THE NEWSLETTER OF THE BRITISH HYDROLOGICAL SOCIETY

Circulation

No. 30 May 1991

Water Resources in South-West England, Post-Privatisation

BHS South-West Section Meeting 22 March 1991

More than 20 participants gathered in the Geography Department at the University of Exeter for a meeting devoted to the roles, functions and responsibilities of the National Rivers Authority South-West Region and South-West Water PLC in relation to the water resources of South-West England.

Giving a brief introduction to BHS activities at international, national and regional levels, **Allan Lambert** (President, BHS), welcomed the theme of the present meeting as being particularly topical, and hoped that there would be a series of discussions in the BHS regions which addressed the different challenges facing the NRAs and PLCs.

The honour fell on **Barry Milford** and **Cliff Tubb** to 'open' on behalf on the NRA, and the audience were treated first to a video presentation outlining the general role of this organization in the South-West. It has a brief to safeguard and to improve the water environment of the region. The NRA is concerned with seven broad areas which comprise:

water quality,
pollution control,
flood defence,
water resources planning,
fisheries,
conservation,
recreation,

and in the South-West Region the Authority has to deal with an area including >5000 km of rivers, 350 km of estuary, 680 km of coastline and 200 beaches, containing two National Parks and receiving more than six million tourists each year. Some 400 staff are employed to undertake a wide range of activities which include routine monitoring of water quality, emergency action to ameliorate the effects of agricultural and industrial pollution episodes, and flood warning, emergency repairs and design of longer-term alleviation schemes in connection with river and sea flooding. The NRA is also responsible for ensuring sufficient water resources to meet the present needs of public supply and fish life; it regulates future use by licensing abstractions. Protection against poaching and the use of breeding programmes and other measures maintain and enhance the health of fisheries. Conservation of the water environment is seen by the NRA to pay dividends in terms of recreational use.

Following this general introduction, the two speakers from the NRA focused more specifically on the issues of water resources and water quality. Cliff Tubb noted at the beginning of his talk that one of the ways in which the NRA aimed to protect and improve the water environment of the South-West was through the effective management of water resources. This objective required the development of a water resources strategy for the region which took into account future climatic trends, reliance upon surface water supplies, pollution risk associated with flashy streams and rivers, environmental impacts and growing public awareness of the water environment. He argued that the Water Resources Act 1963, which covered the licensing of abstractions, and the Water Act 1989, which defined the duties of the National Rivers Authority, were the key pieces of legislation that laid down the role of the NRA in respect of water resources. This role has three main facets: assessment of resources, securing proper use and protection of resources. Table 1 summarises the means by which these duties are achieved.

Cliff Tubb suggested that in fulfilling these roles the interaction between the NRA and the PLC in the South-West is somewhat different to that which exists in some other parts of

Table 1 NRA roles relating to Water Resources

Assessment of Resources

Monitoring hydrological régime
Monitoring uses and future demands

Securing Proper Use

Operating agreements on public water supply sources
Drought order / management of resources
Abstraction and enforcement

Resources Protection

Planning consultation responses
Discharge consenting
Developing protection policies
Promoting nitrate-sensitive areas
Defining water protection zones

the country. This reflects the fact that the region is served by a single PLC so that the NRA does not have to balance potentially conflicting interests of two or more companies within its area of jurisdiction. A 'one-to-one' relationship between the staff of the two organisations, many of whom had worked together in the South-West Water Authority, has fostered a spirit of co-operation between the NRA and the PLC which is apparent in the activities undertaken in relation to water resources issues. Information on the status of groundwater supplies, river flows, reservoir levels and other relevant variables, which is variously collected by the NRA and the PLC, is pooled and published on a routine basis as a 'Water Situation Report' by South-West Water. Comparison of current performance at a number of key sites with that during years which experienced extreme hydrological conditions is used to assess the seriousness of the water resources situation at a given time. Figure 1, for example, shows the record of flows in the River Torridge during the first nine months of 1990 in comparison with the discharge regime in 1989 and 1976. It is evident that although flows occasionally fell below the prescribed level during last summer, conditions in 1990 were by no means as severe as those in 1989 or 1976.

Cliff Tubb explained that routine updates and comparisons are of particular use in drought management. A plot of cumulative monthly rainfall deficit during the first 10 months of 1990 (Fig.2), for example, shows that although conditions appeared to be very severe in the spring period, summer rainfall has ameliorated the situation to a certain extent. Drought management involving the use of drought orders is part of the regulatory role of the NRA, and in general regulation of water use through the licensing of abstractions is a complicated legal process which requires considerable technical skill. Cliff Tubb stresses that the NRA is keen to enhance as well as to regulate water resources in the South-West. For example, a project is under way to alleviate low-flow problems and involves an audit of the scale of abstraction in relation to low-flow volumes. In certain parts of some South Devon rivers, abstractions are licensed to take up to four times the dry weather flow, and improvement of this situation may involve the NRA in buying up the rights to abstract, in paying compensation to vary the licence or in investing in river works.

Barry Milford addressed the role of the NRA in water quality planning. He noted that under the Water Act, the Authority was responsible for controlling the quality of surface, ground and tidal waters, the latter out to a distance of three miles from the coastline. In order to control quality, the uses of all waters have to be assessed and a series of quality objectives related to each use established. Water quality objectives are achieved by setting standards specified in EC directives, and in order to check whether these requirements are met in the South-West Region, the NRA has instigated an extensive monitoring program. This will involve an annual throughput of some 70,000 samples, will cover fresh, ground and tidal waters, together with effluent discharges, and will be based on a brand-new laboratory at the regional headquarters. Barry Milford pointed out that testing of compliance with standards will be based on considerations of statistical probability and he also noted that although the NRA did not comment on whether water bodies have met standards or not, the information from water quality testing was made available through the Public Register.

Two NRA teams in the South-West Region work to identify the occurrence and the causes of the non-compliance of waters with the required standards. Under the Water Act, the NRA has a duty both to protect and to maintain and improve water quality, and this involves not only a controlling but also a preventive function. The Authority has the power to regulate discharges and in the South-West Region there are 11,000 consented discharges, of which 1000 are routinely monitored.

