THE NEWSLETTER OF THE BRITISH HYDROLOGICAL SOCIETY

Circulation

No. 44 December 1994

Walls of water

David Archer, NRA Northumbria and Yorkshire Region

On a sunny day in Newcastle in July 1983, when the Northumbria flood warning team first received a call from an observer who reported seeing "a wall of water" moving down the River Wear, I was deeply sceptical. I suspected an exaggeration of the not uncommon experience of a steep but steady rise over an hour or two in north Pennine upland catchments.

Investigation, however, showed that a localised storm had given a measured rainfall of over 100 mm in a couple of hours and that the resulting flood wave had generated a measured rise of more than 1.30 m in 15 minutes at three gauging stations (Archer, 1992). Given stilling well lag, the observation seemed to justify fully the description as a "wall of water". The associated peat slides and debris entrainment have been well described by Paul Carling and colleagues (1986, 1987). Perhaps most startling was the removal of a slate roof from a stone gauging hut at a small diversion weir taking catchwater flow from the West Grain Beck (catchment area 1.2 km^2) to Burnhope Reservoir. Viewed from the open roof of the hut, Figure 1 shows the mangled remains of a level recorder pinioned in the corner by a large boulder which had burst through the wooden shutters. Alongside lies a rolled up spindle of peat.

As a consequence of that experience, when a member of the public reported a wall of water on 3rd August 1994 on the Hart Burn, a tributary of the Wansbeck in mid-Northumberland, I was more surprised than sceptical. The Wansbeck is a predominantly agricultural lowland catchment, the highest elevation in the Hart Burn catchment is only 330 m O.D. and the primary gauging station at Mitford has a channel slope (S1085) of only 3.23 m/km — by contrast, the channel slope of the River Wear at Stanhope is 14.3 m/km.

Although the peak level of the resulting flood wave on the Wansbeck was nowhere sufficient to flood property or even to reach preliminary alarm levels, the unusual nature of the event prompted further appraisal.

The Wansbeck Storm — Rainfall

The weather had been exceptionally dry over northeast England from May to July. At Cockle Park near Morpeth, it was the second driest such period in a 96-year record. The rains broke on the last day of July with locally severe thunderstorms. Heavier storm rainfall followed on 3rd August; the accompanying lightning killed a horse in County Durham valued at £3000 and caused domestic appliances and TVs to explode. Whirlwinds were observed in the Tyne valley. The synoptic weather chart shows a weak low over the Bay of Biscay with warm moist air drawn northward along the flanks.

Rainfall occurred in several intense bursts from about 14.00 on 3rd August to 06.00 on the 4th. The daily rainfall for 3rd August for the worst affected area is shown in Figure 2. Nine stations recorded over 70mm in the day:

Station	*Grid Ref.*	*Daily total (mm)*
Fawcett	NY 967766	103.0
Clapheaton	NZ 038805	99.7
Hallington Resvr.	NY 973762	87.5
High Warden	NY 910671	85.5
Midgy Ha	NY 966982	83.9
Colt Crag Resvr.	NY 942781	82.2
Wallington Hall	NZ 035843	79.9
Font Resvr.	NZ 052938	75.1
Bingfield Combe	NY 982728	71.4



Figure 1 Devastation in a gauging hut by the West Grain Beck

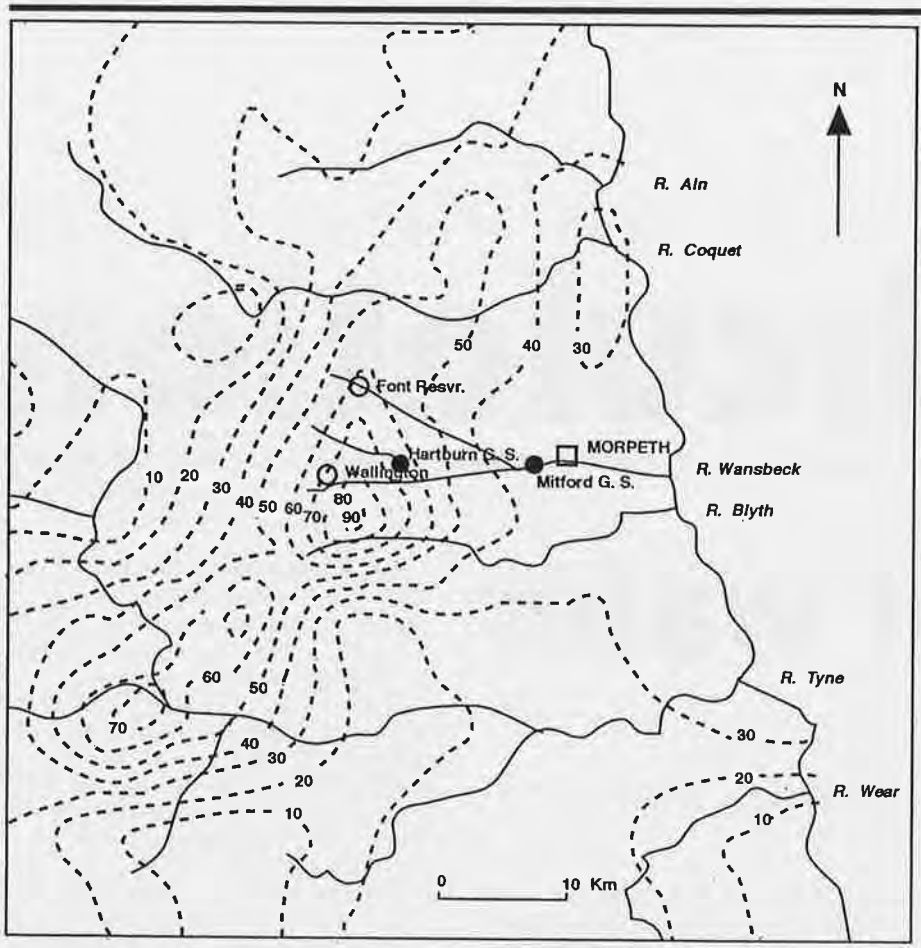


Figure 2 Daily rainfall for 3rd August, as generated by RAINARK graphics

Wansbeck — Flood response

Records from two gauging stations in the Wansbeck catchment fully confirmed the observer's description of a wall of water. At Mitford primary gauging station a rise of 1.26 m was recorded in 15 minutes (Figure 3). The equivalent rise in discharge was from 0.6 to 44.5 m^3s^{-1}. At the Hart Burn flood warning station the 15-minute rise was 1.32 m. The station was established only the previous month with an ARX tube gauge (a unique violation of the Law of Inanimate Hostility?). The most intense rainfall occurred at 15.15 GMT at both Wallington Hall and Font Reservoir; the resulting wall of water passed Hartburn at 19.00 and reached Mitford at 20.45.

The rate of rise in water level was well outside the range of recorded experience on the catchment, although an event of a similar order may have occurred in 1898 (Archer, 1992). Maximum monthly 15-minute and hourly level rises have been routinely archived for Mitford since 1980 and the distribution of the annual maxima is plotted in Figure 4.

Unit hydrographs derived from previous floods at Mitford yield an average time-to-peak of nine hours and they approximate the conventional triangular shape.

Short period intensities were more striking and were recorded at two gauges near the centre of the storm, at Wallington Hall and Font Reservoir. Most remarkable was the occurrence of 30 mm in a 15 min period at Wallington Hall (Figure 3). Return period estimates based on FSR Vol 1 and computed by FLOWPRED are shown in the table (below right).

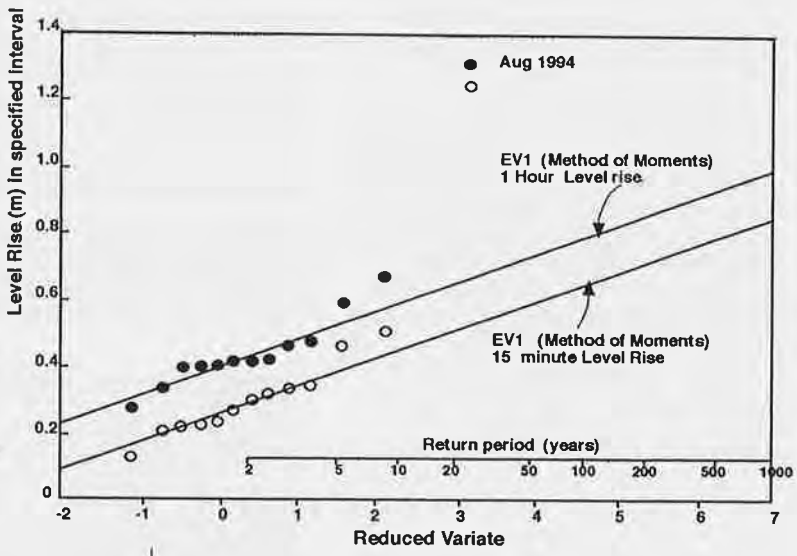


Figure 4

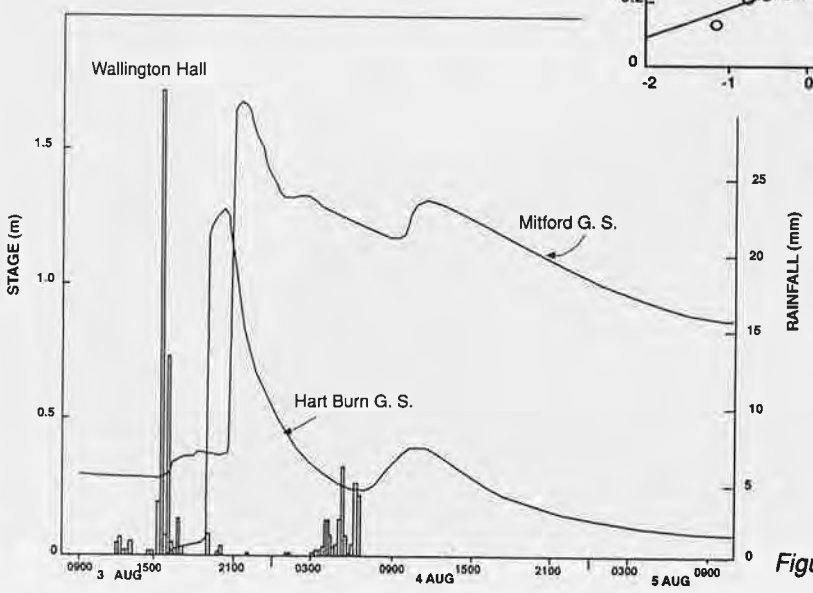


Figure 3

Duration (hours)	Wallington Hall Rainfall (mm)	Wallington Hall Return period (years)	Font Reservoir Rainfall (mm)	Font Reservoir Return period (years)
0.25	30.0	619	11.2	5.7
0.5	33.4	246	18.0	11.9
0.75	44.0	448	28.2	57
1.0	47.4	362	37.6	118
1.5	48.6	233	39.8	88
2.0	51.4	192	43.0	79
2.5	51.6	153	43.4	64

Lessons to be learned

1. The event occurred on a lowland catchment of comparatively gentle slope. This seems to imply that similar conditions could occur on virtually any catchment in the country given a sufficient intensity of rainfall. A similar wall of water caused by thunderstorms on the Berkshire Downs in May 1993 is described by Bill Pike (1994).

2. Flood forecasting is difficult. It is likely that more sophisticated rainfall runoff models would fare no better in prediction than a UH/losses model, especially if there is no such calibration event in the historic record.

3. Flood warning is difficult as alerts cannot be targeted at fixed vulnerable properties. River users could be anywhere on the river bank and beyond the reach of police and media contact. There is a worrying potential in such localised rainstorms, for children playing by the riverside or crossing stepping stones in an unaffected reach downstream, to be overwhelmed.

I would be interested to receive outline information from readers who have a knowledge of other such flood walls in Britain. A compilation of such events would help to provide a broader risk perspective and to guide a response strategy.

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Quality management standard

As this issue of *Circulation* goes to press, almost a month late, there is news of disastrous flooding in the Clyde basin in southern Scotland.

However, **James Curran** has sent in some good news from the Clyde River Purification Board: they have just been awarded registration to BS EN ISO 9002 (formerly known as BS 5750) for *"the provision of hydrological services, including the collection, processing, analysis, archiving and distribution of associated data and information"*. The Clyde RPB becomes the first hydrometric authority in Europe to achieve this standard for quality management.

