

# **WORLD METEOROLOGICAL ORGANIZATION**



## **MEETING OF EXPERTS ON HYDROLOGICAL NEEDS OF SMALL ISLANDS**

(Nadi, Fiji, 4-6 October 1999)

**Report**

## **1. OPENING OF THE MEETING**

1.1 At the kind invitation of the government of the Fiji Islands, the meeting on the hydrological needs of small islands of the South West Pacific was held at the Mocambo Hotel in Nadi from 4 to 6 October 1999. This meeting was held in conjunction with a workshop on Water Resources Assessment - Reviewing of National Capabilities, for the countries of the South West Pacific. The meeting was attended by 18 participants representing ten Pacific Island countries and one regional and two international Organizations. A list of participants is given in Annex 1.

1.2 Mr Rajendra Prasad, Director of the national Meteorological Service and Permanent Representative of Fiji with WMO, extended a warm welcome to the participants. He observed that although Fiji became a Member of WMO only in 1980, it had never-the-less benefited substantially from the programmes and activities of the Organization. One such example was the selection of Fiji to host the South Pacific Regional Specialized Meteorological Centre for tropical cyclones.

1.3 Mr J. L. Bassier, the WMO representative, added his words of welcome to the participants. He stressed that in organizing this meeting, WMO was demonstrating its readiness to work with the countries of the South West Pacific in addressing their hydrological needs.

1.4 Mr Shiu Sharan Sharma, the Honourable Minister of Public Works and Energy of the Fiji Islands declared the meeting open. In so doing he expressed his government's appreciation to WMO for the attention it is giving to the hydrology of small islands and for considering Fiji as the host for this important event. The Minister spoke at length on the impacts of hydrology and water resources on the social and economic life of the small island States with specific reference to recent floods and droughts. He noted that the problems were not insurmountable and challenged the meeting to develop meaningful and attainable proposals to address the issues.

## **2. APPROVAL OF THE AGENDA AND ORGANIZATION OF THE WORK**

2.1 Mr Rishi Raj (Fiji) chaired the meeting. Ms Kumaras Kay Kalim (Papua New Guinea) and Mr Ben Parakoti (Cook Islands) served as co-rapporteurs. The meeting added to the provisional agenda a new item 7 on "Capacity building in a regional context". The agenda as adopted is given in Annex 2. The meeting also agreed on a time schedule and a provisional programme for its work. It also established two working groups, representing respectively the North and Central parts of the region, to consider in detail the issues and needs pertaining specifically to their respective conditions.

## **3. NEEDS OF OPERATIONAL HYDROLOGY IN THE REGION**

### **3.1 Country reports**

3.1.1 Reports highlighting the hydrology and water-related activities of the small island States were presented by the representatives of the various participating countries. The main issues and problems identified in the presentations are summarized below:

### *Cook Islands*

3.1.2 The representative from the Cook Islands reported that following cutbacks in the Public Service resources for hydrology and water resources assessment have been reduced. The following water resources issues within the Cook Islands were identified:

- Limited trained/skilled technical personnel
- Lack of training; both in-house and externally
- Lack of logistic support
- Lack of continuous data
- Lack of continuous maintenance of infrastructure
- Water shortage during drought events
- Lack of adequate and reliable equipment
- No demand management regime
- Lack of awareness; Political, Public and Institutional
- Lack of quality control of data and procedures
- Salt water intrusion of groundwater resources
- Inadequate funding

Institutional issues identified included:

- Out dated legislation
- Inadequate policy and regulations
- Lack of coordination amongst relevant organizations
- Human resources; shortage of qualified staff
- Need for increased regional cooperation

### *Fiji*

3.1.3 The representative from Fiji identified the following issues of importance:

- Shortage of water for most purposes during droughts. Forecast of minimum flows and onset of drought can be helpful in planning.
- Floods pose serious problems to economic development, particularly flash floods. Community involvement and awareness needs to be raised.
- Fiji's natural (waterways) rivers and streams are threatened with pollutants from agricultural chemicals & fertilisers, industrial wastes and forest harvesting. Pine harvested for timber and wood chips increase sediment loads of streams. Water quality sampling and environmental monitoring is not undertaken regularly.
- Replacements for obsolete equipment and a lack of telemetry are two particular concerns.
- Resources are limited and training needs (both professional and technical) cannot be met from national budgets.
- Lack of established standards for data collection, primary processing and quality parameters within the groups of small islands with similar environments.

### *French South Pacific Territories*

3.1.4 With regard to the French South Pacific Territories (New Caledonia, French Polynesia, Wallis and Futuna), the representatives reported the main difficulties as:

- increasing pollution of surface water and groundwater from domestic pollution, salinity intrusion and sediments fluxes. The main impacts are degradation of the environment (terrestrial and coastal aquatic ecosystems) and the reduction of available water resources.
- water loss linked to the poor condition of supply distribution networks, lack of invoicing and public awareness.
- French legislation must be adapted to the French Pacific Territories taking into account local climatic and environmental conditions.