Persistent non-compliance with consent standards will lead to enforced improvement and prosecution, but the Authority also seeks to prevent pollution by schemes for improving the quality of existing discharges and through planning liaison where potential problems associated with developments can be avoided at the planning application stage. Assessment of environmental impacts is being given greater attention, and Barry Milford gave the example of the imminent closure of the Wheal Jane Mine in Cornwall, which will result in a large volume of mine water (7 million gallons day) rising to the surface over the next 6-10 months and discharging into the Carrick Roads. This water will have pH 3 and will contain most of the toxic metals, and the Authority is currently addressing the problem of how to monitor and how to control this major acidic flush.

Dick Beardsall was the main speaker for the PLC with **Neil Whiter** acting as 'long stop' to field specialised questions in discussion. In terms of water resources planning, the main role of the PLC is to identify the needs of customers, both present and future, and to lay plans which are both timely and within budget. In his presentation, Dick Beardsall briefly reviewed the build-up to privatisation, outlined the

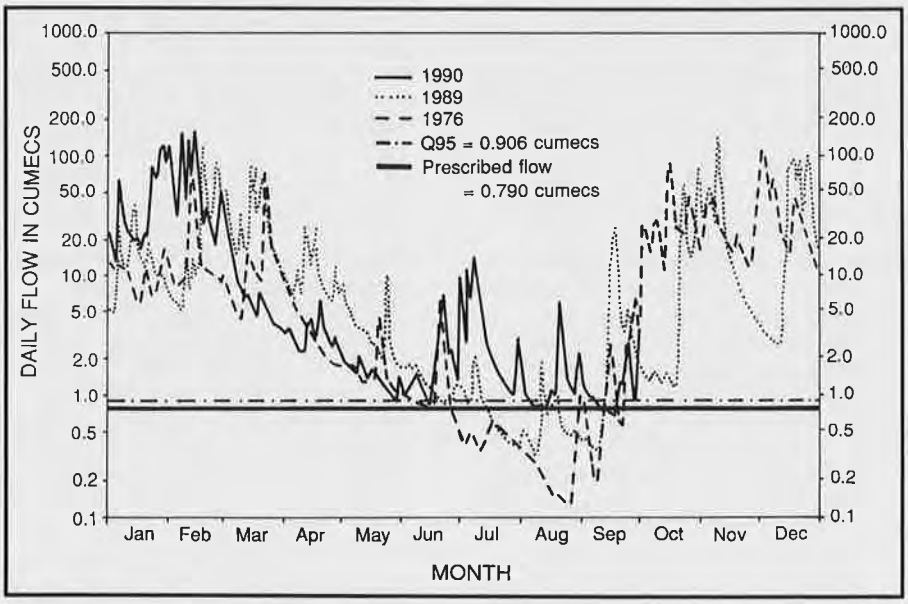


Figure 1. Flows in the River Torridge at Torrington

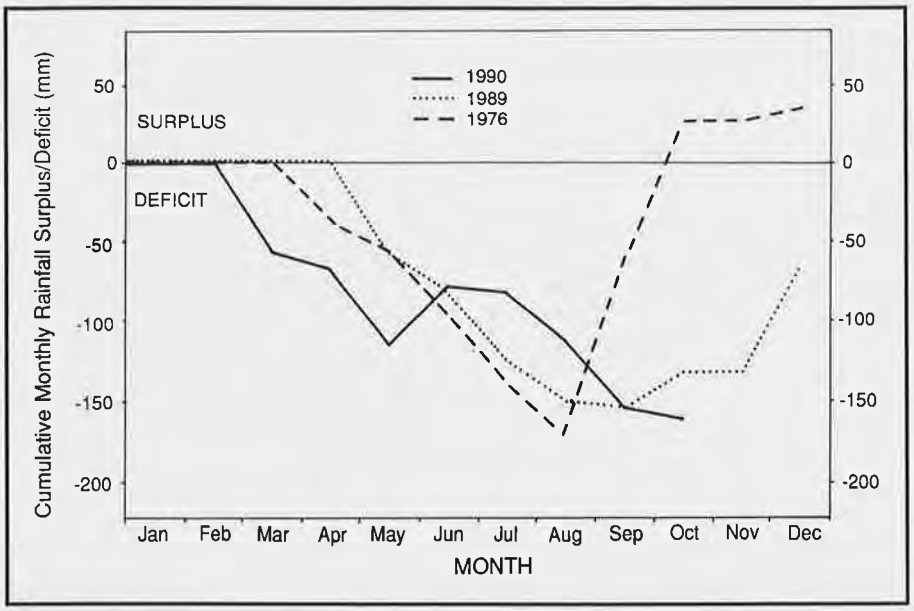


Figure 2. Cumulative monthly rainfall surplus/defecit at RNAS Culdrose meteorological station, Cornwall

activities of the PLC and discussed the main challenges facing South-West Water. Flotation of the PLCs took place in November 1989, and South-West Water was set up in three main parts (Figure 3). These comprise a holding company which overarches a core subsidiary, responsible for providing the public service, and an enterprise subsidiary, formed to make a profit. The customer is central to the role of the PLC (Figure 4) which involves on the one hand supplying, treating and distributing water, and on the other hand includes the collection, treatment and discharge of waste water back into the natural environment. Dick Beardsall suggested that the relationship between the PLC and NRA is potentially more 'comfortable' with respect to the supply compared with the disposal function. The activities of the PLCs, including South-West Water, are in fact regulated at a number of different levels. The Secretary of State for the Environment plays a regulatory role especially through the Drinking Water Inspectorate. The Director General of Water Services has the dual function of ensuring that Water Companies deliver an appropriate service to the customer but at the same time has a responsibility for the economic viability of the PLCs. The NRA has a direct impact on the activities of the Water Companies through its powers to control abstractions, water quality and effluent discharges. Dick Beardsall stressed that although South-West Water was the largest discharger and therefore the largest potential polluter in the region, it was also the largest abstractor and thus relied strongly on maintaining water resources of high quality.