The Board runs a network of 80 gauging stations and 50 rainfall stations as well as supplying data and advice relating to discharge consents, planning applications, flood warning and engineering works. Clyde RPB's own staff took two years to develop their quality management system, closely basing it on the way the Hydrology Unit already operated. The system controls and audits the work with three levels of documentation, down to precise instructions for doing each particular job (such as installing a raingauge, digitising charts, etc.).

The whole system is audited internally (by staff unconnected with the Unit) and externally by assessors. Although it has been a lengthy exercise to achieve the registration, the Clyde RPB believe it provides a worthwhile system, more effective focusing of staff efforts and a more consistent and dependable end-product.

New Members

We welcome the following members to the Society:

Bailey, R.A.	NRA Severn Trent Region, Solihull
Barlow, J.G.	Chiswick, London
Briffett, A.M.	Battersea, London
Clews, J.E.	Newcastle upon Tyne
Darling, B.B.	Swindon, Wiltshire
Faulkner, D.S.	Institute of Hydrology, Wallingford, Oxfordshire
Grieve, S.	Chilwell, Nottingham
Hammond, C.L.	Fulham, London
Hogg, I.G.G.	Crouch End, London
Horrobin, S.G.	SFK Technology, Cranfield, Bedfordshire
Marouf, H.	Swansea, West Glamorgan
McDonnell, R.A.	School of Geography, University of Oxford
Moir, H.J.	University of Aberdeen
Plummer, J.T.G.	Harborne, Birmingham
Solway, S.H.	Queniborough, Leicestershire
Spence, B.	Old Coulsdon, Surrey
Thompson, J.R.	Dept of Geography, University College, London

BHS library

A new report has been added to the BHS collection in the IH library: the NRA Anglian Region's *Blackwater Catchment Management Plan Consultation Report*. Comments on this plan are invited, to be sent to The Blackwater Catchment Management Plan, Area Manager, NRA Eastern Area, Cobham Road, Ipswich, Suffolk, IP3 9JE, to arrive by *8th February 1995.*

The IH library has also received some volumes of the *South African Hydrology Symposium* Proceedings, a biennial series (like ours) which reached No. 6 in 1993. It is hoped that the complete series will soon be held, thanks to Denis Hughes at Rhodes University and Jane Swanepoel of the Computational Centre for Water Research at Natal University. There were 70 papers in the 1993 Proceedings, so members are invited first to contact the Librarian, Sue Wharton (Tel. 01491 838800, Fax 01491 832256) for a photocopy of the contents pages.

The library also has a number of the IHP documents published by UNESCO. These include recent publications: *Continuing Education in Hydrology* by A. van der Beken, *Water in our Common Future: a research agenda for sustainable development of water resources* from the Committee on Water Research (COWAR), and *Hydrological basis of ecologically sound management of soil and ground water*, the report of the working group that met at the IAHS Symposium in Vienna in 1991. Copies of these can also be obtained (free) from The Director, Division of Water Sciences, UNESCO, 1 rue Miollis, F-75732 PARIS Cedex 15; E-mail: *(SCSZO)à(FRUNES21.bitnet).*

President's piece

The strategy to take the Society into the next decade is published with this issue of Circulation. This follows a year of discussion within Main Committee and consultation with the wider membership on the nature of the Society and the direction the Society should take in the coming decade. Thanks are due to all those members who have taken the trouble to be involved in this initiative. From the start the Society has constantly sought to reflect the thoughts and aspirations of its members.

The Strategy seeks to build on the strengths which it currently possesses by undertaking sustained organic growth whilst guarding its independence. The Strategy will help guide myself and future officers and committee members in maintaining key existing activities and the pursuit of various new initiatives which have been proposed. The Strategy also serves to show those outside the Society the nature, role and aspirations of the Society and its members.

The Main Committee has not been slow in developing some of the new initiatives outlined in the strategy.

In previous issues of *Circulation*, I have outlined the various developments which have already taken place regarding International Relations. In addition, plans are currently being formulated to organise an international conference in the UK in 1998. Already support, in principle, has been provided from UNESCO, WMO and various UK organisations. Further details will be published in Circulation as ideas become more crystallised.

Jim McCulloch has recently established bilateral links between BHS and the Hungarian Hydrological Society (details appear elsewhere in this issue).

The international email link with overseas hydrological societies has now been set up via the American Geophysical Union.

Closer to home, **Kevin Tilford** has established a mailing list for BHS members to help provide communication between those members who have access to e-mail. Clearly electronic messaging is the way forward for the future, but we are anxious in the short term not to disadvantage those of our members (some 50%, we think) who do not yet have access to the system.

In line with the Strategy, and in order to complement the existing range of awards and prizes which the Society offers, a prize and a lecture are to be instigated during the coming twelve months. The President's Prize will be awarded in recognition of a formative contribution to hydrology. The opportunity will be taken to establish a BHS named lecture by inviting an eminent speaker to give a keynote address at the Heriot Watt Symposium. Members are invited to suggest ideas for the name of the lecture (details elsewhere in this issue). The President Elect, **Mike Hamlin**, and I are currently considering who should be invited to give the inaugural lecture.

In taking the Society Strategy forwards, Mike Hamlin will have a key role to play as our next President. I am delighted that Mike has taken on this task, since with his background and expertise he will have much to contribute to the next formative stage of

BHS gets a new honorary member

At the AGM in September, **Professor Peter Wolf** was awarded Honorary Membership of the Society. Peter joins Mike Mansell-Moullin and Jim McCulloch, who are existing members of this exclusive set.

The Main Committee was delighted that Peter felt able to accept the award. He has played a long and continuing role in hydrology, in the UK and overseas. The fact that hydrology is now a widely recognised and respected science is due in no small part to Peter's efforts over the last forty years.

Peter Wolf started the first postgraduate course in Engineering Hydrology at Imperial College, London, in 1955. He later, of course, went on to teach at the City University.

His work on the analysis of the Lynmouth flood helped to bring the potential of hydrology to the engineering community. This was followed by various roles within hydrological committees of the Institution of Civil Engineers. This led to the development of the Flood Studies Report. In more recent times Peter has been active in the Hazards Forum.

Peter has been recognised overseas by various institutions and has had numerous medals and honours presented to him by overseas institutes and societies. He has contributed widely to international symposia, especially those organised by IAHS.

Peter was a long standing member of the Royal Society's Hydrological Subcommittee (a committee whose role has now been taken over by BHS), and from 1988 to 1989 he was President of BHS. During and since that time he has continued to give great encouragement and support to the Society, whose well-being he has always had at the forefront of his thoughts.

Sue Walker

News from Members

Members on the move

Congratulations to **Dr David Lerner** who has moved from the School of Earth Sciences at Birmingham University to become Professor of Environmental Management in the Department of Civil Engineering at the University of Bradford.

Former BHS President **Allan Lambert** will be leaving Welsh Water next year. During the last three years working with the UK National Leakage Control Initiative, Allan has developed possibly the first comprehensive conceptual model of leakage management, BABE (Bursts And Background Estimates). Now he intends to look for short consultancy projects, mainly on 'interesting' demand management problems. He hopes he will get to more BHS meetings too!

Dr Nigel Arnell, who has worked at the Institute of Hydrology for ten years, most recently heading the Impacts of Global Change Section, is returning to Southampton University as Reader in Physical Geography, where he will be continuing his research into climate change.

Congratulations to **Alan Werrity**, who has moved from St Andrews to a personal Professorship at Dundee University.

Barney Austin has moved to the Institute of Hydrology from the Water Resources Research Group in the Department of Civil Engineering at Salford University.

Obituary

We regretfully record the death in September of **Val Lewin**, aged 78. He was a Fellow of IWEM, noted for his work on sewage treatment works, as well as for his numerous technical papers and valued contributions in the field of water pollution control. A full obituary was printed in the *IWEM News* for November (No. 51).

Annual General Meeting

Minutes of the 11th Annual General Meeting of the British Hydrological Society, held at the Institution of Civil Engineers, London, on 7th September 1994:

Present: Prof. Susan Walker (President), Dr Richard Harpin (Hon. Secretary), Rod Hawnt (Hon. Treasurer), Celia Kirby (Hon. Editor) and 46 other members.

Apologies
Apologies were received from Dr Paul Younger, Phil Proctor, Richard Davis, Jenny Taylor, Tony Lewis & Angela Gurnell.

President's Introduction
The President welcomed members to the AGM and reported that it had been a hectic year for the Society and for the Main Committee. Details of Main Committee activities were to be to be covered by the Hon. Sec later, but there were one or two points which Professor Walker wanted to highlight.

Firstly, there was good news that the Exeter Fund had finally been transferred from the Royal Society to BHS, who will now organise it (see article in this issue).

There were now three routes to Chartered Status for British Hydrologists. Chartership through the Royal Meteorological Society was now possible and there had already been some BHS applicants. The Royal Charter for IWEM was said to be imminent. Professor Walker also expressed her pleasure that the rules for Chartered Engineer status through ICE were changing, with greater sympathy to professionals with first degrees other than civil engineering.

Several successful meetings had been held with the IWEM Presidential Team to discuss ways in which IWEM and BHS could collaborate.

On the international status of BHS, the President reported that BHS was accepted as the focus for hydrology in the uk by unesco and its International Hydrology Programme (IHP). Information on this initiative was now being channelled through BHS and *Circulation*. Professor Walker had also represented BHS at the Convocation of Geophysical Society Presidents, organised by the American Geophysical Union in Washington, where further communication through E-mail links was agreed as the way forward — the sum (of the various societies) was certain to be far greater than the parts. It was noted that **Dr Kevin Tilford** was also looking into E-mail links for Research and Academic organisations (see page 16).

Minutes of the BHS 10th AGM
The minutes of the 10th AGM, held at Cardiff on 13 September 1993, had been published in *Circulation 40*. There was no discussion. **Prof. Chris Collier** proposed their acceptance, seconded by **Anthony Tollow** and the minutes were duly approved.

Matters Arising
The Hon. Treasurer reported that the issue of life membership, proposed by retired member **James Robertson** had been investigated twice, similar schemes had been reviewed and discussions had been held with ICE. However, canvassing members through *Circulation* had produced no response. **Professor Peter Wolf**, a life member of two societies, thought that it was a good idea, particularly for those who are low on funds: he suggested the proposal should be tried. The Hon. Treasurer said that actuarial costs were high. It was nevertheless agreed in principle that life membership should be made available and the financial aspects should be investigated further. **Professor Hamlin** suggested that a cost of 12 times annual subscription at the age of 60 would be a sensible basis.

Report of the Honorary Secretary
The Hon. Secretary's full report is presented below.

Report of the Honorary Treasurer
Income and expenditure accounts for the year ended *30 June 1994* were presented by Rod Hawnt (see the Hon. Treasurer's formal report below).

Anthony Tollow proposed acceptance of the accounts, **Dr Peter Walsh** seconded that and they were duly approved.

Report on Publications by the Hon. Editor
Celia Kirby reported that during 1994 BHS publications had included four issues of *Circulation*. She thanked all contributors for their inputs to publications and noted that the cost of Occasional Paper No. 3 on *Assessment of Drought Severity* was £5, and not £25 as recently reported.

Changes to Membership of the BHS Main Committee for 1994/1995
The President reported on the elections to the Main Committee. The new ordinary members are **Dr Laura Baird, Dr Angela Gurnell** and **Richard Davis** (young person's representative). **Dr Paul Younger** had been elected unopposed to the position of Honorary Secretary. **Professor Mike Hamlin** was welcomed as President Elect.

Professor Walker gave her thanks for the hard work and dedication of departing committee members **Jenny Taylor, Frank Law** and **Richard Harpin**. Frank Law had been a particularly active member of the committee. Special thanks were given to Dr Harpin who had done "lots of work" in his two years as Hon. Secretary, and had even come into one committee meeting directly from Heathrow Airport after a visit to Argentina.

Changes to Statutes
The proposed changes to the Statutes had been carried in the postal vote. The changes include an amendment to allow one Honorary Member to be appointed every year, an increase in the maximum term of office for elected committee members from 5 years to 7 years, and small amendments to clarify the terms of office and composition of the main committee.

Any Other Business
The Hon. Treasurer drew attention to the BHS merchandise on sale at the meeting.

Prof. Mike Hamlin emphasised that the Exeter Fund was for *young* scientists and hoped that it would be used as such. The President affirmed that it would, but should in addition be open to those members who were precluded from applying for Royal Society funds.