### *Niue*

3.1.5 The representative from Niue identified the following issues of importance to Niue:

- Lack of technical qualified personnel involved with water resource operations.
- Lack of opportunities for training in groundwater resources.
- Difficulty in retaining qualified staff.
- Lack of skills in data collection and database management.
- Lack of water resources monitoring equipment.
- Water quality is another major issue in particular in relation to contamination of groundwater and the uncertainty in the roles of relevant agencies. A draft water policy requires review and approval before implementation.

### *Papua New Guinea*

3.16 The representative of Papua New Guinea outlined the following issues for water resources assessment and management:

- There is increase in water supply demand. Less processed water is supplied and rural areas have to live with direct consumption from water sources with no or little (primary) treatment only.
- There is plenty untapped water sources (surface water and groundwater). However there are insufficient facilities to collect or capacity to store. Rainwater collection is encouraged but this does not last due to corrosion of storage tanks in coastal areas and vandalism in most areas.
- Increasing concern about water quality due to increased natural resources development activities upstream of water courses. Mining and industrial activities pose a risk of groundwater pollution (yet to be confirmed). Microbiological quality is also an area of growing concern.
- There is legislation for resource management and use, especially the Water Resources Act, but there are no specific policies to enforce such legislation.
- There are problems in communication and sharing of information between agencies dealing with hydrology and hydrogeology.

### *Samoa*

3.1.7 The representative of Samoa reported the following issues of concern:

- duplication of responsibilities amongst institutions.
- conflict between traditional Samoa culture, which relies on community consensus, and introduced management techniques.
- insufficient resources and equipment, including no vehicles for ongoing maintenance of hydrological sites.
- budget negotiation concentrates on financial inputs not outcomes.
- financial difficulties due to politically motivated tariffs.
- insufficient skilled staff and inadequate management information systems.
- lack of community support for Samoa Water Authority.
- lack of annual plans.
- lack of equipment such as raingauges and water level recorders to collect data to suit the demand of hydro power generation/mini power projects developments.
- lack of training for all personnel.

### *Solomon Islands*

3.1.8 The representative from the Solomon Islands identified the following issues:

- lack of supporting water resources legislation causing confusion amongst water agencies.
- lack of specialized training for personnel in data collection, analysis, management, assessment and environmental monitoring.
- communication difficulties with aid donors.
- water and food shortages and health hazards on floodplains and very small islands, caused by natural disasters.
- increasing demand on water resources from developments including hydro-power generation, nickel, gold mining, rice production, increasing population and continued logging activities in water catchments.
- increasing infrastructure development (roads, bridges).

### *USA – Hawaii Islands*

3.1.9 The representative from the USA identified the following issues:

- water quality, residuals from agriculture affecting ground water quality.
- water supply, demand for water is outpacing the rate at which new sources can be developed.
- lack of cooperation among government agencies causing duplication and inefficiencies.
- Lack of standardisation of data collection techniques. For example, telemetry archival methods to reduce overhead and make comparable data networks more robust.

## *Vanuatu*

3.1.10 The representative from Vanuatu identified the following issues:

- lack of water quality monitoring for both surface water and groundwater (especially rivers potential mining areas).
- poor links amongst the water resources agencies and lack of legislation for the exchange of data.
- lack of training in hydrological database software and other technical fields
- network reductions caused by staff and vehicle shortages.
- commercialisation of data.
- unmonitored streams and groundwater supplies, including whole islands and urban areas.

3.2 Review of the work of the RAV Working Group on Hydrology during the last inter-session period

3.2.1 The Chairman of the WGH of the WMO Regional Association V, Mr Rishi Raj, made a presentation concerning the fourth session of the WGH held in Brisbane in 1997. He described the proposals made for future activities and highlighted that the present meeting was the result of one of the proposals which was made in Brisbane. These were considered by the twelfth session of RA V in Indonesia in September 1998. XII-RAV had expressed appreciation for the work of the WGH. It had re-established the working group with a core membership of six rapporteurs and had endorsed the new Terms of Reference recommended in Brisbane. An extract from the report of the WGH on the needs of operational hydrology in the region was tabled at the meeting and contributed to the discussion under agenda item 7.

3.2.2 He outlined the terms of reference of the new group and urged the participants at the meeting to support the work of the group. In particular, he emphasised the need to provide full and speedy responses to requests from the rapporteurs for information on their assignments.

3.2.3 The meeting noted that a work plan of the RA V / WGH had been developed for the period until March 2000. The discussions and recommendations of the meeting were to serve in identifying additional activities which could be undertaken by the WGH during current inter-session period ending 2002. Mr Raj solicited proposals for work items which might help in responding to the call by the CSD for small island developing states to strengthen their water resources database.