Privatisation has greatly increased the opportunity for investment in water supply and disposal, and South-West Water is planning to spend some £1.4 billion in the course of the 1990s (Table 2). In order to achieve this level of investment, and (it is argued) to meet higher standards and to make up for previous gross under-investment, the Water Companies have the power to increase water charges by 6.5% and 5% above the retail price index in the first and second five-year periods respectively following privatisation. The money will be spent largely on the various facets of water supply and disposal. In South-West England, the water resources strategy of the PLC has been essentially inherited from the South-West Water Authority, which in the last 15 years constructed three major reservoirs (Wimbleball, Colliford and Roadford) along the 'spine' of the Peninsula and in the process quadrupled reservoir capacity. Dick Beardsall explained that the PLC is now addressing the remaining problem area of East Devon, which hitherto has largely depended on groundwater supplies that are becoming increasingly insufficient to meet demands. Further development of groundwater is unviable and a solution based on the construction of a pump storage reservoir in the Axe Valley is proposed. A compromise is required in connection with this scheme regarding the level of residual flow deemed desirable by the NRA and the PLC.

South-West Water operates 60 water treatment works which will come under increasing pressure to meet the higher standards required by EC directives (in law since 1989) and to cope in an area where demand is growing at the second fastest rate in the country. Distribution, as well as treatment, of water also presents a challenge. South-West Water has 8,000 km of mains to look after, and there are problems associated with rapid expansion of population dependent on particular mains, with the quality of pipes and with leakage losses. Some 200 km of unlined iron pipe are being scraped and reclined each year, and on declared figures, leakage losses in the South-West Water area reach 30%. Leakage control is therefore a priority and in East Devon, for example, the target is to reduce these losses to

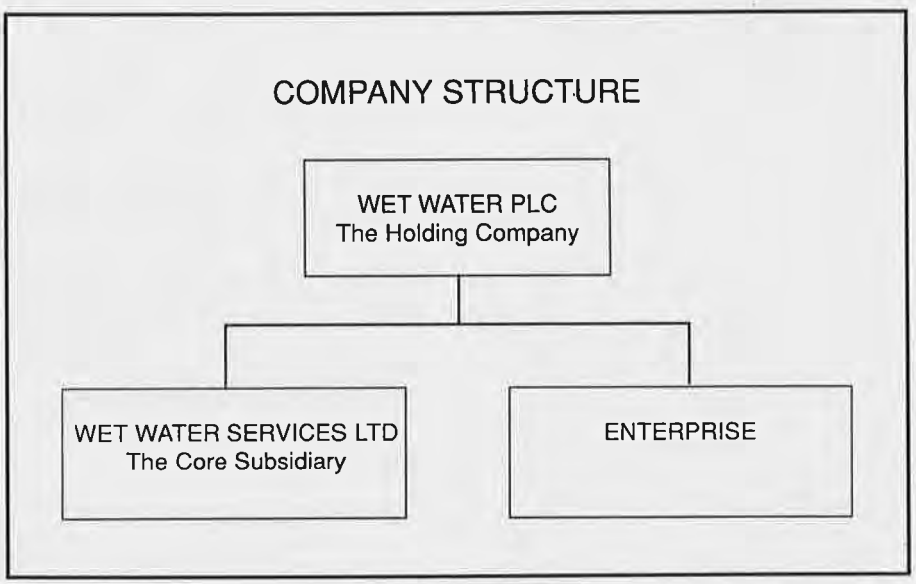


Figure 3. Company structure of South West Water



Figure 4. Central role of the customer in South West Water's activities

Table 2 South West Water's programme of capital expenditure in the period 1990/91 to 2000/01

Water Resources	£40 million	Water Supply Improvements £475 million
Water Treatment	£95 million	
Water Distribution	£340 million	
Marine Sewage Treatment	£435 million	Waste Water Improvements £820 million
Sewerage	£125 million	
Waste Water Treatment and Sludge Disposal	£260 million	
Supporting Activities	£105 million	

between 16 and 18%, and in the longer term to lower levels.

Dick Beardsall went on to review the disposal side of South-West Water's activities. There are 8,000 km of sewers in the region and attention is being given to repairing and expanding the system, especially to reduce the incidence of flooding. South-West Water operates 610 sewage treatment works, which is the same number as Thames Water! It was noted that standards associated with discharges from these works had been relaxed as an inducement to the privatisation process, since it gave legality to effluents of inferior quality inherited by the PLC from the South-West Water Authority. However, Dick Beardsall also stressed that this was very much a temporary waiver and that effluents had to meet new and higher standards within a two-year period, necessitating an accelerated programme of investment. Pollution of the coastal environment by discharges into the sea is a particular problem in South-West England. The legacy of practices during the last 100 years is that 38% of the sewage discharged offshore is untreated, and serious problems for the quality of bathing waters inevitably result. The PLC undertakes monitoring to identify those outfalls which consistently fail to meet standards, employs computer modelling techniques to assess the impact of sewage pollution and is planning 33 capital schemes to remove the major problems, including an £80 million project for the Penzance area. Much of the projected improvement is being advanced into the next five years and this, together with the requirement for primary treatment for all sea outfalls and secondary treatment at some, has substantially added to the PLC's investment programme. Dick Beardsall concluded his presentation by summarizing the 'mission goals' of South-West Water which are to satisfy its customers, enhance the environment and to add value for the shareholders, employees and the community.

A lively and wide-ranging discussion followed the main presentations. Fears were raised, but largely allayed, concerning the use of aluminium sulphate in water treatment; the apparent 'cosiness' of the relationship between the NRA and PLC was questioned and the need for independent arbitration in conflicts between the two organisations raised; and the benefits of a conjunctive use model of Roadford Reservoir in planning was explained. Duplication of activities between NRA and PLC, methods of expressing leakage losses and problems of meeting future needs, including seasonal mismatches in supply and demand, were also discussed.

The relationship between the PLC and NRA was described in discussion as one of constructive abrasiveness, and whether constructiveness or abrasion comes to the fore as the relationship between these two organisations develops in the South-West and elsewhere in the country remains to be seen. On the evidence of the Exeter meeting, there seems a genuine and healthy spirit of co-operation which bodes well for the development of water resources in the region. Peter Sims (BHS South-West Rep.) concluded the meeting by thanking the speakers and those raising points in the discussion for contributing to a most enjoyable afternoon.

Bruce Webb
Exeter University

River Dee to River Alt, via Indonesia and the Mersey Barrage

BHS President *Allan Lambert* and IH-based member *Henry Gunston* were active in the organising of a wide ranging Weekend Symposium of the British Section of the International Commission on Irrigation & Drainage (ICID), held on Merseyside and in North Wales.