Honorary Membership
The President expressed her delight that **Professor Peter Wolf** had been elected by the Main Committee as an Honorary Member of the British Hydrological Society for his services to British hydrology. Professor Wolf was invited to give a short speech at the start of the technical meeting following the AGM.

11th Annual Report of the Honorary Secretary

This is the eleventh annual report of the Hon. Secretary of the British Hydrological Society. Once again it is my pleasure to report that the Society has had a good year: growth continues and BHS has strengthened further.

The membership figures for this year show 684 paid-up members, compared to 637 at the same time last year. This represents 7% growth, the same rate as last year. Based on the three years of data collected in my term of office (and as all good bankers (and hydrologists) know, 7% compound growth doubles the capital in ten years) the *trend analysis* indicates that when we reach the end of our second decade, the then Hon. Sec. will be reporting a membership of about 1,368! Whilst I admit that my trend analysis may be based on a *sparse data set*, I do feel that my prediction may at least be somewhere close to the available pool

of potential BHS members.

Notwithstanding this rather dodgy analysis, the encouraging message is that we are continuing to bring more and more of that pool into the BHS fold: *we must have got something right!*

This year we have been a little more successful in retaining members: there are still 38 members who have not yet paid their fees, compared to 46 last year. To those of you who know anyone who has not yet paid their (still modest) subscription, I would be very grateful if you could remind them of the value for money which we offer.

I also have pleasure in announcing that **Professor Peter Wolf** has been made an Honorary Member of the Society. He was duly rewarded by being asked to give a short and, of course, interesting talk at the end of the AGM.

Our programme of scientific meetings, always the main focus of BHS activities, started the year with a bang with our 4th National Hydrology Symposium in Cardiff last September. The symposium was reported (quite accurately in my opinion) on the front cover of *Circulation 40* as *"a great success"*. It *was* a great success — many of us, particularly **Rob Drayton** and the team from the School of Engineering at Cardiff, were showered with unsolicited compliments. There were 38 very interesting, well-delivered technical papers, starting with a very punchy presentation (and very well chosen slides) from UNESCO's **Andras Szöllösi-Nagy**. The social activities were equally successful with fun time at the Conference Dinner in the frantic Hydrological Games, and the Medieval Banquet at Cardiff Castle — during the songs I distinctly remember our first keynote speaker at the AGM technical meeting adopting a very distinguished Welsh accent (or was it a dream, John?). The question I have to ask is: will the capital city of Scotland, venue for next year's 5th National Symposium, measure up to the high standard set by our friends in Wales? Surely, yes!

This year topics for national meetings have ranged from Areal Rainfall Estimation to Flow Naturalisation and Environmental Modelling in the Hydrological Cycle. There is a full programme for 1994-95, with some promising topics including Water Resources Modelling, Weather Radar Applications, River/Aquifer Interactions, and Scale Problems in Hydrological Modelling.

Our thanks go to **Paul Webster** for organising the 1995 BHS postgraduate symposium, which was very well attended by about 50 research students.

We have had a substantial, interesting and varied programme of regional meetings this year, for which I wish to thank our regional representatives **Howard Wheater, Paul Webster, Tony Lewis** and **Peter Sims**, together with their local committee members. The varied programme from our top performer, Southern Section, included a very useful meeting on Routes to Chartered Status. The Midlands and Pennines Sections have both had well-established meetings programmes. In the South West the battle against the problem of sparse membership continues with a meeting at Bridgwater in December on Water Quality and Water Change which I hope members will make a special effort to support. The Welsh and Scottish Hydrological Groups of ICE have also remained very active: our thanks there go to **Linda Aucott** and **Graham Herbertson** respectively.

The standing of the society has advanced considerably both through continuation of general activities, such as our programme of national and regional meetings, and also through several initiatives.

We continue to provide information for the Member's Handbook: the Membership Directory and the Register of Independent Consultants have both been updated and will be issued soon.

At the Cardiff symposium the President reflected on the Society's first decade and put forward her hopes for the next decade. These hopes have now crystallised into a strategy for the Society, entitled *The British Hydrological Society ... The Next 10 Years*. This document was corroborated through a questionnaire sent to a representative selection of the membership and is to be circulated soon.

As in all forward planning, it first reflects on the last 10 years, then documents the society as it is now, and goes on to declare our aims and ambitions for the next 10 years for an independent society with sustained organic growth.

Former President **Mike Lowing** has kept his promise and is in the final stages of producing an Operations Guide for the use of committee members in running the Society. This has three main aims:

- to set out, in more detail than the statutes or the various leaflets and forms can, the aims and ambitions of the Society, as originally laid down by its founding group and refined in subsequent decisions;
- to provide a record of key events in the growth of the Society;
- to record the duties and functions of the Society's officers and sub-committees as they have evolved up to now.

Three discussion meetings have been held with IWEM this year to explore areas of common interest. Areas where the two organisations can benefit from working together include education and training (particularly chartered status for non-engineering members), publication of our activities and joint meetings. IWEM have set the framework for further technical groups, similar to their river engineering section. They have agreed that any hydrological matters will be addressed through BHS, and they will not set up a hydrological group of their own. We have been very firm on the need for BHS to remain independent.

I have recommended that we proceed with a memorandum of understanding on areas where we could profitably cooperate: this should also include areas where we do *not* wish to work together.

Paul Younger, the incoming Honorary Secretary, has also had responsibility for liaison with the Hydrogeological Group of the Geological Society, and joint meetings have been arranged with them.

Efforts on the international scene continue under the direction of **Jim McCulloch**, chairman of the International Liaison Sub-Committee, which met in January this year. They discussed establishing links with the Nordic, Dutch and Hungarian Hydrological Societies, and a bi-lateral symposium or a meeting in Europe with the various societies was considered. The ILSC is also forming proposals for an international symposium to be organised by BHS to be held in September 1997.

The society is now relatively well protected by a healthy bank balance. Some of our funds have been earmarked for supporting travel to conferences and this year we have given support to two members.

After a long time we have now successfully negotiated an agreement to take over the Exeter Fund from the Royal Society, including the capital. The current value is substantial (about £21,000) and part of the income is earmarked for travel to IAHS meetings.

The Research Sub-committee under the co-chairmanship of **Frank Law** and **Howard Wheater** have compiled the Research Strategy document proposed in April of last year. The document entitled "Sustainability in a Changing World: the Key Role of Hydrology" is now complete and **will be published** very soon. It indicates the relevance of hydrological science to contemporary issues and the need for adequate, high quality data, as well as detailing the current funding and organisation of hydrological research. It outlines key applied problems limiting hydrological practice in user communities and key fundamental problems limiting progress in hydrological science, and goes on to recommend a strategy. The document should be influential in forming a new framework for hydrological research in the UK, and we hope it will help to achieve the necessary funding. Thanks are given to the 16 member committee responsible for putting the paper together and to all those who responded to the questionnaire last year.

Several documents have been

received from government departments (such as the DOE, MAFF, NRA, Scottish and Welsh Offices) in response to our lobbying last year, and these are normally listed in *Circulation*. I would like to thank Frank Law for producing briefing notes on Climate Change for the ICE Water Board's presentation to the government's Technology Foresight Initiative.

To help carry our strategy forward, and particularly to assist the Honorary Officers in their duties, the committee has approved the appointment of a part-time External Affairs Officer on a trial basis for 12 months. This post is likely to be for a retired, active member, who will receive a small salary including expenses.

This AGM was my last duty before I stood down as Honorary Secretary. Some may think it strange that I have enjoyed my term of office and wanted to continue; however the current statutes meant that I could not stand for re-election without a break. I wish my successor, **Dr Paul Younger**, good luck in the post. He has already contributed a lot in his short term on the Main Committee and I am sure he will continue to contribute well as Hon. Secretary.

I would like to welcome the new members to the committee, especially our President Elect, **Professor Mike Hamlin**, and also to record thanks to the rest of the committee for their work, particularly our Secretary, **Louise Picton** and President **Professor Susan Walker**, another sound choice in a line of hard-working, capable Presidents. I would particularly like to thank the departing committee members for their efforts, especially **Frank Law** for his help in the Research Sub-committee and our talks with IWEM.

Having worked on the committee for five years now, and having seen the dedication of the BHS committee members, I am now more positive than ever that the Society will continue to flourish. And who knows, we may even surpass the difficult target, set in the strategy document, of 1000 members in 10 years' time.

Dr Richard Harpin
Hon. Secretary, 1992-94

Hon. Treasurer's report

This written version of the verbal report presented to the AGM expands on the summary presented as a bullet-pointed handout there, and reports on the key areas of my responsibilities as Hon. Treasurer, also performing the role of Membership Secretary.

Membership
Total membership has again increased over the year, although the breakdown into categories of membership has changed slightly with the introduction of a new concessionary rate for all members under 25. The total paid-up membership at the end of the financial year on 30th June stood at 670, with the detailed breakdown shown in Table 1 below. The increase in members confirms a continuing rising trend since the Society was formed 11 years ago.

Table 1 *Paid-up members at 30th June*

Category	*1992/93*	*1993/94*	*Change*
Standard individual	575	567	-8
Student/ under 25	40	78	+38
Retired/ over 62	20	23	+3
Honorary	2	2	0
Totals	637	670	33

Summary of Audited Accounts
The audited accounts for the last financial year up to *30th June 1994* were presented to the AGM and are available from the Hon. Treasurer on request. The 'Balance Sheet' is summarised in this Table:

	1994 (12 months)	*1993* (9 months)
Income:	£20,552	£16,705
Expenditure:	£15,678	£11,402
Surplus:	£ 4,874	£ 5,303

This indicates the very healthy position of a surplus for the year's activities of £4,874. Although lower than the previous year, this surplus nevertheless represents a good result, since it should be compared with a budgeted surplus of £955. The surplus increased the Accumulated Fund to £26,000, most of which is held in a Northern Rock Building Society account.

A summary of the 'Income and Expenditure account' was presented, giving a detailed breakdown of transactions under the various budget headings. The main source of income, subscriptions, increased as a result of the rise in membership numbers. The most notable unbudgeted income came from the very successful Cardiff Symposium, which produced a surplus of £4,966, accounting for all the surplus for the year.

Expenditure cannot be compared directly: the previous year's expenses were lower, because of the shorter financial accounting period of 9 months last year, when the year-end date changed. The increased expenditure compared with 1992/93 was therefore expected, but some additional spending, particularly on publications (the Drought Report published as the Society's third Occasional Paper) and publicity/promotion (purchase of stick-pins for resale), was approved with full knowledge of the availability of the extra income from the successful Symposium.

Budget for 1994/95
The budget for the forthcoming year has already been approved by the Main Committee on 13th July 1994. Without the benefit of a Symposium surplus within the next financial year, total income will actually fall to £17,600. Again the bulk of the income will be derived from subscriptions which must rise to cover a planned increase in total expenditure. The overall objective of the budget is to produce a broadly balanced budget. Additional expenditure will go towards enhancing the profile of BHS at home and abroad, and also increasing awards and grants to individual members.

The present level of the Accumulated Fund is considered to be adequate to cover all potential risks and liabilities, for the time being, but this is being reviewed as part of a Financial Plan to be produced early in the New Year (see below) and in the meantime a neutral budget was considered to be prudent.

Subscription Rate for 1994/95
The new initiatives proposed by the Main Committee to enhance the profile of the Society and to increase grants and prizes to individual members will increase costs significantly. The budget for 1994/95, approved by the Main Committee, has taken account of this increased expenditure. Steps are being taken to control, and if possible reduce, the costs of administration but the proposed balanced budget can only be achieved if subscriptions rise.

A financial plan is being prepared so that the most appropriate level of the Accumulated fund can be set so as to cover adequately the Society's potential risks and liabilities, and also to enable levels of income and expenditure to be determined more objectively. In the meantime the Accumulated fund will be maintained at the current level for the next financial year and it was not considered desirable to draw on this fund to cover the proposed increase in costs.

Subscriptions have not risen for two years and it is therefore proposed to increase the rates as follows:

	Increase	*Proposed*
Full individual	£1.00	£20.00
Concessionary (Retired/student/ under 25)	£0.50	£10.00

This was considered to be a modest increase in line with inflation over the last two years since rates were last increased. It was supported by the Main Committee and it was my duty to propose the new rates and to seek approval by members present at the AGM: the recommendation was passed by a unanimous show of hands.