3.3 Relevant decisions of WMO Cg-XIII, the Executive Council, XII-RA V, and CHy-X

The meeting was informed of recent decisions of the various WMO bodies which were of relevance to the Hydrological and Water Resources Programme (HWRP). It was pleased to note the creation of two new component programmes on "Sustainable Development of Water Resources" and on "Capacity Building in Hydrology and Water Resources", both of which had important implications for the South Pacific region. Information was provided on INFOHYDRO, the GRDC, the new Terms of Reference of the Commission for Hydrology, and on the Resolution 25 adopted by the Thirteenth WMO Congress on the Exchange of Hydrological Data and Products. The twelfth session of the Regional Association V (South-West Pacific) had re-established the regional Working

Group on Hydrology (see 3.2 above) and called for the Pacific-HYCOS proposal to be further developed (see Section 8 below).

#### **4. RELEVANT PROGRAMMES OF OTHER INTERNATIONAL AND INTER-GOVERNMENTAL ORGANIZATIONS**

The meeting was informed of activities within relevant programmes of international and intergovernmental organizations in the region.

##### **4.1 UNESCO IHP**

4.1.1 UNESCO's International Hydrological Programme (IHP) is a vehicle through which member states can upgrade their knowledge of the water cycle and thereby increase their capacity to better manage and develop their water resources. The programme constitutes a framework for applied research and education in the field of hydrology and water resources management. UNESCO organises projects and activities relating to hydrology from its Regional Office for Science and Technology, for South-east Asia based in Jakarta as well as the Pacific Islands Office in Apia, in Western Samoa. Within the Humid Tropics Programme of IHP two applied research projects have been completed in the Pacific. The first one is a study on recharge to fresh water lens on the island of Bonriki, in Kiribati. The second concerns the ground water pollution on Lifuka in Tonga.

4.1.2 To enhance regional collaboration SOPAC and UNESCO have signed a memorandum of understanding that focuses on the freshwater environment, capacity building, data and information management as well as the exchange of publications between the two agencies. While there has been significant cooperation between WMO and UNESCO at the International level, this cooperation could be improved at the regional level. For example, activities in the South Pacific Region could be associated with the Asia Pacific FRIEND project.

##### **4.2 Other UN agencies**

4.2.1 Progress of the Commission for Sustainable Development (CSD) was reported, including progress (CSD, April 1998) on implementation of the Barbados Programme of Action (on Sustainable Development of Small Island Developing States) (1994) with particular emphasis on freshwater resources.

4.2.2 Progress by the following other UN agencies was covered briefly: the Economic and Social Commission for Asia and the Pacific (ESCAP), the United Nations Environment Programme (UNEP), the Sustainable Development of Small Island Developing States, the United Nations Development Programme (UNDP), Small Island Developing States (SIDS).

##### **4.3 South Pacific Applied Geophysics Commission (SOPAC)**

4.3.1 The SOPAC representative reported that the activities of SOPAC are coordinated through ten units which provide technical assistance to South Pacific Member Countries.

4.3.2 The Water Resources Unit (WRU) assists Member Countries with projects concerning:

- Water Supply
- Sanitation
- Water Resources Assessment (Hydrology, Hydrogeology, Desalination and Water Conservation)

4.3.3 SOPAC has the regional mandate to advocate Water Resources issues on behalf of its Member Countries. In the past, it has provided technical assistance to a number of countries with respect to hydrological networks, data storage and retrieval, assistance to the Rural Water Supply sector, water demand management, desalination, training attachments, geophysical WRA manual and water resources legislation reviews. All work embraces a strong training component either on-the-job or as an attachment to the SOPAC Secretariat or both.

4.3.4 Other units of SOPAC with input into the freshwater sector include the Coastal Unit, Hazard Assessment Unit and the Disaster Mitigation Unit. All receive input from the Human Resources Development Unit.

4.3.5 Future activities of SOPAC will include the implementation of the International Waters Freshwater component and the implementation of a comprehensive WRA program funded by the European Union.

#### 4.4 Externally Funded Projects

The participants reported on projects and activities funded within the region by the organisations such as the Asian Development Bank, Japanese International Cooperation Agency (JICA), World Bank and bilateral assistance (for example, AusAID, NZODA). At least five or more countries identified the Asia Development Bank as a source of funding, while seven countries reported funding from AusAID and NZODA provided assistance for at least three countries. JICA provided funding for projects in two countries and the European Union provided assistance for at least one country. All of this assistance was related to water resources and hydrological projects and institutional strengthening.

#### 4.5 WWC and GWP

The participants were informed of recent WMO input to the programmes of the World Water Council (WWC) and Global Water Partnership (GWP). The participants reported very little interaction with these agencies to date. The WMO Secretariat agreed to keep the region informed of future developments and opportunities through the RA V Regional Hydrological Adviser.

#### 4.6 Discussion

The meeting considered the above set of activities in their discussion of the needs of the region. In particular, the region recommended that the activities of the above agencies in the region be undertaken in a more coordinated manner to ensure maximum benefit to the countries of the region.



## **5. HYDROLOGICAL OPERATIONAL MULTIPURPOSE SYSTEM (HOMS)**

5.1 The meeting was informed of the outcomes from the International Workshop on HOMS in the 21<sup>st</sup> Century held at the WMO headquarters in Geneva, 6-8 September 1999. This included a report on the present three phased approach to upgrade HOMS. This covers aspects of updating existing components during the period March-December 1999, submission of new components (October 1999 – December 2000) and promoting increased utilization of HOMS (2001 – onwards).

5.2 The meeting noted that the mission of the Hydrological Operational Multipurpose System (HOMS) is the organised transfer of proven hydrological technology used operationally by national Hydrological and Meteorological Services (NHMSs) for all facets of hydrology and water resources management.

5.3 The meeting also noted that the objectives of HOMS are:

- (i) To provide an efficient means of technology transfer;
- (ii) To aid in the application of and training in appropriate technology, especially in developing countries;
- (iii) To improve the quality of hydrological information available for use by decision-makers; and
- (iv) To provide an international systematic framework for the integration of the many technologies, methodologies, procedures and guidelines for use in hydrology and water resources management.

5.4 The meeting was informed that the primary target group is the NHMSs of Members of WMO. The secondary group is those academic and government agencies involved in hydrology and water resources. The following aspects of the implementation plan for HOMS in the 21<sup>st</sup> Century were reported to the meeting:

- The roles of the various groups involved in HOMS;
- Criteria for new and upgrade of existing components and sequences;
- Commercial components;
- Organization of the HOMS reference manual;
- Distribution of components and the role of the Internet;
- Process to identify gaps in HOMS;
- Training within HOMS;
- Guidelines for the review of components;
- Guidelines for HOMS component descriptions;
- Promotion of HOMS; and
- Performance indicators.

5.5 The meeting participants were encouraged to learn more about the capabilities of HOMS and were advised that the needs of the South Pacific countries would be provided to the HOMS Office in the WMO Secretariat for use in seeking new components for HOMS. Also, the HOMS Office will be requested to forward promotional material on HOMS to the participants as soon as it is available. The participants were also asked to consider the potential benefits of a HOMS Focal Point in the South Pacific, rather than individual HOMS National Reference Centres.

5.6 The issue of commercial components was also discussed, in particular in relation to proprietary software which is often a part of present day software packages.

## **6. WORLD HYDROLOGICAL CYCLE OBSERVING SYSTEM (WHYCOS)**

6.1 A presentation made by the WMO Secretariat informed the meeting of the concept of WHYCOS, its current status of development and the co-ordination mechanism which had been put in place. The WHYCOS brochure which was published in March 1998 and provided much of the same information was made available. The meeting noted that WHYCOS was being developed through a series of regional/sub-regional projects using satellite based Data Collection Platforms (DCPs) for the collection and transmission of both water quantity and water quality parameters. WHYCOS was multi-purpose in nature providing training, technology transfer, and promoting regional co-operation in operational hydrology and water resources assessment.

6.2 The meeting noted that the regional components (HYCOSs) were being developed and implemented independently and responded to local needs, while adhering to the general concept of WHYCOS. At present the whole of the African continent was covered by HYCOS projects, either being implemented, such as MED-HYCOS and SADC-HYCOS for the Mediterranean and Southern African regions respectively, by projects already developed, such as the AOC-HYCOS (West and Central Africa), or by projects that were still in the developmental stage such as Congo-HYCOS and IGAD-HYCOS for the Congo River Basin and Eastern Africa respectively. HYCOS projects were also being developed in other regions such as the Baltic Sea Basin and the Caribbean and Central American regions. Other areas, including the Danube and the Amazon river basins, and the Aral Sea basin were also under consideration.

6.3 A presentation by Mr Marc Morell (France), Coordinator of the MED-HYCOS Pilot Regional Centre, provided further details of a project which was being implemented and gave an opportunity to discuss the type of benefits which accrue to the participating countries. He expressed the readiness of the MED-HYCOS project to share its experience towards the development of similar activities in the South-West Pacific. An updated copy of the MED-HYCOS CD-ROM was provided to all the participants.

6.4 The current development and implementation of the various HYCOS projects were made possible with the financial support of the World Bank, the European Commission and the Government of France.

6.5 The meeting recalled that the WMO Congress had expressed the view that WHYCOS was particularly suitable to countries made up of small islands and had called for the development of HYCOS projects for the Caribbean and Pacific regions.