On the evening of Thursday 4 April, after their arrival in Liverpool, the 25 participants were given an introduction by **Allan Lambert** to management of the River Dee and the history and operation of the Dee Regulation Scheme, before setting out by coach to Bala on the Friday morning. Allan also publicised the activities of the British Hydrological Society.

At Bala the Scheme was discussed further with Allan and NRA Welsh Region staff in the Control Room. Visits followed to the Llyn Tegid/Bala Lake sluices, and to two other lakes forming part of the Scheme, Llyn Celyn (completed in 1965) and Llyn Brenig (1979), where there is a lakeside Visitor Centre.

TOWYN FLOOD DEFENCES

The next stop was Towyn on the North Wales coast, the site of sea defence breaching and extensive flooding in February 1990. Here **Brian Killingworth**, NRA Welsh Region flood defence engineer, explained the immediate action which had to be taken to close the breach, and also the planned action in the longer term. A brisk onshore wind added atmosphere to Brian's seashore explanations, and taking our fairly large coach along a riverside bank track to a pumping station at the back of Rhyl not only worried the driver, but resulted in the arrival of the "village bobby", called out by a zealous local citizen!

SPEAKERS : MERSEY BARRAGE TO INDONESIAN IRRIGATION

Friday ended with a successful symposium dinner, where we welcomed as guests three of the speakers invited to the Saturday morning session, who joined us with their wives.

Chaired by **Henry Gunston**, the Saturday session led off with **Bernard Jones** of Parkman Consulting Engineers giving us a excellent briefing on the planned Mersey Barrage, which if completed would have an installed electrical capacity of 700 MW. Bernard ranged widely over the history, hydrology and engineering design of the project, including the ship locks, as well as the recreational benefits and environment effects along the Mersey estuary which could arise if it was built.

Trevor Simm of North West Water followed with "Urban Sewerage - The Interface with Land Drainage". Urban hydrology design methods and their use in sewerage planning were interesting new ground for some of us with primarily rural catchment experience. The problems for sewerage planners when local authorities become too keen to encourage commercial development on low-lying sites were particularly stressed. There are still "No Votes in Sewage"!

Moving from sewerage to water supply, **Martin Airey** of Mott MacDonald continued with "Reservoir Remedial Works in the North West". Many of the dams dating from the end of the last century are still in good heart structurally, but may need modification to satisfy current design standards, such as those arising from the Reservoirs Act (1975). In the context of routing floods through reservoirs, Martin concentrated on spillway improvements, a number of which have been carried out using masonry to match up with the original stonework.

In view of the extensive overseas experience of many ICID members, it was appropriate that **Vic Hobcroft** of Binnie and Partners ended the session with "Water Resources Planning in Aceh Province, Indonesia". As a contrast to expatriate engineers carrying through water resources design work in tropical countries with little reference to local expertise, this project developed Design Units to strengthen the water resources planning and design capability of provincial Public Works staff. Activities included water resources inventory, hydrology, survey and improvement of Operation and Maintenance.

THE ALTMOUTH PUMPING STATION

The Symposium closed with a visit to the Altmouth Pumping Station, on the coast north of Crosby and Liverpool. NRA North West Region senior engineer **Bernard Whelan** and station superintendent **John McEvoy** made us welcome, and we learnt that although the River Alt is only some 17 miles long, its catchment includes low-lying reclaimed coastal fenland which is at risk from flooding. Work started in 1968 on the £1.25m project which included construction of a new pumping station near the river mouth to replace tidal gates.

Regular drainage demands are met by four 40 cusec capacity electric pumps, but there are also four 700 cusec capacity Vickers storm water pumps driven by English Electric 1800 hp diesels – of the size used to power British Rail main-line locomotives!

John McEvoy had made a storm pump ready for a demonstration run, and the mighty diesel roared into action at the touch of a button by **Kate Ward** of Southampton University, who (from the look in her eye) obviously felt that all the work she had put in to organise such a successful Symposium had been worth it just for that brief button-pushing moment.

Henry Gunston

Hydrological Applications of Satellite-based Rainfall Estimates in Africa

BHS (Southern Section) Meeting
Imperial College, London
14th November 1990

A small but enthusiastic audience heard Dr J. R. Milford of the Department of Meteorology, University of Reading and Dr J. B. Williams from the Natural Resources Institute at Chatham introduce the hydrological applications of satellite-based rainfall estimates in Africa.

Dr Milford, leader of the project TAMSAT (Tropical Application of Meteorology using SATellite and other data), outlined the techniques that are used, emphasising that remote sensing never gave a *measure* of rainfall but only an *estimate*. The favoured technique involved cloud indexing with measures of TIR (Thermal Infra Red) emissions from cloud tops. Then the cloud-top brightness and temperature are statistically related to ground rainfall measurements. The satellite METEOSAT, stationed over Lat. 0°N Long. 0°, has a spatial resolution of 5 km for TIR, repeated every 30 minutes to give maps of cloud top temperatures. From such sequences, storm centres are identified and their movement can be followed and if needed, forecast in real time. The linear regression of cold cloud occasions and rainfall over large areas, e.g. Senegal, gave random errors but the satellite-derived data was as good as the scattered and sometimes unreliable raingauge data when deriving river flow via catchment models. Research continues to establish the accuracy of rainfall estimates over, say, 10-day periods, derived from cold cloud durations.

Dr Williams, working in conjunction with the TAMSAT team, described examples of the successful application of rainfall estimates from satellite observations in East Africa. Monitoring the Blue Nile catchment area in Ethiopia from METEOSAT resulted in successful and very helpful flow forecasts downstream during the serious period of flooding in Khartoum in 1988. Daily cold cloud estimates of storm rainfall over the subcatchments in Ethiopia were found to have a 5-day lag to the flow peak. From the storm movement representations given by sequential satellite cloud-top temperature patterns, the timing of river flows

was forecast successfully. The satellite data over Ethiopia may also provide notice of discharge in the rivers of Somalia one week in advance, which is useful for irrigation management.

Other possible applications were discussed. The question was raised as to whether management of linked reservoirs in Lesotho could be as effective, and yet more economical, by means of satellite rainfall estimation than by a telemetry rain radar system. Similarly, the management of the surface water levels of Lake Malawi, where there is a potential conflict of interest between hydro-electric power development and the fisheries, was likely to be more effectively and economically carried out by satellite monitoring. Finally, contrasting future applications of satellite imagery were mentioned: cloud seeding of suitable potential rain clouds for agricultural purposes and the management of resource-rich wetlands.