R J E Hawnt, Honorary Treasurer

Environmental modelling in the hydrological cycle

BHS AGM
ICE, London, 7th September 1994

The morning session of this technical meeting, which followed the Society's AGM, consisted of two keynote papers and was chaired by *Professor Mike Hamlin* (President Elect). The afternoon session, chaired by the President, *Professor Susan Walker*, considered the current position and provided ideas for the future direction of environmental modelling.

Professor John Gardiner (NRA Thames Region) started the proceedings with a personal assessment of modelling, now and in the future, in his paper entitled *Environmental modelling in the hydrological cycle — what does the client want?*

He explored the major modelling issues of the future, among these being the development of catchment models from a multifunctional perspective and their use at varying scales (from strategic to local) as a tool within an holistic framework of technical assessment.

In an increasingly cost-conscious market, future models need to be developed in a hierarchical, modular and flexible manner. STYX (a development of ONDA and ISIS) was offered as an encouraging example of the sort of package which combines hydrological / river modelling with water quality and sediment modelling that is needed for a multifunctional approach to solving complex environmental problems. The need to make more use of stochastic methods and to include uncertainty analysis was also emphasized.

However, despite recent advances, the gulf still remains between model development and research and model use in management decision making; this needs to be addressed through the development of in-house expertise in modelling. In turn, practical considerations will limit the number of models that can be managed and ideally a limited range of compatible models would be adopted which have satisfied established 'benchmarking' criteria.

Professor Gardiner commented that data acquisition and modelling should be regarded as a 'joint package', particularly with the advent of ENVAGE and all its implications for large amounts of different data, and increased monitoring and modelling requirements. He also foresaw the introduction of neural network technology into catchment modelling and planning via development of expert systems.

Finally, the importance of not 'missing the European bus' was stressed: while the initial cost might be high, it is essential to maintain a strong role in modelling development in Europe.

The benefit to be gained by collaboration with environmental modellers in the rest of Europe was reiterated by **John Cole** (WRc) who stepped in at the last moment for **David Oakes** to give a short talk on *The State of the Art in Europe*. He told us that a literature search during preparation for the paper had revealed 300 references in the English language alone, illustrating the current proliferation of environmental modelling work.

John Cole reviewed the range of environmental problems amenable to modelling, covering such diverse areas as the disposal of dredging spoil, the effects of chemical spills and the long-term effects of acid rain and climate change. The consequences of human activities on resident biota is another area which presents a significant challenge to modellers.

He went on to outline several examples of European environmental modelling. In the Netherlands and France simulation of floodplain inundation has helped planners and river engineers to investigate solutions to the conflict between conservation / recreation interests and the need to manage flood flows effectively. The ever increasing pressure to build on flood plains should serve as a stimulus for the development of techniques that result in efficient yet environmentally sympathetic hydraulic designs.

The River Rhine is a rich example of a system covering several European countries and with many conflicting uses. The Rhine's role as a receiving water for the effluent of the industrial heart of what was West Germany is in direct conflict with its use as a source of 80% of the public water supply for the Netherlands. Here collaboration arose out of necessity, and the International Commission on the Protection of the Rhine aims to resolve some of these issues through coordinating discussion with the many interested parties, and the use of water quality modelling.

The need for an interface between freshwater and coastal / estuarine modelling was illustrated by several examples of coastal pollution. These included mercury inputs into the Tagus estuary in Portugal, which has affected local fisheries, and sewage effluent affecting coastal water quality in northern France and the northern Adriatic coasts. In these cases modelling can further the understanding of the processes involved in the dispersion of the offending pollutant, and can then aid in the assessment of the effects of alternative engineering solutions.

The problem of disposal of sewage sludge and its effect on groundwater quality in Poland illustrated the need for internal collaboration between local government districts. In this case, modelling was used to design a strategy for rationalising and linking sludge sources, and disposal of the sludge by reusing it on agricultural land where appropriate, or by incineration.

Collaboration between environmental modellers and scientists has developed rapidly across Europe in the past five years, partly as a result of the rules governing funding by the European Union, but also because of voluntary collaboration by specialist organisations, who can commonly offer a better service by combining their expertise.

A major European Union project on water quality monitoring in the Danube basin involves a team of British, Danish and Dutch experts working with counterparts in Bulgaria, Hungary, Romania and Slovakia. This international effort will harmonise measurements and improve the modelling and interpretation of water quality problems suffered by this river.

John Cole finished up with some remarks on avoiding undue complexity in modelling, stating the need for a modelling equivalent of Occam's razor. While the most suitable model is one that is robust and reliable, it is not necessarily the most complex. "Horses for courses" was the motto: choosing the model to suit the problem to be tackled.

In discussion, **Mike Hamlin** asked whether it was possible to make a small number of models meet most requirements, and if so, how many? The answer from John Gardiner was 'few'; if models are to be used credibly on a management basis, in-house expertise has to be developed, and there is obviously a limit (in terms of staff, training and expertise) to the number of models that can be managed in this

way. In opposition to the totalitarian concept of a single model solution, **Frank Law** proposed a vision of the future of using alternative models at meetings with comparison of results and 'real time' debate between modellers. This led on to discussion about the choice of models: John Cole proposed a WHICH?-style survey of models available, using consistent testing criteria. The complexity of water quality issues in terms of process, non-linearity and conservatism (or not) enhances the need for 'benchmarking'. However **Richard Harpin** pointed out that, while it is relatively easy to define benchmarking criteria in the well-established field of hydraulic modelling for river flood defence (as in a current NRA benchmarking project), water quality modelling covers a much wider range of possible user needs. This makes it more difficult to define the criteria for model comparisons. **Peter Walsh** pointed out that regional diversity had led to a healthy development of different approaches to flood warning modelling.

However, it was generally agreed that there is a need for rationalisation of modelling, creating a limited subset of 'acceptable' models from which to choose the right 'horse' for the course. The rigours of commercial reality continue to reduce the number of models available, and the need for collaboration with European expertise is clear. Models need to be developed at a 'skeletal' level, with the potential to operate at varying scales and to link with other functional models. There is still not enough involvement of modelling in management decision making, and **Tim Wyatt** commented on the abundance of sophisticated modelling techniques used in the electricity industry, which have not been explored for their potential use in water resource systems development planning.

Professor Paul Whitehead (Institute of Hydrology) presented the first paper in the afternoon, entitled *Environmental Modelling of Catchments*. He highlighted the need for an integrated, multi-discipline approach to modelling allowing the necessary representation of key hydrological, chemical and biological processes.

Several natural situations were cited which need this broad approach, including the management of river catchments, which requires integration of surface water, groundwater and coastal modelling; environmental impact assessment of land-use changes, in which hydrological, chemical, biological and economic predictions would need to be combined, and the study of upland areas, whose delicate hydrochemistry is particularly affected by human activities such as deforestation.

The choice of model is vital in the representation of these situations, necessitating detailed assessment of the model requirement, its cost-effectiveness and the balance between model complexity and simplicity. IH are currently nurturing a combined hydrological and chemical approach to modelling.

Paul went on to describe some examples of this integrated approach to modelling. One example is MAGIC, principally a hydrochemical model imposed on a relatively simple hydrological model allowing the representation of key processes involved in the regional acidification of groundwater. This predictive tool allows the development of sustainable large-scale catchment management strategies.

Similarly, TOPMODEL and IHDM4 characterise surface water catchments in detail; the inclusion of hydrochemical predictions allow the assessment of the catchment response to contamination.

He emphasises the practicality and potential of the Geographical Information System (GIS) for modelling. The integration of detailed information on geology, land-use, soils (HOST) and topography with GIS has been used to study soil moisture in the UK and to develop a nitrate risk map for the Bedford Great Ouse.

The Land-Ocean Interactions Study (LOIS) was described. This large-scale view of Eastern England will provide an integrated understanding of river, estuary and coastal interaction, allowing the representation and prediction of chemical, hydraulic and sediment land-to-sea fluxes. This tool provides a mechanism for regional planning of land-use and industry. Another purpose of this regional approach is its relationship to smaller-scale catchment modelling. Detailed data are provided by these local models, and LOIS returns the regional picture vital for the development of catchment-scale models.

In his conclusion, Paul stressed the requirement of models to represent the key physico-biochemical and hydraulic processes of a natural system, therefore making the choice of model fundamental. The accurate, integrated representation of these processes on a regional scale provides a very useful predictive tool suitable for the management of, for example, water resources, land-use and industry.

A paper on *Subsurface water quality modelling — current status and future prospects* was then presented by **Dr Ray McKay** (Newcastle University).

He began with a brief overview of the dominant directions of research in groundwater modelling. They include the use of GIS, incorporation of Decision Support Systems, development of stochastic methods to represent the inherent uncertainty of geological systems (including hydraulic parameterisation and the prediction of contaminant migration), justification of data collection, and assessment of the effective parameters at different investigative scales.

Environmental modelling, especially involving groundwater, needs to incorporate a diverse range of scientific disciplines, ranging from biochemistry through hydrogeology to mathematical solution methods. The details of each can be delved into in greatly varying degrees of complexity, providing the basis for an enormous proliferation in model characteristics, uses and capabilities. Although this had triggered what could be affectionately termed as the "model-boom", it presents a nightmare in deciding which computer code to use.

Ray McKay suggested that the model used should be the simplest to represent the data available. However, he stressed the need for models to represent the key processes in a system, and pointed out that many of these key processes unfortunately do not have accompanying data. This is particularly true in the sub-surface migration of contaminants and the complex biochemical processes associated with the introduction of pollutants, such as nitrates, into groundwater. So, the decision regarding which model to use is further complicated.

The usefulness of current computer codes was then explored. This started with a description of SHETRAN-UK, a complex model integrating hydrology, chemistry and biology. This has been applied to the River Tyne catchment. Firstly, an hydraulic model, involving surface and ground water was calibrated with sufficient accuracy. The application of nitrate was then assessed with the use of GIS data of soils and land-use. A second model representing the complex biochemical and physical characteristics of the nitrate system was then superimposed on the hydraulic model to quantify the amount of nitrate introduced to surface and ground water stores. With the use of a third, economic model, future land-use changes and subsequent nitrate application were predicted under different economic climates, therefore providing a predictive management tool. However, it is necessary to question whether this highly complex model is representing the system accurately, as the data available is insufficient to test the model representation of processes and future predictions.

The second model described was used for the environmental assessment of a potential radioactive waste disposal site and the prediction of radionuclide release into groundwater. Four models of the area were developed using the same computer code but with different data available for site characterisation. The predictions of future radionuclide concentration made by each model were somewhat alarmingly different. This highlights the immense difficulties involved in environmental modelling and leads us to the philosophical

conclusion that the quality of the code (and the brilliance of the graphics) are not nearly as critical as the modeller's interpretation of the system.

Dr McKay concluded with a few challenges and directions for future subsurface quality modelling. These included investigating the effective parameters and governing equations dominant at different scales; developing practical stochastic methods for the treatment of uncertainty, and, importantly, evaluating model results; and continued integration of data sources and management decision tools with models.

The final paper, on *Techniques in water quality modelling in rivers and estuaries*, co-authored by **Dr Chris Whitlow** (Halcrow), was presented by **Dr Jackie Maskell** (HR Wallingford). This started by describing the traditional methods used in the quality modelling of two very different systems: rivers and estuaries. A river system is often represented by a one-dimensional, steady-state stochastic model allowing the quantified prediction of concentrations of dissolved substances, whereas multi-dimensional, transient-state models are required to represent the transport of dissolved and particulate substances in estuaries, because of their hydro-dynamic nature. The integration of these two approaches involves many difficulties, but it is necessary for the regional study of surface water quality.

Water quality modelling is complicated by the wide range of parameters and processes associated with transportation and deposition. Particular environmental concern is placed on pollutants incorporated into sediments, due to their long-term impact after deposition. The processes involved in the contamination of sediments is complex, being dependent upon the contaminant type, the mechanism of transport, the biochemical controls on deposition and the diverse physical processes involved in sediment deposition and consolidation. This makes the representation of such a system a daunting prospect.

Complicating issues even further are the variable hydraulic characteristics of the estuarine system, caused by the combination of lateral, vertical and temporal flow variations with density-driven gravitational circulation. Because it is fundamentally dependent on these hydraulics, the hydrochemical distribution is very difficult to predict.