## **7. CAPACITY BUILDING IN THE REGIONAL CONTEXT**

7.1 The discussion under this item took into consideration the findings of the Workshop on Water Resources Assessment, Review of National Capabilities, that was conducted in Nadi the week prior to this meeting. A summary of the findings of that Workshop related to the needs of the South Pacific Island countries is contained in Annex 3.

7.2 The participants divided into two working groups, representing the western (predominantly mountainous volcanic) islands and the eastern (predominantly smaller, lower) islands respectively. The groups reviewed hydrological needs in the region, as identified by the RA V WGH, the Water Resources Assessment Workshop during the preceding week, and the country reports presented by the meeting participants. They attempted to identify a small number of specific, achievable actions, which could be further considered by WMO Members and Secretariat.

7.3 Specific areas that were identified for action were:

- (i) *Training of hydrologists and water resources specialists.* The need for training had been repeatedly recognised over the years, and it was concluded that a new approach is needed. It was considered that the concept of a Regional Training Centre should be examined in the medium term; such a Centre need not be at a specific permanent location, but would need to have a focal point which could carry out the necessary functions – specifying training needs, designing means of best meeting those needs, providing or commissioning appropriate training and education events, and facilitating bilateral linkages. The need to ensure collaboration among External Support Agencies, particularly WMO, SOPAC, UNESCO, SPREP and donors, was emphasized, as was the need for a focus on training the trainers.
- (ii) *Immediate needs for specific training events* were identified, although it was considered that a more formal survey was required to refine the needs. The priorities were for short (four week) courses on hydrological analysis, hydrometric (field) techniques, hydrological data processing/archiving, and instrumentation. These would be aimed at senior technical staff and water resources officers, and could be delivered within the region, drawing on regional expertise. Needs for higher level, longer term training and education were also identified, in water resources planning and water quality analysis. These might best be provided via existing postgraduate courses. Attention was drawn to the hydrometric/instrumentation course developed by the French IRD, which might be offered in the region.
- (iii) *Knowledge and information exchange and information transfer.* The need to enhance communication between services within the region (and between agencies within each country) was recognised. Various Internet-based approaches were suggested, including developing a web-site, more extensively using email to circulate material of wide interest, developing bulletin boards, mail groups, etc. The SOPAC representative kindly offered to provide such facilities, and other participants offered assistance in other ways.
- (iv) *Guidance on legislation, policy, and institutional development.* Improvements in the institutional, legal and policy framework for the water sector will be generated from within countries, but a need to exchange experience, examples of “best practice”, and other guidance in this area was recognised. Appropriate means could include developing guidance material, compiling and distributing examples of laws and policies, providing an expert to advise/assist countries for short periods, or mounting a “roving seminar” or similar event. The interest of the Asian Development Bank in promoting institutional change, and the potential of the WMO VCP as a means of providing support, were noted.

- (v) *Data capture, archiving and dissemination (monitoring)*. Assistance to improve the entire sequence of hydrological data acquisition and use was regarded as a regional priority. Groundwater and surface water, water quantity and water quality observations, data and information equally were included. Many country-specific needs could be addressed, such as replacement of obsolete instrumentation, introduction of new software and archiving facilities, staff training in hydrometry and data processing/analysis, infrastructure and institutional change. Together, these warranted a comprehensive, region-wide approach that bore a close resemblance to a HYCOS project emphasising capacity building in its broadest sense. The potential benefits of region-wide collaboration particularly were recognised, in terms of standardisation of techniques, exchange of expertise and technology, approaches to External Support Agencies, etc. It was decided to further consider this area under agenda item 8.

#### **7.4 ACTION PROPOSED**

- (a) The WMO Secretariat is requested to consider appropriate actions to implement (i), (ii) and (iv) above.
- (b) The kind offer of the SOPAC representative concerning (iii) above was accepted with thanks, and with the request that SOPAC might consider and advise on the development of a “package” of Internet-based communication tools.

The meeting also agreed that for collaboration and potential benefits within the region the coordination point be from the WMO Sub-Regional Office in Apia and the training facilities will be in Fiji with assistance from SOPAC.

#### **8. PROSPECTS FOR A PACIFIC-HYCOS**

8.1 The meeting considered Working Paper 1, and held a wide-ranging discussion which can be summarised under the following points:

- (a) Project scope. Taking into account the varying needs of the countries, it was considered that project scope must encompass hardware, promotion of cooperation, training, exchange of expertise, development of archiving capability, and raising the profile of the water sector. Not all countries would need to participate in all aspects of a HYCOS, but could nevertheless benefit from partial participation. It was emphasised that a focus on hardware would be very undesirable, although this aspect is of particular interest to some countries with, for instance, flood forecasting requirements.
- (b) Project implementation. Within a HYCOS project of 3-5 years, good progress in hardware installation, software development and staff training could be expected within 2 years. It was noted that no fees are required of participants, and that the use of satellite telemetry and the GTS are – within a WMO project – free of charge. A HYCOS project could be initiated with a sub-group of countries, but countries were assured that they might enter an ongoing project at a later stage. It was also noted that there are no penalties if a country should find it necessary to withdraw;

- nevertheless, country commitment to a project is essential, and is expressed by signing the project document.
- (c) Need for a Regional Centre. A Regional Centre is required to provide a focal point for many HYCOS related activities. A full-time staff of 4-6 could be anticipated. Countries would also need to commit staff time; this could be up to one person on a full time basis, depending on scale of participation. The location of the Regional Centre is to be decided by the participating countries.
  - (d) Need for in-country support. It is essential that each country's government should be fully aware of and support a HYCOS project. It was noted that the South Pacific Forum provides a governmental-level regional organisation through which a project could be promoted, and which could seek funding from external support agencies. The need to generate long-term governmental commitment to and funding for water resources management and assessment was also noted. It was suggested that a HYCOS project, as a high-profile, regional endeavour, might assist in this.
  - (e) Maintenance and continuity. Considerable concern was expressed about the ability of countries to maintain instrumentation and archives, and retain trained staff, after project completion. Countries must recognise that there are ongoing costs for hydrological programmes, and make appropriate financial allocations for them. Because of the world-wide difficulty of assuring such allocations, it was considered that a key goal of a Pacific-HYCOS would be to address this.

## **ACTION PROPOSED**

8.2 The meeting agreed, in principle, that the HYCOS concept has potential in the South Pacific, particularly if seen as a vehicle for regional cooperation and training, and not simply as a data collection exercise. Numerous questions remained to be answered about project scope, duration, and implementation. There was particular concern about how to assure affordable continuance after a project was completed. The meeting therefore requested the WMO Secretariat, in collaboration with the countries and in consultation with the South Pacific Forum Secretariat, to develop a full project proposal that could be used to seek project funding from external support agencies. The proposal shall take into consideration the issues raised during the meeting.

## **9. CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE ACTION**

9.1 The meeting recalled that agenda items 3 to 6 had considered the water-related needs of the island countries, and reviewed current national and international efforts to meet those needs. It noted that the discussions recorded under items 7 and 8 had comprehensively considered ways in which the countries could collaborate, together with inter-governmental agencies and non-governmental organisations, to further address those needs. A number of specific recommendations had been made as a result.

9.2 Therefore, the meeting recommended that the WMO Secretariat facilitate or carry out the actions proposed under agenda items 7 and 8 above. Immediate attention should be given to those relating to training, but because of the urgency of the needs in the region, prompt action was requested on all matters.

## **10. ADOPTION OF THE REPORT OF THE MEETING**

The meeting adopted the report of its deliberations and requested the WMO Secretariat to make any editorial changes deemed necessary. It further requested the Secretariat to distribute the final report to all participants, Permanent Representatives of WMO Members within RA V and their Hydrological Advisers, members of the RA V Working Group on Hydrology and to regional organizations concerned.

## **11. CLOSURE**

The meeting closed at 17h00 on Wednesday 6 October 1999. At the close, the chairman, Mr Rishi Raj, expressed his thanks to all concerned for contributing to the success of the meeting. The Permanent Representative of Fiji, with WMO, Mr Rajendra Prasad expressed his appreciation to the WMO Secretariat for having given Fiji the opportunity of host the meeting and his hope that the support provided had been adequate. On behalf of the participants, Ms Kay Kalim and Mr Michel Odier expressed their appreciation to both the WMO Secretariat and to the Government of Fiji. Mr J. Bassier reiterated WMO's appreciation to the Government of Fiji and in particular to the Meteorological Service for the excellent support which had been provided to the meeting. He also thanked the participants, the chairman and the resource persons for their valuable contributions.

**LIST OF PARTICIPANTS**

**AUSTRALIA**

Mr Bruce STEWART

Tel : (613) 9669 45 22 (office)  
(613) 9725 16 79 (home)

Fax : (613) 9669 47 25

E-mail : b.stewart@bom.gov.au

Hydrology Unit  
Bureau of Meteorology  
G.P.O Box 1289K  
MELBOURNE, Vic. 3001

**COOK ISLANDS**

Mr Teokotai Ben PARAKOTI

Tel : (682) 200 35

Fax : (682) 211 34

E-mail : nbp@oyster.net.ck (home)

Hydro@mowepp.gov.ck (office)

Ministry of Works, Energy and  
Physical Planning  
Department of Water Works  
P.O. Box 102  
RAROTONGA

**FIJI**

Mr Rishi RAJ

Tel : (679) 31 52 44

Fax : (679) 30 30 23

E-mail : rishi@is.com.fj

Ministry of Works, Private Mail Bag  
Ganilau House  
SUVA

Mr Faga FINIASI

Tel : (679) 66 08 99

Fax : (679) 30 30 23

Public Works Department  
P O Box 128  
LAUTOKA

Mr Ashok KUMAR

Tel : (679) 31 52 44

Fax: (679) 30 30 23

Hydrology Section  
P O Box 3740  
SAMABULA  
SUVA

## FRANCE

Mr Marc MORELL

Tel: (33) 4 67 63 64 20  
Fax: (33) 4 67 41 21 33  
E-mail: marc.morell@mpl.ird.fr  
URL: <http://medhycos.mpl.ird.fr>

MED-HYCOS PRC  
c/o IRD  
911, avenue Agropolis  
BP 5045  
34032 MONTPELLIER

Mr Michel ODIER

Tel: (33) 1 42 19 13 11  
Fax: (33) 1 42 19 13 33  
E-mail: michel.odier@environnement.gouv.fr

Ministère de l'Environnement  
Direction de l'Eau  
20, avenue de Ségur  
75302 PARIS 07 SP

## NEW ZEALAND

Mr Charles PEARSON

Tel : (64 3) 348 89 87  
Fax : (64 3) 348 55 48  
E-mail : c.pearson@niwa.cri.nz

NIWA  
P.O. Box 8602  
CHRISTCHURCH

Dr Paul MOSLEY

Tel : (64 3) 329 62 42 (home)  
Fax : (64 3) 329 62 42 (home)  
(64 3) 348 55 48  
E-mail : p.mosley@niwa.cri.nz

NIWA  
P.O. Box 8602  
CHRISTCHURCH

## NIUE ISLAND

Mr André M. SIOHANE

Tel : (006 83) 42 97  
Fax : (006 83) 42 23  
E-mail : waterworks@mail.gov.nu

Water Supply Division  
Public Works Department  
P.O. Box 38 Fonuakula, Niue Island  
South Pacific

## PAPUA NEW GUINEA

Ms Kumaras Kay KALIM

Tel : (675) 325 0194/325 0180  
Fax : (675) 325 0182

Water Resources - Office of  
Environment and Conservation  
P.O. Box 6601  
BOROKO  
National Capital District



## **SAMOA**

Mr Faafia BROWN

Tel : (685) 20 855 / 20850  
Fax : (685) 20857  
E-mail : Faafia@meteorology.samoa.net

Ministry of Agriculture Forests Fisheries  
and Meteorological Division  
P.O. Box 3020  
Mulinuu  
APIA

## **SOLOMON ISLANDS**

Mr Isaac LEKELALU

Tel : (677) 215 21/255 27  
Fax : (677) 258 11

Water Resources Division  
Department of Mines, Energy and Water  
M.N.R P.O. Box G37, HONIARA

## **USA**

Mr Gerald J. NIBLER

Fax : (907) 266 5182  
E-mail : Jerry.Nibler@noaa.gov

NWS Alaska-Pacific River Forecast Center  
6930 Sand Lake Road  
ANCHORAGE, AK 99502-1845

## **VANUATU**

Mr Erickson SAMMY

Tel : (678) 22 423  
Fax : (678) 22 213  
E-mail : geology@vanuatu.com.vu

Department of Geology, Mines and  
Water Resources  
Private Mail Bag 001  
PORT VILA

## **SOPAC**

Mr Harald SCHOLZEL

Tel : (679) 381 377  
Fax: (679) 370 040  
E-mail : harald@sopac.org.fj

Water Resources Unit  
Private Mail Bag  
Mead road  
SUVA  
Fiji Islands

**UNESCO**

Mr Marc OVERMARS

Tel : (62 21) 3141308 Ext 805  
Fax: (62 21) 3150382  
E-mail: m.overmars@unesco.org

Regional Office for Science &  
Technology for Southeast Asia  
Jl.M.H. Thamrin 14  
P O Box 1273/JKT  
JAKARTA 10002  
Indonesia

**WMO SECRETARIAT**

Mr John L. BASSIER

Tel : (+41 22) 730 83 54  
Fax : (41 22) 730 80 43  
E-mail :bassier\_j@gateway.wmo.ch

7bis, Avenue de la Paix  
Case Postale No 2300  
1211 GENEVE  
SWITZERLAND

**AGENDA**

1. OPENING OF THE MEETING
2. APPROVAL OF THE AGENDA AND ORGANIZATION OF THE WORK
3. NEEDS OF OPERATIONAL HYDROLOGY IN THE REGION
  - 3.1 Review of the work of the RAV Working Group on Hydrology during the last inter-sessional period
  - 3.2 Relevant decisions of Cg-XIII, the Executive Council, XII.RA V, and CHy-X
4. RELEVANT PROGRAMMES OF OTHER INTERNATIONAL AND INTER-GOVERNMENTAL ORGANIZATIONS
5. HYDROLOGICAL OPERATIONAL MULTIPURPOSE SYSTEM (HOMS)
  - 5.1 Current status and future plans
  - 5.2 Current level of use in RA V
  - 5.3 Discussion: opportunities for enhancing the utility of HOMS in RA V
6. WORLD HYDROLOGICAL CYCLE OBSERVING SYSTEM (WHYCOS)
7. CAPACITY BUILDING IN THE REGIONAL CONTEXT
8. PROSPECTS FOR A PACIFIC-HYCOS
9. CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE ACTION
10. ADOPTION OF THE REPORT OF THE MEETING
11. CLOSURE



**SELECTED EXTRACT FROM  
THE REPORT ON THE WATER RESOURCES ASSESSMENT WORKSHOP  
REVIEWING CAPABILITIES FOR WRA IN THE SOUTH-PACIFIC COUNTRIES**

The workshop discussed the main problems and issues facing water resources assessment in the region. A wide range of problems and issues were identified by the participants, including:

- Insufficient funding is provided for water resources assessment in most countries;
- Absence of specific legislative power for water resources assessment, hence WRA is difficult to apply;
- Significant water quality issues (important to WRA) not yet addressed include:
  - Salt water intrusion into freshwater reserves;
  - Pollution;
  - Discharge of pollutants into groundwater and surface water;
- Management decisions tend to address immediate/short-term issues, rather than setting a long-term strategic programme and are sometimes based on inadequate local information;
- Lack of and difficulty in retaining trained staff. This is made worse by the need to go overseas for training, and the rapid pace of development of new technology and supporting hardware and software;
- Fragmentation of roles and responsibilities within the water industry, exacerbated by a lack of communication/linkages and information sharing amongst the various agencies.
- Lack of coordination amongst donors, international organisations and the receiving countries;
- Changing populations, including urbanisation and population decline in some rural areas and on some islands (Nuie);
- Imported activities do not necessarily work in the tropics and there is a need for economically viable technologies for the tropics;
- Insufficient knowledge on the effects of climate variability and climate change (for example, increases in extremes; ENSO episodes);
- Lack of knowledge on whether demand for the resource can be met;
- Lack of knowledge on the interactions between surface water and groundwater;
- Inadequate public awareness of the importance of water and the role played by hydrologists. This can result in the wastage and sub-optimal use of water;
- Lack of an integrated-multi-disciplinary approach to water resources management; and
- An inadequate database, lacking in long records for most hydrological elements in most countries and a shortage of spatial information and interpolation techniques.

The future data needs with respect to data collection, processing and dissemination that the Workshop identified were related to future potential development identified earlier in the Workshop (for example, urbanisation, hydro-power, tourism, mining, integrated management and climate variability) and included:

- Streamflow and river height data in many ungauged catchments
- Rainfall data in more remote high rainfall regions
- Continuation of climate and other rainfall stations at the same level was seen as necessary for future requirements
- Groundwater levels, and river and groundwater quality were targeted as data collection activities which will be required to increase beyond their current extent
- Water use data will be required in areas where there is significant demand for water
- Soil moisture monitoring

The participants of the Workshop also identified a range of education and training issues that have to be confronted, including:

- There is a lack of specialised training in hydrology in most countries;
- There is a lack on in-house training capabilities in most countries;
- There is a great need for locally based relevant training courses at the technical (in particular) and professional levels;
- Very limited funds are provided for training as it is given a low priority;
- Institutional reforms have resulted in the loss of key experienced staff, as has the development of the private sector (attracted to higher salaries);
- Attracting new staff is difficult because salary levels are low;
- Many agencies are becoming more driven by “profit” than providing community services;
- Good, well-qualified staff are often promoted into management or other areas and sometimes their expertise is lost to the organisation without consideration of the consequences;
- The unclear role many agencies have in water resources assessment adds confusion to the situation;
- Because of the low salaries and lack of opportunities within WRA agencies, there has been a “brain drain” of qualified staff;
- The entry level requirements for some specialist courses can sometimes be difficult to meet and therefore valuable training opportunities are sometimes lost;
- There is possibly too much reliance on international organisations for support in training initiatives;
- However, it is essential to involve the regional and international organisations (SOPAC, SPREP, WMO, etc.) in training initiatives;
- Consideration should be given to multi-disciplinary training, for example, training meteorologists in hydrology and visa versa;
- It is essential that proposed development projects within the region include and financially support a training strategy to ensure capacity building within the countries; and
- A change in attitude is necessary from a situation where we only learn from our mistakes to one where we learn in order to reduce the risk of mistakes.