The lively discussion was divided between those newcomers to the subject anxious to learn further details of the techniques, particularly with regard to the cold cloud temperatures and rainfall relationships, and those in practice seeking expanded information on the applications or contributing examples from their own experiences.

Elizabeth M. Shaw

NEWS FROM MEMBERS

French Connection

Dr Ted Hollis of the Geography Department at University College, London, has been appointed Chief Executive at the Station Biologique de la Tour du Valat in the Camargue. He will be working half-time in France, developing projects similar to the one described by **Mike Lowing** in the last *Circulation*, and half-time at University College. A lectureship is advertised on page 7 of this issue, and it is hoped that an article about this work will follow soon.

Hydro-Logic

Dr Stewart Walker, formerly with Severn Trent Water and data-loggers Solutions from Technology Ltd, joined Hydro-Logic Ltd of Leominster in April as Marketing Director to promote their consultancy and service activities.

Hydro-Logic have been engaged as part of the NRA's National Research and Development Programme to conduct a comprehensive review of their hydrometric field techniques, and Dr Walker is leading this project.

They will look at the field measurement and data capture methods used to monitor the hydrological cycle in surface and underground environments. The aims are to review the NRA's abstraction measurement technology, identify the best practice and highlight future research and development needs.

BHS Representatives

The BHS committee representation which was listed in *Circulation 27* is here brought up to date, showing our specialist Sub-committees (A), people who represents BHS on other groups (B), and our formal links with International Societies (C). Do not hesitate to contact the individuals concerned if you require further information or if you have any relevant comments, suggestions or views.

A: SUB-COMMITTEES OF BHS MAIN COMMITTEE

[**N.B.** The President, Hon. Secretary and Hon. Treasurer are *ex-officio* members of all BHS sub-committees.]

Education and Training

Susan Walker, Howard Wheater, Frank Farquharson, Richard Streeter, Richard Harpin

Meetings

Chris Collier, Richard Harpin, James Bathurst, Logan Jack

3rd National Symposium

David Boorman, Angela Gurnell, Jerry Sherriff

Publications

John Mawdsley, Celia Kirby, Peter Sims, Mike Lowing, Graham Herbertson, Ron Manley

International Liaison

Allan Lambert, Jim McCulloch, Enda O'Connell, Des Walling

UK Committee for IAHS

Des Walling, Allan Lambert

B: BHS REPRESENTATIVES ON OTHER GROUPS

British Standards Institution

Paul Johnstone is on Panel PCL/3/-/2: Precipitation measurement.
Alec Willis is on Sub-committee PCL/3/5: Flow measuring instruments and requirements: User requirements.

ICE Reservoir Flood Working Party

Logan Jack

Hazards Forum

BHS is an affiliated Society:
Peter Wolf is Vice-chairman of the Natural Hazards Committee

Interdepartmental Committee on Hydrology

Allan Lambert

C: INTERNATIONAL SOCIETIES

International Council of Scientific Unions (ICSU)

International Association of Hydrological Sciences (IAHS)

BHS has established formal links with the International Relations Committee of the Royal Society on matters relating to international scientific issues in hydrology, through the BHS sub-committee (see section **A** above and *Circulation 29*, page 3).

BHS members may receive *Hydrological Sciences Journal* at reduced subscription rates (contact IAHS Press, c/o Institute of Hydrology, Wallingford, OX10 8BB).

European Geophysical Society (EGS)

BHS is an Institutional member: BHS members may join EGS at a reduced subscription rate. **Enda O'Connell** (Newcastle University) represents the recently-created Hydrology Section as Vice-President of EGS.

BHS/Scottish Hydrological Group
HYDROLOGY AND WATER POWER DEVELOPMENT
14 June 1991
The Albany Hotel, Glasgow

A Reminder!

There is still time to book a place at this one-day meeting. The cost is only £65 including lunch and a copy of the papers.

Topics to be addressed include

- General catchment characteristics
- High and low natural storage: flashiness of streams
- High and low flows
- Evaporation
- Land use effects
- Turbine and generator types
- Head and flow characteristics
- Plant selection techniques
- Fisheries regulations
- Life cycle of fish
- Upstream and downstream passage of fish
- Screens
- Compensation flows, amount and variation
- Pre- and post-scheme flow duration curves
- Environmental effects and their alleviation

Telephone Dr J.G. Herbertson on 041 339 8855, extension 5215, for further details and to book your place.

Opportunities in the Hydrologic Sciences

The US National Research Council have recently completed a major review of the current status of the science of hydrology and its future role and development. The review emphasises how the science of water has historically played second fiddle to its applications and that we must now turn to the hydrologic sciences to solve some of the emerging problems.

The resultant report produced by the Committee on Opportunities in the Hydrologic Sciences chaired by Peter Eagleson is to be published as a book entitled *Opportunities in the Hydrologic Sciences* which may be seen as providing a blueprint for establishing hydrology among the geosciences.

John Wiley and Sons Ltd will be distributing the 368-page book in the UK and copies may be ordered from them. The price has not yet been finalised but will be about £19. The ISBN is 309042445.

New Members

We welcome the following new members to the Society:

Abd Rahman, N. ..... University of Newcastle upon Tyne
Andrews, A.J. ..... Institute of Hydrology
Butcher, D.M. ..... National Rivers Authority
Fountain, E.J. ..... Chief Executive, Fred Fountain Associates
Gascoigne, W. ..... Pontypool, Gwent
Hackett, R.D. ..... University of Newcastle upon Tyne
McKenna, D. ..... Institute of Hydrology
Mundy, R.H. ..... Lymm, Cheshire
Parr, N.M. ..... Technical manager, North West Water
Phillips, G.W. ..... Catchment control manager, NRA Thames Region
Reda, A.L. ..... London
Rodda, H.J.E. ..... Geography Department, University of Exeter
Summerhill, J.A. ..... University of Lancaster
Tsang, W.W. ..... Engineer, Drainage Services Dept., Hong Kong Government
Wyllie, P.J.L. ..... Saxmundham, Suffolk

Occasional Papers

BHS Occasional Paper No. 3, "Droughts" by Terry Marsh, Allan Lambert, Sue Walker and John Mawdesley, will be published later this year. It is intended that future Occasional Papers will come under the general title of "Hydrology for decision makers" and will be of practical use in a particular area. Members are invited to propose titles which they would like to see published, especially if they can suggest potential authors.