But all is not lost: an example was cited from the Hawkesbury river catchment in Australia, in which a steady-state pilot model was used to investigate the sensitivity of estuarine algal blooms to various parameters. The conclusion reached was that algal growth was predominantly controlled by temperature and the duration of temperature stability. A dynamic version of the model was then tested against historical algal data and was found to represent it sufficiently, so verifying the conclusions of the steady-state model. Therefore, although the representation of a complex dynamic system is difficult, models are useful for the investigation and determination of the natural processes controlling a system.

A lively and wide-ranging discussion ensued. As mentioned in the morning's discussion, the concept of benchmarking water quality models, in a similar way to hydrodynamic models, was considered essential, especially with the recent proliferation of codes. However, Paul Whitehead argued that many models are needed to fulfil the wide variety of environmental applications, whilst Ray McKay felt that more fundamental problems, especially in subsurface modelling, lie in the parameterisation of data and the development of stochastic methods. **John Loe** (NRA) was worried about the wide variety of answers obtained from models and suggested that codes be kept in research until sufficient benchmarking criteria have been met.

Peter Wylye questioned the simplification of using land-use data for the assessment of nitrate introduction to water stores, pointing out that, for example, farming consists of many methods which will result in varying degrees of nitrate application.

The question of management involvement in modelling then dominated the discussion. **Susan Taylor** wondered whether the development of glossy, front-end decision support systems for use by managers was sensible, given its distance from the model mechanics. Ray McKay agreed, pointing out that often the criteria involved in decision-making are numerous and wide-ranging, making the development of these packages difficult. Paul Whitehead thought that the training required to operate models often precludes the technical involvement of managers. Likewise, Peter Walsh, himself an NRA area manager, considered the running of models by decision-makers as unrealistic, feeling that it is their priority to provide the right team for model development.

Hugh Goldsmith suggested that model results would be better presented within sensitivity bands, providing a more useful management decision tool, whereas Ray McKay felt that the interpretation of such results would be difficult. Mike Hamlin concluded this section of the discussion by sharing his opinion that the decisions made by managers are the most crucial, financially and strategically, so making their involvement in technical issues essential.

Frank Law then asked who would develop the multi-discipline integrated models widely discussed this afternoon — the biologist, the chemist, the hydrologist, the hydrogeologist or the mathematician? **Jackie Maskell** felt that interaction was needed, ideally, between the different specialists, depending upon the focus of the study. John Cole considered that the modeller should be in the scientific fields used as the criteria to test the model. Ray McKay expressed caution, believing that, unlike a car, it is necessary to know what is going on within a model mathematically to ensure that it is correctly representing the key processes. Perhaps with a hint of bias, he felt that biologists would not be able to do this. John Gardiner then provided a philosophical note that mankind has set impossible goals in its aim to individually conquer nature. He felt that the creation of multi-disciplinary teams in, for example, that highly evolved creature, the NRA, is the right way forward.

Finally, Richard Harpin challenged each of the afternoon speakers to list briefly the current shortfalls and future requirements of modelling techniques. Jackie Maskell believed that further work into detailed soil processes is required, along with the validation of models and the improvement of techniques in comparing model results and data. Paul Whitehead considered the need for more research into detailed processes to be essential. This will also require the collection of well organised data sets. Ray McKay reiterated the need for a deeper understanding of key processes and the development of stochastic methods for coping with uncertainty.

The meeting was closed by Richard Harpin, the outgoing Honorary Secretary, who thanked all the speakers and those who contributed to the discussions for a very interesting and thought provoking day.

Natasha Fellowes (NRA North West)
Oliver Phipps (Halcrow)

Travel grants

Grants in the range £75-£100 are available to help members with the cost of attending meetings (see *Circulation 38*). The scheme is open to anyone, but is intended mainly to help students or younger members whose travelling expenses are not met by an employer.

Please apply to the Hon. Secretary (**Paul Younger**), including details of the meeting, whether a paper or discussion is to be presented, the total costs and benefits of attendance, brief details of your financial situation, your background and your aspirations in hydrology. A brief supporting letter from a supervisor is also required.

Successful applicants are expected to produce a short report of their experiences in attending the meeting.

Acid rain: the use of models in impact assessment on surface waters

This paper was to have been presented to the Environmental Modelling meeting following the AGM on 7th September, but its author *Dr Neil Weatherley* was unable to attend.

Introduction

Wales provides a case study where the impacts of acid rain are extensive and much of the research into acidification has been undertaken. According to the distribution of poorly buffering soils and geology, up to 34% of the country has surface waters potentially sensitive to acidification. It has been estimated that around 12,000 km of first-to-third order streams are affected, with impacts on fish populations, aquatic conservation and potable supplies.

Impact assessment requirements include the effects of national and international acidifying emissions (the 'background' rate), the contributions of individual emissions sources, and the mediation influences of land management, particularly forest planting, felling and replanting.

This paper draws on the work of several organisations, which are acknowledged here. They include the Institute of Terrestrial Ecology, Institute of Hydrology, University of Wales, University of Hull, Department of the Environment, Welsh Office, the NRA Welsh Region and its predecessor the Welsh Water Authority. The views expressed are the author's and do not necessarily represent those of the NRA.

Emissions, deposition and critical loads

Emissions inventories and long-range transport and deposition models have been developed to explore scenarios of changing emissions patterns, taking into account the effects of terrain and vegetation type. These models provide the input for impact assessment modelling, but details are outside the scope of this paper.

The sensitivity of environmental compartments to acidic deposition has recently been mapped for the UK by the Critical Loads Advisory Group to the DOE. For surface waters, a chemical sample from a water body in each 10km grid square was used to characterise sensitivity according to either of two steady state models. The chemistry model relates base cation production in a catchment to acidic anion inputs. The diatom model is based on the empirical ratio of sulphur deposition of acidifying compounds that will not cause chemical changes leading to long-term effects on a specified ecosystem component. For the chemical model, a critical chemistry based on the response of trout to acidity has been used. The resulting map of sensitivity can be combined with the estimated map of deposition to show areas where acidification damage is predicted.

The critical loads approach has several uncertainties but provides an effective large scale appraisal of regional or national acidification impacts. This can be applied to assess the impacts of individual emissions sources, for example power stations.

Forest effects on acidification

Forestry is a significant land use in many acid-sensitive upland catchments. Surveys have demonstrated a statistical relationship between forest cover and increased stream acidity and aluminium concentrations. Analytical studies have identified a number of mechanisms which contribute to this effect, of which the principal is believed to be enhanced scavenging of dry and occult deposition. This can increase atmospheric loadings of sulphur and nitrogen to catchments by up to 50 and 100% respectively.

There is a general need for simple screening criteria to determine sites for which more detailed environmental assessments are required. For afforestation proposals, criteria now proposed to trigger consultation with respect to acidification in Wales, are the presence of sensitive soils/geology at altitudes above 300m (where scavenging is likely to be a significant influence). However, there are a range of possible adverse effects of afforestation on the water environment and similar criteria need to be developed and combined to cover the full range of impacts.

Steady state critical loads can be estimated for identified sub-catchments using the techniques applied at national scale. This can form a second screening tier, leading to dynamic modelling if required, for example the Institute of Hydrology MAGIC model. Only such modelling can predict resulting water chemistry and the rates of change of any impact, though at greater cost and with limited certainty.

Chemical predictions can be input to empirical equilibrium biological models to estimate biological responses, or simply compared with water quality standards. Indicator taxa models can also be applied in the reverse direction as part of the initial site assessment: predicting water chemistry from the occurrence of indicator taxa can be used to reduce the level of chemical sampling required to characterise water chemistry and hence sensitivity to impact.

Acidification impact assessment, management options and needs

In summary, for management at the catchment scale, critical loads estimates should be targeted at the particular water body, stream or river reach of interest. To be cost effective, screening criteria can be applied to eliminate sites where impacts are unlikely. Dynamic models can be applied where there is sufficient concern, and linked to biological models to predict environmental impact.

The suite of models provides a basis for management decisions. The options include emissions controls by international agreement and by regulation of local sources; forestry controls, including restrictions on planting and implementation of best practice to minimise impacts; artificial buffering of acidity by adding limestone to catchments or water bodies.

Some areas where model development is needed (and to varying extents ongoing) include:

- Effects of nitrogen emissions/ deposition on acidification;
- Effects of clearfelling and replanting on acidification;
- Use of GIS catchment models;
- Biological recovery following water chemistry amelioration;
- Validation of existing models.

Dr Neil Weatherley
NRA Welsh Region

Hungarian links

As mentioned in *Circulation* 42, the Hungarians are keen to strengthen links with Britain. They have kindly offered free membership of the Hungarian Hydrological Society to up to three BHS members (a knowledge of the language would be a great advantage, since all their publications are in Hungarian). One or two members have expressed an interest already, but if you are interested, please contact Dr Jim McCulloch (01865 407770.

Symposium on habitat hydraulics

Trondheim, Norway
August 1994

The first International Symposium on Habitat Hydraulics was held in Trondheim, Norway in August. The aim of the four-day meeting was to bring together scientists and environmental managers from different disciplines who have a common interest in freshwater habitats. Consequently, over 80 scientists from 20 countries gathered in Trondheim under the auspices of the International Association of Hydraulics Research (IAHR) and at the hospitality of the Norwegian Institute of Technology. The range of disciplines represented was impressive and included hydrologists, hydraulic engineers, fisheries scientists, geomorphologists, freshwater ecologists and conservationists.

Torkild Carstens, President of IAHR, opened the conference on Thursday 20 August. His opening address outlined the consequences of past reductionist approaches adopted by freshwater scientists. These included the problems of fragmented approaches to managing freshwater habitats and the communication obstacle created by the specialist language of individual scientific disciplines. The current challenge to fresh water scientists, he argued, is to become fully conversant with related disciplines and thus build an integrated scientific basis for freshwater management.

Dr Clair Stalnaker (US Fish and Wildlife Service) immediately responded to this challenge by showing how fluctuations in fish populations varied temporally in relation to prevailing hydrological conditions (over both short and long time scales) and the changing nature of in-stream habitats. Such hydrological variability was, said Dr Stalnaker, one of the primary factors maintaining the biodiversity of freshwater systems. **Professor Jan Heggenes** provided further examples of the interaction between species behaviour and physical conditions by showing how brown trout and Atlantic salmon utilised the heterogeneity of in-stream hydraulic conditions in different ways at different life stages. Professor Heggenes demonstrated how Instream Flow Incremental Methodologies (IFIM) could be used to model fish preferences for contrasting hydraulic conditions, but stressed that many other confounding factors relating to fish response to other environmental variables (e.g. temperature, light) needed to be incorporated into habitat modelling as well as instream hydraulics.

After these three opening talks the conference split into two parallel sessions in adjacent lecture theatres, which led to much to-ing and fro-ing by delegates, particularly as the sessions were not "theme"-based. It is not possible to do justice here to the 50-or-so papers presented in Trondheim (particularly as I was only able to hear half of them!), but a brief description of some of the main topics follows.

Modelling the hydraulics of natural and artificial habitats was a major them of many papers. **Nils Olsen** (Norwegian Institute of Technology) demonstrated how 3-D hydraulic models of fish habitats had been developed and used in Norway for predicting the impact of hydropower peaking and stressed how such detailed modelling was a pre-requisite to identifying the more specific habitat requirements of the periphyton in rivers, and was useful in developing optimal hydraulic conditions in fish farm tanks. The value of using hydraulic models to predict changing habitat conditions in Environmental Impact Assessment was stressed by **Michel Leclerc** (University of Quebec) who had examined the potential changes to salmon spawning habitat resulting from different hydropower release regimes in the Ashuapmushuan River in Quebec. On a similar theme, **Sylvie Valentin** (Laboratoire d'Hydro-ecologie Quantitative, France) showed how Brown Trout habitat could be modelled during hydropeaking situations on the Oriege river in the Pyrenees.

In addition to habitat modelling, many papers focused on characterising the hydraulic conditions of specific habitats and particular species. Two particularly interesting papers on this theme focused on the role of large woody debris in rivers. Both **Chris Gippell** (University of Melbourne, Australia) and **Tim Abbe** (University of Washington, USA) emphasised how important fallen trees were in diversifying instream habitats and how traditional management approaches of removing in-channel woody debris often led to the degradation of habitat conditions. The importance of flood flows and their influence on fish habitat availability was described for some cobble-bed and gravel-bed rivers in North Island New Zealand by **Ian Jowett** (NZ National Institute of Water and Atmosphere Research). Ian stressed that direct observations of habitat use in direct flood flows was difficult (for obvious reasons!) but invaluable in assessing the habitat requirements of aquatic species.

