



International Hydrological Programme

19th session of the Intergovernmental Council
(Paris, 5 – 9 July 2010)

REPORTS OF UNESCO CATEGORY 2 WATER-RELATED CENTRES (2008-2010)

SUMMARY

The following reports of the UNESCO category 2 water-related centres cover the activities for the intersessional period between the 18th and the 19th sessions of the Intergovernmental Council of the IHP (June 2008 - May 2010).

The texts reproduced herewith stand exactly as submitted by the centres. The contents of the reports have not been modified and remain the sole responsibility of the respective centres.

Format for Reports by UNESCO's Water-related Centres on activities related to the IHP in the period June 2008 – May 2010

1. Basic information on the centre

Name of the Centre		The International Institute of the Polish Academy of Sciences – European Regional Center for Ecohydrology under the auspices of UNESCO
Name of Director		Maciej Zalewski
Name and title of contact person (for cooperation)		Iwona Wagner – deputy director Joanna Włodarczyk – director assistant
E-mail		erce@erce.unesco.lodz.pl ;
Address		3 Tylna Str., 90-364 Lodz, Poland Phone: +48 42 681-70-07 Fax: +48 42 681-30-69
Website		www.erce.unesco.lodz.pl
Location of centre		city/town: Lodz, country: Poland
Geographic orientation *		<input type="checkbox"/> global <input checked="" type="checkbox"/> regional
Year of establishment		2006
Themes	Focal Areas ♦	<input type="checkbox"/> groundwater <input checked="" type="checkbox"/> urban water <input type="checkbox"/> arid / semi-arid zones <input type="checkbox"/> humid tropics <input type="checkbox"/> droughts and floods <input type="checkbox"/> sediment transport and management <input checked="" type="checkbox"/> water and environment <input checked="" type="checkbox"/> ecohydrology <input type="checkbox"/> water law and policy <input type="checkbox"/> transboundary river basins/ aquifers <input checked="" type="checkbox"/> IWRM <input checked="" type="checkbox"/> global and climate change <input checked="" type="checkbox"/> mathematical modelling <input checked="" type="checkbox"/> social and cultural dimensions of water <input checked="" type="checkbox"/> water education <input checked="" type="checkbox"/> other: (please specify) _____
	Scope of Activities ♦	<input type="checkbox"/> vocational training <input checked="" type="checkbox"/> postgraduate education <input type="checkbox"/> continuing education <input checked="" type="checkbox"/> research <input checked="" type="checkbox"/> institutional capacity-building <input checked="" type="checkbox"/> advising/ consulting <input type="checkbox"/> software development <input type="checkbox"/> other: (please specify) _____
Support bodies ¹		Government of Republic of Poland
Hosting organization ²		Polish Academy of Sciences
Sources of financial support ³		<ul style="list-style-type: none"> - Ministry of Science and Higher Education Projects - Ministry of Foreign Affairs Projects - Framework Programme (6 & 7 FP) - Life+ Projects - UNESCO Activity-Financing Contracts - Consulting
Existing networks and cooperation ⁴		International Networks:

* check on appropriate box
♦ check all that apply

¹ please specify bodies that cover the operational costs of the centre, and other essential costs such as salaries and utility bills, and that provide institutional support to ensure centre's sustainability

² if different from support bodies

³ please specify sources of main budgetary and extrabudgetary funds to implement projects

⁴ please write international networks, consortiums or projects that the centre is part of, or any other close links that the centre has with international organizations or programmes, which are not already mentioned above

	<ul style="list-style-type: none"> - ALTER Net (A Long Term Biodiversity, Ecosystem and Awareness Research Network) Network of Excellence, 6th FP EU - AlterNet2 - LTER Europe (A Long Term Ecological Research Network) - ILTER (International Long Term Ecological Research) - Ebone: European Biodiversity Observation Network - Member of advisory committee <p>International Programmes:</p> <ul style="list-style-type: none"> - InterAcademy Water Programme (IAP) – coordination IAP in Europe - UNESCO Demosites - UNEP GEMS Water Programme - UNESCO HELP - UNESCO MaB <p>International organizations:</p> <ul style="list-style-type: none"> - SIL - International Society of Limnology <p>International Projects:</p> <ul style="list-style-type: none"> - SWITCH - Sustainable Water management Improves Tomorrow`s Cities' Health – FP6 / GOCE 018530 - EKOROB: Ecotones for reducing diffusion pollution, EU Life+ / LIFE08 ENV/PL/000519 - EH-REK: Ecohydrologic rehabilitation of Arturowek recreational reservoirs (in Lodz) as a model approach to rehabilitation of urban reservoirs, EU Life+ / LIFE08 ENV/PL/000517 - ENVEUROPE: Environmental quality and pressures assessment across Europe: the LTER network as an integrated and shared system for ecosystem monitoring, EU Life+ / LIFE 08 ENV/IT/000399 - FORMAN: Forest Management and the Water Cycle, FP6 European Concerted Research Action designated as COST Action FP0601 - Enhancement of river ecosystem tolerance to human impact and harmonization with cultural heritage space in the condition of global change. Polish-French Twin Research Project - "Ecohydrology - a transdisciplinary science for integrated water resources and sustainable development in Ethiopia" - Project no 1280/2008/AD and 1018/2009/AD, Ministry for Foreign Affairs Republic of Poland
Governance	<input checked="" type="checkbox"/> director and governing board <input type="checkbox"/> other: (please specify) _____ Link to election of board members to the IHP Intergovernmental Council (IGC) and hosting country IHP National Committee Frequency of meetings: once every 2 year(s) <input checked="" type="checkbox"/> Existence of UNESCO presence at meetings
Institutional affiliation of director	The International Institute of the Polish Academy of Sciences – European Regional Center for Ecohydrology under the auspices of UNESCO
Number of staff and types of staff	total number of staff (full-time, or equivalent) : 14 number of staff who are water experts: 8

	number of visiting scientists and postgraduate students: 4
Annual turnover budget in USD	0.8 mil USD

2. Activities undertaken in the framework of IHP in the period June 2008 – May 2010

- 2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII (Appendix-1) and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.

Researchers from European Regional Center for Ecohydrology run lectures for the University of Lodz students on the basis of Cooperation Agreement between ERCE and University of Lodz in a field of Ecohydrology. Lectures on:

- Ecohydrology
- Urban Ecohydrology
- Applied Ecology
- Ecology Basis
- Environmental Monitoring
- Integrated Water Resources Management
- Ecological Biotechnologies

ERCE in co-operation with ICCE (International Centre for Coastal Ecohydrology) has successfully applied for an ERASMUS MUNDUS PROJECT:

MASTER OF SCIENCE IN ECOHYDROLOGY, Ecological Engineering of Aquatic Resources (EME). The International M.Sc. Course on Ecohydrology starts September this year.

On the basis of cooperation with Department of Applied Ecology UL, ERCE participated in research of the following master thesis in 2008-2009:

- Identification of point source contaminants in Sokołówka River valley based on the nitrates concentration and E. coli determination.
- Presence of toxigenic cyanobacterial strains in hypertrophic lakes of Wielkopolska Region.
- Application of nucleic acids as the indicator in analysis of ecohydrological processes.
- Variation in cyanobacteria toxicity in selected water bodies of Wielkopolska and Lodz.
- Influence of socioeconomical parameters on landscape structure and water quality of Grabia watershed.
- Influence of Zebra Mussel on succession of phytoplankton complexes – field experiment.
- The application of ecosystem biotechnologies in protection and recultivation of water resources.
- Influence of ground water level dynamics on differentiation and stability of plant complexes in Sokołówka River Valley.
- Influence of hydrological processes on sedimentation in sediment ponds cascade on Sokołówka River.
- Vermicompost of sewage sediments to obtain higher biomass of *Salix viminalis* on experimental plantation of energetic willow in the area of limited use of GOŚ ŁAM.
- Application of direct toxicity tests and soil activity studies for soil quality assessments from areas recultivated by willows.
- Identification of critical points („red points”) in supply of Pilica and Sulejow Reservoir by nutrients from the indirect catchment for the elaboration of strategy for limitation of their eutrophication.

- Application of denitrification walls for nutrient contaminant reduction – comparative analysis of different carbon sources.
- Determination of influence of land cover in sub catchments of Pilica river watershed on the quality of water, based on the GIS technique and CORINE data base.
- Influence of nanoparticles on the condition of water and terrestrial organisms in the aspect of ecotoxicological research.

On the basis of cooperation with Department of Applied Ecology UL, ERCE participated in the following Ph.D. thesis in 2008-2009:

- Drobniowska A. Optimization of the use of sewage sludge for bioenergy production based on a large scale experimental willow plantation and mathematical model.
- Magdalena Urbaniak. Comparative analysis of dioxin and dioxin-like compounds in reservoirs of different types of anthropoprsion. University of Lodz

2.2 Research activities that directly contributed to the IHP-VII and activities by WWAP

Please include research/applied projects outputs such as publications that directly contributed to the IHP-VII and WWAP objectives

Research projects:

- "Towards Engineering Harmony Between Water, Ecosystem and Society. Strengthening the Collaboration between European Academies of Sciences in the IAP Water Programme". IAP 3240226102/010/013.
- ENVEUROPE: Environmental quality and pressures assessment across Europe: the LTER network as an integrated and shared system for ecosystem monitoring. LIFE08 ENV/IT/000399.
- Ecohydrology - a transdisciplinary science for integrated water resources and sustainable development in Ethiopia. Project financed by the Ministry for Foreign Affairs.
- EXPEER: Distributed Infrastructure for EXPERimentation in Ecosystem Research. FP7-INFRASTRUCTURES-2010-1.
- Within the framework of Life+ Project GPPinfoNET (LIFE07 INF/IT/000410) action "Creation of regional networks for GPP in European regions".
- ALTER-Net: A Long-Term Biodiversity, Ecosystem and Awareness Research Network. (Network of Excellence, 6th FP EU)
- EKOROB: Ecotones for reducing diffusion pollution. LIFE08 ENV/PL/000519.
- EH-REK: Ecohydrologic rehabilitation of Arturowek recreational reservoirs (in Lodz) as a model approach to rehabilitation of urban reservoirs. LIFE08 ENV/PL/000517.
- "Analysis of point sources pollution of nutrients, dioxins and dioxin-like compounds in the Pilica River catchment and draw up of reclamation methods". N305 365738. Project financed by the Ministry of Sciences.
- Blue-Green Network in Lodz Concept. Project financed by the City Lodz Office.

List of publications attached in annex 8.1.

2.3 Training activities that directly contributed to the IHP-VII and WWAP objectives

6-months scholarships in ERCE for Africa:

ERCE participates in UNESCO/Poland Co-Sponsored Fellowships for 2008 and 2010 in Ecohydrology – The New Approach and Methods for Integrated River Basin Management. In the framework of this exchange programme it provides 6 months scholarships for water professionals and decision makers:

- In 2008 ERCE hosted two fellows: Mr Ephrem Legesse Zewdie from Ministry of Water Resources in Ethiopia and Mr Lupakisyo George from the Mbeya Institute of Science and Technology in Tanzania
- In 2010 ERCE hosts Mrs Genzebe Kebede from Ministry of Water Resources in Ethiopia

Other exchange programmes:

Within the framework of the project "Ecohydrology - a transdisciplinary science for integrated water resources and sustainable development in Ethiopia", financed by the Ministry for Foreign Affairs, ERCE hosted:

- Mr Tegenu Tsegaye Mekuria from Ministry of Water Resource in Addis Ababa, Ethiopia – 3 months;
- Mr Mitiku Eshetu Gizaw from Ministry of Water Resource in Addis Ababa, Ethiopia – 3 months;
- Mr Maru Alem Asegahegn from Amhara National Regional State Bureau Of Water Resource Development Bahir Dar in Ethiopia – 1 month;
- Mr Abrham Asha Rolke from Water Resources Development Bureau in Awassa, Ethiopia – 1 month;
- Mr Wondwosane Abeje Fenta from Ministry of Water Resource in Addis Ababa, Ethiopia – 1 month.

International Advanced Study Course on Ecohydrology:

- In September 2009 ERCE organized International Advanced Study Course: "Ecohydrology & Ecosystems Biotechnologies in Water Resources Management" on the basis of cooperation with UNESCO. This course was for young scientists, PhD students, practitioners and decision makers from whole world.
- In November 2008 in Ethiopia (26-28 Oct 2008) ERCE organized International Study Course in Ecohydrology for policy makers and stakeholders from Ethiopia.

3. Collaboration and linkages

- 3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies

UNESCO IHP

- Iwona Wagner – member of the Scientific Steering Committee of the UNESCO IHP Ecohydrology Programme;
- Maciej Zalewski – member of the Special Task Force for IHP-VIII

Other International Programmes:

- UNEP GEMS Water Programme
- UNESCO HELP
- UNESCO Men and Biosphere
- InterAcademy Water Programme (IAP) – coordination IAP in Europe

International Networks:

- ALTER Net (A Long Term Biodiversity, Ecosystem and Awareness Research Network) Network of Excellence, 6th FP EU.
- AlterNet2 Consortium.
- ILTER (International Long Term Ecological Research).
- LTER Europe (A Long Term Ecological Research Network) – dr Kinga Krauze vice-chair of LTER.
- EBONE: European Biodiversity Observation Network – dr Kinga Krauze member of advisory committee.

- 3.2 Participation in meetings related to the IHP and UNESCO (e.g., the UNESCO General Conference, the UNESCO Executive Board, the IHP Intergovernmental Council and/or other meetings organized by IHP)

Prof. Maciej Zalewski:

- UNESCO IHP VIII Task Force Group Meeting, Paris 19-21 May 2010;
- 35th Session of UNESCO General Conference, Paris 12-16 October 2009;
- Beijing International Workshop of Geo-Information Techniques & Eco-hydrology for Adapting Global Change. Organized by UNESCO and Capital Normal University of China, 28-29 September 2009;
- International Center for Coastal Ecohydrology (UNESCO) Public Presentation Ceremony, Portugal, 4th September 2009;
- International Conference on International Perspective on Environmental and Water Resources "Ecohydrology – an interdisciplinary challenge". Organized by UNESCO IHP, Bangkok 5-7 January 2009;
- 18th Session of the IHP Intergovernmental Council, Paris, 8-13 June 2008;
- Advisors for the Ecohydrology Programme of UNESCO IHP Meeting, Paris 16-18 February 2008;

Dr Iwona Wagner

- International Symposium on Flood Pulsed Wetlands, Special Session on Floodplain Ecohydrology, Botswana, 1-5 February 2010;
- Ecohydrology Programme Steering Committee Meeting, Addis Ababa, Ethiopia 18-21 November 2009;
- Conference "Ecohydrology for Sustainability in the context of Global Change", Paraguay 2-3 July 2009;
- Ecohydrology Meeting, Kiel, Germany 28-29 March 2009;
- International Conference on International Perspective on Environmental and Water Resources "Ecohydrology – an interdisciplinary challenge". Organized by UNESCO IHP, Bangkok 5-7 January 2009;

3.3 Collaboration and networking with other UNESCO category 1 or 2 institutes/ centres

3.3.1 cross-appointment of directors of the category 1 or 2 institutes or centres on the governing board

Prof. Maciej Zalewski

- member of ICHARM (Japan) Governing Board
- nomination for member of ICCE (Portugal) Governing Board

3.3.2 exchange of information on activities such as training/educational materials, and funding opportunities

Joint publication ERCE UNESCO and ICCE UNESCO– Students book – "Practical experiments guide for Ecohydrology".

Successful joint application with ICCE for ERASMUS MUNDUS MASTER OF SCIENCE IN ECOHYDROLOGY, Ecological Engineering of Aquatic Resources (EME).

3.3.3 exchange of staff, most notably professionals and students

Participation in International Advanced Study Course (September 2009) student Renata Goncalves from Algarve University/ICCE UNESCO.

Guest lecture of Prof. Luis Chicharo from ICCE UNESCO at International Symposium "Ecohydrology for water ecosystems and society in Ethiopia", Addis Ababa 18-20 November 2009.

- 3.3.4 implementation of joint activities, such as workshops, conferences, training programmes, joint projects, field visits, software and data sharing, knowledge exchange and publications

Join project of ERASMUS MUNDUS Master Course on Ecohydrology (ECOHYD) with ICCE UNESCO/Algarve University.

Knowledge exchange with:

- ICCE UNESCO & Algarve University, Portugal,
- UNESCO-IHE Institute for Water Education in Delft, the Netherlands,
- US Corps of Engineers, USA,
- Wien University, Austria,
- Leibniz-Institut für Gewässerökologie und Binnenfischerei, Germany,
- Faculty of Urban Construction and Environmental Engineering, Chongqing University, China,
- Ministry for Water Resources of Ethiopia,
- YEHA Natural Resources Management Institute for Eastern Africa, Ethiopia,
- Integrated Biofarm Enterprise, Ethiopia,
- Tours University, France,
- CEMAGREF, Hydrology-Hydraulics Research Unit, France
- Leicester University, UK

- 3.4 Relationships with the UNESCO field and regional office whose jurisdiction covers the country of location

none

- 3.5 Relationship with the UNESCO National Commission and the IHP National Committee in the country of location and with other organizations of other countries

Cooperation with UNESCO National Commission within the framework of UNESCO/Poland Co-Sponsored Fellowships in Ecohydrology – The New Approach and Methods for Integrated River Basin Management.

The Director of ERCE is serving as a member of IHP National Committee.

- 3.6 Relationship with other UNESCO-related networks, such as UNESCO Clubs, ASPnet, and UNESCO chairs

None

4. Communication

- 4.1 Communication and knowledge dissemination activities undertaken in the framework of IHP

Meetings/conferences/courses organized by ERCE:

- International Symposium "Ecohydrology for water ecosystems and society in Ethiopia", Addis Ababa, Ethiopia, 18-20 November 2009;
- International Advanced Study Course: "Ecohydrology & Ecosystems Biotechnologies in Water Resources Management", Lodz, Poland, 14-22 September 2009;

Participation in meetings/conferences:

- ILTER Annual Meeting. 18-22 August 2008, Stara Lesna.; Slovakia
- EURECO - GFOE 2008, "Biodiversity in an Ecosystem Context". 15-19 September 2008, Leipzig.; Germany

- XXVII International Phycological Conference: "Renaturalisation of Aquatic Ecosystems and Algal Communities". 12-15.06.2008, Łódź – Spała.; Poland;
- SWITCH 3rd Scientific Meeting, 30 XI – 4 XII 2008, Belo Horizonte; Brazil;
- ERB 2008. Krakow, September 2008.; Poland;
- 4th ECRR International Conference on River Restoration. June 2008, Venice.; Italy;
- Congress of Polish Hydrobiologists. XXI century - will we run out of water?. 9-12 September 2009; Lublin, Poland;
- Underwater Acoustic Measurements: Technologies & Results. 3rd International Conference and Exhibition.; 2009 Greece;
- The ALTER Net Final Conference, 2009 Leipzig.; Germany;
- International symposium "Ecohydrology for water ecosystems and society in Ethiopia". 18-20 November 2009. Addis Ababa.; Ethiopia;
- Conference "Dioxins in industry and environment" 4-5 June 2009.; Poland ;
- International Water Association: Water Convention - Singapore International Water Week 2009, IWA Cities of the Future Visioning Workshop, 2009 Suntec Singapore.; Singapore;
- UNESCO IHP International Conference: Ecohydrology for the Sustainability in the context of Global Change, 2009 Asunción.; Paraguay;
- World Water Week 2009: Responding to Global Changes: Accessing Water for the Common Good, Stockholm, Sweden. IWA SIWI Workshop: Cities of the Future Public and Private Sector Perspectives on Sustainable Cities.; 2009 Sweden;
- SWITCH IV Scientific Meeting 2009, Delft.; Holland;
- International Conference on International Perspective on Environmental and Water Resources, 2009 Bangkok.; Thailand;
- Future Lodz Conference, 2009 Dobieszów.; Poland;
- International Conference on International Perspective on Environmental and Water Resources, 2009 Bangkok.; Thailand;
- International Conference on Implementing Environmental Water Allocations, 2009 Port Elizabeth.; Republic of South Africa;
- International Workshop of Geo-Information Techniques & Eco-hydrology for Adapting Global Change, 2009 Beijing.; China;
- Workshop The Scientific Scope to find Mutual Solutions in Large River Management and Restoration, 2009 Vienna.; Austria;
- China-Europa Forum on Healthy Rivers and the Implementation of Sustainable Water Resources Management, 2009 Chongqing.; China;
- 49th European Congress of the Regional Science Association International ERSA: Territorial Cohesion of Europe and territorial planning, 2009 Lodz.; Poland;
- International Symposium on Flood Pulsed Wetlands, 1-5 February 2010, Maun Botswana;
- 4th BALWOIS scientific conference on Water Observation and Information System for Decision Support, 25-29 May 2010, Ohrid, Macedonia;

Media coverage resealed – newspaper articles:

- In issue of Gazeta Wyborcza (October 11, 2009) an Aleksandra Hac's article appeared on the City water Forum" in Delft "We are helping the world to care about water".
- In issue of Gazeta Wyborcza (September 25, 2009) an Aleksandra Hac's article appeared on the improvement of Arturówek bathing site " Arturówek will be clean again".
- In issue of Gazeta Wyborcza (September 20, 2009) an Aleksandra Hac's article appeared on the Advance Study Course on Ecohydrology in Lodz " They showed how to do river in Lodz".