John Pirt

BHS members will be saddened to hear of the tragic death of Dr John Pirt in a car accident on 23 April.

John was an active member who contributed greatly to the main committee and the Midlands Section of the Society.

Editor's Apologies

The editor wishes to apologise to **Roy Ward** for misspelling his name in the AGM Minutes on page 3 of *Circulation 29*, and to **Ron Manley**, one of the newly-elected committee members, for omitting his name and address from the BHS Committee list on page 4: it should have read

R. E. Manley
59 Panton Street
Cambridge
CB2 1HL
Tel.: 0223 323491
(home and business)

UNCED Fellowships

The UNCED Research Fellowships announced in *Circulation 29* are already oversubscribed. We have heard that the Secretariat has five boxes full of applications and they are not accepting any more for the time being.

UNIVERSITY COLLEGE LONDON
Department of Geography

WETLAND HYDROLOGY

Applications are sought for a five-year lectureship in wetland hydrology. The post is in the Wetland Research Unit, led by Dr G.E. Hollis, and is associated with the Station Biologique de la Tour du Valat in the Camargue, France. The lecturer will undertake research and consultancy on wetland functioning, management and conservation in the Mediterranean, Europe and elsewhere. Undergraduate and post-graduate teaching will focus on wetlands, water management and hydrology. French and/or another language will be an advantage.

The appointment will be on Lecturer Scale A, £12,086 to £16,755 plus London allowance. For further details please contact Dr G.E. Hollis, Department of Geography, University College, 26 Bedford Way, London, WC1H 0AP. Fax: 071 380 7565.

Advertisements

IHE
DELFT

International Institute for Hydraulic and Environmental Engineering (IHE)

For almost 35 years the International Institute for Hydraulic and Environmental Engineering (IHE) has offered postgraduate diploma courses. More recently, Master of Science and Ph.D. programmes as well as a wide variety of short courses constitute a large part of the educational activities of the institute in The Netherlands and abroad. IHE is also engaged in research and in the evaluation and supervision of civil and environmental engineering projects in developing countries. IHE has a permanent staff of 120, 60 of which are professionals (8 professors), while some 450 guest lecturers from various countries contribute to the educational programme. Each year the courses are attended by over 750 participants from all over the world. Instruction is given in English. IHE has three scientific departments:
- The department of Hydraulic and Hydrologic Engineering (HH);
- The Department of Environmental Engineering (EE);
- The Department of Infrastructural Engineering and Physical Planning (IP).

In the Department of Hydraulic and Hydrologic Engineering there is a vacancy for

Professor of hydrology (m/f)

Background information
In the last decades hydrology has evolved from a practical oriented technology for the development of water resources towards a comprehensive science integrating all aspects related to water resources planning and management. The growing awareness of the effect of global change on the hydrological environment has resulted in both an increased interest in small-scale hydrological processes as well as in the entire terrestrial part of the hydrological cycle, including its interactions with the atmosphere and oceans. In particular the impact of the activities of man in all qualitative and quantitative processes of the hydrological cycle is a major aspect of research.

The professor of Hydrology will head the Hydrology Section within the Department of Hydraulic and Hydrologic Engineering. This section comprises seven academic staff members, of whom two are temporarily stationed abroad. Major activities include the organization of an 11-month Course for Hydrologists, short courses in Delft and abroad, and educational projects in Barbados, India, Sri Lanka and Yemen. Moreover, the staff is actively engaged in research and the supervision of M.Sc. participants.

The Unesco-sponsored international postgraduate Course for Hydrologists is presently being held for the 25th time. Throughout the years it attracted over 600 participants originated from more than 90 countries. Based on the above considerations the programme has been adapted for the coming academic year to include specializations on Surface Water Hydrology, Groundwater Hydrology and Water Resources Planning. The division of the course into branches allowed the introduction of specialized hydrological and hydrology-related subjects.

Requirements
Candidates should have experience in field studies and in the application of computer models to hydrological engineering projects in developing countries, preferably in various climatic regions including the humid tropics and arid zones. A broad overview of surface water hydrology, groundwater hydrology and water resources management is expected. The scientific qualifications of the candidate are supported by publications in internationally-refereed journals. Experience in international education at a postgraduate level is preferred.

The candidate should contribute to the development of the Course for Hydrologists in the direction outlined above. He or she should initiate, pursue and coordinate research within the Hydrology Section on both small scale and integrated hydrological topics. The professor of Hydrology should be commited to teaching various courses, supervising research of M.Sc. students and further developing the Ph.D programme. It is essential that the professor remains involved in ongoing developments in hydrological science.

Additional information
A preselection of candidates will be done by a international selection advisory committee of specialists from universities, other organizations and the IHE staff. Persons who wish to be considered for this post or persons who can propose eligible candidates are requested to contact Prof. ir. W.A. Segeren, Director of IHE, within four weeks of the appearance of this notice.

The salary is based upon The Netherlands Civil Service salary scales for professors and the appointment implies entry into The Netherlands' Civil Service Pension Fund.
Information can be obtained by telephone from Prof. ir. W.A. Segeren, tel.: +31-15-783401 or from Ir J. Luijendijk, Head of the Department of Hydraulic and Hydrologic Engineering, tel.: +31-15-783388.

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National Rivers Authority - Southern Region

SENIOR HYDROGEOLOGIST/HYDROLOGIST, WORTHING
Up to £21,500

The Southern Region of the National Rivers Authority has a major dependance on groundwater for public water supply, yet is faced with increasing development pressures. To help us meet this challenge we are looking for two Senior Hydrogeologists/Hydrologists to work with a small headquarters team responsible for the Region's water resources and catchment management functions. Duties will include the assessment and monitoring of river and groundwater resources, abstraction control and groundwater protection, together with external liaison, including contact with water undertakings, consultants and local authorities.

You should have postgraduate qualifications in hydrology, hydrogeology or a closely related subject, with a minimum of five years' relevant experience. We will consider, however, first-degree graduates with experience in water resources topics and data techniques. Salary will depend on qualifications and experience.

Some experience of mathematical modelling and statistical techniques would also be an advantage, but we may consider those with proven aptitude in these areas who are willing to pursue further training.

For an application form, please contact the Personnel Officer, National Rivers Authority, Southern Region, Guildbourne House, Chatsworth Road, Worthing, West Sussex, BN11 1LD. Telephone: 0903 820692. The closing date for applications is 31st May 1991.

NRA is an Equal Opportunities Employer

Institute of Hydrology

The Institute of Hydrology needs two highly capable people to help build a database of high quality precipitation, streamflow and meteorological data from a series of studies of densely-instrumented experimental catchments in the UK and overseas. The work will involve data quality control, analysis and interpretation.

HYDROLOGIST / PROGRAMMER
2 year contract

Your particular responsibilities will include developing the ORACLE-based system and preparing data sub-sets for users. For this you will need to be experienced in FORTRAN and preferably should have a knowledge of SQL.

HYDROMETEOROLOGIST
3 year contract

You will need experience of data acquisition systems and of methods of analysing and presenting hydrometeorological data; you will be responsible for managing a long-term meteorological station, and will participate in commissioned studies which may include field work. Physical fitness and a driving licence are essential.

Salaries will be in the ranges £9,907 to £13,262 or £11,586 to £16,176 depending on qualifications and experience.

For an application form call Sue Fenton on 0491 38800 or write to her at the Institute of Hydrology, Maclean Building, Crowmarsh Gifford, Wallingford, Oxfordshire, OX10 8BB. Closing date for applications is 31st May 1991.

Natural Environment Research Council

NERC welcomes applications from women, disabled people and members of ethnic minorities.

THE UNIVERSITY OF BIRMINGHAM

School of Civil Engineering

Lecturer in Surface Water Hydrology

The School is seeking a permanent lecturer in surface water hydrology to join the Water Engineering Group and to teach on the internationally-acclaimed M.Sc. course in Water Resources Technology. The successful candidate will be expected to develop his/her own research interests and to relate them to the very active Water Research Group at Birmingham. Candidates with experience in any aspect of water resources engineering are encouraged to apply.

For further information please contact Professor Ken Rushton, School of Civil Engineering, The University of Birmingham, Edgbaston, Birmingham, B15 2TT. Telephone 021 414 5067.

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Books

Revised Hydrology Textbook

Principles of Hydrology. R.C. Ward and M. Robinson. Third edition, 1990. McGraw-Hill Book Company, London, 365pp, £15.95.

The changes in *Principles of Hydrology* from its initial publication in 1967 through to this third edition provide a true reflection of the development of physical hydrology over two decades.

From the gradual evolution of hydrological knowledge over the ages, the recent world-wide population expansions and demands for water have stimulated research into the physical processes involved in the hydrological cycle. Geographers and earth scientists have contributed widely to these researches, and, aided by the latest technology advances in instrumentation, they are producing answers to many of the problems facing the applied scientists, the engineering hydrologists. Thus in fulfilling the primary aims of the text, to provide scientific hydrology for students of pure sciences, it is continuing to present the scientific advances appreciated by the students and practitioners in engineering.

Although significant differences did exist between the first and second editions, considerable restructuring and rewriting is apparent in this third edition. One omission from this edition is regretted: Chapter 9 on the Drainage Basin, which was an addition to the second edition. While the potential developments from catchment characteristics, drainage patterns, and channel form, the fashionable research in the 1960s and 1970s, have not fulfilled expectations, further applications may prove to be rewarding in understanding total catchment behaviour. Other omissions are the detailed instrumentations for measurement of hydrological variables: these have recently been covered in a text addressed primarily to engineering hydrologists. Extended criticism and comment on measurement techniques, particularly on precipitation, have replaced the instruments in the measurement sections. Greater emphasis is given to the presentation of runoff theories and results of process studies from scientific researches. These valuable contributions will have benefited from the expertise of the new second author, Mark Robinson, from the Institute of Hydrology.

The resulting eight chapters are all refreshingly new with only one major change from the first edition. Evaporation and Evapotranspiration have been amalgamated under the one heading, Evaporation, and the combined topic is presented in progressive complexity, from an open water surface through the effects of soils to the problems of vegetation, concluding with aspects of modelling evaporation. The eighth chapter is now devoted to Water Quality which is the main concern of practising hydrologists today. Geographers and earth scientists have a great deal to offer in identifying the natural origins of water pollutants and no doubt they have had to revise their basic chemistry. When it comes to dealing with man-made pollutants, the help of the specialist chemists will be needed in future work.

The advances in technology are also apparent in the physical production of the book. The completely new format has modern typesetting on larger pages and a bright attractive cover, although this reviewer would have welcomed some of the water globules(?) in a more dynamic form! The impeccably-presented figures are also to be commended: a ready facility for redrawing borrowed illustrations results in a high degree of uniformity in style. Copious references are given at the end of each chapter and these have been fully revised and updated. The single index contains a preponderance of authors; a separate subject index would have been more helpful.

Elizabeth M Shaw
London

Natural Disaster Reduction

Hydrology of Disasters, Proceedings of Technical Conference organized by the World Meteorological Organization in November 1988. O. Starosolszky and O.M Melder (Eds), 1989. 319 + viii pages, including brief index. James & James, London. £40, hardback.

The publication of this book coincided with the start of the United Nations IDNDR (International Decade for Natural Disaster Reduction) which is intended to lead to the establishment of national committees on natural disaster reduction to identify, monitor and predict hazards, advise on warnings, short-term protective measures and long-term preventive measures, on education and technology transfer. A start has been made in the UK by the Committee on Natural Hazards of the Hazards Forum, a creature of engineering institutions and scientific societies, of which the British Hydrological Society is one sponsor.

The book contains 27 papers presented by 39 named authors (with shadowy evidence of a number of "ghosts"!) from 19 countries, chosen for their distinction in hydrology, water management and hazard analysis. The first two papers deal with the United Nations framework, the next ten were grouped together under the general title of hydrological problems of extreme floods and droughts, followed by four papers under the heading of the consequences of accidental water pollution (spillage), three on hydrological problems of dam and levee rupture, three on the hydrological consequences of volcanic eruptions, four on hydrological consequences of earthquakes, landslides and avalanches, and finally Professor Starosolszky's conclusions.

It appears that no great effort was made to co-ordinate the contributions so as to ensure a complete coverage of the IDNDR aims in hydrology, although there is evidence of some first-class linguistic editing. Each of the eminent authors seems in effect to have addressed topics central to his interests. Thus the reader is privileged to share in the experiences, pre-occupations and - occasionally - frustrations of the experts. One good example is the sole British contribution, Hydrological Systems Applied to the Management of Drought and Floods, by Dr Peter Walsh of the NRA North West Region, who provides an outline of the elements of his Region's reservoir management in drought conditions and of the region-wide scheme for flood warning, based on 14 years of study and improvement. Another example is the paper on Improbable Probabilities of Extreme Floods and Droughts by the President of IAHS, Dr Vit Klemes, who likens our current understanding to that of the drunk searching for his key under a street lamp, the only place where he can see, even though he had lost his key elsewhere in the dark.

This book will be read with profit by experienced practitioners who like to see how their expert colleagues approach their tasks, and by researchers looking for areas meriting further study. However, for beginners it is recommended as a stimulating start rather than as a systematic guide to the whole subject of the title.

P.O. Wolf
City University

New IH Reports

Published this month, two new titles in the Institute of Hydrology Report Series:

Impact of Improved Land Drainage on River Flows, by Mark Robinson, Report 113, £16.

Impact of Climatic Variability and Change on River Flow Regimes in the UK, by Nigel Arnell. Report 107, £12.

Also available from IH is a Bibliography on Hydrological Aspects of Weather Radar, published to mark the fifth anniversary of the NERC Steering Committee on this subject. This will be supplied free on request.

FORTHCOMING EVENTS

STOP PRESS

The Southern Section has organised a joint meeting with IWEM on **4th June** on "Rethinking flood control channel design - the Californian experience".

Full details in the Diary below.

Meetings

Pennines Hydrological Group Symposium on RIVER AND ESTUARY MODELLING
5 June 1991
University of Bradford

Following a short AGM, this symposium will consist of five papers:

- **Two-dimensional modelling of flow and pollutant transport in estuaries,**
- **Hydrodynamic modelling of urbanised river systems,**
- **Pollution incident prediction with uncertainty,**
- **Three-dimensional particle tracking models of dispersion in rivers, and**
- **River and estuary modelling from the perspective of the NRA.**

This conference will run from 10.00 a.m. to 4.15 p.m.; the fee of £12 will cover lunch and hire of the room. Cheques, payable to the Institution of Civil Engineers, should be sent to the Hon. Secretary of the Pennines Hydrological Group, Dr Nick Chappell, Institute of Environmental and Biological Sciences, University of Lancaster, Lancaster LA1 4YQ. Telephone: 0524 65201, extension 4334; Fax: 0524 843854.

MODELLING FLOWS TO BOREHOLES
9 July 1991
University of Birmingham

Protection zones and the understanding of wells are the key topics of this joint meeting of BHS with the Hydrogeological Group of the Geological Society and the International Association of Hydrogeologists.

Full details are enclosed with this issue of *Circulation*. Prior booking is only necessary if you wish to take lunch. The convenor is David Lerner, School of Earth Sciences, University of Birmingham, B15 2TT (Telephone 021 414 6156).

International Symposium on Erosion and Sediment Transport Monitoring in River Basins
24 - 28 August 1992
Oslo

Soil erosion is one of the main environmental effects of climate change. River monitoring programmes may give early warnings of erosion problems and help to assess control measures. Erosion is also a major result of land use change, threatening crop yields and leading to sedimentation in reservoirs and irrigation schemes.

This symposium will focus on the design and methodology of monitoring programmes, including physical processes of erosion, suspended sediment and bed-load transport, sediment-associated pollution and environmental problems.

There will be field excursions. All papers will be pre-published by IAHS.

Details may be obtained from the Hydrology Department, Norwegian Water Resources and Energy Administration, P.O. Box 5091, Majorstua, N-0301 Oslo 3, Norway, Telephone +47 2 959595, Fax +47 2 959000.

HYDROCHEMISTRY 1993
International Symposium on Hydrological, Chemical and Biological Processes of Transformation and Transport of Contaminants in Aquatic Environments
24 -29 May 1993
Rostov-on-Don, USSR

This symposium, part of UNESCO's IHP-IV Project H-3, will be research-oriented, emphasising mathematical modelling of the transformation and transport processes, including the interaction with groundwater.

Papers are invited and abstracts in English should be sent to the Chairman of the Organising Committee by 31 October 1991. The address is Hydrochemical Institute, 198 Stachki pr., Rostov-on-Don 344104, USSR, Tel.: +7 863 22 4470, Telex 123240 WODA SU

Diary

21st May 1991
BHS Southern Section
"Operation Experience with FRONTIERS Rainfall Forecasts"
Venue: Civil Engineering Department, Imperial College, London, SW7 2BU.
Contact: Dr Howard Wheater, Imperial College, 071 589 5111.

4th June 1991
BHS Southern Section/IWEM Joint Meeting
"Rethinking flood control channel design - the Californian experience", Philip Williams.
Venue: Civil Engineering Department, Imperial College, London
Time: 6.00 p.m. (tea at 5.30 p.m.)
Contact: Dr Howard Wheater (address above)

5th June 1991
Pennines Hydrological Group Symposium on "River and Estuary Modelling" and 1991 AGM
For further details see under *Meetings*.

11th - 14th June 1991
Institution of Water Officers Conference and Exhibition
Venue: Eastbourne, Sussex
Details: David McConnell, Eurocom (UK) Ltd, 12 Summerhill Terrace, Newcastle upon Tyne, NE4 6EB

23rd September 1991
Fellowship of Engineering/Royal Society Lecture
Dr Frank Press, originator of the International Decade for Natural Disaster Reduction.
Venue: Royal Society, 6 Carlton House Terrace, London
Time: 5.30 p.m.

Copy Deadline for Issue No. 31 5th July 1991

Circulation is the quarterly newsletter of the British Hydrological Society. It is issued free to members, but is also available on an annual subscription of £17. All enquiries concerning membership should be made to Peter Bacos, Institution of Civil Engineers, 1-7 Great George Street, London SW1. Telephone 071 222 7722. Please address all other correspondence to the Editor, Celia Kirby, Institute of Hydrology, Wallingford, OX10 8BB. Telephone: 0491-38800 extension 2360.