Jim Layzer (Tennessee Technological University) presented a fascinating paper on the habitat requirements of freshwater mussels. The sensitivity of mussels to instream flows was stressed by Jim and their value as target species in IFIM studies emphasised. Several speakers noted the importance of sediment transport and channel geomorphology in determining the physical habitat of streams including **Tetsuro Tsujimoto** (Kanazawa University, Japan) and **Shogo Murakami** (Kyoto University).

A few papers focused on instream hydraulic requirements of macro-invertebrates, which I found interesting as my own paper, written with **Chris Gibbins** and **Michael Jeffries** (University of Northumbria), examined how inter-basin water transfers from the River Tyne to the River Wear in north-east England affected macro-invertebrate communities. **Hans Berger** (Norwegian Institute of Nature Research) showed how stabilising the habitat for macroinvertebrates and **Arne Fjellheim** (University of Bergen) demonstrated the hydrophysical preferences of macroinvertebrates on River Gjengedal in Norway.

Many presentations tackled the increasingly important subject of stream restoration. **David Scruton** (Canadian Fisheries and Ocean Science Branch) explained how any freshwater habitat loss in development projects in Canada must be compensated by habitat creation. Dave showed how highway construction involved the culverting of the Seal Cove River in Newfoundland and described a 160 m long stretch of fluvial habitat that was created in compensation. The need for post-restoration monitoring was emphasised and the necessity of recognising the need for remedial work in restoration schemes was demonstrated. Other restoration projects described included huge rehabilitation works on the Rhine delta, presented by **Machteld van Boetzelaer** of the Netherlands; the reconstruction of the Nohgu-gawa brook on Honshu Island, Japan by **Shunroku Nakamuru** of Toyohashi

University and the revitalisation of the Glinscica Brook in Slovenia by **Marko Bertok** and **Franci Rojnik** (Slovenian Fisheries Research Institute). The need for inter-disciplinary work between freshwater scientists was particularly clear in restoration schemes, where recreating habitat conditions required a thorough understanding of species preferences and channel conditions.

Several keynote addresses at the meeting highlighted points of specific importance. **Professor Barry Biggs** from New Zealand reminded us of the importance of the periphyton in rivers. Barry used the powerful analogy of tropical rainforests to show how no-one would study tropical rain forest habit without reference to the forest trees, yet the macrophytes and periphyton of river channels, which create much of the habitat structure, are often ignored in aquatic habitat studies. **Dr Odon Starosolszky** (Water Resources Centre, Hungary) reminded delegates of the international commitments to conservation of freshwater habitats enshrined in Agenda 21 and called for an integrated approach to the emerging discipline of Eco-hydraulics. **Prof George Janauer** of the University of Vienna provided a practical example of such an integrated approach being applied in the restoration of the River Danube floodplain.

UK scientists were well-represented at the meeting: Institute of Hydrology modeller **Dr Ian Johnson** and Birmingham University's **Prof. Geoff Petts** were there; so was **Prof. Robert Sellin** (University of Bristol) who co-authored a paper with **Martin Lambert** (Newcastle University, New South Wales) on environmentally sensitive design. It was encouraging to see two postgraduates **Richard Acornley** (Southampton University) and **Catherine Padmore** (University of Newcastle upon Tyne) taking a keen interest in the conference. Richard presented an excellent poster (with some stunning photographs) on his PhD work investigating the silting of trout spawning gravels in chalk streams in southern England.

It was also heartening to see two NRA fisheries scientists present: **Andy Strevens** (South Western Region) and **Dave Willis** (Thames Region), both of whom were comparing a broad range of fisheries habitat studies with the habitat management strategies that they are developing for salmonid fisheries in the UK. However, it is slightly disappointing that no NRA *hydrologists* were present: the conference stressed the need for interdisciplinary work involving both ecologists and hydrologists in all river management schemes, and surely there is a need for NRA hydrologists to cease viewing their role as restricted to hydrometric data gathering, flood forecasting and water resource management. The need for integrated catchment management appears to demand that hydrologists in the NRA broaden their outlook and become fully involved in the diversity of hydrological science, rather than restricting themselves to a limited remit as hitherto.

The social programme of the conference was excellent, including a reception in the Archbishop's Palace, a banquet on the Island of Monkenholm (with Atlantic salmon served in 101 different ways!). An excursion on Trondheim Fjord provided the delegates with spectacular scenery and a visit to a commercial fish farm. Finally, some rehabilitation schemes on Norwegian rivers that have been developed for hydropower schemes were visited. **Kjetil Arne Vaskinn** and **Per Bjeke** of the Norwegian Institute of Technology deserve special mention for organising an excellent conference and providing first class hospitality.

The conference dealt with a topic that is increasingly important in hydrology, and (like the other delegates) I look forward to the Second International Symposium on Habitat Hydraulics, to be held in Quebec in 1996. I hope the UK hydrological community will be well represented there, reflecting increasing involvement of hydrologists in the kind of inter-disciplinary research that will be essential to the restoration and preservation of freshwater habitats in the UK.

If any BHS members are interested in any of the papers mentioned I will be happy to send them copies from the Proceedings.

Chris Soulsby
University of Aberdeen

Rehabilitation of the Gezira Scheme

M Riaz Hasan

Built early this century, the Gezira Irrigation Scheme (GIS), together with the Roseires and the Sennar dams on the Blue Nile in Sudan, stand out as monuments to British engineering skills. The Roseires dam was built in 1910 mainly as a hydropower scheme with some irrigation potential whereas the Sennar dam was completed in 1925 as part of the GIS to irrigate, initially, some 300,000 feddans of cotton (1 feddan = 1.04 acre or 0.42 hectare). Thanks to the foresight of the British engineers, the GIS not only expanded in area since 1925 but also adopted diverse cropping patterns to suit the changing local and international agricultural demands. At present, the GIS encompasses a total area of 2.1 million feddans (0.9 million hectares) and grows wheat, sorghum, groundnut and vegetables in addition to cotton.

Located in the triangle formed by the confluence of the Blue and White Niles immediately south of Khartoum, the GIS is not only the oldest and most important scheme in Sudan but it is often described as the largest farm in the world irrigated from a single source and managed by a single agency. The scheme can be roughly divided into two halves: the western area irrigated by the Gezira main canal and the Menagil extension to the east developed during the 1960s and 1970s. The salient features of the GIS are its relatively flat topography, low percolation and water holding clay soils, almost uniform farm-size distribution among 102,000 tenants and a centralised system of agricultural operations.

During the late 1970s and early 1980s, the GIS declined and its production fell sharply due to a variety of reasons such as: neglect of maintenance in favour of new expansion, lack of spares for agricultural and other machinery, inadequate supplies of inputs for crop diversification/intensification and flight of skilled manpower to neighbouring oil-producing countries. Not only were the irrigation and drainage systems, the agricultural services and the infrastructure badly in need of rehabilitation but also the Sennar Dam, the only source of irrigation water, required major repairs and renovation.

The Sennar Dam has outlived its economic life and its active storage is now reduced to about 52%. However, its present live storage, together with the available Roseires live storage, is adequate to meet the irrigation

demands of all schemes, including the GIS, located along the Blue Nile in an average year. The reduction in the unacceptably high seepage losses through its sluice and spillway gates makes the repair of the dam a matter of high priority.

The rehabilitation of the GIS started in 1985 with multi-donor funding led by the World Bank (UK's contribution was in the form of a grant of US$8.2 million). By 1993, some 70% of the rehabilitation work was completed but due to withdrawal of funding by some of the donors, the renovation and repair of the Sennar Dam and the canal improvement works have not been implemented. The improvements carried out so far have already been effective, resulting in significant increases in cropping intensity, crop yields and on-farm water management. Other intangible benefits from rehabilitation include a sharp decline in the incidence of schistosomiasis and provision of protected water supply to hundreds of villages in the project area for the first time.

Contrary to some reports, the GIS has not caused any visible adverse environmental impacts so far. Problems such as salinity and water-logging are conspicuously absent. The only problem that the GIS is facing concerns the removal of silt and weeds from the canals. The canal siltation has become very acute during the last decade or so and the silt/sediment inflow to the canals, according to some studies, has increased ten-fold. The Gezira authorities are not able to remove all the deposited silt mechanically and are seeking for a long-term hydraulic solution to the problem.

The UK consultants associated with the GIS rehabilitation are: Sir Alexander Gibbs (feasibility study), Coode-Blizzard (Sennar Dam renovation), and HR Wallingford Ltd (advice on canal siltation).

The parlous state of hydrometry overseas

About three years ago I spent a short time at WMO, Geneva — writes *James Dent* — assisting with a programme aimed at alerting donors to the need for support of hydrological projects world-wide. In a high proportion of the countries of sub-Saharan Africa, the need was for a complete rehabilitation of the hydrometric service. The pattern emerging from various reports and appraisals was consistent and depressing. Building on the basic system set up by the colonial administration, the immediate post-colonial period commonly showed a growth in facilities as aid support was forthcoming and was able to use the existing infrastructure and skills. As aid and technical assistance to the hydrological service came to an end, the decline set in. With home government support fixed to pre-aid levels or even nonexistent, there was no money available for equipment maintenance, replacement of unserviceable instruments and the logistic support to get staff into the field. In the worst cases, staff were no longer being paid. The end result was an almost total collapse of the hydrological service, in terms of instruments, logistics and staff capacities.

One would hope that in the more prosperous developing nations, the situation would be somewhat better than described in Africa, where so many countries are beset by famine, corruption and political instability. My present assignment has brought me back to Indonesia after an absence of 15 years. Although the country has prospered and is unquestionably becoming an economic force in the region, the hydrological service is one area which has appeared to have stagnated or even regressed. In my area of interest, where 47 hydrometric stations had been constructed, mostly in the 1960s and 1970s, over the past few years only five have consistently had data published in the national hydrological year book.

What has happened to the rest? Have they closed? Have they been washed away? Are the instruments broken? Do field teams no longer change charts or carry out discharge measurements, as there are no longer field vehicles available or funds to purchase fuel or pay field allowances?

Where data have been collected, despite the provision of computers and database systems, backlogs of unprocessed and unpublished data are building up. Close inspection of records which have been published reveals gaps and inconsistencies which indicate that validation and quality control are also absent. On this particular project, as with many where hydrology forms a small component, there is no time for a massive reworking or processing of data and there will have to be heavy reliance on basic assumptions and models which are only one or two steps away from guesswork.

Hydrologists working abroad become familiar with the task of producing a silk purse out of a sow's ear, but the unfortunate truth is that hydrological and hydrometeorological information in "developing countries" is getting scantier and less reliable. It is not just the result of poor technology but one of organisation, skills and morale that have been lost through the inability to perform. Aid targets are as prone to trendiness and fashion as everything else and unfortunately, despite the much vaunted interest in "the environment", basic hydrology is definitely "out". As the media all over the world happily seize on any flood for drought as an indicator of climatic change (most often referred to as global warming or the greenhouse effect) it is surely a good time to highlight the importance of hydrometric services.

In my experience of Asian countries, most hydrological services have more than enough people with adequate numeric and literate skills to perform field measurement and data processing operations in a fully competent manner. This becomes startlingly clear when one can obtain comprehensive, well presented records prior say to 1980, after which the gaps and the errors start to appear. Yet both donors and recipient governments have, in my experience, shied away from the reality that what is needed to maintain many national hydrometric services is basic support to keep these staff productive, more often than not with their current facilities. Donors appear more than happy to provide state-of-the-art telemetry or database systems and short-term training. Once expensive systems are established, they have to be operated and maintained, and nothing is done by the donor or the recipient to provide the continued support necessary. In the

event of a component failure or system breakdown, no spare part or service facilities may exist in that country. What can be sorted out by a 'phone call to a competent supplier or a software support system for say an NRA unit, is not so easy when access is needed to foreign currency and some leverage is necessary to overcome the bureaucracy and corruption encountered in dealing with an offshore supplier.

I have lost count of the numbers of broken field instruments and defunct computer equipment I have seen in my travels. All too often the fact that the equipment was recommended by a consultant, and paid for by a donor, is viewed by the recipient body as an indication of the outsider's incompetence and the failure of aid. BHS, as a professional group, should act as a lobby to highlight to all sides involved in development that the accumulation of hydrometric data is a long-term process requiring the maintenance of consistent high standards. This may not always necessarily be done through technology transfer of sophisticated equipment and methods which will be useless if they cannot be supported or the information they access is low quality. There must be appreciation of what is sustainable, and what is appropriate to a country's needs and capacities.

James Dent
Indonesia

In defence of the Baccalaureate

BHS member **Mike Rourke**, a hydrogeologist with Aspinwall & Co., has written to the Editor in response to Tim Wyatt's article in *Circulation* 42 entitled "BHS and the Parliamentary and Scientific Committee".

Tim's article invited comment from members about "the case for a British Baccalaureate: an alternative to A-levels" — the subject of a meeting of the Parliamentary and Scientific Committee last December.

As a hydrologist who had all his university training in the UK (BA Hons in Geology, then an Engineering Hydrology MSc), and having previously completed the International Baccalaureate Diploma abroad, Mike felt that his observations based on personal experience might be of interest. He also wanted to rebut the point about British academics seemingly concerned about lowering standards in science, as if a baccalaureate system would exacerbate the problem. Mike goes on:

1 The IB programme covers a basic spectrum of 6 subjects, of which 3 are studied at "Higher" and three at "Subsidiary" level. It is possible to exceed requirements, for example 4 higher and 2 subsidiary (as in my case) or even have 7 subjects. In addition, requirements exist for study of music or dance, theory of knowledge and sport as well as for an "extended essay" (an independent research paper in one of the subjects studied).

2 The choice of subjects is: ... 1) Maths, 2) a science, 3) a humanity, 4) a first language, 5) a second language and 6) one other (another science or humanity subject usually). The choice of level for each subject is up to the student. Studying three sciences would only be possible by including seven subjects in the core curriculum. ... Usually a language is completed in the first year — leaving greater scope for concentration on sciences in the second year.

3 High level subjects I consider comparable to A level. Although there is slightly less time available in the IB, from my experience and those of my high school friends who went on to study sciences or medicine in the UK, the difference is minimal. IB teaching does not contain much emphasis on "cramming". I studied maths, physics, chemistry and geography at higher level and achieved good results. In my first year at university in Oxford for our exams in maths and chemistry (subsidiary to geology) I finished 6th and 1st respectively out of a group of about 30. At no time did I feel at a disadvantage compared to the students who had A levels.

4 In addition to not being handicapped in sciences I have the advantage of foreign language skills which most of my colleagues do not possess. This occasionally is very useful at work. If more of my colleagues had better language skills we could really make strides in Europe. Although British companies often possess the skills needed abroad, it's the ones from the more linguistic European countries such as Denmark and Holland that get the business in Europe.

5 The IB is hard work, I think more so than A levels, but the rewards are potentially greater.

6 If educational institutions are worried about the decline of science than how could they be against a system which makes maths + one science compulsory for the last two years of secondary school? At any rate most jobs even with a high technical content don't really require the full depth of knowledge which is obtained in post secondary education.

I hope the above is interesting and useful comment with respect to the aforementioned article.

Yours sincerely, Mike Rourke

President's Prize — for services to hydrology

BHS will be awarding a prize, on a biennial basis, for "services to hydrology". This £200 prize will normally be awarded on alternate years to the BHS National Symposium but an inaugural award will be made at the 1995 Symposium at Heriot Watt University. All categories of BHS membership are eligible, except Honorary Members.

The scheme will operate like this: Requests for nominations will appear in the February issue of *Circulation*, with a closing date of end-April. Nominations will be judged by a panel of three, normally drawn from the BHS Committee. The winner will be announced in the August issue of *Circulation* and the presentation made to the award winner at the AGM in September. [***Note*** that for the 1995 award, however, nominations are requested by *31st January1995*.]

Nomination criteria: A "service to hydrology" should be described on a single A4 sheet. Examples of the types of categories which the service could cover include:

- advancement of the science;
- development of new methodology/analytical method;
- publication and promotion of hydrology to the public;
- career hydrologist — achievements over a long period;
- contribution to the third World;
- contribution to environmental stability;
- data collection and processing.

Members are welcome to nominate under alternative categories, providing they are clearly within the theme, spirit and intent conveyed within the phrase "services to hydrology". Nominations may be on behalf of single members, or teams/groups (of whom at least one person must be a BHS member).

1995 nominations should be sent to Prof. Mike Hamlin, The Coombes, Near Ludlow, Shropshire, SY8 3AQ.

Research grant

Prof. John Thornes (King's College, London) has received an EC grant to support research into desertification processes in the Mediterranean area and their links with the global climate.

The new BHS hydrological electronic mailing list

After considerable 'behind-the-scenes' activity, one of the first mailing lists dedicated entirely to hydrology is now on-line. This article explains the technology involved and the likely implications for the Society and its membership, as well as providing information on how to join the list.

Electronic mailing lists

Co-operation and discussion have always been vital in every walk of professional life, but traditional methods of exchanging research ideas are often limited in their scope. The advent of electronic mail (*email*) based on computer networks is revolutionising the way we communicate with each other. An extension of email is the *mailing list*: an electronic mailing list consists of names and (email) addresses held on a central computer *server*. When a message is sent to the list, all registered participants are automatically sent a copy. Thus an announcement, enquiry or opinion can be addressed simultaneously to all members on the list.

Organisations are increasingly using internal email networks and mailing lists for communication and information dissemination within the organisation. A slightly different approach (and one that has been largely dominated by academics and research workers) is to create subject-based mailing lists whereby individuals with a particular interest communicate with others of like mind *via* a subject-specific mailing list.

Mailbase

Electronic mailing lists can be difficult for the inexperienced user to set up and use. To overcome this, the BHS has decided to use the *Mailbase* service for its hydrological mailing list. This was the UK's first major electronic mailing list service and enables groups to manage their own discussion topics (Mailbase lists) and associated files. The service is based at Newcastle University and funded by the Joint Information Systems Committee of the Higher Education Funding Councils for England, Scotland and Wales.

From its inception in 1989, Mailbase has expanded rapidly: today the service manages hundreds of mailing lists, covering topics from Social Theory to Software Engineering and from Victorian English literature to Concrete Engineering, with many thousands of members in the UK and overseas. One of its main aims is to encourage the non-specialist to use a computer-based service which combines the speed of the fax, the friendliness of the 'phone, the permanence of the post and the flexibility of the computer.

The BHS-Hydrology mailing list

The BHS Main Committee took the decision to set up a hydrological mailing list for a number of reasons. The primary one is that it will provide an easy and effective way for members to communicate with each other. At present, the mailing list supports group discussion and houses a number of documents in the mailing list archive: details of national and regional meetings, including the forthcoming National Symposium at Heriot-Watt University and the postgraduate Symposium at the University of Salford, as well as a list of Committee members and contact addresses.

In the longer term it is hoped that the list will evolve to become an active forum for discussion of technical and scientific hydrological problems, where opinions can be expressed, meetings, seminars and conferences publicised, calls made for papers, and research studentships, job vacancies, scientific papers and reports advertised. Even *Circulation* and BHS Occasional Papers could become available in 'electronic' form, perhaps complemented by a refereed electronic hydrological journal. The potential is enormous and no amount of crystal-ball gazing is likely to reveal all the future developments that may take place.

Interested? How do I join?

For BHS members who have access to JANET, the UK's Joint Academic Network, joining the BHS-hydrology mailing list is quick and easy — regardless of whether you are in the UK or overseas. To join the list, simply send an email message to the *list-owner* (email address provided at the end of this article) asking to join the list — remember to include your first and last names. After a membership check, you will be added to the list. Providing your BHS Membership Number will speed this process up.

Once you have been added to the list you will receive an Introductory Message, which provides full details about the mailing list and guidelines for its use, as well as a brief introduction to the Mailbase world. Naturally, establishing a new 'electronic hydrological community' will take some time (although such things can be remarkably rapid) and some of the initial discussions may be stifled, but I suggest you be brave, bite the bullet, and go for it!

Wot! No JANET

About 50% of the BHS membership currently has direct access to an electronic network (either JANET or commercial networks, such as Compuserve or CIX, which have gateways onto JANET). Most of these members belong to the academic and research community, but increasing numbers of the business community are now recognising the benefits of an external electronic link to the world and are also becoming networked. For those who do not currently have access, and may not for the foreseeable future, it should be stressed that the BHS will continue to safeguard and support the interests of *all* members: those without access to an electronic network will not be disadvantaged in any way whatsoever.

The BHS-Hydrology file archive

Messages sent to the mailing list will be collected together and stored in monthly archive files for later retrieval as required by list members. Larger files, such as reports and papers, may also be placed individually on the Mailbase server. The information is then readily available to all list members. Regularly updated files containing information on forthcoming BHS regional and national meetings are already available from the file archive.

FTP, WWW and Gopher!

The BHS-hydrology mailing list supports access via ftp, PAD, Telnet, Gopher and World Wide Web services. More information on these will be provided in the next issue of *Circulation*.

The owner of the Mailbase 'bhs-hydrology' list and author of this article is Kevin Tilford who can be contacted via telephone — 061 734 5000 ext. 3458; fax — 016 745 5060; or email — bhs-hydrology-request@mailbase.ac.uk (for enquiries related to the bhs-hydrology list).

Kevin Tilford
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The Exeter travel fund

The Main Committee is pleased to announce that BHS has reached agreement with the Royal Society about future control and administration of the IAHS Exeter Fund. This substantial fund amounts to some £21 000 and has recently been transferred to a special separate BHS account, invested in a Charities Official Investment Account to provide income for travel grants, designed to help hydrologists with the costs of attending IAHS biennial General and Scientific Assemblies.

Background

The origins of BHS and the Exeter Fund are inextricably intertwined. Following the very successful IAHS Scientific Assembly in Exeter in 1982, the uncommitted funds remaining were split: half went to fund the IAHS Tison Award; half was used to create the "Exeter Fund". Less young members will recall that an informal meeting at Exeter discussed the idea of forming a national learned society for UK hydrologists. Such was the enthusiasm for this that a working party was set up to make proposals and draw up a constitution for what was to become BHS: Mike Mansell-Moullin chaired this group and became the first President when the Society was established the following year.

At first, the Royal Society's Hydrology Subcommittee, acting as the UK Committee for IAHS, administered the fund, investing the money to provide travel funds for UK hydrologists. When this Hydrology Subcommittee was disbanded in 1989, BHS became the umbrella for the UK Committee for IAHS, but the Royal Society continued to administer the fund. In 1994, agreement was reached that BHS would take over the administration of the fund under the original terms of reference.

Terms of Reference

1 To facilitate participation by British hydrologists domiciled in the United Kingdom in the activities of IAHS and of kindred organisations — through the provision of grants to facilitate attendance at IAHS and related international meetings.

2 To promote interest and scholarship in both the scientific and applied aspects of hydrology in the United Kingdom.

3 To provide financial assistance in the organising of international hydrological meetings in the United Kingdom.

4 The capital would be available to assist with the organisation of another IAHS Assembly should one ever be held in the UK.

Management Sub-Committee

A Sub-Committee of the BHS Main Committee has been set up to administer the Exeter Travel Fund. The membership of the Sub-Committee is as follows:

BHS President
Chairman, UK Committee for IAHS
Chairman, BHS International Liaison Sub-Committee
BHS Hon. Treasurer

Procedure for Allocation of Funds

In the past, the Exeter Travel Fund has been used exclusively to support the attendance of UK hydrologists, and particularly young hydrologists, at IAHS Scientific and General Assemblies. This will continue to be the main priority. The fund will be open to all UK hydrologists, but preference will be given to young hydrologists and to individuals who are unable to obtain support from other sources. For example, Royal Society funds are not available to postgraduate students nor to those working outside academia.

A call for applications for financial support to attend the Assembly will be published in *Circulation* about nine months before each IAHS Assembly. A deadline for return of application forms will be set and these will be considered by the Management Sub-Committee. The Royal Society also allocates funds to assist university academics to attend IUGG General Assemblies, but since the Chairman of the UK Committee for IAHS usually advises the Royal Society on the allocation of their funds, co-ordination of the two procedures can easily be achieved.

IAHS Assemblies are normally held every other year. Income which accrues in the interval will be accumulated until the time comes to allocate it. This should provide sufficient money to ensure that grants can be awarded which will cover a realistic proportion of the costs associated with an overseas meeting. If funds remain uncommitted the Management Subcommittee will consider applications for other uses in accordance with the Terms of Reference of the Fund.

Financial Administration of the Fund

Since 1982, the Royal Society has successfully combined capital growth of the Fund with providing income for grants. Between £1500 and £2000 has been made available in alternate years to support attendance at the IAHS Assembly. The number of grants each time has been about four, but varying with the Assembly's location.

The Fund finances will be administered by the ICE's Finance Section on behalf of the Honorary Treasurer. The capital will be held in a separate account from the main BHS funds. The dual objectives (maintaining the real capital value, whilst still allowing an annual income from the interest accruing) will be satisfied by investing the fund in a Charities Official Investment Fund account, or similar. The Hon. Treasurer will provide an annual statement of the fund and will review the investment strategy from time to time to ensure that the capital value is being maintained. The Management Subcommittee will decide whether the recommendations should be adopted. Only the value of the travel award will be withdrawn, and only when disbursement is about to be made.

Other BHS Travel Funds

The BHS Committee has set aside other funds to support travel awards to members. Their allocation will be decided by the Management Subcommittee of the Exeter Fund in order that the funds may be used in a complementary way. A call for applications will be placed in *Circulation* on an annual basis, but *ad hoc* applications may also be considered. The application form will be common to both types of award.

Before hydrology was born

Henry Gunston has passed to the Editor a copy of a book of 100 leaflets from the Board of Agriculture and Fisheries (price One Shilling, post free, in 1918). *Leaflet No. 99* (dated 1904) summarises in three pages the general views at that time about the relationship between woods and domestic water supplies, although experimental data were clearly not available until much later. Historians of hydrology might wish to ask Henry for a copy.

APOLOGIES

We are sorry for the delay in getting this issue of *Circulation* to you: we had hoped you would be getting your mince pies crumbs all over it but now it seems that it will be (one of) the first really important documents you'll receive in 1995!

Win a bottle of champagne and help BHS launch a prestigious lecture

The Main Committee, in line with the BHS strategy document, has decided to inaugurate a prestigious biennial lecture. The lecture will be held at the 5th National Hydrology Symposium and seeks to increase the status and prestige of the Society and the Symposium by providing the opportunity to invite an eminent speaker to address the Society.

The speaker will be chosen for his/her eminence in hydrology, water resources or a related field. Consideration will be given to opportunities to invite an international speaker. A synopsis of the lecture will be published in *Circulation*, and it is anticipated that the paper will be offered for publication in an appropriate journal. The first such lecture is to be held at the Heriot Watt Symposium next year.

Members are invited to suggest a title for the lecture. This may, for example, take the name of an eminent hydrologist or it may reflect a more esoteric theme. Suggestions should be addressed to the President, **Prof. Susan Walker**, NRA North West Region, Richard Fairclough House, Knutsford Road, Warrington, Cheshire WA4 1HG by *31st January 1995*. A bottle of champagne will be given to the person suggesting the name which is adopted.

Should any member wish to contribute a donation to help to finance the establishment of the award fund, they should contact the President (in confidence) in the first instance.

FORTHCOMING EVENTS

Fifth National Hydrology Symposium
Edinburgh, 4th-7th September 1995

Programme update

The Fifth National Hydrology Symposium, on the theme of *River basins: the integration of effects*, will begin on Monday evening with the BHS AGM. This will be followed by an invited lecture on *The Water of Life*, and there will be some practical experiments on the same subject. Afterwards there will be an informal buffet in the University Restaurant.

Technical sessions begin on the Tuesday morning, culminating in the late afternoon with an invited lecture, hosted jointly by BHS and IWEM Scotland, on the reorganisation of the Scottish water industry. In the evening there will be the President's reception and a buffet supper, probably in the Royal Scottish Museum (coach transport will be provided from Heriot-Watt University).

The field trip to Loch Katrine, Callander and Balquhidder is now scheduled for the Wednesday *morning*, returning to Heriot-Watt University for an afternoon of technical sessions.

The Symposium Dinner (and the famous hydrological games) will take place on Wednesday evening at a traditional venue in Edinburgh's Old Town, close by the castle (coach transport will again be provided).

There will be further technical sessions on Thursday morning and early afternoon.

A variety of accommodation will be available on the University campus, ranging from single study-bedrooms (with hand-basin and sharing other facilities) to executive rooms (with *en suite* WC, shower, TV, telephone and tea/coffee-making facilities). Costs are expected to be in the range £275-350 for the full Symposium package, depending on accommodation type.

Enquiries about exhibiting at the Symposium should be addressed to **Bob Sargent**, Forth River Purification Board, Heriot-Watt Research Park, Riccarton, Edinburgh, EH14 4AP. *(Tel: 0131 449 7296; Fax: 0131 449 7277).*

Please make sure you indicate your intention to take part in the Symposium to **Dick Johnson**, Institute of Hydrology, Alpha Centre, Innovation Park, Stirling, FK9 4NF *(Tel: 01786 447612; Fax: 01786 447614)* by *31st March 1995*.

Fifth BHS Postgraduate Symposium

The next Postgraduate Symposium will be held at the University of Salford, Manchester from *3rd to 5th April 1995*. It will provide an opportunity for postgraduate students (current and recent) to present their work and discuss it within their peer group in an informal and friendly environment. As in previous years, presentations are expected on a wide range of hydrological topics.

The experiences of giving a presentation and contributing to the ensuing discussion are usually regarded as extremely valuable by all those who take part. The programme also includes a hydrological field visit and guest presentations. Interested postgraduate students/employees should return the Symposium questionnaire to **Kevin Tilford** at the University of Salford by *16th December 1994* — see the flyer accompanying *Circulation*. Supervisors/mentors/managers are encouraged to inform their students of this Symposium and to support their attendance at it.

Kevin Tilford
University of Salford

Meetings

International Symposium on
EUROPEAN FLOODPLAIN FOREST ECOSYSTEMS
Leicester
22-25 March 1995

Lowland alluvial forests are one of the rarest, yet ecologically richest, landscapes in Europe. They are also among the least studied although they are rich in their variety of habitats maintained by distinct hydrological gradients in a small area. The remnants which have survived, with all their biodiversity, are

the subject of this conference.

The aim is to link together researchers and knowledge, in order to understand and model the hydraulic geomorphological and biological forces involved. It is hoped that those interested in aquatic ecology and floodplain management will attend.

Further details may be obtained from Mrs Kate Penny, *European Floodplain Forests*, Professional Development Unit, University of Leicester, LE1 7RH (Tel.: 0533 522464, Fax: 0533 522460).

Diary

9th January 1995
BHS National Meeting / NERC
"Hydrological uses of weather radar"
Venue: ICE, 1 Great George St, London
Contact: Dr Kevin Tilford, Dept of Civil Engineering, University of Salford
(Tel: 0161 745 5000, Fax: 0161 745 5060)

12th January 1995
Welsh Hydrological Group
"Demand management — the work of the National Leakage Control Initiative"
Venue: Bristol
Contact: Rob Drayton, 208 Fidlas Road, Cardiff CF4 5NA *(Tel: 01222 754879)*

18th January 1995
BHS Southern Section
"Aquifer protection: how is it working?"
Venue: Civil Eng. Dept, Imperial College
Time: 5.30 p.m. (tea at 5 p.m.)
Contact: Prof. Howard Wheater, Dept. of Civil Engineering, Imperial College, London SW7 2BU *(Tel: 0171 589 5111 ext 4736/4720. Fax: 0171 823 8525)*

19th January 1995
Scottish Hydrological Group
"Environmental impact assessment of river engineering works" — Amanda Chisholm (Babtie, Shaw & Morton)
Venue: Royal Society of Edinburgh
Time: 6.30 p.m. (tea at 6 p.m.)
Contact: Dr Andrew Black, Institute of Hydrology, Alpha Centre, Innovation Park, Stirling, FK9 4NF *(Tel: 01786 447612; Fax: 01786 447614)*

20th January 1995
BHS South West Section
"Hydrological models — a user's perspective"
Venue: University of Exeter
Time: 6.30 p.m. (tea at 6 p.m.)
Contact: Graeme Boyce, NRA South Western Region, Manley House, Kestrel Way, Exeter, Devon, EX2 7LQ
(Tel: 01392 444000; Fax: 01392 444238)

15th February 1995
Institution of Civil Engineers
"Reservoirs — an environmental gain?"
Venue: ICE, 1-7 Great George Street, London
Time: 14.00 - 17.30 p.m.
Contact: Louise Picton *(Tel: 0171 839 9836)*

15th February 1995
Welsh Hydrological Group
"Meeting *Section 20* water quality standards"
Venue: Cardiff
Contact: Rob Drayton *(see above)*

22nd February 1995
BHS Pennines Section
"Flood prediction and warning"
Venue: University of Salford
Time: 2.00 p.m.
Elizabeth Kaar, NRA North West, P.O. Box 12, Knutsford Road, Warrington, Cheshire *(Tel.: 01925 653999)*

8th March 1995
BHS Southern Section
"Water in the Middle East"
Venue: Civil Eng. Dept, Imperial College
Time: 5.30 p.m. (tea at 5 p.m.)
Contact: Howard Wheater *(see above)*

9th March 1995
Scottish Hydrological Group
"Overseas hydrology: a world of engineering possibilities" — Robert Walker (Babtie, Shaw & Morton); Robin Wardlaw (Edinburgh University)
Venue: Royal Society of Edinburgh
Time: 6.30 p.m. (tea at 6 p.m.)
Contact: Andrew Black *(address above)*

12th March 1995
Welsh Hydrological Group
"History and current strategy for a national raingauge network"
Venue: Chepstow
Contact: Rob Drayton *(see above)*

28th March 1995
BHS National Meeting / Geol. Soc. Hydrogeological Group
"Modelling river/aquifer interactions"
Venue: Burlington House, London
Contact: Dr Paul Younger, Dept of Civil Engineering, University of Newcastle upon Tyne, NE 1 7RU *(Tel: 0191 222 7942)*

3rd-5th April 1995
BHS Postgraduate Symposium
Venue: Salford University
Contact: Dr Kevin Tilford, Dept of Civil Engineering, University of Salford *(Tel: 0161 7455000 ext 3458 Fax: 0161 7455060 E-mail: k.a.tilford@civils.salford.ac.uk)*

3rd-7th April 1994
EGS XX General Assembly
Venue: Hamburg, Germany
Contact: Prof Philip O'Kane, University College, Cork *(Tel: 00 353 21 276871, Fax: 00 353 21 276648, E-mail jpokane@iruccvax.ucc.ie)*

26th April 1995
BHS / Royal Met. Soc.
"Hydrological Radar Experiment"
Venue: Imperial College, London
Contact: Howard Wheater *(see above)*

10th May 1995
BHS Southern Section AGM
"Wetland management"
Venue: Civil Eng. Dept, Imperial College
Time: 5.30 p.m. (tea at 5 p.m.)
Contact: Howard Wheater *(see above)*

17th May 1995
BHS Pennines Section
AGM followed by technical meeting on "Rainfall modelling"
Venue: University of Lancaster
Contact: Elizabeth Kaar *(address above)*

3rd – 14th July 1995
IUGG Assembly (including IAHS Symposia & Workshops)
Boulder, Colorado, USA

4th – 7th September 1995
5th National Hydrology Symposium,
Heriot-Watt University, Edinburgh
(see separate announcement)

4th December 1995
"Rainfall and flood forecasting in reservoir design"
Venue: ICE, London
Contact: Dr Hilary Smithers, NRA North West, P.O. Box 12, Knutsford Road, Warrington, Cheshire WA4 1HG
(Tel.: 01925 653999, Fax: 01925 415961)

Copy Deadline for Issue No. 45
13th January 1994
[Yes, we know you've only just received this copy, but we want to get back on schedule again.]

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 £20. All enquiries concerning membership should be made to Louise Picton, Institution of Civil Engineers, 1-7 Great George Street, London SW1P 3AA. Telephone 0171 839 9836. Please address all other correspondence to the Editor, John Griffin, Institute of Hydrology, Wallingford, OX10 8BB. Telephone: 01491 838800 extension 2395. Fax: 01491 832256.

Circulation is produced by the **Institute of Hydrology** and indexed in *Geosystems' Hydrotitles & GeoArchive.*