- In issue of Gazeta Wyborcza (September 09, 2009) an Aleksandra Hac's article appeared on the management of storm water in Lodz "We will pay for storm water runoff"
- In issue of Gazeta Wyborcza (September 08, 2009) an Aleksandra Hac's article appeared on the management of storm water in Lodz "Don't want to pay for storm water? Use it!"
- In issue of Gazeta Wyborcza (August 27, 2009) an Aleksandra Hac's article appeared on the renaturalization of Lodka river. The article is available here:
http://miasta.gazeta.pl/lodz/1,35136,6973584,Czy_Lodka_moze_byc_z_nowu_rzeka_.html
- In issue of "Dziennik Polonii w Kanadzie (August 26, 2009) an article about the Stockholm "water Week" conference – Łódź – city of the future.
- In issue of Ekspres Ilustrowany (August 9, 2009) and Monika Pawlak's article appeared on the recreational potential of Lodz. The article is available here: <http://lodz.naszemiasto.pl/wydarzenia/1033694.html>
- In issue of Ekspres Ilustrowany (August 3, 2009) and Monika Pawlak's article appeared on the recreational potential of Lodz.
- In issue of Gazeta Wyborcza (August 2, 2009) an Aleksandra Hac's article appeared on the Żabieniec bathing site "The cleanest Lodz's pond will occur in a year" .
- In issue of Gazeta Wyborcza (July 31, 2009) an Jakub Wojtczak's article appeared on the improving of Arturówek bathing site. The article is available here:
http://miasta.gazeta.pl/lodz/1,35153,6882952,Nowe_oblicze_Arturowka_Za_1_5_ml_euro.html
- On Gazeta Wyborcza „Spacerownik” (July 18, 2009), two articles of Aleksandra Hac about Sokolowka river appeared. „Sokołówka can be a river again” and „The walk along the river”. Articles are available here:
<http://bi.gazeta.pl/im/2/6744/m6744312.pdf>
- On Web portal „Project Lodz” (June 30, 2009) an article appeared on improving of Stawy Stefańskiego bathing site. The article is available here: <http://www.projektlodz.pl/aktualnosci/1/788>
- In Lodz's edition of the "Ekspresu Ilustrowanego" Bohdana Dmochowski's article appeared about the project of renaturalization of Sokolowka river. An article is available here: Odkopię Łódzkie Rzeki_19 czerwca 2009 <http://lodz.naszemiasto.pl/wydarzenia/1014128.html>
- An article on storm water management appeared on journal "Piotrkowska 104" in issue 5 (72) published by The city of Lodz Office. An article is available here: <http://uml.lodz.pl/plik.php?id=4901>
- In issue of Gazeta Wyborcza (May 4, 2009) an article appeared on the revitalization of Sokolowka River. The article is available here:
http://woda.org.pl/e107_plugins/content/content.php?content.1657
- In issue of Gazeta Wyborcza (May 3, 2009) an article of Aleksandra Hac appeared on the revitalization of Sokolowka River " Bath in city reservoir will be possible in a year".
- In issue of Gazeta Wyborcza (April 6, 2009) an Aleksandra Hac's article appeared on the creation of new parks in Lodz. The article is available here:
<http://szukaj.wyborcza.pl/archiwum/1,0,5291394.html?kdl=20090406LO-DLO&artTyp=zwykly&wyr=nowe%2Bparki%2B>
- An article on revitalization of Jasien River Valey appeared on journal "Piotrkowska 104" in issue 3 (70) published by The City of Lodz Office. An article is available here: <http://uml.lodz.pl/plik.php?id=4684>
- In issue of Gateza Wyborcza (March 6, 2009) an Aleksandra Hac article appeared on the Blue Green Network : Beton Blocks in Blue Green Network.
- In issue of Gazeta Wyborcza (March 5, 2009) an Barbara Gortat's article appeared on the Blue-Green Network. The article is available here:
<http://uml.lodz.pl/plik.php?id=5042> .

Films realized by ERCE:

- "Ecohydrology in the City of the Future" - a 20-minute film, including information about the Water Management in the Lodz City'
- "Water for Life" - a 30-minute film referring to Water in Ethiopia.

4.2 Policy documents and advice

Policy documents

Recommendations for the City of Lodz Spatial Plan, developed jointly with the local authorities, approved and included into the "Study of Conditions and Recommendations for Directions of the City of Lodz Development", related to:

- 1) sustainable stormwater management based on urban ecohydrology concept;
- 2) implementation of the Blue-Green Network concept.

5. Update on Centre Operations

5.1 Membership of the Board of Governors between designated period

- Prof. Zbigniew Kundzewicz - Research Centre for Agricultural and Forest Environment PAS
- Dr András Szöllösi-Nagy - International Hydrological Programme (IHP), UNESCO/Division of Water Sciences (SC/HYD)
- Prof. Marek Gromiec - Institute of Meteorology and Water Management (IMGW)
- Prof. Paweł Jokiel - Department of Hydrology and Water Management, University of Lodz
- Prof. David Harper - Department of Biology University of Leicester, UK
- Prof. Luis Chicharo - University of Algarve, Portugal
- Prof. Nicola Fohrer - Ecology Centre, CAU Kiel, Department of Hydrology and Water Resources Management
- Prof. Vladimir M. Timchenko - Institute of Hydrobiology, Ukrainian Academy of Sciences
- Prof. Geza Jolankai - Department of Water Resources Research Centre (VITUKI)
- Olga Gorelits - State Oceanographic Institute of Hydrometeorological Committee of the Russian Federation
- Dr Pascal Breil - Cemagref, Cemagref, Hydrology-Hydraulics Research Unit
- Prof. Cedo Maksimovic - Imperial College London,
- Prof. Dr Richard D. Robarts - UNEP GEMS/Water Programme Office Environment Canada
- Prof. Artur Magnuszewski - Faculty of Geography and Regional Studies, Warsaw University
- Prof. Jay O'Keeffe - UNESCO-IHE Institute for Water Education

5.2 Key decisions made (attach minutes of meetings)

Minutes of the meeting attached to the report.

6. Evidence of the Centre's Impacts

6.1 Science Impacts (Major contributions to the science, technology, education, and regional and/or international cooperation in the field of water)

Science

List of publications attached in annex 8.1.

Technology

Elaboration of a concept and technical project and patenting of the Sequential Sedimentation/Biofiltration System on the Sokolowka river: Zalewski M., Frątczak W. 2009: "Technical project for the concept of the detention pond modernization"; Patent application number P.390099 [WIOP ST 10/C PL 390099] - Sequence method for water biofiltration,

specially for seminatural watercourses, and sequence system form water biofiltration, specially for seminatural watercourses.

Education

Educational and training activities described in section 2.1, 2.2 and 2.3.

Demonstration Activities:

Ner River/WWTP Project:

- Exploitation of the existing willow plantation at the Protection Zone of the WWTP in Lodz continued; The biomass was used for bioenergy production;

Sokolowka River Project:

- The construction of the Żabieniec reservoir, planned for 2009, had to be rescheduled in terms of receiving all of the necessary permits. The building permit obtaining has been apprehended by the objection of the owners of the land situated next to the Sokolowka River bed up the reservoir. None of this objections became accepted.
- The accomplishment of formalities and construction of the reservoir is going to be continued after receiving the rejection of objections. The construction is foreseen in 2010.
- Elaboration of the concept document for the Sokolowka river bed restoration – including the BMP's guidelines, gained through the SWITCH project duration: Zalewski M., Wagner I., Łapińska M., Krauze K., Frątczak W. (2009). Ecohydrological basis for renaturization of Sokolowka River. Report. (The continuation of research carried out for SWITCH Project). In the collaboration with Technical University of Lodz – Department of Environmental Engineering in the name of Agreement of scientific-research collaboration" (nr 2/2009; 08.10.2009r.).
- Elaboration of a concept and technical project and patenting of the Sequential Sedimentation/Biofiltration System on the Sokolowka river: 1) Zalewski M., Frątczak W. 2009: "Technical project for the concept of the detention pond modernization"; 2) Patent application number P.390099 [WIOP ST 10/C PL 390099] – Sequence method for water biofiltration, specially for seminatural watercourses, and sequence system form water biofiltration, specially for seminatural watercourses.
- Planting activities in the protective zone of the Teresa Reservoir were not continued due to achieving an advanced stage of the succession of vegetation and change into a sustainable self-maintained stage;

6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)

Lectures for international bodies and organizations:

- Wagner Iwona; SWITCH LA progress assessment project. Tel Aviv, Israel, 25-30 August, 2008 "LA process in the SWITCH Project and the mid-term assessment"; 25-30 August 2008, Tel Aviv. ; Israel
- Dzięgielewska-Geitz Monika; SWITCH LA progress assessment project. Tel Aviv, Israel, 25-30 August, 2009 "LA process in Lodz within the SWITCH Project"; 25-30 August 2008, Tel Aviv. ; Israel
- Wagner Iwona; SWITCH Theme 2 meeting on stormwater management "Research Progress and Leeds in the context of stormwater management"; 7-9 July 2008, Essen. ; Germany
- Dzięgielewska-Geitz Monika; SWITCH Theme 2 meeting on stormwater management "Progress of the LA development in Lodz"; 7-9 July 2008, Essen. ; Germany

- Wagner Iwona; SWITCH Training workshop: "Advancing Learning Alliances to increase research impact".; 26-29 November 2008, Belo Horizonte.; Brazil
- Wagner Iwona; Water Tribune @ EXPO ZARAGOZA 2008. Theme: Water and Cities: Local Governments and Governance, and Urban Development. Teleconference of Cities: Washington, Zaragoza, Lodz, Accra, Delft, Belo Horizonte.; 23 – 27 June 2008, Zaragoza; Spain
- Zalewski Maciej; Ecohydrology – trans-disciplinary science for reversing the landscape degradation and „good ecological status“ of freshwater and costal ecosystems; Academy of Finland, 15-16 December 2009, Helsinki.; Finland
- Zalewski Maciej; Ecohydrology – the system approach for implementing environmental water allocation; Engineer Research and Development Centre, Corps of Engineers, U.S. Army, 2009 Vicksburg. ; USA

6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)

- Instructions to the Study of Conditions and Directions for Spatial Planning in the City of Łódź for sustainable stormwater management and landscape planning
- Elaboration of recommendations on "Needs and possibilities for introduction of stormwater fees in Łódź"
- Elaboration of concept and plan for "The ecohydrological background for the restoration of the Sokołówka river" for the City of Lodz

7. Future activities that will contribute directly to IHP and/or to WWAP

7.1 Operational Plan (2010-2011) (attach operational plan for 2008-09 if available)

Research (international projects):

- "Towards Engineering Harmony Between Water, Ecosystem and Society. Strengthening the Collaboration between European Academies of Sciences in the IAP Water Programme". IAP 3240226102/010/013.
- ENVEUROPE: Environmental quality and pressures assessment across Europe: the LTER network as an integrated and shared system for ecosystem monitoring. LIFE08 ENV/IT/000399.
- Ecohydrology – a *inżyniering* science for integrated water resources and sustainable development in Ethiopia. Project financed by the Ministry for Foreign Affairs.
- EXPEER: Distributed Infrastructure for EXPERimentation in Ecosystem Research. FP7-INFRASTRUCTURES-2010-1.
- Within the framework of Life+ Project GPPinfoNET (LIFE07 INF/IT/000410) action "Creation of regional networks for GPP in European regions".

Research (national projects):

- EKOROB: Ecotones for reducing diffusion pollution. LIFE08 ENV/PL/000519.
- EH-REK: Ecohydrologic rehabilitation of Arturowek recreational reservoirs (in Lodz) as a model approach to rehabilitation of urban reservoirs. LIFE08 ENV/PL/000517.
- "Analysis of point sources pollution of nutrients, dioxins and dioxin-like compounds in the Pilica River catchment and draw up of reclamation methods". N305 365738. Project financed by the Ministry of Sciences.
- Blue-Green Network in Lodz Concept. Project financed by the City Lodz Office.

Other activities:

- Advanced Study Course: "Ecohydrology & Biotechnology for Sustainable Integrated Water Resources Management in HELP and Ecohydrology Basins" – 13-20 September 2010 in Lodz, Poland.
- 3rd European Regional Workshop of the InterAcademy Panel (IAP) Water Programme, entitled 'Towards Engineering Harmony Between Water, Ecosystem and Society', 9-11 September 2010 in Zakopane, Poland.
- 5th SWITCH Scientific Conference 2010 "Sustainable Water management Improves Tomorrow's Cities' Health: achievements and way forward", 13-16 October 2010, Lodz, Poland.
- Regional consultation on water education and training in Lodz City – development of a strategic framework (education).
- Ner River: Application of phytotechnology for modernization of the sewage treatment plant in Lodz and biomass production; co-operation with the City of Lodz.
- City of Lodz: Renaturalisation of the municipal Sokolowka River; co-operation with the City of Lodz.

7.2 Strategic Plan linked with IHP-VII (attach strategic plan for 2010-13 if available)

8. Annexes

8.1 List of publications released by the centre (there can be overlap with those listed in 2.3 above)

2008

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- Breil P., Marsalek J., Wagner I., Dogse P. Introduction to urban aquatic habitats management In: Wagner I., Marshalek J., Breil P. (eds). *Aquatic Habitats in Sustainable Urban Water Management: Science, Policy and Practice*. Taylor and Francis/Balkema: Leiden. 2008: 1-8
- Godlewska M., Doroszczyk L., Długoszewski B., Mokwa M. Acoustical Monitoring of Fish at an Electric Barrier. *Hydroacoustics*. 2008: Vol. 11, 97-104 pp
- Harper D., Zalewski M., Pacini N. (eds). *Ecohydrology: Processes, Models and Case Studies. An approach to the sustainable management of water resources*. CAB International, UK. 2008: 391 pp
- Izydorczyk K., Jurczak T., Wojtal-Frankiewicz A., Skowron A., Mankiewicz-Boczek J., Tarczyńska M. Influence of abiotic and biotic factors on microcystin content in *Microcystis aeruginosa* cells in a eutrophic temperate reservoir. *Journal of Plankton Research*. 2008, 30 (4): 393-400
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- Krauze K., Zawilski M., Wagner I. Aquatic habitat rehabilitation: Goals, constraints and techniques. In: Wagner I., Marshalek J., Breil P. (eds). Aquatic Habitats in Sustainable Urban Water Management: Science, Policy and Practice. .Taylor and Francis/Balkema: Leiden. 2008: 71-93
- Krauze K., Wagner I..An ecohydrological approach for the protection and enhancement of ecosystem services. In: Petrosillo I., Jones B., Muller F., Zurlini G., Krauze K., Victorov S. (eds). Use of landscape sciences for the assessment of environmental security. .Springer-Verlag Publishers. 2008: 177-207
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- Sumorok B., Trojanowska A., Drobnińska A., Flisiak Ł., Izydorczyk K., Sas Paszt L..The effect of fertilization by bottom sediments on the vegetative growth of native and energy willow species grown in the pot and field experiments..Polish Journal of Environmental Studies . 2008, 17 (3a): 555-559
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Zalewski, M. Ecohydrology: A framework for reversing the degradation of the Baltic Sea. *Baltex Newsletter*, Oct. 2009. pp 7-10

- 8.2 List of training courses conducted (there can be overlap with those listed in 2.1 above)

International Advanced Study Course on Ecohydrology:

In September 2009 ERCE organized International Advanced Study Course: “Ecohydrology & Ecosystems Biotechnologies in Water Resources Management” on the basis of cooperation with UNESCO. This course was for young scientists, PhD students, practitioners and decision makers from whole world (Course Programme in Attachment).

In November 2008 in Etiopia (26-28 Oct 2008) ERCE organized International Study Course in Ecohydrology for policy makers and stakeholders from Ethiopia.

Appendix-1

Overview of the Core Programme Themes of the Seventh Phase of the IHP (2008-2013)

WATER DEPENDENCIES: SYSTEMS UNDER STRESS AND SOCIETAL RESPONSES

Theme 1: ADAPTING TO THE IMPACTS OF GLOBAL CHANGES ON RIVER BASINS AND AQUIFER SYSTEMS

Focal area 1.1 - Global changes and feedback mechanisms of hydrological processes in stressed systems

Focal area 1.2 - Climate change impacts on the hydrological cycle and consequent impact on water resources

Focal area 1.3 - Hydro-hazards, hydrological extremes and water-related disasters

Focal area 1.4 - Managing groundwater systems' response to global changes

Focal area 1.5 - Global change and climate variability in arid and semi-arid regions

Theme 2: STRENGTHENING WATER GOVERNANCE FOR SUSTAINABILITY

Focal area 2.1 - Cultural, societal and scientific responses to the crises in water governance

Focal area 2.2 - Capacity development for improved governance; enhanced legislation for wise stewardship of water resources

Focal area 2.3 - Governance strategies that enhance affordability and assure financing

Focal area 2.4 - Managing water as a shared responsibility across geographical & social boundaries

Focal area 2.5 - Addressing the water-energy nexus in basin-wide water resources

Theme 3: ECOHYDROLOGY FOR SUSTAINABILITY

Focal area 3.1 - Ecological measures to protect and remediate catchments process

Focal area 3.2 - Improving ecosystem quality and services by combining structural solutions with ecological biotechnologies

Focal area 3.3 - Risk-based environmental management and accounting

Focal area 3.4 - Groundwater-dependent ecosystems identification, inventory and assessment

Theme 4: WATER AND LIFE SUPPORT SYSTEMS

Focal area 4.1 - Protecting water quality for sustainable livelihoods and poverty alleviation

Focal area 4.2 - Augmenting scarce water resources especially in SIDS

Focal area 4.3 - Achieving sustainable urban water management

Focal area 4.4 - Achieving sustainable rural water management

Theme 5: WATER EDUCATION FOR SUSTAINABLE DEVELOPMENT

Focal area 5.1: Tertiary water education and professional development

Focal area 5.2: Vocational education and training of water technicians

Focal area 5.3: Water education in schools

Focal area 5.4: Water education for communities, stakeholders and mass-media professionals



The Minutes of the 1st Governing Board Meeting of the International Institute of PAS European Regional Centre for Ecohydrology under the auspices of UNESCO (ERCE)

European Regional Centre for Ecohydrology under the auspices of UNESCO
Lodz, Poland, 23rd May 2008

INTRODUCTION

The International Institute of the Polish Academy of Sciences - European Regional Centre for Ecohydrology under the auspices of UNESCO (ERCE) was established on the basis of the International Centre for Ecology, Polish Academy of Sciences (ICE PAS) with special consideration of the partnership between the Polish Academy of Sciences and the University of Lodz (UL). The long term, mutual cooperation between the ICE PAS and the Department of Applied Ecology UL, on implementation of the theory of Ecohydrology for sustainable water resources was formally enforced by agreement between PAS and UL.

The agreement on the establishment of the ERCE was signed by the Director-General of UNESCO, Koichiro Matsuura, and the Minister of Science and Education of Poland, Mr Michal Sewerynski, on 8 March 2006. The Centre was officially launched on the 30-31 May 2006 at the Opening Symposium held in Lodz, Poland.

The first meeting of the ERCE Governing Board was held on the Centre's premises on May 23rd 2008. The objective of the meeting in agreement with the ERCE statute was to:

- (a) accept the Operational Procedures for the Governing Board;
- (b) approve the candidate for the Centre Director's position;
- (c) approve of the activity report of ERCE for 2006-2008;
- (d) approve of the Centre's programme and adopt the financial plans submitted by the Director;
- (e) formulate general guidelines and instructions concerning the Centre's functioning and activities;
- (f) approve the Centre's financial regulations and staff rules.

The meeting was opened by Professor Zbigniew Kundzewicz (nominated by the President of the Polish Academy of Sciences as the Chairman of the Governing Board) and by Professor Maciej Zalewski. Next, the participants introduced themselves. The opening was followed by presentations of:

1. the scientific objectives, vision, strategy action plan for further development for ERCE, delivered by Prof. Zalewski;
2. the activities of ERCE from 2006 to 2008, delivered by Dr Iwona Wagner;

3. the organizational structure, budget and financial plans for ERCE, delivered by Prof. Piotr Frankiewicz.

Professor Zalewski emphasized that thanks to participation of the Centre in the UNESCO-IHP programme, scientists working at ERCE have the opportunity to work on exchange of knowledge and experience with scientists from all over the world in the process of development of ecohydrology and inter-disciplinary environmental sciences. Also, he underlined the important role of the Department of Applied Ecology of the University of Lodz where the pilot investigation on ecohydrological interactions was initiated. The establishment of the ERCE in the Campus of the Polish Academy of Sciences in Lodz provides the opportunity to collaborate with the top molecular biologists and chemists in Poland and is highly stimulating for the development of ERCE's professional research staff. The 23 students have been developing their MSc and PhD theses at the facilities of ERCE since 2006. Thus the Centre has the opportunity to identify the most talented students to be employed at the Centre or to be potentially recommended to other employers in the field. Finally, Professor Zalewski informed the audience that the Centre has achieved the prestigious, first position among 38 institutions rated in the recent evaluation of institutes and university faculties in biological sciences, done by the Ministry of Science and Higher Education of the Republic of Poland.

In course of discussions, ERCE was highly recognized for participating in ongoing European Union projects and activities that "put things on the ground". In particular:

- EU SWITCH – „Sustainable Water Management Improves Tomorrow City's Health”, developing ecohydrological solutions for urban areas and their successful implementation through application of Multi-Stakeholder Engagement Processes methodology.
- FP7 NoE AlterNet, contributing to the challenge of halting the loss of biodiversity by 2010, through developing strategies for biodiversity protection and its management in socio-ecological landscapes (including rural and urban areas), and development of indices for assessment of landscape changes and freshwater systems that serve European agencies and policy, education and communication with stakeholders.
- Chairing LTER Europe Network (European Long Term Ecological Research) and membership in Task Groups for developing scientific agenda for both the European and global networks (ILTER), and through this shaping long-term ecological monitoring and research in Europe. This includes elaboration of methods for identification of socio-economic drivers of environmental change, risk assessment, ecosystem services-related monitoring, and developing socio-ecological platforms for elaboration and implementation of sound science and efficient environmental policies.

Prof. Piotr Frankiewicz in the budget review presented that the Centre operates on financial resources available from the statutory funding from the Ministry of Science and Higher Education and the subject-based subsidy of the Polish Academy of Sciences, and over 50% of funds are generated from short-term and long-term grants, projects, or expert consulting conducted by ERCE staff. The Board members emphasized that prestigious institutes for water research in Western Europe generate only 20% of their budget thanks to substantially higher core funding and therefore they made a recommendation to increase the core funding

of ERCE in order to maintain the high level of scientific performance rather than being engaged in multiple, and *ad-hoc*, consultancy services.

CONCLUSIONS AND RECOMMENDATIONS

1. The activities carried out by ERCE in 2006 – 2008 were approved by the Governing Board with strong statements of support and recognition for their scope and results in view of the available resources, and for the Centre's contributions to the development of ecohydrology.
2. The Centre's programme based on the ongoing and planned research activities and projects was approved together with the financial plans.
3. Recognizing the high level of science developed at ERCE, and ensuring further development of ecohydrology, which became one of the five priorities of the 7th phase of the UNESCO International Hydrological Programme, for the years 2008 – 2013, as well as in support of the recommended increase of the core funding for ERCE, the Governing Board wrote a letter to the Minister of Science and Higher Education of the Republic of Poland and to the President of the Polish Academy of Sciences. The Governing Board recommended in it an increase in the core budget by 25% in the year 2009, and 15% in 2010, and 10% in the following three years (2011-2013) in order to maintain, and enhance, the existing high level of scientific performance.
4. A recommendation was made that in order to foresee and secure future fund-raising options, ERCE draws up a 5-year action and strategic plan identifying research and financial objectives and sources of funding, and presents it to the Governing Board.
5. The Governing Board approved Professor Maciej Zalewski appointed as Director of the ERCE u/a UNESCO in Lodz.
6. Mrs Monika Dziegielewska-Geitz was appointed Secretary of the Governing Board. The responsibilities of ERCE staff as well as the organizational procedures were presented to the Board Members and approved by them. The staff list will be added to the meeting documents for the Members' reference.
7. ERCE staff rules were approved, which was stated in the letter to the President of the Polish Academy of Sciences.
8. The "Operational Procedures" of ERCE u/a UNESCO were approved by the members of the Governing Board. The following suggestions were made:
 - the name "Policy Statement" was suggested to be changed to "Operational Procedures";
 - Article 5, Point 2: the statement "The Board meetings shall be held every year and when necessary" was decided to be changed into "The Board meetings shall be held every two years and when necessary", analogically to the procedure employed by the UNESCO's ICHARM (International Centre for Water Hazard and Risk Management) in Japan. Relevant annex to the Agreement between UNESCO and the Government of the Republic of Poland will be requested by ERCE.
9. The Board Members emphasized numerous times that the Centre succeeds in carrying out top quality research and other activities, and remains a leading research institution, in the international scale, devoted to the development of ecohydrology and its Applications.

LIST OF MEMBERS OF THE GOVERNING BOARD PRESENT AT THE MEETING

A representative of the President of the Polish Academy of Sciences

Prof. Zbigniew Kundzewicz (Chairman)

Research Centre for Agricultural and Forest Environment PAS
19 Bukowska Str., 60-809 Poznan, Poland
zkundze@man.poznan.pl

A representative of the Director-General of UNESCO

Dr Lisa Hiwasaki

International Hydrological Programme (IHP)
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Prof. Dr Richard D. Robarts

UNEP GEMS/Water Programme Office Environment Canada
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Representatives from other relevant centres under the auspices of UNESCO

Prof. Jay O’Keeffe

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The Netherlands
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Representatives of ERCE u/a UNESCO in Lodz

Prof. Maciej Zalewski – Director

Prof. Piotr Frankiewicz – Deputy Director

Dr. Iwona Wagner – Deputy Director

Monika Dziegielewska-Geitz, M.A. – Secretary to the Governing Board

LIST OF MEMBERS OF THE GOVERNING BOARD ABSENT FROM THE MEETING

A representative of the Chancellor of the University of Lodz

Prof. Paweł Jokiel

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Format for Reports by UNESCO's Water-related Centres (category 1 and 2) on activities related to the IHP in the period June 2008 – May 2010

1. Basic information on the centre

Name of the Centre		The Regional Humid Tropics Hydrology And Water Resources Centre For South-East Asia And The Pacific (HTC Kuala Lumpur)
Name of Director		Dr. Mohamed Roseli Bin Zainal Abidin
Name and title of contact person (for cooperation)		Rohani Binti Ahmad Hezrin Haslinda Binti Hashim
E-mail		rohani@water.gov.my / hezrin@water.gov.my
Address		No. 2, Jalan Ledang, Off Jalan Duta, 50480 Kuala Lumpur, Malaysia.
Website		http://htckl.org.my
Location of centre		city/town : <u>Kuala Lumpur</u> country : <u>Malaysia</u>
Geographic orientation *		<input type="checkbox"/> global <input checked="" type="checkbox"/> regional
Year of establishment		1999
Themes	Focal Areas ♦	<input type="checkbox"/> groundwater <input checked="" type="checkbox"/> urban water <input type="checkbox"/> arid / semi-arid zones <input checked="" type="checkbox"/> humid tropics <input type="checkbox"/> droughts and floods <input type="checkbox"/> sediment transport and management <input checked="" type="checkbox"/> water and environment <input checked="" type="checkbox"/> ecohydrology <input type="checkbox"/> water law and policy <input type="checkbox"/> transboundary river basins/ aquifers <input checked="" type="checkbox"/> IWRM <input type="checkbox"/> global and climate change <input type="checkbox"/> mathematical modelling <input type="checkbox"/> social and cultural dimensions of water <input checked="" type="checkbox"/> water education <input checked="" type="checkbox"/> other: <u>stormwater management, water hazard.</u>
	Scope of Activities ♦	<input type="checkbox"/> vocational training <input type="checkbox"/> postgraduate education <input type="checkbox"/> continuing education <input checked="" type="checkbox"/> research <input type="checkbox"/> institutional capacity-building <input checked="" type="checkbox"/> advising/ consulting <input type="checkbox"/> software development <input type="checkbox"/> other: (please specify) _____
Support bodies ¹		The Government of Malaysia
Hosting organization ²		Department of Irrigation and Drainage Malaysia/ Ministry of Natural Resources and Environment
Sources of financial support ³		The Government of Malaysia/ UNESCO
Existing networks and cooperation ⁴		UNESCO/ICHARM/RCUWM/RSC for Southeast Asia and The Pacific/ Partner of the GWP/ IWA/ APAC Water-related Centre Category II/MyWP/Malaysian Stormwater Organization

* check on appropriate box

♦ check all that apply

¹ please specify bodies that cover the operational costs of the centre, and other essential costs such as salaries and utility bills, and that provide institutional support to ensure centre's sustainability

² if different from support bodies

³ please specify sources of main budgetary and extrabudgetary funds to implement projects

⁴ please write international networks, consortiums or projects that the centre is part of, or any other close links that the centre has with international organizations or programmes, which are not already mentioned above

Governance	<input checked="" type="checkbox"/> director and governing board <input checked="" type="checkbox"/> other: <u>Exco of Malaysia IHP, Research Malaysia IHP</u> Link to election of board members to the IHP IGC and hosting country IHP National Committee Frequency of meetings: twice every year(s) <input checked="" type="checkbox"/> Existence of UNESCO presence at meetings (UNESCO Jakarta Office)
Institutional affiliation of director	IWA/IAHS/Partner of the GWP/Malaysia Nuclear Agency
Number of staff and types of staff	total number of staff (full-time, or equivalent) : <u>13 persons</u> number of staff who are water experts: <u>2 person</u> number of visiting scientists and postgraduate students: <u>1 person</u>
Annual turnover budget in USD	Operational = USD 180,000.00 Programmes and Activities = USD 350,000.00

2. Activities undertaken in the framework of IHP in the period June 2008 – May 2010

- 2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VI and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.
- 2.2 Research activities that directly contributed to the IHP-VI and activities by WWAP
Please include research/applied projects outputs such as publications that directly contributed to the IHP-VI and WWAP objectives
- National Level
 - Research And Development On Application Of Water Sensitive Urban Design For Integrated Stormwater Management At Local Scale In Kuala Lumpur.
 - Integrated and Multidisciplinary Research On Flood Hazard Assessment In Johor Malaysia.
 - Regional Level
 - Regional consultation on water education and training in Asia - development of a strategic framework (education) (*HTC KL/ ICHARM-Japan/AIT-Thailand/ APCE-Indonesia*)
 - Flood Forecasting and Warning System For Tropical Regions (research) (*HTC KL/ ICHARM-Japan/ APCE-Indonesia*)
- 2.3 Training activities that directly contributed to the IHP-VI and WWAP objectives
- Technical Visit to UNESCO Jakarta Office, Jakarta, Indonesia, 16-18 July 2008.
 - Participation in Malaysia World Water Day 2008, Negeri Sembilan, Malaysia, 25-27 July 2008.
 - Organised Best Thesis Award For Malaysia's Universities and Higher Learning Institution For Malaysia World Water Day 2009, Sarawak, Malaysia, 11-12 April 2009.
 - International Training Workshop On Flash Flood Risk Assessment And Mitigation Strategies, Kuala Lumpur, 10-13 August 2009.
 - Organised Best Thesis Award For Malaysia's Universities and Higher Learning Institution For Malaysia World Water Day 2010, Muar, Johor, 26 March 2010.
 - International Seminar on Flood Forecasting and Warning System For Tropical Region, UNITEN, Malaysia, 24-25 May 2010.

3. Collaboration and linkages

3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies

- SWITCH in ASIA Urban Water Management
- Networking/ Partnerships
 - UNESCO
 - ICHARM-Japan
 - RCUWM-Tehran
 - UNESCO Jakarta Office
 - UNESCO Water Centers
 - Partner of the GWP
 - International Water Association (IWA)
- Trainings
 - International Conference on Civilisational Values Environment and the Sacred, Shah Village Hotel, Petaling Jaya, Malaysia, 3-4 June 2008.
 - Technical Visit to UNESCO Jakarta Office, Jakarta, Indonesia, 16-18 July 2008.
 - Malaysia World Water Day 2008, Negeri Sembilan, Malaysia, 25-27 July 2008.
 - Malaysia World Water Day 2009, Sarawak, Malaysia, 11-12 April 2009.
 - International Conference on Water Resources ICWR 2009, Hotel Bayview Langkawi, Kedah, 26-27 May 2009.
 - ISTIC Training Workshop on Assessment on Industry Needs to Develop A Sustainable & Productive S&T Policy, Hotel Corus Kuala Lumpur, 22-26 June 2009.
 - International Training Workshop On Flash Flood Risk Assessment And Mitigation Strategies, Kuala Lumpur, 10-13 August 2009.
 - International Conference on Hydrology and Disaster Management, Central International Hotel, Wuhan China, 2-3 November 2009.
 - SWITCH-in-ASIA Regional Partnership Workshop, Hotel Grand Kemang, Jakarta, 8-10 December 2009.
 - Preparation of Guidelines For Site Selection And Evaluation of Nuclear Power Plant Workshop, Ancasa All-Suites & Spa Port Dickson, Negeri Sembilan, 14-17 December 2009.
 - DID Technical Talk No. 11/2009, Dahlia Hall DID Ampang Kuala Lumpur, 22 December 2009.
 - International Seminar on Flood Forecasting and Warning System For Tropical Region, UNITEN, Malaysia, 24-25 May 2010.

3.2 Participation in meetings related to the IHP and UNESCO (e.g., the UNESCO General Conference, the UNESCO Executive Board, the IHP Intergovernmental Council and/or other meetings organized by IHP)

- International/ Regional
 - 18th Session of the Intergovernmental Council, 9-13 June 2008, Paris.
 - 16th IHP Regional Steering Committee Meeting for Southeast Asia and Pacific, 2-3 October 2008, Ulaanbataar, Mongolia.
 - 6th General Session on World Commission on Ethics of Science and Technology - COMEST, 10-16 June 2009, Kuala Lumpur.
 - IHP Regional Steering Committee Meeting for Southeast Asia and Pacific, 22-23 November 2007, Manila, Philippines.
 - 17th IHP Regional Steering Committee Meeting for Southeast Asia and Pacific, 5-6 November 2009, Wuhan, China.
- National
 - Malaysia National Committee for International Hydrological Programme Meeting (MIHP).

- 3.3 Collaboration and networking with other UNESCO category 1 or 2 institutes/ centres
- 3.3.1 cross-appointment of directors of the category 1 or 2 institutes or centres on the governing board
-
- 3.3.2 exchange of information on activities such as training/educational materials, and funding opportunities
- Proceedings
 - Draft Proceeding of International Training Workshop On Flash Flood Risk Assessment And Mitigation Strategies, Kuala Lumpur, 10-13 August 2009.
 - Publications/ Reports
 - Newsletter Volume 10
 - Husaini A., and Roseli, M. (2009). *"Keynote Address 2: Research and Development from Science, Technology and Innovation Perspective"*, AWAM09 Conference, Corus Hotel, Kuala Lumpur, 27 – 29 Oct, 2009.
 - Roseli, M. (2009). *"Introduction to River Management in Malaysia – Clean, Living and Vibrant River"*, The Malaysian Technical Cooperation Programme (MTCP) 3rd International Course on Flood Mitigation and Stormwater Management, NAWMI, Kota Bharu, Kelantan, Malaysia, 5 – 23Oct 2009.
 - Roseli, M. (2009). *"Malaysia's Initiative in Integrated Water Resources Management (IWRM) and Integrated River Basin management (IRBM) – Making Space for Water"*, The Malaysian Technical Cooperation Programme (MTCP) 3rd International Course on Flood Mitigation and Stormwater Management, NAWMI, Kota Bharu, Kelantan, Malaysia, 5 – 23Oct 2009.
 - Roseli, M. (2009). *"River Restoration and River Hydraulics"*, The Malaysian Technical Cooperation Programme (MTCP) 3rd International Course on Flood Mitigation and Stormwater Management, NAWMI, Kota Bharu, Kelantan, Malaysia, 5 – 23Oct 2009.
 - Lim, C.H. and Roseli, M (2009). *"Enhancing the Management of Water Resources Towards Sustainable Environment: Managing Environment Flow"*, National Colloquium on Water Demand Management, PWTC, Kuala Lumpur, 19 – 21 Oct, 2009.
 - UNESCO IHP Technical Publication : Porous And Permeable Pavement System (*in progress*)
 - UNESCO IHP Technical Publication : Greywater Reuse System (*in progress*)
 - UNESCO IHP Technical Publication : Constructed Wetland System (*in progress*)
 - UNESCO IHP Technical Publication : Rain Water Harvesting System (*in progress*)
 - UNESCO IHP Technical Publication : Green Roof System (*in progress*)
 - UNESCO IHP Technical Publication : Bioretention System (*in progress*)
 - The 10 Year Report of HTC Kuala Lumpur. (*in progress*)
 - Published activities conducted through HTC Kuala Lumpur website (<http://htckl.org.my>)

3.3.3 exchange of staff, most notably professionals and students

-

3.3.4 implementation of joint activities, such as workshops, conferences, training programmes, joint projects, field visits, software and data sharing, knowledge exchange and publications

- Research
 - Integrated and Multidisciplinary Research On Flood Hazard Assessment In Johor Malaysia. (*HTCKL/ ICHARM-Japan*).
 - Regional consultation on water education and training in Asia - development of a strategic framework (education) (*HTC KL/ ICHARM-Japan/AIT-Thailand/ APCE-Indonesia*).
 - Flood Forecasting and warning system for tropical regions (research) (*HTC KL/ ICHARM-Japan/ APCE-Indonesia*).
- Data Archive
 - Asia Pacific FRIEND - Asian Pacific Water Archive - Central Node : HTC KL (<http://htckl.org.my/apfriend/wa/index.shtml>)
- Trainings
 - International Training Workshop On Flash Flood Risk Assessment And Mitigation Strategies, Kuala Lumpur, 10-13 August 2009.
 - International Seminar on Flood Forecasting and Warning System For Tropical Region, UNITEN, Malaysia, 24-25 May 2010.

3.4 Relationships with the UNESCO field office whose jurisdiction covers the country of location

- Good relationship with UNESCO Jakarta Office

3.5 Relationship with the UNESCO National Commission and the IHP National Committee in the country of location

- Good relationship with:
 - Malaysian National Commission for UNESCO
 - Malaysia National Committee for International Hydrological Programme (MIHP)

3.6 Relationship with other UNESCO-related networks, such as UNESCO Clubs, ASPnet, and UNESCO chairs

- Malaysian National Commission of UNESCO

4. Communication

4.1 Communication and knowledge dissemination activities undertaken in the framework of IHP

- Trainings
 - Technical Visit to UNESCO Jakarta Office, Jakarta, Indonesia, 16-18 July 2008.
 - Participation in Malaysia World Water Day 2008, Negeri Sembilan, Malaysia, 25-27 July 2008.
 - Organised Best Thesis Award For Malaysia's Universities and Higher Learning Institution For Malaysia World Water Day 2009, Sarawak, Malaysia, 11-12 April 2009.
 - International Training Workshop On Flash Flood Risk Assessment And Mitigation Strategies, Kuala Lumpur, 10-13 August 2009.

- Organised Best Thesis Award For Malaysia's Universities and Higher Learning Institution For Malaysia World Water Day 2010, Muar, Johor, 26 March 2010.
- International Seminar on Flood Forecasting and Warning System For Tropical Region, UNITEN, Malaysia, 24-25 May 2010.
- Proceedings
 - Draft Proceeding of International Training Workshop On Flash Flood Risk Assessment And Mitigation Strategies, Kuala Lumpur, 10-13 August 2009.
- Publications/ Reports
 - Newsletter Volume 10
 - Husaini A., and Roseli, M. (2009). *"Keynote Address 2: Research and Development from Science, Technology and Innovation Perspective"*, AWAM09 Conference, Corus Hotel, Kuala Lumpur, 27 – 29 Oct, 2009.
 - Roseli, M. (2009). *"Introduction to River Management in Malaysia – Clean, Living and Vibrant River"*, The Malaysian Technical Cooperation Programme (MTCP) 3rd International Course on Flood Mitigation and Stormwater Management, NAWMI, Kota Bharu, Kelantan, Malaysia, 5 – 23Oct 2009.
 - Roseli, M. (2009). *"Malaysia's Initiative in Integrated Water Resources Management (IWRM) and Integrated River Basin management (IRBM) – Making Space for Water"*, The Malaysian Technical Cooperation Programme (MTCP) 3rd International Course on Flood Mitigation and Stormwater Management, NAWMI, Kota Bharu, Kelantan, Malaysia, 5 – 23Oct 2009.
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 - Lim, C.H. and Roseli, M (2009). *"Enhancing the Management of Water Resources Towards Sustainable Environment: Managing Environment Flow"*, National Colloquium on Water Demand Management, PWTC, Kuala Lumpur, 19 – 21 Oct, 2009.
 - UNESCO IHP Technical Publication : Porous And Permeable Pavement System (*in progress*)
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 - UNESCO IHP Technical Publication : Bioretention System (*in progress*)
 - The 10 Year Report of HTC Kuala Lumpur. (*in progress*)
- Published activities conducted through HTC Kuala Lumpur website (<http://htckl.org.my>)

4.2 Policy documents and advice

- DID Manual
- Guidelines on Siting and Evaluation of Nuclear Power Plant in Malaysia
- Water Governance Policy through National Water Resources Study
- Industrial Advisory Panels For Faculty of Civil Engineering Faculty, University of Technology Malaysia
- Committee of Consultant's Financial and Technical for Ministry of Agriculture Malaysia

5. Update on Centre Operations

- 5.1 Membership of the Board of Governors during designated period
 - IHP National Committee Chairman of Southeast Asia and Pacific
 - Co-ordination Committee
- 5.2 Key decisions made (attach minutes of meetings)
 -

6. Assessment of the Centre's Impacts

- 6.1 Science Impacts (Major contributions to the science, technology, education, and regional and/or international cooperation in the field of water)
 - Research And Development On Application Of Water Sensitive Urban Design For Integrated Stormwater Management At Local Scale In Kuala Lumpur.
 - Porous And Permeable Pavement System
 - Greywater Reuse System
 - Constructed Wetland System
 - Rain Water Harvesting System
 - Green Roof System
 - Bioretention System
- 6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)
 - Technical Visit to UNESCO Jakarta Office, Jakarta, Indonesia, 16-18 July 2008.
 - Participation in Malaysia World Water Day 2008, Negeri Sembilan, Malaysia, 25-27 July 2008.
 - Organised Best Thesis Award For Malaysia's Universities and Higher Learning Institution For Malaysia World Water Day 2009, Sarawak, Malaysia, 11-12 April 2009.
 - International Training Workshop On Flash Flood Risk Assessment And Mitigation Strategies, Kuala Lumpur, 10-13 August 2009.
 - Organised Best Thesis Award For Malaysia's Universities and Higher Learning Institution For Malaysia World Water Day 2010, Muar, Johor, 26 March 2010.
 - International Seminar on Flood Forecasting and Warning System For Tropical Region, UNITEN, Malaysia, 24-25 May 2010.
- 6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)
 - DID Manual
 - Guidelines on Siting and Evaluation of Nuclear Power Plant in Malaysia
 - Water Governance Policy through National Water Resources Study
 - Industrial Advisory Panels For Faculty of Civil Engineering Faculty, University of Technology Malaysia
 - Committee of Consultant's Financial and Technical for Ministry of Agriculture Malaysia

7. Future activities that will contribute directly to IHP and/or to WWAP

- 7.1 Operational Plan (2010-2011) (attach operational plan for 2008-09 if available)
 - Organisation Chart & Function of each units (Annexes I & II)
- 7.2 Strategic Plan linked with IHP-VII (attach strategic plan for 2010-13 if available)
 - Department Of Irrigation And Drainage Themes And Focus Area On R&D Based On UNESCO IHP VII Themes 2008 – 2013 (Annexes III)

8. Annexes

8.1 List of publications released by the centre (there can be overlap with those listed in 2.2 above)

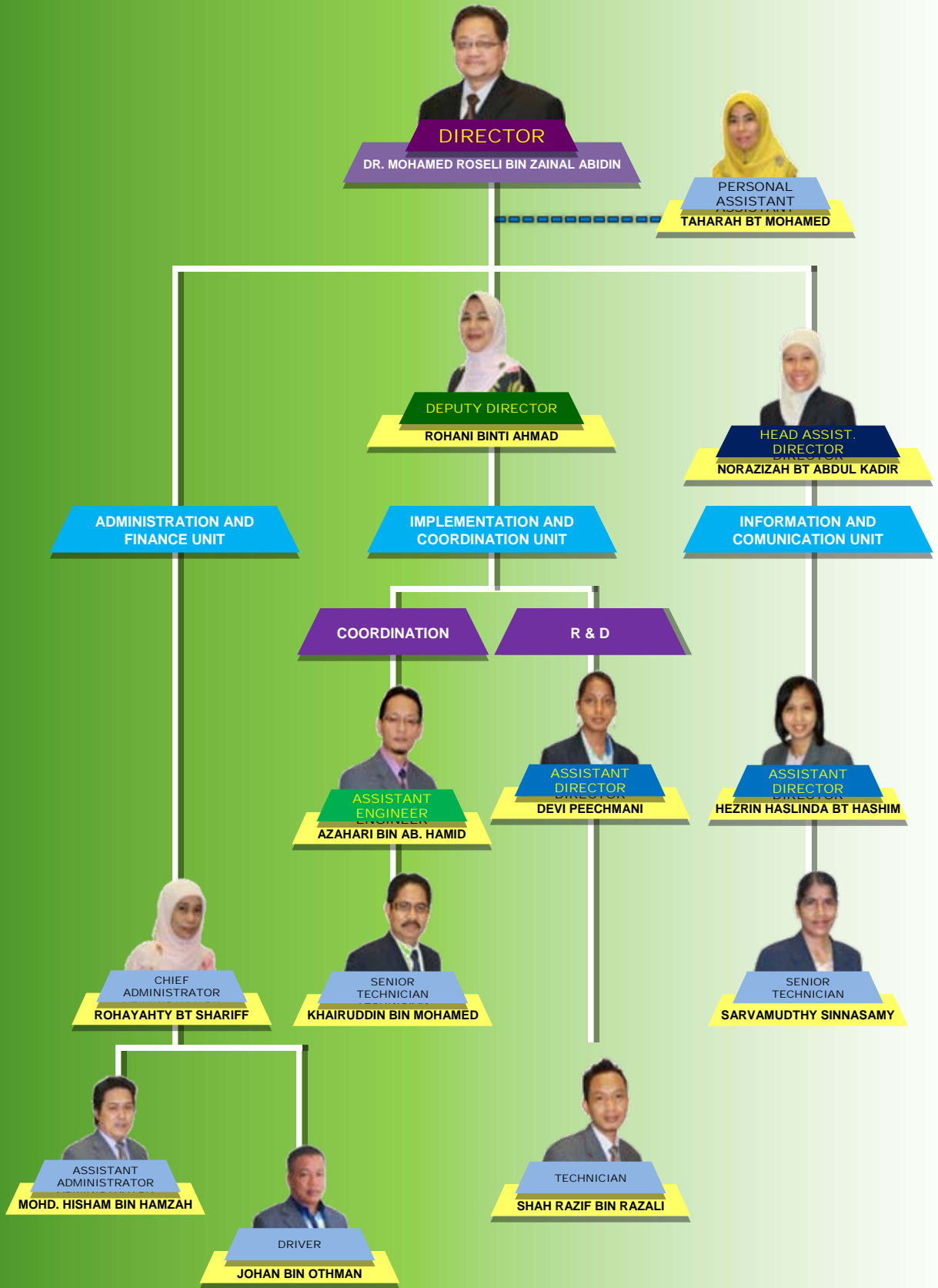
- Newsletter Volume 10
- Husaini A., and Roseli, M. (2009). *"Keynote Address 2: Research and Development from Science, Technology and Innovation Perspective"*, AWAM09 Conference, Corus Hotel, Kuala Lumpur, 27 – 29 Oct, 2009.
- Roseli, M. (2009). *"Introduction to River Management in Malaysia – Clean, Living and Vibrant River"*, The Malaysian Technical Cooperation Programme (MTCP) 3rd International Course on Flood Mitigation and Stormwater Management, NAWMI, Kota Bharu, Kelantan, Malaysia, 5 – 23Oct 2009.
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- UNESCO IHP Technical Publication : Green Roof System (*in progress*)
- UNESCO IHP Technical Publication : Bioretention System (*in progress*)
- The 10 Year Report of HTC Kuala Lumpur. (*in progress*)

8.2 List of training courses conducted (there can be overlap with those listed in 2.3 above)

- Technical Visit to UNESCO Jakarta Office, Jakarta, Indonesia, 16-18 July 2008.
- Participation in Malaysia World Water Day 2008, Negeri Sembilan, Malaysia, 25-27 July 2008.
- Organised Best Thesis Award For Malaysia's Universities and Higher Learning Institution For Malaysia World Water Day 2009, Sarawak, Malaysia, 11-12 April 2009.
- International Training Workshop On Flash Flood Risk Assessment And Mitigation Strategies, Kuala Lumpur, 10-13 August 2009.
- Organised Best Thesis Award For Malaysia's Universities and Higher Learning Institution For Malaysia World Water Day 2010, Muar, Johor, 26 March 2010.
- International Seminar on Flood Forecasting and Warning System For Tropical Region, UNITEN, Malaysia, 24-25 May 2010.

ORGANIZATION CHART



DIRECTOR

DEPUTY DIRECTOR		HEAD OF ASSISTANT DIRECTOR	
IMPLEMENTATION ANF COORDINATION SECTION		ADMINISTRATION UNIT	INFORMATION AND COMMUNICATION SECTION
R & D IMPLEMENTATION UNIT	COORDINATION UNIT		
<ol style="list-style-type: none"> 1. To develop a mechanism on research cooperation between UNESCO Water Centres Category II and water family including to identify 'areas of common interest and synergy' including preparing matric capacity. (preparing the document for evaluation of HTCKL for the continuation of MoA). 2. To execute collaboration research in multi disciplinary with research experts from local and UNESCO Water Centres Category II for UNESCO IHP Programme. 3. To lead research projects under the Malaysian IHP headed by experts from department and academician – collaborate with universities and NAHRIM. 4. To extend technical expert advice for research programme of HTCKL which is executed from development funds. 	<ol style="list-style-type: none"> 1. To develop a matrix which compromise of HTC Kuala Lumpur's strength and other UNESCO Water Centres with expertise sharing. 2. Collaboration of expertise among other UNESCO Water Centres to execute project 'SWITCH Asia: An Integrated and Innovative Programme Towards Sustainable Water Management in Asia' City of Future' organised by UNESCO IHE (deliver the knowledge to DID's business sector) 3. To work together with other UNESCO Water Centres expertise in execution of project "Regional Consultation on Water Education and Training in Asia - Development of a Strategic Framework (Education)". 4. To join together with other UNESCO Water Centres expertise in execution of project "Compilation of Major Flood events in the region (outreach)". 	<ol style="list-style-type: none"> 1. To manage and implement the administration of the office. 2. Staff management. 3. To assist in preparation of annual budget. 4. Management of funds. 5. To assist in meetings coordination between division and other agencies. 	<ol style="list-style-type: none"> 1. To promote the image of HTCKL as the Regional Humid Tropics Hydrology and Water Resources Centre for Southeast Asia and the Pacific. 2. To develop strategic communication through the join website and publications for knowledge transfer and exchange of expertise among UNESCO Water Family and to promote the corporate image of UNESCO's water family. 3. To identify other experts in hydrology and water resources areas for development of wide network global, regional and local cooperation. 4. To develop expert networking among research agencies in the field of hydrology and water resources locally, regionally and globally. 5. To legislate strategies for strengthening the network

DEPUTY DIRECTOR		HEAD OF ASSISTANT DIRECTOR
IMPLEMENTATION ANF COORDINATION SECTION		ADMINISTRATION UNIT
R & D IMPLEMENTATION UNIT	COORDINATION UNIT	INFORMATION AND COMMUNICATION SECTION
<p>5. To identify latest technology in the field of hydrology and water resources.</p> <p>6. To promote output of the research through presentation of papers and publication of journal globally, regional and local-</p> <ol style="list-style-type: none"> a. Outline WSUD b. Operational manual and maintenance of WSUD <p>7. To prepare research papers and identify products those are suitable for commercialization and prepare the action plan.</p> <p>8. Monitoring the strategic plan for water centres under the auspices of UNESCO.</p> <p>9. To implement human capitalization in the field of Water Education as to strengthen development for Southeast Asia and the Pacific including Malaysia.</p> <p>10. To monitor development program in the field of R&D – construction of components of Water Sensitive Urban Drainage (WSUD) in the compound of HTCKL. (development budget</p>	<p>5. To draft an expert program on capacity building with academic expert of institute of higher learning globally, regional and local in the field of hydrology and water resources.</p> <p>6. To evaluate programmes executed as meets the expectation of UNESCO IHP.</p> <p>7. To prepare strategic plan and action for UNESCO Water Centres staff exchange.</p> <p>8. To prepare 10 Year Report of HTCKL which compromising of R&D, networking output, training, workshop and publication of technical papers and journal.</p> <p>9. To prepare documents for evaluation of HTCKL according to TOR by UNESCO.</p> <p>10. To prepare Policy and Guidelines on:-</p> <ol style="list-style-type: none"> a. UNESCO Reference document b. Strategic Framework of HTC <p>11. Preparing suggested</p>	<p>cooperation between UNESCO water family and local experts in the field of hydrology and water resources.</p> <p>6. Analyze and validate AP FRIEND’s Data Archive system from time to time as the sharing of ‘River Catalogue’ information is effective and to meet its needs of customers globally, regional and local (disseminating knowledge to Business Sector JPS).</p> <p>7. To execute AP FRIEND project phase II.</p> <p>8. Develop, revise and improve the database system as the technical information on hydrology and water resources and ensure the accessibility and satisfy the needs of the customer (promotes information on R&D, guidelines and other technical information through the website).</p> <p>9. Study on impact of R&D of water resources – listing and monitoring the KPIs and achievement of DID R&D on 9th MP (to study the effectiveness of the research program which is undertaken and met the satisfaction of the</p>

DEPUTY DIRECTOR		HEAD OF ASSISTANT DIRECTOR
IMPLEMENTATION ANF COORDINATION SECTION		ADMINISTRATION UNIT
R & D IMPLEMENTATION UNIT	COORDINATION UNIT	INFORMATION AND COMMUNICATION SECTION
RM1.4million 2010) 11. To prepare R&D report and also guidelines on design of WSUD.	transformation paperwork of HTCKL. 12. To supervise HTCKL building and monitor training program for HTCKL staff. 13. Coordinate in the organization of workshop, seminar and symposium in national and international category.	customers and stakeholders). 10. DID Strategic Plan – Champion of Focus Area 5 – Centre of Excellence for Hydrology, River Management, Coastal Management and Urban Drainage. 11. To implement and monitoring the Management Quality System of MS ISO 9001:2008. 12. To manage library and technical document database, publications, proceedings and research papers.

**DEPARTMENT OF IRRIGATION AND DRAINAGE THEMES AND FOCUS AREA ON R&D BASED ON
UNESCO-IHP-VII THEMES (2008 – 2013)**

A Global Perspective on Research and Development

‘Developing scientific skills and infrastructure is the first step towards improving a country’s ability to use science and technology to promote sustainable development’ - UNESCO Institute for Statistics Fact Sheet, October 2007

- **Knowledge** Comes From Basic Research
- **Technology** is the Output of Applied R&D

Water Related Issues in Malaysia

Ranking	Water-Related Issues
1	River Water Quality
2	Catchment/Landuse Management
3	Flooding
4	Potable Water Supply
5	Institutional Arrangement
6	Segmented Management
7	River Corridor Management
8	Wetlands Management
9	Water Borne Diseases
10	Biodiversity
11	Drought
12	Environmental Flow

THEMES AND FOCAL AREA

Theme 1: Adapting to the impacts of global changes on river basins and aquifer systems

- Flood mapping due to hydrological hazards (river flood from large watershed, dam failure (water release from dam), high sea water level, rainfall on site, wind wave on sea, wind wave on river and channel, swelling, seiche, ground water rising (the drainage system).
- Urban hydrology (due to urbanization)
- Estimating streamflow at ungauge site

Theme 2: Strengthening water governance for sustainability

- Delivery system through IHP programme
- Application of ICT in water resources management
- Water Resources - land use and water allocation policies
- Water Resources - legal and institutional arrangement
- Water Resources - local watershed, basin scale and beyond
- Water Resources - Integrated Water Resources Management

Theme 3: Ecohydrology for sustainability

- IRBM (legislation, planning, preventive, curative, river basin authority, enforcement, finance, public participation) – river rehabilitation and conservation using ecohydrology technique.
- Limnology and wetland ecosystem
- Improving river biodiversity/ecosystem

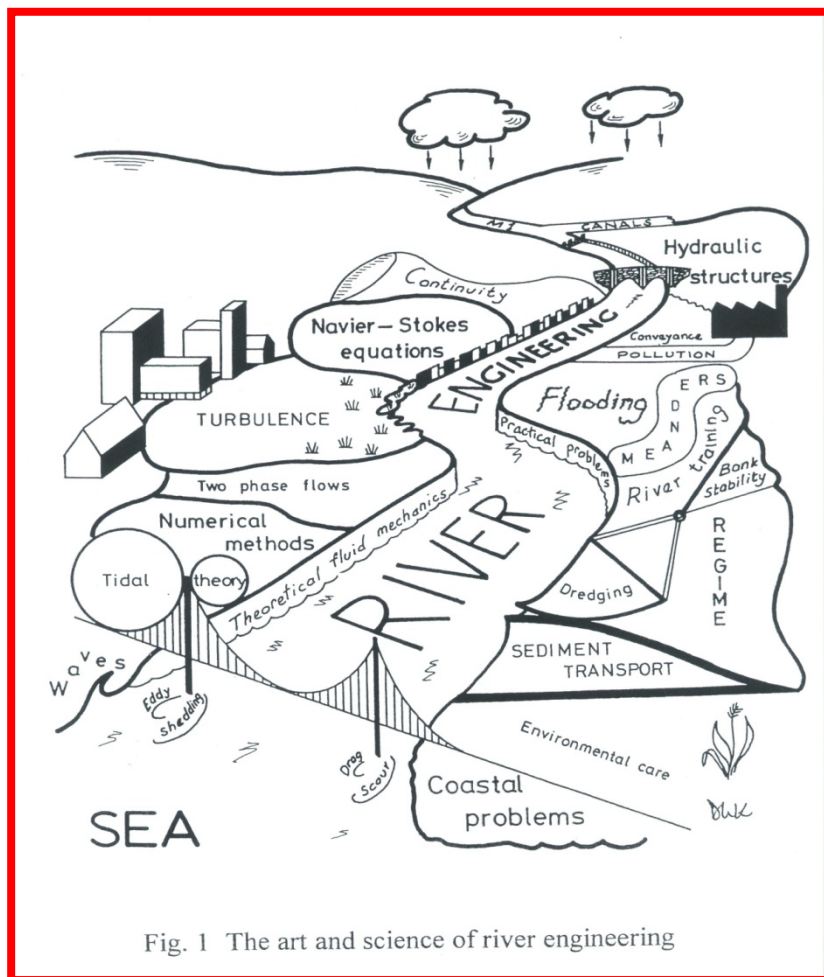
Theme 4: Water and life support system

- Bringing nature back to rivers
- Enhancing the Management of Water Resources Towards Sustainable Environment: Managing Environment Flow
- Sustainable urban storm water management (e.g. MSMA-USWM-Ecohydrology, rainwater harvesting, greywater treatment system, greenroof system, porous system, bioretention system, wetland system)
- Water Resources - water availability and use
- Water Quality - water quality impacts on human socio-economics activities
- Water Quality - environmental stress
- Water Quality - impact on river aquatic ecosystem
- Water Quality - possible remedial actions
- Rainfall-Runoff flood estimation
- Flood modeling techniques guideline (hydrology and hydraulics)
- Integrated Flood Management-Making space for water
- Coastal engineering – breakwater
- Flood forecasting and alert system

Theme 5: Water education for sustainable development

- Capacity building (training workshop)
- Manage and restore water conflicts

EXAMPLES OF R&D IN THE FIELD OF WATER RESOURCES



R&D Proposals

- Not only to concentrate on the requirement of additional water resources but also to improve the efficiency and saving on the usage of water resources (such as water demand management)
- Can be categorized as follows:
 - R&D in the field of water resources hydrology and hydraulics
 - R&D related to river basin management (upstream, middle reach, estuary)
 - R&D based on certain disciplines
 - R&D through development of intellectual property innovation products

R&D in the Field Of Water Resources Hydraulics

- Hydraulics In Industry
- Hydraulics and Hydrology in Agriculture
- Eco-hydraulics in Environment
- Urban Hydraulics and Hydrology
- Maritime Hydraulic

Examples: Eco-hydraulics in Environment

- Best Management Practices (BMP) for the problem areas
- Treatment technologies for products or processes
- River basin approach : effluent and water quality impacts on ecosystems
- Formulating standards and indices and review of current requirements
- Water quality enhancement in natural water bodies, methods to design and develop mitigating measures such as silt control, sediment inflow and minimum base flow determination
- Model development, in linking hydraulic and ecological processes

Examples: Urban Hydraulics and Hydrology

- Reliable methods of urban runoff estimation
- Effective erosion control in construction sites
- Design methodology for storm water detention facilities especially in control structures
- Characterization of sediment in storm water runoff
- Design of Gross Pollutant Trap

River - Upstream (*nature zone and nature use zone*)

- Water Resources Study –reservoir and dam
 - Balancing inflow, storage, water level in the dam, outflow and water level downstream of the dam for optimization of water supply requirement and lessen the effect of flood. Programme: eg. Optimization the operation of reservoir/dam
- Studies on river management – effect of deforestation, erosion and sedimentation.
 - Involve in the catchment area (source of water meet with river tributary and form into river); effect on water resources, increase in peak discharge, river morphology; effect to ‘young river’ (waterfall, rapid, underground river)
- Effect of landuse change to river regime.
 - Forest to agriculture; open up of highland for agriculture, urbanization, commercial, industries, housing; reservoir.

River - Middle reach (*nature use zone and development zone*)

- Control of river banks erosion and sedimentation of river bed.
- Flood and pollution control.
 - Modelling of flood risk and water quality.
- Environmental flow requirement – river water quality guaranteed – conservation of ecosystem / biodiversity .
- Development of river hydrodynamic information system.
- Effect of unregulated development on river regime– suggestion in solving the problem
 - Effect of land development.
- The need for river system to function as conveyance and storage - control at source strategy.
 - Understanding the function of river in its natural state to solve flooding problems
- Flood simulation and mapping.
- Urban area water resources management.
- Urban stormwater management.
- The use of wetland as retention pond dan facilities to reduce water quantity for flood attenuation.
- Rainwater harvesting techniques – reducing the dependant on freshwater supply.

River estuary (*development zone*)

- Modelling of water quality phenomena – point source and non point source
- Instrumentation for laboratories and testing facilities.
- Automation and software development.
- Sedimentation at river mouth – the need for breakwater and dredging.
- Replanting of mangrove.
- remote sensing – monitoring of shoreline movement.
- Overtopping of coastal bund - best fit configuration.
- Sediment transport – the changing morphology because of sea waves, siting and establishment of fish port/ landing facilities.
- Dynamic breakwater structure and artificial coral reef for fish gathering.
- Hyperspectral mapping –bathymetry and coastal processes and the need for protection works.
- Marine pollution.

(This is discussed under R&D IHP Committee, collaboration and networking between Department of Irrigation and Drainage and various universities, chaired by the Director of HTC)

LISTS OF R&D PROJECTS/PROGRAMMES INTENDED TO BE CARRIED OUT BY HTC AND OTHER DIVISIONS IN THE DEPARTMENT OF IRRIGATION AND DRAINAGE MALAYSIA FOR THE 10TH MALAYSIA PLAN (2011 – 2015)

No.	Title of R&D Projects/Programmes
1. Theme: Water and Life Support System – (1.1) Protecting water quality for sustainable livelihood	
1	Effectiveness of various products (e.g. Bio-Media, Bio-Curtain, FOG and GPT) for storm water quality improvement.
2	Application of various components of Erosion and Sediment Control (ESC) measures for sediment reduction and monitoring
3	Optimisation of integrated urban water management facilities.
4	Adaptation of USLE parameters to Malaysian environment
5	Life cycle analysis of installed stormwater infrastructure.
6	Total Maximum Daily Load (TMDL) establishment in Malaysia
7	Development of prototype mechanical rubbish trap for rivers and coastal areas.
1. Theme: Water and Life Support System – (1.2) Achieving sustainable urban water management	
8	Application of Water Sensitive Urban Design (WSUD) for Integrated Stormwater Management at Local Scale Phase II - Rainwater Harvesting System
9	Upscaling of water sensitive urban design at catchment level
10	Development of Light Foam Concrete Drain including pilot project
No.	Title of R&D Projects/Programmes
2. Theme: Adapting to the impacts of global changes on river basins and aquifer systems – (2.1) Hydro-hazards, hydrological extremes and water related disasters	
11	Development of Interlocking Modular Erosion Control (MESCO) and river slope protection structure at Sungai Chuau, Putrajaya
12	Hydrologic regionalization of watersheds in Malaysia
13	Suitability of concrete block unit for breakwater construction in muddy coast
14	Technique for construction on soft coastal mud
15	Improvement of SAUH concrete unit for coastal protection works in muddy coastline
16	Enhanced flood Forecasting And Alert System For Tropical Region
17	Scouring behaviour in concrete lined channel to determine depth of erosion due to frequent flood.
18	Failure characteristics of L-Unit channel in Klang valey
19	Effect of ground water on river bank stability
20	Settlement behaviour on marine clay due to construction of creek closure in Sungai Belukang.
21	Establishing discharge rainfall curve for dam catchment area
22	Assessment of slope stability after excavation
23	Assessment of open excavation on weathered rocks.
2. Theme: Adapting to the impacts of global changes on river basins and aquifer systems – (2.2) Climate change impacts on the hydrological cycle and consequent impact on water resources	
24	Urban hydrology study for Sungai Kerayong catchment and Sungai Damansara catchment and related rivers.
25	Reliability of urban drainage infrastructures under the influence of extreme precipitation events

No.	Title of R&D Projects/Programmes
3. Theme: Ecohydrology for sustainability – Ecohydrology measure to protect and remediate catchment processes	
26	Limnology and eutrophication of Lake Chini, Pekan Pahang.
27	Integrated ecohydrological studies and modeling of a river basin using SWAT model (water quality modelling for polluted rivers, erosion, suspended sediment)

No.	Title of R&D Projects/Programmes
4. Theme: Strengthening water governance for sustainability – Improvement of delivery system	
28	Development of Fuel Cell Power For Reliable And Sustainable Power Supply System
29	Impact study on improvement of delivery system
30	Application of ICT for integration of pumps and tidal gates operation system.

Noted: HTC is the coordinator for the Department of Irrigation and Drainage R&D

Format for Reports by UNESCO's Water-related Centres on activities related to the IHP in the period June 2008 – May 2010

1. Basic information on the centre

Name of the Centre		International Centre for Water Hazard and Risk Management (ICHARM)
Name of Director		Prof. Kuniyoshi Takeuchi
Name and title of contact person (for cooperation)		Dr. Shigenobu Tanaka, Deputy Director
E-mail		s_tanaka@pwri.go.jp
Address		1-6 Minamihara, Tsukuba, Ibaraki, 305-8516 Japan
Website		http://www.icharm.pwri.go.jp/
Location of centre		city/town __Tsukuba__ country __Japan__
Geographic orientation *		<input checked="" type="checkbox"/> global <input type="checkbox"/> regional
Year of establishment		2006
Themes	Focal Areas ♦	<input type="checkbox"/> groundwater <input type="checkbox"/> urban water <input type="checkbox"/> arid / semi-arid zones <input type="checkbox"/> humid tropics <input checked="" type="checkbox"/> droughts and floods <input type="checkbox"/> sediment transport and management <input type="checkbox"/> water and environment <input type="checkbox"/> ecohydrology <input type="checkbox"/> water law and policy <input type="checkbox"/> transboundary river basins/ aquifers <input type="checkbox"/> IWRM <input checked="" type="checkbox"/> global and climate change <input checked="" type="checkbox"/> mathematical modelling <input type="checkbox"/> social and cultural dimensions of water <input checked="" type="checkbox"/> water education <input type="checkbox"/> other: (please specify) _____
	Scope of Activities ♦	<input type="checkbox"/> vocational training <input checked="" type="checkbox"/> postgraduate education <input type="checkbox"/> continuing education <input checked="" type="checkbox"/> research <input checked="" type="checkbox"/> institutional capacity-building <input checked="" type="checkbox"/> advising/ consulting <input checked="" type="checkbox"/> software development <input type="checkbox"/> other: (please specify) _____
Support bodies ¹		Public Works Research Institute (PWRI) Ministry of Land, Infrastructure, Transport and Tourism (MLIT)
Hosting organization ²		PWRI
Sources of financial support ³		PWRI, JICA, ADB, MEXT (Ministry of Education, Culture, Sports, Science and Technology)
Existing networks and cooperation ⁴		Asia-Pacific Knowledge Hub (APKH),
Governance		<input checked="" type="checkbox"/> director and governing board (ICHARM Advisory Board) <input type="checkbox"/> other: (please specify) _____ Link to election of board members to the IHP

* check on appropriate box

♦ check all that apply

¹ please specify bodies that cover the operational costs of the centre, and other essential costs such as salaries and utility bills, and that provide institutional support to ensure centre's sustainability

² if different from support bodies

³ please specify sources of main budgetary and extrabudgetary funds to implement projects

⁴ please write international networks, consortiums or projects that the centre is part of, or any other close links that the centre has with international organizations or programmes, which are not already mentioned above

	Intergovernmental Council (IGC) and hosting country IHP National Committee Frequency of meetings: once every 2 year(s) <input checked="" type="checkbox"/> Existence of UNESCO presence at meetings
Institutional affiliation of director	
Number of staff and types of staff	total number of staff (full-time, or equivalent) : 33 (as of June 2010) number of staff who are water experts: 24 (as of June 2010) number of visiting scientists and postgraduate students: 12 (No. of Master Course students as of June 2010)
Annual turnover budget in USD	App. 2.7 Mil. USD (249 Mil. JPY for FY 2010)

2. Activities undertaken in the framework of IHP in the period June 2008 – May 2010

- 2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII (Appendix-1) and WWAP

Please include here those activities which led to accreditation of degrees, or those held in formal school settings.

"Water-related Disaster Management Course of Disaster Management Policy Program"

ICHARM has been conducting one-year Master's course from September 2007 in collaboration with the Japan International Cooperation Agency (JICA) and the National Graduate Institute for Policy Studies (GRIPS). The third batch of the course is now being conducted. The overall goal of this course is to develop the trainee's capacity to practically manage problems and issues concerning water-related disasters in local levels and to contribute towards socio-economic and environmental improvements at regional and national levels in developing countries.

The first course was organized from 30th September 2007 to 19th September 2008. Ten students, consisting of three each from China and Japan, two from Bangladesh, one each from Nepal and India, finally fulfilled the graduating requirements and were awarded the degree of "Master of Disaster Management". The second course was from 30th September 2008 to 19th September 2009. Out of nine who initially started the course, seven students (two each from China and Bangladesh, one each from Nepal, Indonesia and Ethiopia) finally met the graduating requirements and obtained the degree.

The third year began on 28th September 2009 and now twelve students (three from Indonesia, two from Bangladesh, one each from China, Ethiopia, Myanmar, Japan, the Philippines, Sri Lanka, and Thailand) are endeavoring to prepare their master thesis.

- 2.2 Research activities that directly contributed to the IHP-VII and activities by WWAP

Contributions to the World Water Development Report 3 (WWDR3) ICHARM, in collaboration with UN/ISDR and WMO, greatly contributed in WWDR3 planning and compilation process especially on water-related disaster management issues, including active participation in preparatory meetings. As for the main volume of WWDR3, ICHARM's contribution was for Chapter 12 of Part 3 titled "Evolving Hazards- and emerging opportunities". ICHARM also took full responsibility of compiling one of side publications of WWDR3, which was titled "Global Trends in Water-Related Disasters: an insight for policymakers".

Research on sustainable measures for tsunami damage mitigation in developing countries

In this research, in order to develop sustainable measures for tsunami damage mitigation in developing countries, three main activities were carried out within the

frame of this research, i.e. (1) investigation on the possible measures of comprehensive tsunami disaster prevention based on the potential tsunami hazard and the existing land use in the target area; (2) assessment and development of education materials on comprehensive tsunami disaster prevention and study on the potential implementation of coastal vegetation as a tsunami barrier; and (3) development of guideline for planning and design of tsunami mitigative coastal vegetation belt.

According to this research, the possible measures of comprehensive tsunami disaster prevention in target countries were proposed based on the characteristics of social conditions and topography. A textbook for comprehensive tsunami disaster prevention education and two guidelines for planning and design of tsunami mitigative coastal vegetation belt and for tsunami hazard mapping were developed.

Research on flood hazard mapping in developing countries

In this research, we examined more efficient, effective methods for the production and use of flood hazard maps (FHMs) to promote their use in developing countries. To this end, we investigated various aspects related to FHMs, including their current production and use, local needs, and local mapping capability, by collecting information through overseas field investigations and participants of flood hazard mapping training and seminars. By the investigation, we identified problems in the promotion of the use, rather than production, of FHMs. Many of the developing countries investigated for this research showed a reasonable level of progress in the production of FHMs, but were not able to distribute them to the public yet. In the meantime, we found some cases in which community-based flood hazard mapping improved public awareness toward disaster preparedness. Those cases indicated that to reduce flood disaster damage, FHMs did not necessarily have to be based on elaborated simulation data. We finally developed a guideline for the production and use of FHMs based on such research results.

Study on Utilization of Satellite-based Topographical Data for Flood Risk Assessment

Developing countries often lack accurate topographic data necessary for water-related disaster risk assessment, and it is hoped that satellite-based topographic data will help those countries overcome this disadvantage. In this study, we will first test SRTM3 of NASA and ALOS of JAXA for reproducibility and then develop a topographic data processing method for each type of the data products to be used for inundation simulation. We will also develop a method for water-related disaster risk assessment which can use satellite topographic data.

- 2.3 *Please include research/applied projects outputs such as publications that directly contributed to the IHP-VII and WWAP objectives*

Please refer to publications listed under section 8.1.

- 2.4 Training activities that directly contributed to the IHP-VII and WWAP objectives

"UN/ISDR Comprehensive Tsunami Disaster Prevention" Training Course

ICHARM conducted the training course for section chief-level personnel who are responsible for promoting tsunami disaster mitigation from 2nd June to 11th July, 2008 in collaboration with UN/ISDR.

The overall objective is to develop human resources who work for comprehensive tsunami disaster mitigation including structural measures, tsunami early warning systems, local disaster management plans in developing countries. After returning their home countries, they are also expected to share the information and know-how acquired through the course among fellow personnel in tsunami disaster mitigation.

"The 5th Flood Hazard Mapping in East/Southeast-Asian Region" Training Course

ICHARM conducted the training course from October 28th through November 28th in 2008 in collaboration with JICA. The course duration was five weeks mainly comprising lectures, practical studies, site observation and discussions.

The target trainees were engineers and administrative officials who work for the organizations that are responsible for flood control and river management in Southeast Asian countries. Total 10 trainees, those from China, Malaysia, Philippines, Cambodia, Laos, Thailand, and Vietnam, participated.

“Local Emergency Operation Plan with Flood Hazard Map” Training Course

ICHARM conducted the training course from 9th to 27th November 2009 in collaboration with JICA.

This training program is planned for organizations meeting the following qualifications. They are in countries with frequent flood disasters.

The program is designed to enhance the institutional capacity of the participating organizations by recruiting trainees from the same organizations every year for three years. After the three-year training program ends, progress in each country will be followed up, and the original plans may be adjusted as necessary.

A total of ten trainees participated in 2009 – one each from Bangladesh, Bhutan, Laos, Myanmar, Pakistan, Sri Lanka, Thailand and Tajikistan and two from Indonesia. (The Asia Development Bank funded two of them to participate.).

Follow-up Seminar on Flood Hazard Mapping Training Course

ICHARM has conducted the follow-up seminars three times in series from 2007 to 2009.

In these seminars, ex-trainees of the “Flood Hazard Mapping” training course reported on the current situations of flood hazard map development in their countries and their activities after completing the training course, and discussed how to make and disseminate FHMs effectively in their countries.

3. Collaboration and linkages

- 3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies

International Flood Initiative (IFI) Secretariat at ICHARM:

ICHARM is providing secretariat services to IFI. The following are major activities of the IFI Secretariat in the period June 2008-May 2010.

- Hosting the IFI Website after its launch in June 2008 (www.ifi-home.info)
- Organizing the 3rd IFI AC/MC meeting in Tsukuba-Japan, October 2008
- Mapping IFI-related activities of the partners as January 2008
- Issuance of IFI Newsletters
- Organizing workshop on “Charting Global Agenda for Meeting Today’s Flood Management Challenges” on occasion of WWF5 (21 March 2009)
- Organizing workshop to follow-up actions recommended in the “Water and Disaster” Action Plan as special event during the 2nd Global Platform for Disaster Risk Reduction in Geneva (19 June 2009)
- Organizing IFI e-meetings (4 and 26 Jan. 2010, and 2 March 2010)
- Coordination with the IFI partners in preparatory process of the 5th International Conference on Flood Management (ICFM5)
- Involvement in the IFI Book series coordinated by UNESCO-IHP
- Preparation of the 5th IFI AC/MC meeting in Paris (7 July 2010)

Contributions to the Fifth World Water Forum (WWF5)

At the early stage of WWF5 preparation, ICHARM, together with the Japan Water Forum (JWF), was appointed to coordinate the topic 1.3 titled “Managing Disasters” of the Forum. After the appointment ICHARM actively made numerous coordination activities during the preparation and on occasion of WWF5, which included planning of relevant sessions, identifying and discussing with key contributors, and delivering unified messages from the topic.

Apart from above, ICHARM members have actively participated global and regional scale-frameworks. Some of which are introduced as annex 1.

- 3.2 Participation in meetings related to the IHP and UNESCO (e.g., the UNESCO General Conference, the UNESCO Executive Board, the IHP Intergovernmental Council and/or other meetings organized by IHP)

Participation in the WS on “Flood Management in the West-Africa”

This IHP Africa-related WS was organized in Niamey, Niger from 6 to 10 June 2009 for drafting a comprehensive flood management project proposal for the region.

Participation in the IWRM Guidelines at River Basin Level Steering Committee meetings

ICHARM actively contributed in UNESCO-led IWRM Guidelines at River Basin Level production processes including Steering Committee meetings.

In addition to above, ICHARM members participated numerous UNESCO-related international and regional agendas, which are included in the list under Annex 1.

- 3.3 Collaboration and networking with other UNESCO category 1 or 2 institutes/ centres

3.3.1 cross-appointment of directors of the category 1 or 2 institutes or centres on the governing board

3.3.2 exchange of information on activities such as training/educational materials, and funding opportunities

3.3.3 exchange of staff, most notably professionals and students

Visiting lectures to and from UNESCO-IHE

ICHARM is strengthening mutual collaboration with the IHE. The two parties have been exchanging expertise in the form of guest lecturers for their courses since the year 2006. ICHARM has been taking part in one of the IHE's short course entitled "Climate Change in Integrated Water Management". Dr. Rabindra Osti, ICHARM senior researcher has been dispatched every year as visiting guest lecturer to the IHE. In exchange for this from IHE, Dr. Frank van der Muelen has been visiting ICHARM annually to deliver lectures related-to Flood Hazard Mapping.

Agreements exchanged between UNESCO centres/institutes during reporting period

ICHARM has been actively extending mutual collaboration with UNESCO centers and other internationally renowned organizations. So far 20 agreements have been exchanged for this purpose. During reporting period, four agreements have newly been signed between other UNESCO Centers, as follows.

- On 9 June 2008, MOU with Regional Centre on Urban Water Management (RCUWM-TEHRAN, Iran) on “Comprehensive cooperation”
- On 9 June 2008, MOU with UNESCO-IHE Institute for Water Education (UNESCO-IHE) on “Collaboration in research and capacity building in the fields of water hazard and risk management in the context of climate change”
- On 18 September 2009, MOU with International Research and Training Center on Erosion and Sedimentation (IRTCES, China)
- On 25 May 2010, Preliminary MOU with HydroEX, Brazil

3.3.4 implementation of joint activities, such as workshops, conferences, training programmes, joint projects, field visits, software and data sharing, knowledge exchange and publications

Joint training workshop on flash flood risk assessment and mitigation strategies

ICHARM co-organized this WS with two other category 2 centers (HTC-Malaysia and RCUWM-Iran) in Kuala Lumpur from 10 to 13 August 2009

Flood hazard assessment in Johor, Malaysia

ICHARM, HTC-Malaysia and Malaysian Department of Irrigation and Drainage (DID) agreed, taking opportunity of co-organization of FHM follow-up seminar in Malaysia, to collaborate on a project on flood hazard assessment in Johor Malaysia. This planned study is still under development because of administrative process within DID and HTC.

- 3.4 Relationships with the UNESCO field and regional office whose jurisdiction covers the country of location : Included in the list under Annex 1.
 - 3.5 Relationship with the UNESCO National Commission and the IHP National Committee in the country of location and with other organizations of other countries : Included in the list under Annex 1.
 - 3.6 Relationship with other UNESCO-related networks, such as UNESCO Clubs, ASPnet, and UNESCO chairs
- 4. Communication**
- 4.1 Communication and knowledge dissemination activities undertaken in the framework of IHP
 - 4.2 Policy documents and advice
See list of publications under 8.1.
- 5. Update on Centre Operations**
- 5.1 Membership of the Board of Governors between designated period

The following is a list of ICHARM Advisory Board (IAB) Members as of second IAB held on 1 Oct. 2008. There are some necessary updates for the third IAB to be held in Sep. 2010, as shown in the parentheses.

(UNESCO)	Dr. Andras Szollosi-Nagy; Deputy Assistant Director General, Secretary of the International Hydrological Programme, UNESCO (this position is expected to be designated by 3 rd IAB)
(UN/ISDR)	Mr. Salvano Briceno; Director, UN/ISDR
(WMO)	Mr. Avinash C. Tyagi; Director, Climate and Water Department
(UNESCO-IHE)	Mr. Richard A. Meganck; Director, UNESCO-IHE Institute for Water Education (currently Dr. Andras Szollosi-Nagy)
(UNU)	Mr. Konrad Ostervalder; Rector of UN University
(MLIT, Japan)	Mr. Hiroaki Taniguchi; Vice-Minister for Engineering Affairs, Ministry of Land, Infrastructure, Transport and Tourism (MLIT) (Currently Mr. Kanetomo Komura)
(JICA)	Mr. Keizo Ohshima; Senior Vice- President, Japan International Cooperation Agency (JICA)

Regional Delegates

(Group1)	Mr. Eugene Stakhiv; Executive Director, Institute for Water Resources (IWR), U.S. Army Corps of Engineers
(Group2)	Mr. Maciej Zalewski; Director of the European Regional Centre for Ecohydrology u/a UNESCO (to be re-designated)
(Group3)	Prof. Carlos Tucci; Professor, UFRGS (Federal University of Rio Grande do Sul) (to be re-designated)
(Group4)	Mr. Keizrul bin Abdullah; Former Director General of the Department of Irrigation and Drainage
(Group 5a)	Mr. Francis Musyoka Mutua ; Associate Professor, University of Nairobi (to be re-designated)

(Group 5b) Mr. Mohamed-Bahaa Eldins Ahmaed Mohamed Saad; Emeritus Professor, Hydraulics Research Institute, National Water Research Center

5.2 Key decisions made (attach minutes of meetings)
Minutes of Meeting of second IAB is attached as Annex 2.

6. Evidence of the Centre's Impacts

6.1 Science Impacts (Major contributions to the science, technology, education, and regional and/or international cooperation in the field of water)

1) Development of flood-runoff analysis system "Integrated Flood Analysis System (IFAS)"

IFAS is a toolkit for more effective and efficient implementation of flood forecasting and analytical system in developing countries. IFAS is useful to calculate river discharge with not only ground-based but also satellite-based rainfall data even in poorly-gauged river basins. (Sugiura et al, 2009)

2) Development of a self-correction method for satellite-based rainfall data with precipitation-field movement information

Precipitation can be evaluated only by using satellite-based rainfall data themselves except any other additional data. This correction method can improve the underestimation of satellite-based rainfall (JAXA-GSMaP) and make the corrected data applicable to flood runoff forecasting and analysis even in poorly-gauged river basins. (Ozawa et al, 2009)

3) Development of a hydrodynamic flood-inundation simulation model using a finite element method (FEM) with 2D shallow-water equations.

This can incorporate local features in large areas effectively and evaluate the impact of climate change on flood inundation using GCM output. (Hai et al, 2009)

4) Development of a simple statistical method to correct bias of GCM precipitation outputs as the basis for climate change impact assessment.

This method is based upon historical databases of ground-based rainfall data. Since this method does not require any high-performance computational resources, down-scaling & bias correction can be conducted very efficiently and rapidly. In Asia, a mesh-based rainfall database, APHRODITE, can be used as the historical rainfall data. (Inomata et al, 2009)

5) Development of scale-free global stream-flow network creation method as the basis of basin-wide hydrologic analyses for any integrated river basins.

The most important advantage of this method is to conserve fundamental hydraulic information based on the finest-resolution stream-flow channel network, on any spatial scale. (Magome et al, 2009)

6) Development of basin-wide material (nitrogen and phosphorus) transport components in the process-based distributed-parameter hydrologic model

WEP (Water and Energy Processes) model, was further improved. The main focus was to introduce the model simulation procedures in regard to particulate nitrogen/phosphorus and to further improve dissolved phosphorus dynamics components. (Rajapakse Hemantha et al, 2009)

7) Development of a precise & practical flood flow measurement system

ADCP (Acoustic Doppler Current Profiler) on unmanned mooring boat has been developed which can be widely applicable to severe hydraulic conditions with high flow and suspended objects/sediments of steep rivers in Asian Monsoon region. In addition another automatic and continuous river-flow measurement system through observing actual water surface velocities with non-contact current meters (radio current meters) has been elaborated. This system should be calibrated with ADCP for each zonal cross-

sections. Missing data of radio current meter can be interpolated based on observational data of water surface slope. (Yorozuya et al, 2010)

6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)

Knowledge transfer/dissemination in partnership with ADB

On 17 June 2008, ICHARM was officially acknowledged by the Asia-Pacific Water Forum (APWF) as one of the regional Knowledge Hubs (KHs) with particular focus on "Disaster Risk Reduction and Flood Management." Knowledge Hubs, developed under the framework of Asia Pacific Water Forum (APWF). Since its recognition as KH, ICHARM becomes an implementing partner of ADB for regional technical assistance (RETA) for Supporting Investments in Water-Related Disaster Management in selected countries in Asia. In this connection the partnership agreement was signed on 13 November 2009 between ICHARM and ADB.

In this RETA framework support will be provided to Bangladesh, India, Indonesia, and to the Mekong River Commission Secretariat. National executing and implementing agencies will be assisted with a package of advisory services and technical support based on advanced scientific know-how.

In Bangladesh, the TA will support Bangladesh to implement the recommendations of an earlier TA for Early-Warning Systems Study by ADB, which identified 22 high-priority improvements in the flood forecasting strategy of Bangladesh. In India, the TA will provide knowledge on international good practices in comprehensive risk mitigation, integrated planning for long-term flood management in river basins and best practices for nonstructural flood risk management. Similarly, in Indonesia, the TA will support improvements in (a) flood forecasting system in the Bengawan Solo river basin, shared by the Central and East Java provinces, (b) community-managed flood risk management interventions in the selected community in Solo river basin, (c) capacity building on local disaster management. In lower Mekong basin countries namely Cambodia, Laos and Vietnam, the TA will support the development of flood vulnerability indices, which have been identified as suitable instrument for preparing further ADB investment projects in the region.

In addition to project support activities, RETA also includes the program quality support components. Under the provision of program quality support, the TA will provide support to improve knowledge networking and regional cooperation among interested parties and development partners in the Asia and Pacific region. The planned activities under this scheme are (i) Regional workshops on different aspects of Disaster Risk Management, (ii) Exchange visits, (iii) developing DM capacity of countries and region through trainings etc.

Through the implementation of relevant activities in these countries, it is expected that knowledge is ICHARM is keen to implement relevant

Contribution to "Asian Water Development Outlook (AWDO)"

The Asian Development Bank (ADB) has commissioned the second edition of its AWDO in the run up to the Asia-Pacific Water Summit in 2010. A team of experts from regional water knowledge hubs and lead organizations of the Asia-Pacific Water Forum (APWF) are designated to prepare AWDO 2010. AWDO 2010 will focus on how countries in the region are coping with a wide range of water security issues that pose critical challenges to boost inclusive economic growth, reduce poverty, and bring about environmental change in the Asia-Pacific region.

From the beginning of 2009, ICHARM has been invited to take part in drafting of second Asian Water Development Outlook (AWDO2010), especially to take responsibility of "Key Dimension 5 (KD 5): building resilient communities" that addresses how we can adapt to changes, focusing on disaster risk management, disaster preparedness and adaptation, among other four key dimensions. The AWDO are now in compilation process and expected to be made public in a few months' time.

6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)

- Compilation of messages from topic 1.3 “Managing Disasters” as topic coordinator, Fifth World Water Forum, March 2009, Istanbul
- Contribution to compilation of the action plan, High Level Expert Panel on Water and Disasters/UNSGAB, March 2010, Istanbul
- Contribution to compilation of Asian Water Development Outlook (AWDO)

In addition to above, ICHARM members contributed in various occasions to compile/deliver policy-related messages/advises listed under Annex 1.

7. Future activities that will contribute directly to IHP and/or to WWAP

7.1 Operational Plan (2010-2011) (attach operational plan for 2008-09 if available)

Current ICHARM Action Plan is attached as Annex 3. The next ICHARM Action Plan for 2011-2012 is currently in preparation, which is expected to be authorized at next ICHARM Advisory Board to be held in Sep. 2010.

7.2 Strategic Plan linked with IHP-VII (attach strategic plan for 2010-13 if available)

Same as the Action Plan (Annex 3)

8. Annexes

8.1 List of publications released by the centre (there can be overlap with those listed in 2.3 above) : Long list of publications as Annex 4

1) List of Publications

(Note: all publications below are downloadable at ICHARM website)

- ‘Integrated community based flood risk mapping in West Rapti river basin, Banke, Nepal - a feasibility study’, Local Study Series, ICHARM, PWRI, Japan. ISSN 0386-5878 (technical Note of PWRI No.4122)
- “Global Trends in Water-related Disasters: an insight for policymakers”, WWAP Side publication series (ISBN 978-92-3-104109-9)
- Report on 2007-2008 “Water-related Risk Management Course of Disaster Management Policy Program”; January 2009, ICHARM, PWRI, Japan. ISSN 0386-5878 (technical Note of PWRI No.4127)
- Report on 2008-2009 “Water-related Risk Management Course of Disaster Management Policy Program”; February 2010, ICHARM, PWRI, Japan. ISSN 0386-5878 (technical Note of PWRI No.4166)
- Progress Report on Flood Hazard Mapping in Asian Countries, Feb. 2010 ICHARM, PWRI, Japan. ISSN 0386-5878 (technical Note of PWRI No.4164)
- Report on "UN/ISDR Comprehensive Tsunami Disaster Prevention Training Course, Nov. 2008 ICHARM, PWRI, Japan. ISSN 0386-5878 (technical Note of PWRI No.4114)
- A Tale of Ise-Enza, Feb. 2010, ICHARM, PWRI, Japan. ISSN 0386-5878 (technical Note of PWRI No.4165)
- Report on 2004 - 2008 JICA Training Course "Flood Hazard Mapping" Feb. 2010 ICHARM, PWRI, Japan. ISSN 0386-5878 (technical Note of PWRI No.4164)
- Integrated Flood Analysis System (IFAS Version 1.2) User’s manual; ICHARM, PWRI, Japan. ISSN 0386-5878 (technical Note of PWRI No.4148)
- “Planning and Design of Tsunami-mitigative Coastal Vegetation Belt”, Technical Note of PWRI, ICHARM Publication, ISSN 0386-5878.(publication in process)
- “Tsunami Hazard Mapping in Developing Countries: an Effective Way Raising Awareness for Tsunami Disaster Risk Reduction”, Technical Note of PWRI, ICHARM Publication, ISSN 0386-5878. (publication in process)

2) List of peer-reviewed papers

(Note: published English papers during reporting period)

- Bastora, Satish, Hiroshi Ishidaira, Kuniyoshi Takeuchi (2009.11), Regionalization of joint distribution of model parameters: prediction on ungaged basins, *J. Hydroscience and Hydraulic Engineering*, 27(2) 1-15
- Kundzewicz, Z.W., Nohara, D., Tong, J., Oki, T., Buda, S., Takeuchi, K. (2009.10), Discharge of large Asian rivers - Observations and projections, *Quaternary International*, 208, 1-2, 4-10
- Yoshimura, C., Zhou, M., Kiem, A.S., Fukami, K., Prasantha, H.H.A., Ishidaira, H., Takeuchi, K. (2009), 2020s scenario analysis of nutrient load in the Mekong River Basin using a distributed hydrological model, *Science of the Total Environment*, 407 (20), 5356-5366
- Wang, Guoqiang, Prasantha Hapuarachchi, Hiroshi Ishidaira, Anthony S. Kiem and Kuniyoshi Takeuchi (2009), Estimation of soil erosion and sediment yield during individual rainstorms at catchment scale, *Water Resources Management*, 23, 1447-1465
- Zhou, M., H. Ishidaira, K. Takeuchi, Y. Gao (2009.6), Evapotranspiration in the Mekong and Yellow river basins, *Hydrological Sciences Journal*, 54(3), 623-638
- Bastola, Satish, Hiroshi Ishidaira, Kuniyoshi Takeuchi (2008.8), Regionalisation of hydrological model parameters under parameter uncertainty: A case study involving TOPMODEL and basins across the globe. *Journal of Hydrology*, 357, 3-4, 188-206
- Jayawardena, A. W. (2009), Challenges in Hydrological Modelling – Simplicity vs. Complexity, Keynote Paper, Proceedings of the International Conference on “Water, Environment, Energy and Society (WEES2009)”, New Delhi, India January 12-16, 2009, vol I, pp 549-553.
- Jayawardena A. W. (2009): *Challenges in catchment hydrological modeling*, Proceedings of Asia Oceania Geosciences Society 6th Annual Meeting, AOGS 2009, 11-15 August 2009, Singapore (Abstracts in CD ROM; Session HS-06-A011).
- Jayawardena, A. W. (2009): *Challenges in coping with water problems in the 21st century*, Proceedings of the World City Water Forum (WCWF2009), August 18-21, 2009, Incheon, Korea. Abstract in Volume 1, p 3; Full Paper (TC-A2-2) in CD ROM. Pp 57-63.
- Jayawardena, A. W., Xu, P.C., and Li, W. K. (2008): *A method of estimating the noise level in a chaotic time series*, Chaos, American Institute of Physics, vol 18, issue 2, pp 023115-023115-11, DOI:10.1063/1.2903757
- Jayawardena, A. W., Xu, P.C., and Li, W. K. (2009): *Rainfall data simulation by hidden Markov model and discrete wavelet transformation*, Stochastic Environment Research and Risk Assessment (SERRA), vol 23: 863-877, DOI: 10.1007/s00477-008-0264-0.
- Muttil, N. and Jayawardena, A. W. (2008): *Shuffled Complex Evolution model calibrating algorithm: enhancing its robustness and efficiency*, Hydrological Processes, vol 22, pp 4628-4638 (Published online on July 10, 2008).
- Jayawardena, A. W., Xu, P.C., and Li, W. K. (2010): *Modified correlation entropy estimation for a noisy chaotic time series*, Chaos, American Institute of Physics, vol 20, 023104 (2010), DOI:10.1063/1.3382013, pp. 023104-1 – 023104-11.
- Jayawardena, A. W. (2008): *Low flow characteristics of some small catchments*, Proceedings of the Second International Symposium on Shallow Flows (ISSF2008), Hong Kong, December 10-12, 2008.
- Jayawardena, A. W. (2009): *How global is “global warming”?*, Poster paper presented at the Environment and Water Resources Institute (EWRI) of the American Society of Civil Engineers (ASCE) Conference held in Bangkok, Thailand, January 5-7, 2009.
- Jayawardena, A. W. (2009): *Riverflow prediction with artificial neural networks*, In: Engineering Applications of Neural Networks, (Eds: D. Palmer-Brown et. al.), EANN 2009, London, UK, CCIS 43, 463-471, Springer-Verlag Berlin Heidelberg.

- Jayawardena, A. W. (2009): *Least squares method of estimating the noise level in a chaotic time series*, Proceedings of the 8th IAHS Scientific Assembly, Session HW7: New Statistics in Hydrology (Paper ID 04828), Abstract in CD ROM, September 6-12, 2009, Hyderabad, India
- Biswas, R. K., Jayawardena, A. W. and Hai, P.T. (2009): *Water level forecasting using artificial neural networks*, Proceedings of the eleventh international summer symposium, Japan Society of Civil Engineers, September 11, 2009, Tokyo, Japan, pp 65-68.
- Biswas, R. K., Jayawardena, A. W. and Takeuchi, K.(2009): *Prediction of water level in the Surma River of Bangladesh by Artificial Neural Networks*, Proceedings of 2009 Annual Conference, Japan Society of Hydrology and Water Resources, August 19-21, 2009, Kanazawa, Japan, P-17. (In CD ROM).
- Jayawardena, A. W. and Sivakumar, Bellie (2010): *Hydrologic modeling and forecasting: Advances, challenges and future directions*, Proceedings of Environment and Water Resources Institute (EWRI) of the American Society of Civil Engineers (ASCE) Conference held in Chennai, India, January 5-7, 2010. 10 pp (in CD ROM)
- Jayawardena, A. W. (2010): Floods – A global problem that needs local solutions, Proceedings of the Japan Geosciences Union Meeting 2010, May 23-28, 2010, Makuhari, Chiba, Japan (Abstract ID: 021098), Session A-CG033 Global-scale material circulation through river runoff.
- Anthony S. Kiem, Kuniyoshi Takeuchi, Estimation of Soil Erosion and Sediment Yield During Individual Rainstorms at Catchment Scale, Guoqiang Wang , Prasantha Hapuarachchi, Hiroshi Ishidaira, Water Resour Manage, Springer Science + Business Media, DOI 10.1007/s11269-008-9335-8, Sep 2008
- Atsuhiko Yorozuya, Kazuhiko Fukami, Naotoshi Shibata, Yuya Kanno, Hitoki Imamura, Flow characteristics in actual river based on field observations using ADCP, The Second International Symposium on Shallow Flows (ISSF2008), International Association for Hydro-Environment Engineering and Research (IAHR), Dec 2008
- Yoganath Adikari, Junichi Yoshitani, Global trends in water-related disasters: an insight for policymakers, WWF5, UNESCO Publication, Mar 2009
- Rabindra Osti, et al., Hydrodynamic characteristics of Tam Pokhari glacial lake outburst flood in Mt. Everest region, Nepal, Hydrological Processes, Wiley Interscience, Vol 23/Issue.20, pp2943-2955, Aug 2009
- Atsuhiko Yorozuya, Sachio Shintaku, Keizo Ejima, Kazuhiko Fukami, Hirokatsu Kanazawa, Development of a Sediment Discharge Measurement System with ADCP, 10th international conference on Fluid control, measurements, and visualization (FLUCOME 2009), FLUCOME, Vol 10, Aug 2009
- Shoji Okada, Atsuhiko Yorozuya, Takashi Kitsuda, Effect of Fluctuation of a Moving Boat Equipped with ADCP on Velocity-Profiles and Water-Depth Measurements, 33rd International Association of Hydraulic Engineering & Research (IAHR) congress, International Association for Hydro-Environment Engineering and Research (IAHR), Aug 2009
- Rabindra Osti, et al, Application and operational procedure for formulating guidelines on flood emergence response mapping for public use, J of Flood Risk Management, Wiley Interscience, Vol2/Issue4, pp293-305, Oct 2009
- Rabindra Osti, Dinar Istiyanto, "Chapter 4: Application of Coastal Forest in Tsunami Disaster Mitigation" in Tsunamis: Causes, Characteristics, Warnings and Protection (ed. Neil Veitch and Gordon Jaffray), Nova Science Publishers, ISBN 978-1-60876-360-3, Jul 2009
- Atsuhiko Yorozuya, Keizo Ejima, Yuya Kanno, Kazuhiko Fukami, Study on Estimation of Shear Velocity in Rivers, 3rd International Perspective on Current & Future State of Water Resources & the Environment, EWRI, ASCE, Vol.3, Jan 2010
- Yoganath Adikari, Flood-Related Disaster Vulnerability: an impending crisis of megacities in Asia, et al, Journal of Flood Risk Management, Wiley Interscience, Apr 2010

- Rabindra Osti, Shinji Egashira, Katsuhito Miyake, Tara Nidhi Bhattarai, Field Assessment of Tam Pokhari Glacial Lake Outburst Flood in Khumbu Reguon, Nepal, Journal of Disaster Research, Fuji Tchnology Press Ltd, Vol.5, No.3, pp 264-273, May 2010
- Atsuhiko Yorozuya, Yuya Kanno, Kazuhiko Fukami, Kazunori Oodaira, Development of automatic water discharge measurement system, 6th International Symposium on Environmental Hydraulics, International Association for Hydro-Environment Engineering and Research (IAHR), June 2010

3) Book Chapter Contributions

- Takeuchi, Kuniyoshi (2010) Closing the gap between science and practice to reduce human losses in hydro-meteorological disasters. In Tom Beer (ed.) Geophysical Hazards –Minimizing risk, maximizing awareness, (Springer Science+Business Media B.V., 2010) 105-114
- Rabindra Osti, et al., Sediment transportation from bed-load to debris-flow and its control by check dams in torrential streams, March 2010, Nova Science Publisher USA
- Rabindra Osti, Dinar Istyanto et al., Application of Coastal Forest in Tsunami Disaster Mitigation, Nova Science Publisher USA
- Yoganath Adikari, Yoshiyuki Imamura, Key Dimension 5: Building resilient communities, The Asian Water Development Outlook (publication in process)

8.2 List of training courses conducted (there can be overlap with those listed in 2.1 above)

- "UN/ISDR Comprehensive Tsunami Disaster Prevention" Training Course
- Local Emergency Operation Plan with Flood Hazard Map
- "The 5th Flood Hazard Mapping in East/Southeast-Asian Region"
- Follow-up Seminar on Flood Hazard Mapping Training Course

Details of above training courses are shown under section 2.4.

ICHARM participation/contribution to international and regional agendas during reporting period

- 18th session of the IHP Intergovernmental Council, 9-14 June 2008, France
- 5th Asia Oceania Geosciences Society Conference (AOGS 2008), 16-20 June 2008, Pusan, Korea
- Strengthening of Flood Risk Management in Lai Nullah Basin, 16-25 June 2008, Pakistan
- Regional Consultation Meeting on Climate Change Adaptation and Water-related Disaster Management – Knowledge Networking for Water Security in the 21st Century, 26-27 June 2008, Singapore
- Ministry for Ecology, Energy, Sustainable Development and Spatial Planning 15-18 July 2008, France
- GEOSS/AWCI /Workshop on Use Satellite Based Information in Flood Risk Management , 20-25 July 2008, Bandung, Indonesia
- Stockholm World Water Week, August 2008
- XIII^World Water Congress, 1-4 September 2008, France
- UNESCO-IHE Lecture Summer Course, 10-20 September 2008, Delft, Netherland
- 5th Meeting of the Expert Working Group on Measuring Vulnerability, 14-16 September, Ho Chi Minh, Vietnam
- SWOT Hydrology Workshop, 15-17 September 2008, Ohio, USA
- Integration Meeting on the Side Publication of the World Water Development 3 Report , 18-23 September 2008, Geneva, Switzerland
- NARBO 2nd Thematic Workshop, 6-11 October 2008, Phillipine
- Regional Meeting on Hydro-informatics and Developing Knowledge Hub Networks, 15-17 October 2008, China
- High-level International Forum on Water Resources and Hydropower, 16-18 October, China
- Meetings of the High Level Expert Panel on Water and Disasters/UNSGAB (2008-2009, several times)
- 4th Conference of The Asia Pacific Association of Hydrology and Water Resources (APHW), 3-5 November 2008, China
- Thirteenth Session of the Commission for Hydrology-CHy-XIII, 4-12 November 2008, Geneva Switzerland
- International Symposium of IAHS-PUB and the 2nd International Symposium of China-Pub, 7-9 November 2008, China
- Thirteenth session of the Commission for Hydrology (CHy-XIII), 4-12 November 2008, Geneva Switzerland
- The 3rd International Coordination Group Meeting for GEOSS-AWCI, 6 November 2008, Beijing, China
- Global Facility for Disaster Reduction and Recovery (GFDRR)-RMC, 11 November 2008, Denmark
- Public Seminar and Policy Forum on Linking Climate Change Negotiations and Disaster Risk Reduction, 12-13 November 2008, Copenhagen, Denmark
- ESCAP/Committee of Information and Communications Technology , first session, 19-21 November 2008, Bangkok, Thailand
- International Conference on Water Scarcity, Global Changes and Groundwater Management Responses, 1-5 December 2008, Carifornia USA
- Regional Workshop on Developing Partnerships for Water and Climate Change Adaptation, 1-5 December 2008, Kuala Lumpur, Malaysia
- The 15th Session of the Asia-Pacific regional Space Agency forum (APRSAF-15) "Space for sustainable Development", 9-12 December 2008, Hanoi and Ha Long Bay, Vietnam
- The 2nd International Symposium on Shallow Flows, 10-12 December 2008, Hong Kong
- Inception Workshop/Training on Application of Satellite Rainfall Estimates in the HKH region- Phase II, 15-19 December 2008, Kathmandu, Nepal
- The 3th Annual International Workshop & Expo on Sumatra Tsunami Disaster & Recovery, 17-19 December 2008, Indonesia
- International Seminar on Long Lead Flood Forecast Technology for the Disaster Management in Bangladesh, Dhaka, Bangladesh
- EWRI-AIT International Conference, 5-7 January 2009, Thailand

- 3rd Steering Committee of the IWRM Guideline at River Basin Level Project, 8-9 January 2009, Thailand
- JICA Expert Mission on Sabo and Flood Management Program in Jordan, 10-24 January 2009, Jordan
- The 8th International Conference on Hydro-informatics, 12-16 January 2009, Concepcion, Chile
- WEES-2009, 12-16 January 2009, India
- 1st Asia Water Development Outlook 2010 Team meeting, 15-16, January 2009, Singapore
- The 41st Session of ESCAP/WMO Typhoon Committee, 19-23 January 2009, Chiang Mai, Thailand
- Short-term JICA Expert on Flood Forecast Model, CD Project for RBOs in Water Resources Management & Technology, 27 January-5 February 2009, Bandung & Solo, Indonesia
- Terminal Evaluation and 6th JCC Meeting (1), Strengthening the Flood Management Function of DPWH, 9-25 February 2009, Philippines
- East & Southeast Asia Regional Seminar on Flood Hazard Mapping, 2009, 17-19 February 2009, Manila, Philippines
- Meeting on Action Plan for Water and Climate Change, ADB, 24-26 February 2009, Manila, Philippines
- ESCAP, Committee on Disaster Risk Reduction, First Session, 1-5 March 2009, Bangkok, Thailand
- 2nd Asia Water Development Outlook 2010 Team meeting, 4-5, March 2009, Singapore
- World Water Forum, 16-22 March 2009, Turkey
- ADB PDA (Pilot Demonstration Activity) for Philippines: Testing and Demonstrating a Technology to Cope with Debris Flows in Mountain Regions, 22-28 March 2009, Philippines
- Lecturer of Spring School on Fluid Mechanics and Geophysics of Environmental Hazards, Institute for Mathematical Sciences, National University of Singapore, 19 April-2 May 2009, Singapore
- The CRBOM (Centre for River Basin Organization and Management) launch workshop, 27 April-1 May 2009, Solo, Indonesia
- Second Experts' Symposium on Multi-Hazard Early Warning Systems, 5-7 May 2009, France
- World Social Science Forum 2009, 10-12 May 2009, Norway
- 7th Annual Mekong Flood Forum, 13-14 May 2009, Bangkok, Thailand
- The Second Session of the Global Platform for Disaster Risk Reduction, 16-19 May 2009, Geneva
- Meeting of ISO/TC113/SC1, 18-22 May 2009, Birmingham, UK
- The 77th ICOLD Annual Meeting, 21-29 May 2009, Brasilia, Brazil
- Workshop and meeting on Developing Water and Climate Change Adaptation Guidelines, 26-28 May 2009, Putrajaya, Malaysia
- FCSEC Training on Planning and Design of Sabo Works, 1-5 June 2009, Manila, Philippines
- 8th GPM Planning Workshop, 18 June 2009, Paris, France
- International Seminar on Wetland and Sustainability 2009, 26-28 June 2009, Malaysia
- 2nd NARBO Technical Advisory Committee and The 5th Governing Council Meeting of the Asia Pacific Water Forum, 25-26 June 2009, Singapore
- JICA Expert on Water Resources and Draught, 26 June-2 July 2009, Tehran, Iran
- Fourth Iran Water resources Management Seminar: Application of hydrologic models for flood and water resources decision making, 28-29 June 2009, Tehran, Iran
- The 3rd Asia Water Development Outlook 2010 Team meeting, 29-30, June 2009, Singapore
- Sub-Regional Workshop on Capacity Building on Floods Mapping, Prevention and Management, 6-10 July 2009, Niamey, Niger
- 2nd Meeting of the Flood Forecasting and Warning Study, 15-18 July 2009, Bali, Indonesia
- Risk Assessment and Flash Flood Mitigation Strategies, 10-13 August 2009, Kuala Lumpur, Malaysia
- AOGS2009, 11-15 August 2009, Singapore
- 4th Asia Water Development Outlook 2010 Team meeting, 17-18 September 2009, Singapore
- World City Water Forum 2009, 18-21 August 2009, Korea
- Launch of K-water as the Asia Pacific Water Forum's Regional Water Knowledge Hub on Water Quality Management in River & Indonesia Citarum Project Inauguration, 18-23 August 2009, Daejeon and Incheon, Korea

- Knowledge Sharing Workshop on Water Science and Technology for Sustainable Well Being and Koshi Field Visit, 22-27 August 2009, Nepal
- The 11th International Conference on Engineering Applications of Neural Networks, 27-29 August 2009, London
- World Climate Conference-3, 31 August-2 September 2009, Geneva
- Chuncheon Global Water Forum (CGWF 2009), 3-4 September 2009, Chuncheon, Korea
- 8th IAHS Scientific Assembly & 37th IAH Congress, 6-12 September 2009, India
- UNESCO-IHE Lecture Summer Course Climate Change, 7-11 September 2009, Delft, Netherland
- 3rd ICSU Regional Consultation in Asia & the Pacific, 13-14 October 2009, Malaysia
- ESCAP/WMO Typhoon Committee Integrated Workshop, 14-18 September 2009, Cebu, Philippines
- ADCP in Action 2009, 5-7 October 2009, San Diego, USA
- The Thirteenth International Conference on Diffuse Pollution and Integrated Watershed Management, DIPCON 2009 (IWA DIPCON 2009), 12-15 October 2009, Seoul, Korea
- Preparation Meeting on ADB-RETA 7276 with MRC member countries, 18 -25 October 2009, Phnom Penh, Cambodia and Vientiane, Laos
- Integrated Research on Disaster Risk (IRDR) Second Meeting of the Science Committee, 21-23 October 2009, Paris
- Operational Management Refresher Course Dedicated to 'Flood Response Management,' 21-23 October 2009, Revinge, Sweden
- ADB-RETA 7276 fact-finding mission, 26-30 October 2009, Bangkok, Thailand
- Japan-Taiwan Comprehensive Flood Management Conference, 2-5 November 2009, Taipei, China
- Preparation Meeting on ADB-RETA 7276 with Bangladesh Water Development Board, and ADB-ICHARM Partnership Agreement Signing Ceremony, 8-14 November 2009, Dhaka Bangladesh and Manila Philippines
- 3rd ALOS Joint PI Symposium, 9-13 November 2009, Hawaii, USA
- WWDR4 Issues Workshop, 16-17 November 2009, Perugia, Italy
- 4th Annual International Workshop & Expo on Sumatra Tsunami Disaster & Recovery 2009, 23-25 November 2009, Indonesia
- 5th Asia Water Development Outlook 2010 Team meeting, 25-26, November 2009, Manila, Philippines
- International Conference on "Hydrology and Disaster Management" & 17th Regional Steering Committee Meeting UNESCO-IHP Southeast Asia and The Pacific, 2-6 November 2009, Wuhan, China
- UNESCO-IHE/AIT Refresher Seminar, 23-28 November 2009, Thailand
- Advanced Study Institute on Recent Developments in Nearshore Coastal Water Quality Research: Prediction, Hydro-biological Interactions and Management, 14-19 December 2009, Hong Kong
- 6th Steering Committee meeting of IWRM Guidelines at River Basin Level, 15-16 December 2009, Paris France
- Field survey on Typhoon Ketsana Disaster, 16-20 December 2009, Hue & Quang Nam, Vietnam
- The 3rd International Perspective on Current & Future State of Water Resources & the Environment, 5-7 January 2010, Chennai, India
- Workshop on Nonstationarity, Hydrologic Frequency Analysis, and Water Management, 13-15 January 2010, Colorado USA
- The 16th Session of the Asia-Pacific Regional Space Agency Forum (APRSAP-16), 26-29 January 2010, Bangkok, Thailand
- 6^h Asia Water Development Outlook 2010 Team meeting, 8-9 February, 2010, Manila, Philippines
- Coordination Meeting with BWDB on RETA 7276, and IFAS Workshop in Solo, 24 February -10 March, 2010, Bangladesh, Indonesia
- Implementation of ADB-RETA 7276 – 1st Training Workshop with BBWS, Satellite-based rainfall and its accuracy, 2-4 March 2010, Solo, Indonesia
- "Workshop on Sustainable Tsunami Disaster Management" -Developing Awareness, Hazard Mapping and Coastal Forest Implementation-, 9-11 March 2010, Indonesia
- The 4th GEOSS Asia Pacific (GEOSS-AP) Symposium, 11-12 March 2010, Bali, Indonesia

- The 6th International Coordination Group(ICG) Meeting, GEOSS Asian Water Cycle Initiative(AWCI), 13 March 2010, Bali, Indonesia
- Asia-Pacific Water Forum (APWF) Secretariat and Asian Development Bank (ADB) Joint International Workshop on Climate Change Projection, Impact Assessment and Adaptation Planning in the Asia-Pacific Water Sector, 24-25 March 2010, Manila, Philippines
- Coordination Meeting with Assam government , Orissa government and India Central Water Commission on ADB RETA 7276, 4-16 April 2010, India
- 7th Asia Water Development Outlook 2010 Team meeting, 6-8 April, 2010, Beijing, China
- Integrated Research on Disaster Risk(IRDR) 3rd meeting of the Scientific Committee, 14-16 April 2010, Paris
- Asia-Pacific Water Forum Knowledge Hubs knowledge sharing WS,19-23 April 2010, Manila
- Seminar on the Flood Forecasting & Warning System for Tropical Region, 24-25 May 2010, Selangor, Malaysia
- KWRA-IHES joint Symposium,26-27 April 2010, Korea
- 8th Annual Mekong Flood Forum and Coordination Meeting with MRC in Lao on ADB RETA 7276 , 24-30 May 2010, Vientiane Laos

Minutes of 2nd ICHARM Advisory Board Meeting 1st October 2008, Tsukuba, Japan

1. Opening (Chair Mr. Terakawa, Acting Director, ICHARM)

➤ Dr. Sakamoto, the Chief Executive of PWRI

Presented his opening remarks welcoming the Board members and briefing them on achievements of ICHARM during the past two years. The Chief Executive also called on the Board Members to extend their wholehearted constructive opinion for future project of ICHARM which is an integral part of PWRI on water resource management for the global community.

➤ Mr. Kiso:

Thanked the Board members as the Director of International Affairs (MEXT) and also as the member of the National Commission of UNESCO, Japan. He stressed that that Japan has experience of many natural disasters and hazard; through these experiences Japan has gained expertise and proud of the establishment of ICHARM. The national commission of UNESCO promotes IHP, IHP training in the Asia Pacific and also focuses on water problems, water hazards and climate change for sustainable development.

➤ Self Introduction

The initial chair of the session, Mr. Terakawa requested for self introduction of all participants of Advisory Board Meeting including the ICHARM staff

➤ Election of the Chairperson of the 2nd Advisory Board of ICHARM

After the self introduction Mr. Eugene Z. Stakhiv (Group1:USA), Executive Director, Institute for Water Resources (IWR), U.S. Army Corps of Engineers was nominated by Mr. Saad as Chair and everybody agreed on the nomination hence he was elected as the Chair of the Board. The elected Chair requested Mr. Matua to nominate someone as Vice-Chair so he nominated Mr. Keizrul bin Abdullah (Group4:Malaysia), Former Director General of the Department of Irrigation and Drainage, everybody agreed on his nomination and was elected as Vice-chair

Introduction of Achievement Report and Action Plan of ICHARM

➤ Prof. Takeuchi, the Director of ICHARM

Welcomed and thanked the advisory board members for their participation, and expressed his high hope of receiving support and advices to improve the ICHARM activities. Prof. Takeuchi first reviewed the major activities and achievements of ICHARM in the past biennium 2006-2008 and thanked for the kind supports of MLIT, PWRI, JICA, UNESCO, WMO, GRIPS and many others for their continued support. He also introduced Action Plan for the period 2008-2010 and requested the advices.

The Director stressed that ICHARM is still in the initial stage of establishment and the concentration of the limited resources to prioritized areas is important. He introduced the areas of focus on high technology for early warning system, capacity development programs including master course, local practices assistance and Kakushin Program for impact assessment of climate change on floods. The following are the points highlighted.

➤ Research Projects

- Most of research projects are funded by PWRI core budget. The project on the climate change impact assessment on flood is funded by MEXT.
- Localism is the major challenge of ICHARM and local studies are considered very important. ICHARM is developing flood preparedness indicators as a guide for local consultation.
- Development of Integrated Flood Analysis System (IFAS) is also put high priority as the high-tech supported early warning is important.

➤ Training courses

ICHARM is especially pleased to have ten first year students graduated its master course on Disaster Management Policy Program (Water-related Risk Management Course) jointly organized with National Graduate Institute of Policy Studies supported by JICA.

➤ **Information Networking**

ICHARM is serving as the secretariat of International Flood Initiative (IFI) and the knowledge-hub on disaster management designated by the Asia-Pacific Water Forum (APWF). ICHARM has various cooperation plans with various organizations such as RCUWM-Teheran and USACE ICIWaRM.

➤ **External Fund Raising**

The Director announced that a collaboration program between ADB and ICHARM is in the final stage of agreement. This is to jointly implement the ADB and ICHARM plan in several Asian nations for their local disaster management programs. He also stressed the importance of growing funding from JICA, MEXT, ISDR and others.

2. Comments from each member of the Advisory Board

Chair Eugene Stakhiv proposed that:

Each member of the Board makes introductory remark on the draft Action Plan 2008 – 2010 of ICHARM before starting the discussion on ICHARM Action Plan proposal. He also stress that water is a very import part of integrated development so the disaster managers should look into not only flood policies but also other related policies.

➤ **Introductory remarks:**

All the board members praised the achievements of ICHARM during the past two years. Everybody said that it was a surprised that ICHARM could do so much within so short period of time.

➤ **Individual remarks:**

Mr. Carlos EDUARDO Tucci advised ICHARM to collaborate with other UNESCO centers and also look for more external funding.

Mr. Keizrul bin Abdullah pointed out the importance of allocation the funds among the three pillars of ICHARM to achieve the goals in unbiased manner

Mr. Mohamed-Bahaa Eldin Ahmed Mohamed Saad praised the good work of ICHARM and mentioned that ICHARM should be involved in urbanization and water quality

Mr. Francis Musyoka Mutua pointed out that Arid Region is neglected so ICHARM should reach to that region.

Mr. Andras Szollosi-Nagy advised to consider making public outreach strategy such as the use of internet and publication of different ICHARM materials in UNESCO-IHP format. He also mentioned that ICHARM should identify what other governments need not just think what they need.

Mr. Avinash C. Tyagi explained that Latin American and African nations are suffering a lot from floods so ICHARM should help these regions in flood forecasting and capacity building

Mr. Konrad Ostervalder stressed that the MS students are too less for the effort and are from on few countries in Asia so ICHARM should cover widely including Africa and Latin America in the training or the master programme

Mr. Salvano Briceno pointed out that ICHARM is involved in too many individual activities which may not be bring good result so advised to categorize the activities into groups such as IFI or WWAP etc to work effectively

Mr. Kenzo Ohshima praised the work of ICHARM and committed to support ICHARM

Mr. Eugene Z. Stakhiv the chair wrapped up by saing that ICHARM should identify priority, collaborate, look outside of ICHARM in a broad prospective

3. Discussion

- **Chair Mr. Eugene Z. Stakhiv** opened the floor for the discussion in the afternoon session requesting the Board Members to make open and frank discussion which is *sine quo non* for ICHARM to come up with an effective Action Plan for the next two years to achieve the goals.

Mr. Carlos EDUARDO Tucci advised ICHARM to collaborate with other UNESCO centers and also look for more external funding especially for education and training. He also said that the number of masters' student are not worth the effort (cost benefit) telling that identifying whose capacity to build is very important and gave his own example as going to teach the students rather than students coming to him. He also pointed out that ICHARM should increase its visibility to the world. And also he stressed the importance of collaboration with UNESCO centres.

Mr. Keizrul bin Abdullah pointed out the importance of allocation the funds among the three pillars of ICHARM to achieve the goals in unbiased manner. He also stressed that the ICHARM should plan the training strategically and train the planners NOT the engineers. Besides, he also mentioned that cities are more important than rural area in terms of planning and managing disaster especially in the coastal areas considering the effect of CC where structural measures especially for tsunami are very expensive, so ICHARM should look into these problems

Mr. Mohamed-Bahaa Eldin Ahmed Mohamed Saad praised the good work of ICHARM and mentioned that ICHARM should be involved in urbanization and water quality, it does not require much funding but is very important aspect human life. Also mentioned that due to CC Arid regions are vulnerable to flash flooding so ICHARM should consider this aspect too

Mr. Francis Musyoka Mutua pointed out that Arid Region is neglected so ICHARM should reach to that region and should collaborate with other UNESCO centers especially in the field of sediment transport. Mr. Mutua also stressed that the important Forums and Summits that ICHARM is dealing with should be publicized

Mr. Andras Szollosi-Nagy advised to consider making public outreach strategy such as the use of internet and publication of different ICHARM materials in UNESCO-IHP format. He also mentioned that ICHARM should identify what other governments need not just think what they need. In addition, ICHARM was advised to focus on joining hands with other UNESCO centers especially IHE and standardize all the publication in UNESCO format mentioning that UNESCO will work hand in hand with ICHARM and support all the activities of ICHARM. Mr. Szollosi-Nagy also stressed the importance of publicizing ICHARM in an effective way, for this purpose he mentioned that ICHARM should think of market, clients, target and products in a corporate manner and first of all start with an ICHARM brochure. Furthermore, he also stressed the importance of publication of Masters' thesis so that ICHARM will have a line of publication. In addition he also encouraged ICHARM to deliver unique products without duplication. Mr. Szollosi-Nagy brought the topic of natural dam Lake Sarej in Tajikistan which poses a threat of breaching and flooding downstream riparian cities and urged ICHARM to take an initiative to study and find a suitable solution. In this case he sought help of JICA financially. He added that ICHARM is independent so can decide what window (such as Google) to choose for outreach. Last but not the least, Mr. Andras Szollosi-Nagy informed about the legal way paved recently that funds such as JICA support to ICHARM could be diverted as UNESCO scholarships for ICHARM students if that is deemed necessary

Mr. Avinash C. Tyagi explained that Latin American and African nations are suffering a lot from floods so ICHARM should help these regions in flood forecasting and capacity building. He also stressed that ICHARM should study the impact of CC on flood and droughts/water shortage. Masters' course should be multidisciplinary

Mr. Konrad Ostervalder stressed that the MS students are too less for the effort and are from a few countries in Asia so ICHARM should cover widely including Africa and Latin America in the training or the master programme. He also pointed out the importance of validation of high tech forecasting methods through the cross-check with field methods. Mr. Herrat who substituted Mr. Ostervalder in the afternoon remarked that collaboration with local universities may be helpful to fulfill the objectives of ICHARM

Mr. Salvano Briceno pointed out that ICHARM is involved in too many individual activities which may not bring good results so advised to categorize the activities into groups such as IFI or WWAP etc to work effectively. Mr. Briceno welcomed ICHARM to develop goals together with UN/ISDR to meet the Hyogo Framework of Actions such as the Side-publication of World Water Development Report. He also pointed out that the concept of IWRM is misunderstood by most people around the world so wherever possible involve governments in the process of ICHARM activities to educate them. In addition, Mr. Salvano cited that Australia, Spain, Mediterranean and so on are suffering from severe drought and recommended ICHARM to consider research on this matter.

Mr. Kenzo Ohshima praised the work of ICHARM and committed that JICA will support ICHARM. He mentioned that the Nepal Government approached JICA to help them about Glacier Lake Outburst Flood and requested ICHARM to think about it

Mr. Okazumi: He represented MLIT in the afternoon session and urged that ICHARM should work closely with agencies and organizations working on similar causes within Japan such as NILIM, JICA, Water Agency and so on to avoid duplication and benefit each other. He also mentioned that he is not clear about the ICHARM participation as a knowledge-hub. He extended MLIT's support.

Mr. Eugene Z. Stakhiv the chair wrapped up by saying that ICHARM should identify priority, collaborate and look outside of ICHARM in a broad perspective. Reviewing and synthesizing literatures from various UN Organizations is important. IFAS is important and ICHARM has a good chance to collaborate with NASA since Latin American countries have a good collaboration with NASA already. Another point he observed was that the training could be implemented in a third country which could be cost effective rather than conducting in Japan. Besides, he also reiterated that JICA's support for capacity building could be transformed into UNESCO scholarships as mentioned earlier. The chair also made a point that the sediment-related disasters and water quality are equally important and these components together with water pollution, industrial waste are major concerns of urban areas. Climate change cannot be ignored since it is catalyzing disasters and bringing changes in natural circulation as well. Finally the chair thanked all the participants and closed the discussion inviting the Director of ICHARM to give his closing remarks

4. Closing

The Director renewed the commitment of ICHARM to achieve its mandates in cooperation with present organization and in support of ongoing activities such as WWAP, APFM of WMO, ICSU IRDR and acting as the secretariat of IFI. He made a point that ICHARM will collaborate with all its partners and stakeholders to come out with flying colors stressing that the collaboration with NASA is important. He also showed interest to work in Arid Regions though ICHARM is still hurdling with floods. He took his opportunity to thank all the participants especially the Advisory Board Members.

Format for Reports by UNESCO's Water-related Centres on activities related to the IHP in the period June 2008 – May 2010

1. Basic information on the centre

Name of the Centre		International Center for Integrated Water Resources Management
Name of Director		Robert A. Pietrowsky
Name and title of contact person (for cooperation)		William S. Logan
E-mail		Will.Logan@usace.army.mil
Address		7701 Telegraph Rd., Casey Bldg.
Website		www.iciwarm.org
Location of centre		city/town: Alexandria, Virginia 22315 country: USA
Geographic orientation *		<input checked="" type="checkbox"/> global <input type="checkbox"/> regional
Year of establishment		
Themes	Focal Areas ♦	<input type="checkbox"/> groundwater <input type="checkbox"/> urban water <input checked="" type="checkbox"/> arid / semi-arid zones <input type="checkbox"/> humid tropics <input checked="" type="checkbox"/> droughts and floods <input type="checkbox"/> sediment transport and management <input checked="" type="checkbox"/> water and environment <input type="checkbox"/> ecohydrology <input type="checkbox"/> water law and policy <input type="checkbox"/> transboundary river basins/ aquifers <input checked="" type="checkbox"/> IWRM <input checked="" type="checkbox"/> global and climate change <input checked="" type="checkbox"/> mathematical modelling <input type="checkbox"/> social and cultural dimensions of water <input type="checkbox"/> water education <input type="checkbox"/> other: (please specify) _____
	Scope of Activities ♦	<input type="checkbox"/> vocational training <input type="checkbox"/> postgraduate education <input checked="" type="checkbox"/> continuing education <input checked="" type="checkbox"/> research <input checked="" type="checkbox"/> institutional capacity-building <input type="checkbox"/> advising/ consulting <input type="checkbox"/> software development <input type="checkbox"/> other: (please specify) _____
Support bodies ¹		US Army Corps of Engineers
Hosting organization ²		USA Institute for Water Resources
Sources of financial support ³		Other US government agencies
Existing networks and cooperation ⁴		ICIWaRM itself is designed as a network of US government, academic institutions, professional organizations and other non-governmental organizations.
Governance		<input type="checkbox"/> director and governing board <input checked="" type="checkbox"/> other: director and advisory board _____ Frequency of meetings: once every 2 years

* check on appropriate box

♦ check all that apply

¹ please specify bodies that cover the operational costs of the centre, and other essential costs such as salaries and utility bills, and that provide institutional support to ensure centre's sustainability

² if different from support bodies

³ please specify sources of main budgetary and extrabudgetary funds to implement projects

⁴ please write international networks, consortiums or projects that the centre is part of, or any other close links that the centre has with international organizations or programmes, which are not already mentioned above

	<input checked="" type="checkbox"/> Existence of UNESCO presence at meetings
Institutional affiliation of director	USA Institute for Water Resources
Number of staff and types of staff	total number of staff (full-time, or equivalent) : _____4.5_____ number of staff who are water experts: _____3.5_____ number of visiting scientists and postgraduate students: _____2_____
Annual turnover budget in USD	

2. Activities undertaken in the framework of IHP in the period June 2008 – May 2010

- 2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII (Appendix-1) and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.

Training of 11 Iraqi hydrologists and water managers at IHE. A series of activities, held in July 2008, for Iraqi hydrologists, including capacity building in reservoir simulation modeling, a water data management workshop, and a UNESCO-IHE Short Course (July 2008).

- 2.2 Research activities that directly contributed to the IHP-VII and activities by WWAP. *Please include research/applied projects outputs such as publications that directly contributed to the IHP-VII and WWAP objectives*

Author of Chapter 10 **“The Earth’s natural water cycles”**, The United Nations World Water Development Report 3: Water in a Changing World (2009).

Contributor to Chapter 11 **“Changes in the global water cycle”**, The United Nations World Water Development Report 3: Water in a Changing World (2009).

Contributor to Chapter 15 **“Water Resources and Climate Change”**, The United Nations World Water Development Report 3: Water in a Changing World (2009).

Member, **Expert Group on “Indicators, monitoring and databases”**, The United Nations World Water Development Report 3: Water in a Changing World (2009).

Co-Chair (and additional support), World Water Assessment Programme **Expert Group on Policy Relevance** (2008-present).

Co-Chair of the Steering Committee for 2009 UNESCO IHP/WWAP/NARBO publications **Integrated Water Resources Management at River Basin Scale** (Part 1: Principles, Part 2.1: Guidelines for IWRM, Part 2.2: Flood Management, and Part 2.3: Invitation to IWRM for Irrigation Practitioners) (2008-present).

Development of **open-source software and analytical tool for flood and drought frequency analysis** based on analysis of “L-moments”

statistical methods applied to areas with short and/or sparsely located databases (ongoing).

Presented paper on **Ecohydrologic Valuation Methods** at UNESCO Category 2 Centre in Lodz, Poland (2008).

Translation to Spanish of UNESCO IHP/WWAP/NARBO publication Integrated Water Resources Management at River Basin Scale in collaboration with UNESCO (LAC) and the Inter-American Development Bank (ongoing, 2010).

Hydrologic Modeling of the Ogaden Basin, Ethiopia (Hydrologic Engineering Center, 2009-present).

Near real-time streamflow forecasting system using satellite precipitation measurements in the International **Senegal River Basin** (2008-present).

2.3 Training activities that directly contributed to the IHP-VII and WWAP objectives

Workshop on integrated participatory water resources planning tools for Peru's National Water Authority (ANA) (August 2009, Lima, Peru).

Collaboration with ANA staff to develop **shared vision planning guidelines for Peru**, in coordination with the World Bank and the Inter-American Development Bank (2009-present).

Rainfall-runoff modeling and model building, Kenya Water Ministry and University of Nairobi (Hydrologic Engineering Center, September-October 2008).

Groundwater training and model building, University of Addis Ababa, **Ethiopia** (July 2008).

Training seminars on **conflict management techniques for the Mekong River Commission** (MRC) (2008 and 2009).

Arranged for UNESCO IHP staff member to participate in three-week program in the US through the U.S. State Department's **International Visitor Leadership Program** (December 2009).

3. **Collaboration and linkages**

3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies

Member, Steering Committee, Global Water Partnership.

Member, Steering Committee, International Flood Initiative.

Member, UN Secretary's General Advisory Board (UNSGAB); implementing Initiative 27 on new methods for climate change adaptation.

Learning Session on Environmental Flows. 5th World Water Forum (co-sponsored and co-presented).

Learning Session on Improving Water Information Systems to Support Water Management and Environmental Restoration: A Case Study of Capacity Development in Iraq. 5th World Water Forum (co-sponsored and co-presented).

Participation and presentation in **G-WADI Workshop: Water – Science, Policy and Capacity Development** (Dakar, **Senegal**, May 2010).

Participation in US government-led effort to create a network of **Middle East Centers of Excellence on Water** (2009-present).

Participation in and presentation at **WMO World Climate Conference** (September 2009).

Cosponsored the First Inter-Academic **US-Ukrainian Meeting on Scientific Approaches to Adaptation to Climate Change in the Water Sector**, in collaboration with the Global Water Partnership and the National Academies of Science of the US and Ukraine (December 2009).

Participated in 181st and 182nd **UNESCO Executive Committee** meetings (2009).

Participated in 35th **UNESCO General Conference** meeting (2009).

Observers to 18th **IHP-Intergovernmental Council** (2008).

Co-Sponsored (along with UNESCO and others) the **International Conference on Water Scarcity, Global Changes, and Groundwater Management Responses**, University of California, Irvine, USA December 2008).

Sponsored **North American HELP Basin Organizations** Workshop on Lessons Learned (May 2010).

3.2 Collaboration and networking with other UNESCO category 1 or 2 institutes/ centres

3.2.1 cross-appointment of directors of the category 1 or 2 institutes or centres on the governing board

Member, **Governing Board of UNESCO IHE**.

Chair, **Advisory Board of ICHARM**.

3.2.2 exchange of information on activities such as training/educational materials, and funding opportunities

Participated in and provided financial support to **International Floodplain Ecohydrology Conference**, Lodz UNESCO Center, Poland (2008).

Participated in US-hosted informal **meeting of UNESCO Group 1 National IHP Committees** (2009).

Attended, as an observer, a Coordination **meeting of UNESCO group 2 National IHP committees** and contacts, (Asuncion, Paraguay, 2009)

Attended, as an observer, two **Coordination meetings of programs, projects and work groups, IHP Latin America and the Caribbean**, Montevideo (September 2008 and January 2010).

Participated in the **Caribbean Workshop on Networking and Cooperation for Research in Water Resources**, hosted by the Centre for the Sustainable Management of Water Resources for the Caribbean Island States (CEHICA), Santo Domingo, Dominican Republic (December 2008).

Participated as part of a **group of experts** to analyze and improve **CAZALAC**'s formal proposal for a third, three-year funding cycle from the Flanders government through UNESCO (August 2009).

3.2.3 exchange of staff, most notably professionals and students
None.

3.2.4 implementation of joint activities, such as workshops, conferences, training programmes, joint projects, field visits, software and data sharing, knowledge exchange and publications

Support of work on the development of a **Drought Atlas for** selected pilot areas of **Latin America** in partnership with the Water Center for Arid and Semi-Arid Zones in Latin America and the Caribbean (CAZALAC) and The University of Ghent (2008-present).

Planning meeting in Nassau and North Andros Island, The Bahamas, in support of UNESCO IHP's "Groundwater Resources Assessment under the Pressures of Humanity and Climate Change" (**GRAPHIC**) **pilot project on Andros Aquifer, Bahamas** (March 2009).

3.3 Relationships with the UNESCO field and regional office whose jurisdiction covers the country of location

Primarily related to UNESCO Regional Office for Science and Technology for Latin America and the Caribbean, Montevideo.

3.4 Relationship with the UNESCO National Commission and the IHP National Committee in the country of location and with other organizations of other countries

One of six permanent Federal agency members of the **US-IHP Committee**. Attended and presented updates at the semi-annual meetings, and are involved in strategic planning and in drafting recommendations of the committee to the US National Commission for UNESCO.

Attended and presented updates at the bi-annual **US National Commission for UNESCO**. Active in drafting recommendations of the Commission for the Natural Sciences.

3.5 Relationship with other UNESCO-related networks, such as UNESCO Clubs, ASPnet, and UNESCO chairs

4. Communication

4.1 Communication and knowledge dissemination activities undertaken in the framework of IHP

Sponsored **Global Water News Watch**, which is associated with G-WADI website hosted by University of Arizona/SAHRA (August 2009-present).

Website: <http://www.iciwarm.org>.

4.2 Policy documents and advice

Editor-in-Chief for Water Policy, a peer-reviewed international journal that is published six times per year.

Co-funded and co-organized International **Workshop on Non-Stationarity, Hydrologic Frequency Analysis & Water Management**,

Boulder, CO 13-15 Jan 2010, on alternatives to the assumption of stationarity in hydrologic frequency analysis and water management, and alternative technical and policy and paths ahead. Proceedings available at www.cwi.colostate.edu/NonstationarityWorkshop/proceedings.shtml.

Advised the World Bank in Peru on **institutional issues related to conflict resolution in Peruvian water management** (2010).

5. Update on Centre Operations

- 5.1 Membership of the Board of Governors between designated period

Advisory Board to be established July 2010.

- 5.2 Key decisions made (attach minutes of meetings)

Not applicable.

6. Evidence of the Centre's Impacts

- 6.1 Science Impacts (Major contributions to the science, technology, education, and regional and/or international cooperation in the field of water)

Contributed significantly to the four-part UNESCO publication **Integrated Water Resources Management at River Basin Scale**.

- 6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)

Functioning **hydrologic models** were left with the participating agencies of the training courses on modeling in Kenya and Ethiopia.

- 6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)

Work done for UNESCO is supporting policy development with other US agencies **formulating new methods for climate adaptation**.

Influence on **International Joint Commission studies** on the Great Lakes of the US and Canada.

7. Future activities that will contribute directly to IHP and/or to WWAP

- 7.1 Operational Plan (2010-2011) (attach operational plan for 2008-09 if available)

Under development.

- 7.2 Strategic Plan linked with IHP-VII (attach strategic plan for 2010-13 if available)

Under development.

8. Annexes

- 8.1 List of publications released by the centre (there can be overlap with those listed in 2.3 above)

- 8.2 List of training courses conducted (there can be overlap with those listed in 2.1 above)

Integrated participatory water resources planning tools, National Water Authority (ANA) of Peru, August 2009, Lima.

Rainfall runoff modeling and model building, Kenya Water Ministry and University of Nairobi, September-October 2008.

Groundwater training and model building, University of Addis Ababa, Ethiopia, July 2008.

Conflict management techniques, Mekong River Commission (MRC), 2008 and 2009.

Learning Session on Environmental Flows. 5th World Water Forum (co-sponsored and co-presented).

Learning Session on Improving Water Information Systems to Support Water Management and Environmental Restoration: A Case Study of Capacity Development in Iraq. 5th World Water Forum (co-sponsored and co-presented).

Format for Reports by UNESCO's Water-related Centres (category 1 and 2) on activities related to the IHP in the period July 2006 – May 2008

1. Basic information on the centre

Name of the Centre		International Centre on Qanats and Historic Hydraulic Structures (ICQHS)
Name of Director		Dr. Ali A. Semsar Yazdi
Name and title of contact person (for cooperation)		Mr. Majid Labbaf Khaneiki, Programme Specialist
E-mail		icqhs@yahoo.com / labbaf@icqhs.org
Address		Danesjoo Blvd., Yazd, Iran, POBox:89165-1553
Website		www.icqhs.org
Location of centre		city/town: Yazd country: IRAN
Geographic orientation *		<input checked="" type="checkbox"/> global <input type="checkbox"/> region
Year of establishment		2006
Themes	Focal Areas *	<input checked="" type="checkbox"/> groundwater <input type="checkbox"/> urban water <input checked="" type="checkbox"/> arid / semi-arid zones <input type="checkbox"/> humid tropics <input type="checkbox"/> droughts and floods <input type="checkbox"/> sediment transport and management <input checked="" type="checkbox"/> water and environment <input type="checkbox"/> ecohydrology <input type="checkbox"/> water law and policy <input type="checkbox"/> transboundary river basins/ aquifers <input type="checkbox"/> IWRM <input type="checkbox"/> global and climate change <input type="checkbox"/> mathematical modelling <input checked="" type="checkbox"/> social and cultural dimensions of water <input checked="" type="checkbox"/> water education <input type="checkbox"/> other: (please specify) _____
	Scope of Activities *	<input checked="" type="checkbox"/> vocational training <input type="checkbox"/> postgraduate education <input type="checkbox"/> continuing education <input checked="" type="checkbox"/> research <input checked="" type="checkbox"/> institutional capacity-building <input checked="" type="checkbox"/> advising/ consulting <input type="checkbox"/> software development <input type="checkbox"/> other: (please specify) _____
Support bodies ¹		Ministry of Energy of the Islamic Republic of Iran (IRI)
Hosting organization ²		
Sources of financial support ³		IRI Ministry of Energy, IRI Ministry of Agriculture, UNESCO Tehran Cluster Office
Existing networks and cooperation ⁴		G-wadi network, International Water History Association
Governance		<input checked="" type="checkbox"/> director and governing board <input type="checkbox"/> other: (please specify) _____ Link to election of board members to the IHP IGC and hosting country IHP National Committee _____ Frequency of meetings: once every 1year(s) <input checked="" type="checkbox"/> Existence of UNESCO presence at meetings

* check on appropriate box
 ♦ check all that apply

¹ please specify bodies that cover the operational costs of the centre, and other essential costs such as salaries and utility bills, and that provide institutional support to ensure centre's sustainability

² if different from support bodies

³ please specify sources of main budgetary and extrabudgetary funds to implement projects

⁴ please write international networks, consortiums or projects that the centre is part of, or any other close links that the centre has with international organizations or programmes, which are not already mentioned above

Institutional affiliation of director	Ministry of Energy
Number of staff and types of staff	total number of staff (full-time, or equivalent) : _____11_____
	number of staff who are water experts: _____5_____
	number of visiting scientists and postgraduate students: _____10_____
Annual turnover budget in USD	200,000 USD

2. Activities undertaken in the framework of IHP in the period June 2008 – May 2010

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VI and WWAP

One of the Educational activities of ICQHS which can be categorized under the topic of educational activities was an educational program in the framework of some courses on qanat for Iranian Experts.

The efforts made by ICQHS to pave the way for an educational campaign for the experts involved in qanat technology eventually led to an agreement which was signed by the Iranian ministries of energy and agriculture in early 2009. According to this agreement the ministry of energy undertook to hold some short term training courses on the indigenous techniques of groundwater extraction so that the experts of the both ministries can attend these training courses.

The first round of this program on the technology of Qanat was held at ICQHS on 11 October 2008, in which 18 experts from different parts of the country enthusiastically participated, and all of them passed the final exam of the course successfully. The second round which started on 1 November 2008 was attended by 12 trainees including the experts and directors of the water related centers of Yazd. The third round was held between 20 and 25 December 2008, in which 23 trainees from the provinces of Fars and Semnan participated enthusiastically, and they expressed their interest in the future advanced courses if held. In the one week preliminary course, we tried to give an overview of geology, groundwater, surface water, hydrography, hydraulic, history of qanat, topography, qanat terminology, and social and cultural aspects of qanat. The classes were administered like a round table in a mutual way, so that the trainees could freely discuss the issues with the lecturers to gain a better result. Field tours were also organized to take a closer look at some alluvial plains and qanats and the gullies feeding the qanats.

2.2 Research activities that directly contributed to the IHP-VI and activities by WWAP

ICQHS has conducted some research projects in line with IHP-VI, whose results have been published as books or papers.

A. A survey on the negative impacts of the developmental projects on qanats and the ways to prevent the further destructions. This project is being done with the support of the Iranian ministry of energy (WRMO).

B. A survey on the qanats of Nakhchivan (Republic of Azerbaijan). Taking into account the importance role the qanat system is playing in Nakhchivan, a comprehensive study was done in the wake of a contract between IOM International Organization for Migration and ICQHS. The focal point of this agreement is an assessment of the situation of qanats as well as the efficiency of the procedure conducted by IOM herein. Given that most of the rural areas are in the grip of water scarcity, the villagers are completely prone to immigrate to the larger towns and cities, bringing about lots of social and economical side effects. On the other hand, drilling pumped wells to

quench the thirst of the farmlands is not an appropriate remedy, because the experiences of some similar countries show that resorting to pumped wells may lead to the depletion of groundwater, earth subsidence, groundwater salinity and eventually the annihilation of groundwater resources. Therefore, it is wiser to pay more attention to the traditional techniques such as qanats which are in harmony with environment.

- C. **Study on Extracting Electricity from Qanat; A New Environment Friendly Source of Energy.** In Iran, extracting energy from groundwater flow was an ancient technical tradition which unfortunately has been abolished in the wake of the advent of modern means of power generating. The subterranean irrigational canals called Qanat in Persia made it possible to build many watermills rotating with the force of groundwater. Qanat is a gently sloping subterranean canal, which tap a water-bearing zone at a higher elevation than cultivated lands. At present there exist some 34355 active qanats running all over Iran, discharging about 8.2 billion cubic meters groundwater a year. The head of water in a qanat canal with a discharge of 80 liters per second is such that the flow can spin a millstone weighing over 800 kilos, in a traditional way in which the friction is so high. ICQHS experts are studying on the possibility of replacing the abandoned traditional watermills with the modern optimized turbines to generate electricity in an environment friendly way. The qanat holding countries like Iran, Oman, Afghanistan, China, Pakistan, Azerbaijan and Iraq can consider the qanat system a new source of energy, which not only can supply water to the rural communities but also can provide them with cheap, renewable and clean electricity. We also reflect upon some considerable initiatives taken in Iran to make use of the groundwater flow in the qanat canals to generate electricity.
- D. **Study on possibility of using the qanat of Dowlat-Abad in supplying drinking water to the town of Mehriz.** Given that the town of Mehriz has long been in the grip of water shortage, ICQHS put on agenda the issue of supplying drinking water to the town by using qanat system. A research project was conducted on the situation and potential of the qanat of Dowlat-Abad in cooperation with some resourceful engineers and local authorities. After a year of study, the final report was prepared and submitted to the Yazd Water and Wastewater Company as agreed in a contract signed between ICQHS and them
- E. **Study on determining the buffer zone of the qanats of Arsanjan, the province of Fars, Iran.** Following the request of the Iranian ministry of agriculture, four active qanats named Ayeshe, Bonab, Ketk and Mahmood Abad in the region of Arsanjan were examined by the ICQHS experts. They wanted ICQHS to figure out how to determine the buffer zone of these qanats, so that the qanats would not be affected by human activities. After a comprehensive study, a technical report was submitted to the ministry of agriculture, explaining the characteristics of these qanats in terms of their buffer zone. Also it was suggested to nominate these qanats to be included in the list of national heritages.
- F. **Qanats of Emamiyeh and Qasem-Abad in Mashhad, northeast of Iran.** Upon the recommendation of Mashhad Water and Wastewater Company, the ICQHS experts paid a visit to the Qanats of Emamiyeh and Qasem-Abad in Mashhad. Following this visit, it was agreed to exchange a contract between ICQHS and the company on identification of these qanats as well as their nomination for the national heritage list. This project is under way now.
- G. **Shekh Mamudian (Iraq) Kahriz Renovation; Study phase.** The kahriz (qanat) of Sheykh Mamudian is located in a village named the same, in the region of Erbil, Iraq. Since some two years ago, the kahriz came to drizzle and gradually dried up. It seems that the main reason of its drying is negligence and lack of a regular maintenance, though we can not rule out the role of the recent droughts which has led to the depletion of groundwater in the area. In 2005, the villagers managed to repair the kahriz which was on

the verge of annihilation. Later UNDP helped them to go ahead with the project by cleaning out the gallery and shoring up the wells and the gallery with stone, though this job did not lead to the qanat flowing. To find the best solution for the kahriz, ICQHS team was dispatched to the field to examine the present situation of the kahriz on 23 July 2009 for 3 weeks. ICQHS experts traveled from the exit point to the kahriz mother well to see up-close what has happened to the kahriz. Eventually they chose the option of deepening the old gallery from the third shaft well down. They measured the well depth and the depth to water level in some other wells nearby and compared them to each other. Afterward they came to the conclusion that the water table might be 1.5 m below the bottom of the third well of the kahriz. They had the bottom of the well dug and eventually their prediction came true.

H. Program of applied studies on preservation and development of qanats. With reference to the article 16 of the bill no. 37018-11151 ratified by the board of ministers of the Islamic Republic of Iran, a special budget was allocated to the applied studies on preservation and development of qanats, and the Iran Water Resources Management Organization was specified responsible for the implementation of this program. The director of ICQHS was appointed as the program representative by the director general of the Iran Water Resources Management Organization. The above mentioned program encompasses the following research projects:

- Preparing qanat encyclopedia
- Preparing the atlas of qanats
- Study on the outstanding qanats to nominate them for UNESCO world heritage list
- Application of new technologies in qanat construction
- Methods to determine qanat buffer zone
- Enhancing public awareness on qanat system
- Documenting traditional know how

2.3 Training activities that directly contributed to the IHP-VI and WWAP objectives

• **Training Course for Iraqi Experts:** ICQHS has organized a two week technical training course on qanat for Iraqi experts between 28 June and 11 July 2008. UNESCO Office for Iraq has recommended the center to foresee such a training course to update the Iraqi experts on the methods of rehabilitating and repairing qanat systems, in order to better preserve this technique in Iraq. The main objectives of the course are to:

- 1- incorporate the indigenous knowledge into the new methods of construction, preservation, rehabilitation and operation of Qanat systems.
- 2- get familiar the Iraqi experts with the significant role the Qanats in Iraq can play in sustainable groundwater exploitation.
- 3- get familiar the Iraqi experts with the cultural and technical values the system of Qanat carries. This technical course has been started on 28 June 2008.

The training course was composed of 2 parts: theoretic part and practical part. The theoretic part covered 80 hours and 30 hours went to some field visits.

Four main courses were administered for the theoretic part:

Identification of Qanat which covered all basic definitions fundamental and principals issues of qanat.

Qanat building method: This course explained all methods used for construction and maintenance of qanat and introduced new technologies in qanat construction and maintenance.

Technical bound and legal vicinity of qanat was another topic of our training course. And finally we introduced the different methods used for rehabilitation and maintenance of qanats.

• **Contribution to the world water forum by holding three training courses (16-22 March 2009):** The International Center on Qanats and Historic Hydraulic Structures participated in the world water forum that took place between 16 and 22 March 2009 in Turkey. ICQHS held three training courses as follows, which were welcomed by the participants:

•How to preserve & rehabilitate Qanats as a sustainable irrigational technique in arid & semi-arid regions?

•How can water play a role in the political history in the arid & semi-arid regions?

•How to enhance the economic efficiency of Qanats?

Also, the director of ICQHS gave a presentation on "the present situation of qanat in the world and its role in sustainable development" at the UN pavilion. The participants could get a view of the center's activities and missions through some brochures handed out.

• **Second international conference on water, environment and sustainable development in arid and semi arid region (WATARID):**

This scientific gathering which took place at ICQHS from 6 to 8 May 2009 brought together some scholars from academic and research centers from different countries like French, China and Iran. At this event many invaluable scientific issues were discussed, and the conference ended with a declaration with ten articles emphasizing the significant role of Iran in nourishing the world culture and civilization especially in the field of water mining and water management.

• **Training course on qanat technology for Azerbaijani experts (from Nakhchivan):** This training course was held between 13 and 19 April 2009 at the International Center on Qanats and Historic Hydraulic Structures. The experts of IOM Nakhchivan visited several qanats in Yazd and were acquainted with new methods of construction and rehabilitation, after attending their classes.

• **Holding a two week training course for the qanat practitioners of Azerbaijan:**

A training course on the qanat renovation methods took place between 18 and 30 July 2009 at the International Center on Qanats and Historic Hydraulic Centers. This course included two parts as theoretical and practical. The theoretical part was administered at the center and the practical consisted in some field visits to the qanats that were under repair. The theoretical part contained the following topics:

•An introduction to qanat

•Methods of qanat construction

•Methods of qanat maintenance and rehabilitation

•Application of modern devices in qanat construction

•Safety in qanat

• **Training Course on "Restoration and Maintenance of Karez: Advanced Techniques in Planning, Methodology and Applications" for Iraqi Experts:**

This training course took place at ICQHS between 7 and 21 December 2009. This course was built on the last course that took place between 28 June and 11 July, 2008 in the historical city of Yazd which is famous as the capital of qanats. The last course was focused on almost principles of qanat and some general issues revolving around qanat technology of which everyone involved in qanat system should be aware. Given that our syllabuses were in fact the continuation of that of last course, UNESCO Iraq office dispatched those who had attended the last course. Seventeen Iraqi experts most of whom were geologist from Kurdistan region attended the course, because almost all of the qanats of Iraq are located in Kurdistan region where qanat still has a role to play in rural economy. This course covered the following topics:

•Groundwater surveying techniques and tools

•Materials and bills-of-quantity drafting

•Mathematical models in qanat reconstruction

- Techniques for mitigating against physical hazards to qanats
- Application of new methods and technologies in qanat restoration
- Interview-based groundwater assessment using qanats and traditional wells for data
- Geographic information system (GIS) for managing qanat resources and regional qanat networks
- Harvesting seasonal floods and replenishing the aquifer
- Qanat geology
- Enhancing the economic efficiency of qanats
- Qanat cartography
- Qanat documentation and registration
- Water and qanat legislation (laws)

Also some field visits were envisaged for the trainees. The field visits were in fact complementary to the lectures given, and the trainees could experiment all the issues up close. Many qanat were chosen to be visited in the provinces of Yazd and Isfahan according to their different characteristics. Some of the qanats were mountainous and long and some were plain and short, some were relatively new and some were historical and ancient, some were under reconstruction and some were left abandoned. Thus the trainees could see a variety of qanats in different types and conditions, and their leader's explanations supplemented what they had learned during the theoretical classes. Moreover some meetings with traditional qanat practitioners were envisaged during which the trainees could have dialogue directly with the Iranian qanat masters, asking about their indigenous knowledge. Some issues like how to locate a qanat, how to find right direction underground, how to refurbish a qanat, etc were brought up during those alive meetings. At the end of the training course an exam was administered, which included some questions about all the issues discussed during the course. This exam was aimed at evaluating the efficiency of the training course and its effect on the participants' knowledge on the system of qanat.

3. Collaboration and linkages

3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies
ICQHS is an official member of the International Water History Association, and has a close cooperation with them. Also ICQHS is in close contact with UNESCO Regional Centre on Urban Water Management (RCUWM – Tehran) and the director of this center is one of the members of ICQHS governing board.

3.2 Participation in meetings related to the IHP and UNESCO (e.g., the UNESCO General Conference, the UNESCO Executive Board, the IHP Intergovernmental Council and/or other meetings organized by IHP)

To date ICQHS has participated in some meetings of this kind such as:

- a) Meeting of the Directors of Water Related Centers (Category I and Category II Centers) in Delft, the Netherlands, IHE-UNESCO Venue, 11-12 June 2007*
- b) Meeting of Asia-Pacific Category II Water-Related Centers, Bangkok, Thailand, UNESCO, 26-27 September 2007*
- c) Cooperation in organizing a training course on history of water management at UNESCO-IHE, 14-18 September 2009*

3.3 Collaboration and networking with other UNESCO category 1 or 2 institutes/ centres

3.3.1 cross-appointment of directors of the category 1 or 2 institutes or centres on the governing board

The Director of the Regional Center on Urban water Management (RCUWM) is a member of the Governing Board of ICQHS.

3.3.2 exchange of information on activities such as training/educational materials, and funding opportunities

Following the invitation of Research Institute for Humanity and Nature (RIHN), ICQHS attended the International Water Symposium in Japan and gave two presentations on qanat and its relation with environment on 6 and 8 March 2010. Also, it was agreed that the issue of the membership of RIHN in the governing board of ICQHS would be put on the agenda, given the common objectives of both centers.

3.3.3 exchange of staff, most notably professionals and students

3.3.4 implementation of joint activities, such as workshops, conferences, training programmes, joint projects, field visits, software and data sharing, knowledge exchange and publications

In 2010, ICQHS has published a book entitled "Veins of Desert" in cooperation with Iran Water Resources Management Company.

3.4 Relationships with the UNESCO field office whose jurisdiction covers the country of location

ICQHS is in close relationship with UNESCO Tehran Cluster Office (UTCO). Most of our research and training activities are done under the supervision of this office. Recently ICQHS and UTCO are jointly organizing an International Conference on traditional knowledge for water resources management: Lessons learnt from Sustainability, Adaptation to Climatic Variability, right Level of Decision-Making, and Socio-Cultural compatibility. This conference is to be held in May 2011.

3.5 Relationship with the UNESCO National Commission and the IHP National Committee in the country of location

Director of ICQHS is member of IHP National Committee and regularly attends its meetings which are held every month in Tehran.

3.6 Relationship with other UNESCO-related networks, such as UNESCO Clubs, ASPnet, and UNESCO chairs

There are some cooperation and links between ICQHS and UNESCO Iraq Office in the field of training. Also, upon their recommendation we are in the process of translating some books for Iraqi experts.

4. Communication

4.1 Communication and knowledge dissemination activities undertaken in the framework of IHP

Herein ICQHS has taken some measures as follows:

a. Putting forward a proposal on adding some information on Qanat to the primary schools textbooks

b. Getting on Iranian TV programs to describe the importance of Qanats and historic hydraulic structures in order to enhance the public awareness about the role of traditional water harvesting systems in sustainable development.

c. Teaming up with some directors in making some documentary movies and animations about Qanats and historic hydraulic structures

4.2 Policy documents and advice

5. Update on Centre Operations

5.1 Membership of the Board of Governors during designated period

The International center is administered by a Governing Board composed of:

a. A representative of the Iranian Government.

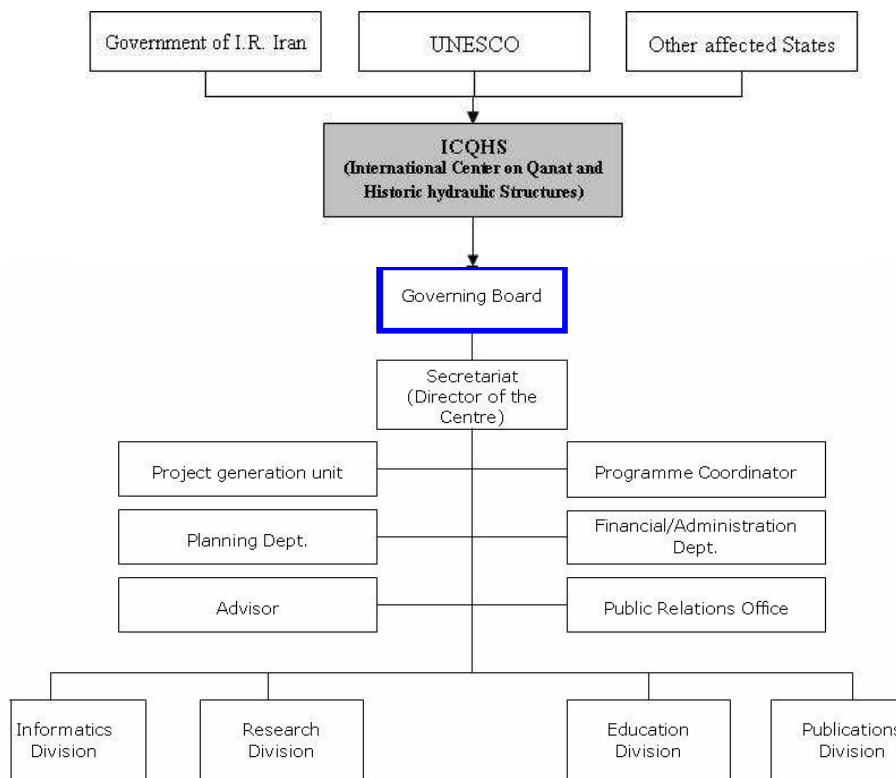
b. A representative of each of the other Member States that have sent the Director General of UNESCO notification, and make a substantial contribution to the operating budget or running of the international center, and are thus accorded a seat by a decision of the Governing Board.

c. A representative of the Director- General of UNESCO.

d. Director of the Regional center on Urban water Management (RCUWM) Tehran.

- e. A representative of any other intergovernmental organization or international non governmental organization making a substantial contribution to the operating budget or running of the international center and accorded a seat by a decision of the Governing Board.
- f. The Minister of Energy (Minister in charge of water affairs) of the Islamic Republic of Iran or the person he designates.

The I.R. of Iran's minister of energy has designated deputy minister in water and wastewater affairs as the chairman of the governing board and has also invited the water-related ministers of some qanat holding countries. The first governing board meeting took place in July 2008, with the presence of Dr. Nagy UNESCO's representative and the representatives of the countries Iraq, China, Afghanistan and Pakistan. The Second Governing Board meeting of ICQHS was held in Yazd-Iran, 23 November 2009. The meeting was attended by the representatives of Azerbaijan, Iraq, UNESCO, Regional Centre on Urban Water Management (RCUWM - Tehran), Director of ICQHS and the chairperson of the governing board.



5.2 Key decisions made (attach minutes of meetings)

At the beginning of the second governing board meeting of ICQHS, the chairperson drew the attendees' attention to the fact that following the agreement signed and exchanged between I.R. