInfo for member of the Niue water section.* ▪ Itemised maintenance on the Niue system be carried out. ▪ Bulk flow meters be read on a monthly basis. ▪ Additional baseline data on the Niue supply systems be collected. ▪ Hydraulic models of the Niue supply systems be developed.
16	Regional (Task Profile RT 1999.43)	▪ MOU with SPREP to collaborate on WWD campaigns. ▪ Development of WWD campaign and publication materials.	▪ *Continuation of the collaboration with SPREP on WWD activities.*
17	Samoa (Task Profile WS 1999.01)	▪ Awareness raising of water conservation issues at 9 schools in Apia. ▪ Consultative meetings with engineers at SWA on future collaboration with SOPAC.	▪ Hydraulic training for members of the SWA. ▪ Demand analysis, leakage assessment and leak detection once domestic metering in Apia is complete.
18	Marshall Islands (Task Profile MH 1999.01)	▪ To be done October 2001.	

Table 3: Recommendations that Have Been Addressed- How, by Whom, and Further Work Required

(Bullets in italics- Task Profiles developed)

Recommendations Addressed by SOPAC or Other Parties			**How addressed?**	**More Assistance/ Activity Required by SOPAC?**
Recommendation	**Who**	**Scope**		
Member countries should pursue WDM and conservation through: legislation, public education and awareness programmes, technical measures	SOPAC WHO PWA ESCAP Member Countries SPREP ADB	Regional	▪ Workshops held by SOPAC, PWA, ESCAP ▪ Technical missions performed by WHO, SOPAC ▪ World Water Day campaigns run by SOPAC, member-country campaigns ▪ Individual member-country initiatives	Yes
Data on amount of water supplied and consumed	SOPAC Member Countries	Regional	▪ Data collected during numerous SOPAC country visits ▪ Member-country collection of system data	Yes
Installation of bulk and individual water meters	Member Countries	Regional	▪ Either already in place or have been initiated in all member countries except Niue and the Cooks	
Introduction of user pay systems	Member Countries ESCAP	Regional	▪ Either already in place or have been initiated in all member countries except Niue and the Cooks ▪ Workshop held in the Cook Islands	Yes
Leak detection and rehabilitation programmes	SOPAC Member Countries WHO	Regional	▪ SOPAC's WDM Project ▪ WHO consultants provided training to the Cook Islands ▪ Member countries establishing leak-detection teams such as in Fiji, Tonga	Yes
Public awareness and education programmes	SOPAC Member Countries SPREP	Regional	▪ World Water Day campaigns run by SOPAC ▪ Member-country campaigns such as in Niue, Tuvalu, Samoa ▪ SPREP collaboration on World Water Day activities and generation of water and health educational awareness kits	Yes
Carry out minimum night time flow measurements and step tests	TWB	Tonga	▪ Performed by TWB leak-detection unit	
Provide training to TWB staff	SOPAC	Tonga	▪ TO 1999.37 Fellowship Attachment for TWB Planning Engineer ▪ TO 1999.32 Network Modelling of the Nuku'alofa Water Distribution System	

Review and update the draft Tuvalu Water and Sanitation plan-design standards, building codes, operational and maintenance procedures for rainwater systems	SOPAC	Tuvalu	▪ TV 1999.02 Standards for Roof Catchments	
PWD needs to invest in hydraulic modelling software, and allocate resources to the task of modelling their system	PWD SOPAC	Fiji	▪ WaterCAD and a model of the Suva-Nausori were provided as part of a review of the Master Plan by outside consultants ▪ FJ 2000.25 WaterCAD Training for PWD	
SOPAC should assist PWD in using GPS and GIS technology to design or upgrade water supply systems	SOPAC	Fiji	▪ SOPAC helped develop a project proposal for funding the development of a GIS of the Suva water supply ▪ *Task profile for development of a Suva water supply GIS established (FJ 1999.38)*	Yes
To implement items identified in the water resources policy and strategy	SOPAC Water Works WHO ADB	Cook Islands	▪ Initiatives by the Rarotonga Water Works to follow up on items ▪ Assistance by SOPAC, WHO, ADB	
Continue with provision of technical advice	SOPAC	Kiribati	▪ *Task profile for possible training in hydraulic modelling in development*	Yes
Assessment of water losses	SOPAC Member Countries ADB	Regional	▪ Continual collection of baseline data by all parties	Yes
Generation of electronic maps and database inventories	SOPAC EU Member Countries	Regional	▪ GIS of water systems aided by SOPAC in Niue, Tuvalu, Solomons, Tonga, Fiji, Cook Islands ▪ GIS in Samoa created as part of EU project ▪ Databases of utility assets, water quality, customers, system data developed	Yes
Management issues	SOPAC Member Countries	Regional	▪ Helped countries to develop country-specific action plans ▪ Workshop sessions on financing, dealing with stakeholders, employees, customers, PPP ▪ Helped to develop bilateral funding proposals	Yes
Generation of hydraulic network models	SOPAC Member Countries	Regional	▪ Network models aided by SOPAC in Vanuatu, Fiji, Cook Islands, Solomon Islands, Tonga ▪ Outside consultants hired by member countries to develop network models- Samoa, Fiji	Yes

Leak detection	SOPAC WHO Member Countries	Regional	▪ SOPAC's WDM Project ▪ WHO consultants provided training to the Cook Islands ▪ Member countries establishing leak-detection teams such as in Fiji, Tonga ▪ Member countries bringing in leak-detection consultants – ACTEW, Australian Leak Detection	Yes
On the job training and training attachments at SOPAC	SOPAC	Regional	▪ Continual activity	Yes
Hydraulic modelling of the system be performed as part of a training attachment to SOPAC for the design engineer	SOPAC	Solomon Islands	▪ *Task profile for possible training attachment in development*	Yes
Continued calibration of the model is required	TWB	Tonga	▪ Model development now the responsibility of TWB, unless assistance required of SOPAC	
Nuku'alofa water supply system needs to be upgraded following the 1992 Masterplan, with a few changes	TWB	Tonga	▪ TWB looking at financing upgrades through large scale bilateral project with Japan	
SOPAC provide training in hydraulics for members of the RWSS		Vanuatu	▪ VU 2000.01 Hydraulic Training for Department of Rural Water Supply	Yes
RWSS should purchase essential water supply system monitoring equipment	SOPAC NZ ODA	Vanuatu	▪ Assistance of SOPAC sought in identifying appropriate equipment ▪ NZ ODA institutional strengthening project	
Further training in hydraulics and hydraulic modelling for staff of Water Works	SOPAC	Cook Islands	▪ *Task profile for possible training in development (CK 1999.04)*	Yes
Greater public awareness of water conservation needs to be raised	SOPAC Water Works	Cook Islands	▪ World Water Day campaigns raising awareness with cooperation of Rarotonga Water Works	
Continue the pipe detection surveys in the remaining villages and input data into the asset GIS	SOPAC	Niue	▪ *Task profile for completion of work in development (NU 2000.03)*	Yes
Training in MapInfo for member of the Niue water section	SOPAC	Niue	▪ *Task profile for completion of work in development (NU 2000.03)*	Yes
Continuation of the collaboration with SPREP on WWD activities and other pubic awareness and educational campaigns	SOPAC SPREP WHO	Regional	▪ RT 2000.44 World Water Day 2001- Water & Health ▪ RT 2000.43 Water and Health Publication	Yes

CONCLUSION

Water demand management first started as a concept with European utilities looking for a new way to manage water supply systems that did not focus on increasing supply. In Pacific Island countries, with their limited and vulnerable water resources, a demand, as opposed to a supply driven approach to water systems management is also the logical and most sustainable option.

This approach first made its way to the Pacific Region through the efforts of SOPAC's water resources unit in 1997. Since then, SOPAC has been the focal point for WDM in the region – organising workshops, providing technical assistance and training at the request of member countries.

Suitability of Pacific Region for WDM practices.

In the Pacific there is a combination of vulnerable water sources (evident through widespread drought suffered throughout the region during the 1998-99 El Niño/La Nina events), wasteful user practices, and large percentages of unaccounted for water from most water-distribution systems. All these factors made it an ideal location for effecting water demand management practices and of being able to see real results.

SOPAC's efforts to help establish water demand management practices within the different water utilities in the region has seen the approach adopted by many. The concept has not only been taken up by the countries themselves, but also by other organisations working in the water sector, both regional and international, and by donors funding water projects in the Pacific.

Results of WDM activities in the Pacific.

SOPAC's water demand management activities have seen a multitude of results-establishment of utility leak-detection units, introduction of new management technologies such as GIS and hydraulic models, transfer of knowledge and skills, regional awareness-raising campaigns, collection of baseline information, and technical assessments of numerous water distribution systems both rural and urban. A great deal of work has been achieved, but there is still much to be done.

The table of recommendations includes many that have not yet been addressed, and of the ones that have received attention, many of these also require further work. As some utilities are further ahead than others with water demand management practices, the scope of work to be done is still large. The high turnover of staff at many Pacific water utilities also means that training issues need constantly to be addressed. Continuity is essential, and as a focal point for WDM in the region, SOPAC offers that kind of sustainability.

The future of WDM in the Pacific.

To maintain the momentum that the last five years of work by SOPAC and others has generated; more funding and more assistance will definitely be required. Water demand management is a long-term strategy, but the benefits are already evident.

REFERENCES

Bower, R., 2000. World Water Day 2000 – Water for the 21st Century, *SOPAC Projects 14*, June 2000.

Burke, E., 1998. Demand Management and Conservation Investigations in Funafuti – Tuvalu, Nov 1998, *SOPAC Technical Report 269*.

Burke, E., 1998. Demand Management and Conservation Investigation on the Island of 'Eua – Kingdom of Tonga, August 1998, *SOPAC Technical Report 264*.

Burke, E., 1997. Water Demand Management and Conservation in the Pacific Region, June 1997, *SOPAC Miscellaneous Report 252*.

Burke, E. 1997. Water Supply and Sanitation Collaborative Council Working Group on Demand Management and Conservation Workshop Trip Report, April 1997, *SOPAC Trip Report 246*.

Burke, E. 1998. Demand Management and Conservation Project Field Investigation in South Tarawa – Kiribati, October 1998, *SOPAC Miscellaneous Report 302*.

Burke, E. 1998. ESCAP/SOPAC Water Pricing and Demand Management and Conservation Workshop, July 1998, *SOPAC Miscellaneous Report 292*.

Burke E., Scholzel, H., 1998. Demand Management and Conservation Project Field Investigations – Solomon Islands Water Authority, June 1998, *SOPAC Miscellaneous Report 284*.

Dawe, P., 2000. Pipe Detection Surveys and Creation of a Water Utility GIS – Niue, September 2000, *SOPAC Technical Report 311*.

Dawe, P., Scholzel, H. 2000. Hydraulic Network Modelling of the Rarotonga Water Supply System – Cook Islands, September 2000, *SOPAC Technical Report 296*.

Scholzel, H., 1999. Rural Water Supply and Water Demand Management: Report of a Visit to Vanuatu, September 1999, *SOPAC Miscellaneous Report 351*.

Scholzel, H., 1999. Water Demand Management as a Tool to Mitigate Drought Impacts in rural Water Supply Systems: Report of a Visit to Kadavu (Fiji) September 1999, *SOPAC Miscellaneous Report 353.*

Scholzel, H., Bower, R. 1999. SOPAC Water Demand Management Workshop, June 1999, SOPAC Miscellaneous Report 345.

Scholzel, H., 1999. Hydraulic Modelling of the Nuku'alofa Water Supply System – Kingdom of Tonga, August 1999, *SOPAC Technical Report 273*.

Scholzel, H., 1999. A Technical Appraisal of the Auki Water Supply System Malaita Island,- Solomon Islands, August 1999, *SOPAC Technical Report 261*.

Scholzel, H., 1998. Workshop on Numerical Modelling of Water Distribution Networks, June 1998, *SOPAC Miscellaneous Report 287*.

Appendix A:

WDM PROPOSALS

PROJECT PROPOSAL FOR FUNDING CONSIDERATION BY TAIWAN/REPUBLIC OF CHINA

1. PROJECT TITLE : Demand Management and Conservation of Water Supplies in Pacific Island Countries

2. REQUESTING AGENCY : South Pacific Applied Geoscience Commission (SOPAC)

3. IMPLEMENTING AGENCY : SOPAC

4. TOTAL PROJECT COST : US$50,000

5. ASSISTANCE REQUESTED : US$50,000

6. BACKGROUND

The lack of sustainable freshwater and increasing demands on freshwater resources have been identified as factors contributing to the Primary Constraints to Development of the South Pacific (Reference: Forum Secretariat Regional Strategy Document 1997). Currently in the order of 50% of the water that is taken from rivers, stream and groundwater in Pacific countries never reaches the user. And of the water that does reach the user a significant proportion is wasted through poor usage practices.

Through efficient demand management and conservation of water supplies, pressure on freshwater resources will reduce thus making more water available for other development or for future use. The actual savings to the operational budgets of small island economies will also be significant.

7. OBJECTIVE

The objective is to reduce wastage of freshwater through good demand management and conservation practices by water suppliers and water users in five Pacific Island countries. This would in turn make more water available for future generations.

8. PROJECT DESCRIPTION

Kiribati, Tuvalu, Tonga, Samoa and Solomon Islands will be visited to assess current water supply and usage rates and practices. This will involve meeting with the water sector,

measuring and observing water taken and water usage. The in-country water suppliers and users will be fully involved with the project.

Outputs will focus on recommendations to reduce water wasted through physical and education means, and possible physical improvements will be identified.

Education and public awareness programmes will be developed with each country to reduce water usage.

9. PROJECT COST AND FINANCE

The following is an estimate to implement the proposed project:

A Activity	US$
• visit five countries (travel and expenses)	11,000
• collect information and reporting	16,000
• equipment (portable flow meter)	7,000
• prepare educational/awareness materials	11,000
• communication and administration costs	5,000
TOTAL	50,000

PROJECT PROPOSAL

WATER DEMAND MANAGEMENT AND CONSERVATION IN THE PACIFIC REGION

GOAL

The goal is to reduce wastage of freshwater through good demand management and conservation practices by water suppliers and water users in selected Pacific Island Countries (Cook Islands, Federated States of Micronesia; Chuuk, Marshall Islands, Niue, Samoa and Vanuatu). This would in turn make more water available for the environment enhancement and for future generations.

BACKGROUND

The lack of sustainable freshwater and increasing demands of freshwater resources have been identified as amongst some of the primary constraints to development of the South Pacific (Reference: Forum Secretariat Regional Strategy Document 1997). Currently in the order of 50% of the water that is taken from rivers, stream and groundwater in Pacific countries never reaches the user. And of the water that does reach the use a significant proportion is wasted through poor usage practices.

Through efficient demand management and conservation of water supplies pressure on freshwater resources will reduce thus making more water available for other development or for future use. The actual savings to the operational budgets of small island economies will also be significant. By taking less out of already stressed water sources the environment benefits as well.

This project will compliment a demand management project for work in Kiribati, Tonga, Tuvalu and Solomon Islands. This project funded by ROC-Taiwan was approved in late 1997.

ACTIVITES

- The selected countries will be visited to assess current water supply and usage rates and practices. This will involve meeting with the water sector, measuring and observing water taken and water usage. The in-country water suppliers and users will be fully involved with the project.
- Outputs will focus on recommendations to reduce water wasted through physical and education means, and possible physical improvements will be scheduled and costed.
- Education and public awareness programmes will be developed with each country to reduce water usage.
- The information will be disseminated through a regional workshop held at the SOPAC Secretariat in Suva, Fiji.

OUTPUTS

- Enhanced reliability of existing water supply systems.
- Reductions in water usage and water losses.
- Enhanced future access to supplies.

PERFORMANCE MEASURES

- One SOPAC technical report with recommendations and proposals.
- Information disseminated through a regional workshop, virtual library and CD Rom.

TIMEFRAME AND FUNDING

The project timeframe will be 1 year commencing no sooner than mid-1998.

The project requires funds totalling NZ$110,000 as outlined below. SOPAC will contribute by providing the workshop local resource personal and venue.

Activity	NZ$	F$
• visit six countries (travel and expenses)	24,000	১৩,৫৮০
• collect information and reporting	28,000	১৪০০০
• develop public educational/awareness	12,000	১১,৫৮০
• communication and support	3,000	১,৯৩৫.১১
• regional workshop (14 participants)		
▪ travel and per diem 14 @ 2300/each	32,200	৫০,৫৮০
▪ overseas resource persons 2 @ 3,700/each	7,400	
▪ workshop costs	3,400	
	110,000	১১১,৯৩৫.১১

Total Water Demand Management:
An alternative to infrastructure development

Concept Paper

Title:	Total Water Demand Management: an alternative to infrastructure development.
Implementing Agency:	South Pacific Applied Geoscience Commission (SOPAC)
Contact Person:	Alfred Simpson, Director SOPAC
Phone:	(679) 381 377
Fax:	(679) 370 040
Email:	alf@sopac.org
Beneficiaries:	Cook Islands, FSM, Fiji, Kiribati, Niue, Nauru, Marshall Islands, PNG, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu
Budget AUD$	**$252,000**
Project Priorities	*Environment* *Good Governance*
Areas of Strategic Focus	*Water Resources Management* *Institutional Strengthening/Capacity Development*

CONCEPT PAPER

South Pacific Applied Geoscience Commission (SOPAC)

Total Water Demand Management:
An alternative to infrastructure development

Purpose

Implementation and establishment of Water Demand Management units and measures in Pacific Islands Countries water supply utilities.

Background

In the past development projects in the water supply sector have mainly concentrated on the upgrading or extension of existing water supply infrastructure. This supply driven approach has proved to be very costly for both, the donor and the receiving country and has not lead to a safe water supply even for the bigger urban centres in most of the Pacific Islands Countries (PIC). Most water supply systems operate at the edge of collapse and, contrary to common knowledge, the reason is usually not that there is insufficient water available at the source of abstraction. Instead, it is simply the consequence of the fact that water supply systems in PIC loose more water through leakage and wastage than they actually deliver to customers. The patched design of these distribution systems renders not only the technical design of many aid projects technically questionable but also makes the management and operation for the local water authority very difficult.

With more pressure on limited resources many PIC have realised that the key towards sustainability lies not necessarily in costly infrastructure extension but rather in the sound management of water supply systems. This trend has been enforced with the appearance of institutional strengthening projects in the water sector mainly funded by AusAID. The Total Water Demand Management Project (TWDMP) aims at supplementing these initiatives.

In the past, SOPAC managed and implemented two water demand management projects in the Pacific: one funded by the Republic of China and the other by New Zealand Overseas Development Assistance (NZODA). These projects comprised Technical Assistance with the assessment of water losses, generation of 'as-built' electronic maps (inventories), generation of hydraulic network models, leak detection, management problems and on-the-job-training as well as training attachments to the SOPAC Secretariat in Suva, Fiji.

The current NZODA Water Demand Management Project will wrap up in October of 2001 during which time an evaluation of work done will be performed and key areas of further activity will be identified. Each PIC is at a different stage of progression in terms of water demand management. The continuation of the project and SOPAC's role as a co-ordinating centre for the region needs to be maintained if this valuable and strategic work is to be progressed further.

Beneficiaries and Parties Involved

Cook Islands, FSM, Fiji, Kiribati, Niue, Nauru, Marshall Islands, PNG, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu are island countries that will directly benefit from the project. Specifically, in-country involvement will be with the local Water Utility or government department responsible for water supply.

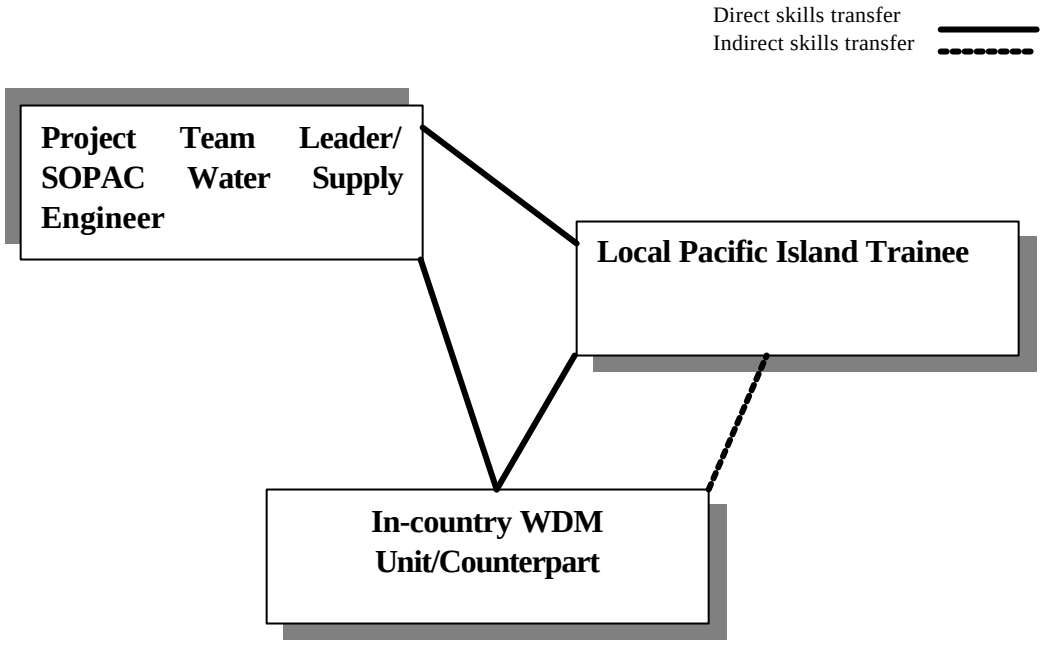
Of the 13 countries identified, activities will be confined to 8 following the evaluation of previous WDM activities and the identification of necessary future work for each country. This is due to time and resource constraints on the project. Future work will be prioritised based on each country's progress with WDM works and the sustainability of their activities without outside assistance.

Implementing Team

A professional member of staff in the SOPAC Water Resource Unit, the Water Supply Engineer, will oversee the project. To further the sustainability of WDM activities in the Region and strengthen the role of SOPAC as an implementing agency for such projects, a local Pacific Island Trainee will be taken on as part of the project. This individual will have a background in the technical aspects of civil works and will work closely with the Project Leader to develop skills, learn about WDM methodologies, and eventually take on projects independently.

The transfer of skills will then be from the Project Leader to WDM Units set up within the selected country utilities, but also between the Project Leader and the Trainee. In time, responsibility and knowledge of WDM projects will fall to this individual, so as to enhance the sustainability of activities in the Region.

The following chart outlines the proposed establishment of the project implementing team.



Expected Project Outcomes

Good Governance

Fiscal improvement
Environmental conservation
Increased skills and capacity
Asset inventory and management planning

Environment

Resource conservation
Adequate water supply

Areas of strategic focus will include;

Water Resources Management
Institutional Strengthening/Capacity Development

Time Table

The project duration is for two years. The following table shows the initial project phase and the ensuing phases for each country if selected for future activity, depending on their current level of progress.

	Activities	**Outcomes**	**Approx. duration**
Preliminary Phase	• Review of previous WDM projects • Assessment of future country WDM needs • Identifying country constraints	• Priority activities and countries identified	1 month
Phase 1 **Assessment**	• Leakage / wastage assessments • Water supply system assessments	• Electronic 'as-built' plans • System inventory / asset management system • Hydraulic network models • WDM plan • WDM units	11 months
Phase 2 **Implementation and Consolidation**	• Leakage detection • System zoning (flow / pressure) • Leak fixing • Public awareness campaign	• Reduced water demand on the system • Increased revenues for the utility • WDM unit integrated into utility • Skilled staff	11 months
Phase 3 **Evaluation**	• Project Impact Assessment (PIA)	• Evaluation Report for each country	1 month

The Preliminary Phase follows out of the wrapping up of the previous NZODA funded WDM project. From this evaluation, the direction of future work will be determined based on the assessment of each identified country's needs and the constraints they are facing that may limit their ability to perform this work independently.

Phase 1 starts with a comprehensive leakage assessment comprising the set-up of the local WDM-unit and the evaluation of existing WDM work as well as existing plans. The local WDM counterpart will assist in updating all plans and relevant information and train local units under them in carrying out step-tests and noise correlation. They will be supported by the SOPAC coordinators as necessary. The outcome of Phase 1 is a priority plan of WDM activities according to the major sources of high water consumption.

During Phase 2 concrete steps will be undertaken to reduce overall water demand/consumption according to economical and environmental criteria. Phase 2 concludes with a measurable reduction in water demand/consumption as far as technical improvements are concerned. In the case of public awareness campaigns a longer-term perspective will be applied. Phase 2 requires bilateral equipment purchases on a national scale.

Phase 3 independently evaluates the impact of the project.

Implementing Agency

The project is co-ordinated by SOPAC with one professional staff and a local junior/trainee staff member of the Water Resources Unit as well as the usual management involvement (ie. all accounts will be managed by SOPAC finance staff). Each country will have its own WDM counterpart who is preferably an employee of the local water utility. All WDM counterparts will be extensively trained prior to each phase enabling him/her to train local staff in the respective country.

Budget

A budget of AUD$ 252,000 is being sought.

Indicative Costs (all costs in AUD$)

	Year 1	Year 2	Total
Personnel:			
Coordinator Senior Person:	32,800	32,800	65,600
Coordinator Assistant (USP Graduate):	16,400	18,040	34,440
			100,040
Travel:			
Coordinator Senior Person:	21020	21020	42,040
Coordinator Assistant (USP Graduate):	21020	21020	42,040
			84,080
Training Attachments to SOPAC:			
For Selected Countries:	17220	11480	**28,700**
Public Awareness Campaign Material:			
Over 8 countries	8,200	8,200	**16,400**
Overheads:			
Over 8 countries	12300	10250	22,550
			22,550
Total:			**251,770**

This budget contains no provisions for the physical improvements of the different water supply systems or for leak detection equipment. It is SOPAC's preference not to purchase equipment for countries or support maintenance costs that should be borne by the utility. During phase 1, an evaluation of leak detection equipment requirements will be made and funding sought bilaterally from the individual countries. Indicative costs regarding the purchase of necessary hardware would be purely speculative at this point in time. The project should be in the position to provide reliable figures after completion of Phase 1. Discussions should be held to clarify the contribution of water utilities and possible donors. It is felt that this approach will promote ownership and long term sustainability of WDM initiatives within the member country utility.

Appendix B:

COUNTRY ACTION PLANS AND ASSESSMENT QUESTIONNAIRES FROM SOPAC WDM CONFERENCE IN NADI, 1999

WATER DEMAND MANAGEMENT WORKSHOP - ACTION PLANS

COUNTRIES	WHAT	HOW	WHEN	WHO	TRAINING NEEDS
Amerika Siale - Samoa	Reduce expenses on funding new water sources	Be sure water wastages through leakages were fixed	Continual program (3 years time)	Leak detection team and operation team and public awareness officer	Yes - Trainers within SWA will train others in the team
	Minimise expenses on hiring water trucks	Sustain existing capacity by dealing with all defects within system that causes leaks	3 years	Leak detection and operation team and public awareness officer	Yes - Public awareness training for customers/ training of work force how to detect and deal with leakages
	To get effective communication with work force	Motivation : rewards; increment	12 months	Managers	Yes - Human Resource Officer to train workforce Manager to take management training
	To get staff involved in deciding what's good and best	Effective communication	12 months	Managers/staff	Yes - same as above
	To have an ongoing leakage detection program	A complete plan of the program	12 months	Managers/supervisors	Yes - train workforce how to prepare action plan
	Relocation of pipes on to the safe alignment	Identifying existing alignments on drawings or getting from someone in the workforce who has a good understanding of system	12 months	Supervisors/team leaders	Yes - training how to report & record assets underground as well as following construction procedures
	Good and most appropriate and economical design to get the job done	Taking into account all the relevant hydraulic aspects	12 months	Engineers	
	To have good construction method	Supervision (make sure pipes were laid according to standards required as well as laying on right alignment	12 months	Engineer/Project supervisor	Yes - refer operation
Steve Dalos - Marshall Is	Cost of leakage control	Overlook the leakage Reduce the cost of leakage	1 yr plan	Water company	Financial staff
	Total management plan	Be in control cost saving	1 yr plan	Manager & Accountant	Leakage policy
	Leakage/detection	Test the pipe/check the pressure	1 yr plan	Engineering	Step testing/Leak noise correlatively
	Hydraulic/Analysis	Set up data for data logging	1 yr plan	Water authority - EPA	

Robert Hartley - FSM	Working attitude (change)	Attend field work	July 1999	ARNO OBED	No
	Zoning	Zoning each junction of the H20	July 1999	Engineering section	
	District Metering	District meter each junction	July 1999	Maintenance section	
	Water use in the home	Assess household	July 1999	Maintenance staff	
	Leak detection	Using advance equipment	July - whenever finish	Maintenance staff	SOPACA
	Hydraulic analysis	Model the whole H20 system	July 1999	. . ..	No need
Tekeia Mcfarlane - Kiribati	Unit cost of leakage	Determine/calculate unit cost of leakage	September 1999	Financial Manager/Water Engineer	No
	Re-engineering	Changing or reallocating responsibility of certain staff	January 2000	Plumbers/Water Engineer/Personnel Officer	Yes, mainly on-site training
	District Metering	Instal meter at strategic locations on the reticulation system	November 1999	Water Engineer and team	No
	Leak Detection	Locate leaks on the main pipe from source	September 1999	Water Engineer and team	Training on the use of equipment - one week duration
	Step testing	Reticulation systems	January 2001	Leak detection unit	ADB Project - should have conduct training
	Hydraulic analysis	Learn using the modeling software	October 1999	Water Engineer/Senior technical officer	Intensive one week training on the use
	Pressure measurement	Installation of pressure gauges on the rising main	January 2000	Water Engineer/Technical Officer	No
Losiali Niu - Tonga	Data organising and collection	System inventory - tools & equipment, piping network using Mapinfo/collect flow data, pressure data, operational data, inventory data, topographical data, hydrology etc.	On going	Technical Officers (Setaleki)	Nil
	Hydraulic Analysis	Cybernet modelling, physical measurement using data loggers etc	On going	Malakai, Setaleki and Nafe	Cybernet modelling, wisdom software for Nafe
	Monitoring	Daily operation, night flows, salinity etc	On going	Malakai, Lisiate and myself	Nil

Samuela Tubui - Fiji	Capital cost & capital deferment	History of capital project Through master plan proposal Check on future capital cost	Short term - within 3 months time	Head office/DWS Senior operation engineer at division level	Financial analysis training Accounting
	Cost of leakage control & predicting cost savings	Look through past records Water rates	Short term - within 3 months time	DWS - H/O Division level - metering & leak detection office	As above
	Unit operation cost	Operation data Production data	Short term - 3 months	Senior engineers & supervisors & water rates	As above
	Hydraulic models	Review construction plan Field investigation	Long term	Senior engineers & supervisors	Analysis Cybernet Mapinfo
	District metering Zoning District monitoring	Review network	Short term	Senior engineer ops Supervisor Metering section team	Skills enhancement
	Persuasion Communication Motivate change (at times)	Thorough in-house training Corporatisation	On going Need to start now	DWS - H/O Senior engineer ops Supervisor	Courses related to the need
	Re-engineering Total management plan Leakage policy in corporate plan	Organisational review	Short term Implementation ST & LT Constant review	DSO/DSPD DWS Senior engineers	Strategic ..... Planning
	Training	Internal & External review required	Short term Long term	Division Level All staff	Management skills Financial monitoring skills
Roy Matariki - Vanuatu	Capital Cost	Inlude in budget to cover for metering on pilot projects only.	Next annual budget commencing Feb, 2000	Dept of Water Resources	
	Hydraulic Analysis	Review current designing and design to accommodate basic metering	For the next financial year	Current ..... and probably assistance from aid agencies and UNELCO	From SOPAC - for direction
	Data Organisation	Start collecting data into .... include budget	ASAP	Dept of Water Resources	Mines Dept with SOPAC

(Yamuate cont)	Leakage Control	Create community awareness	ASAP after approval of budget	Dept of Water Resources	Maintenance and cultural awareness unit
	Reservoir test	Measure flow test	Monthly	Dept of Water Resources PWD	
	Pipe locating	Through project files On-site locating of pipes	For the next financial year commencing July 99 - July 2000	As above	
	District Metering	Identify two pilot projects Locate areas needed to be metered i.e. zoning	January 2000	As above	Basics
	Leakage Policy in Corporate Plan	Include this into our program for major rural systems i.e. gravity and pumps	For the next financial year commencing February 2000	To persuade Management to provide funding	Seek aid fundings for the specific training
	Re-engineering	Provide policy to cater for the changes	As above	Engineering and formulation unit to include into design	Engineer needs to train other personnel to undertake this task.
	Training	Undertake a training exercise to include the task into the maintenance unit. Also by identifying one or two systems for a start as a pilot project	As above and assess its effectiveness to be included into a long-term plan	UNELCO	
Walter Joel - PNG	Hydraulic analysis	Assess current network	Within 1 month for each water districts	Engineering Division Operations Division	Perhaps hydraulics analysis training Operations Manager and Engineering Manager will decide.
	Flow Measurement	Daily flow monitoring in plants and zones	Daily routine	District Operations staff	Internal Training
	Pressure Measurements	As above	As above	As above	As above
	Data Organising	As above	As above	As above	As above
	Zone Analysis	As Above	As above	As above	Internal training

(PNG cont'd)	A cost effective detection methods Note: Electronic devices for detention not metered at this stage	Actively undertake detection exercises monthly	Monthly basis	District operation staff	On-the-job attachment with experts, say 4 weeks.
	Persuasion	Justify submission to management	With 2 weeks	District Manager Leak Detection Officer Principal Engineer Operation	Not necessary
	Training	Identify specific areas of training Justify the effects/impacts of training Sought approval	Within 1 week	District Manager Leak Detection Officer Principal Engineer Operation	On-the-job attachments with experts or specialists
	Leakage Policy in Corporate Plan	Justify submission to Management	Within 1 month	District Manager Principal Engineer Operation Operations Manager Corporate Planner	Corporate Planner and Operations Manager to decide
	Capital Cost	Establish proper equipment and machinery	Within 1 month	Principal Engineer Operations District Managers	District Managers Supervisors
	Cost of leakage control	Establish detection team Draw detection structure Salaries etc	Within 1 month	Operations Manager Principal Engineer Operations District Manager	Not necessary
	Prediction costs/savings	Data Analysis - current data on water wastage - assume reduction estimates	Within 1 month	Principal Engineer Operations Finance Manager District Manager	Not necessary
A. Wickham - Solomon Is	Data Organising GIS Inventory Flow measurement Pressure measurement System Investigation (field)	Using microsoft, access & Mapinfo	1999 - LT ST - 4 months June - Sept	Planning Design - surveyors info tech engineers	Design of database

(Solomon Is cont....)	Leakage Control - zone analysis district metering siphonage prevention waste metering intrinsic ...	Mapinfo printout Purchase of meters	October 1999	Engineers P & D & O & M	
	Hydraulic Analysis - data analysis leakage level analysis	Using cybernet software	June 1999	Planning & design engineer	Hydraulics
Andre Siohane - Niue	Predicting Costs/Savings	..... Out leak detections Flow/pressure test	3 months time Ongoing	Public Power corporation Health Dept Telecom	Employers Engineering
	Capital Cost	.... Needed metres for detecting water loss on our tanks	5 months time Ongoing	Government	Financial training Software training
	Underground water modelling	Financially from government Installation tubes Survey	Water level reading was taken and do not know where to start	Staff Government Land/survey dept	Assistance from overseas for engineering works Software training Survey training
	Siphonage Prevention	Survey	7-year plan	Public Government	Engineering SOPAC Assistance
	Pipe location in villages	Existing Plans Go out and digit out Planning	In three months time for 4 months project	Staff - work Telecom - locate cables Power Supply Locate power cables	Machinery operation Engineering framing for value/metering the system Hand-on engineering technique
	District metering note: for leading up to corporisation	meter tanks meter zones meter area	4 month job	Division	Assistance with engineering technique
	Leakage Policy in Corporate Plan	Draft Decision Making Public	2 months middle of financial year	Ministry - government Health Dept Planning Dept	Management training Engineering knowledge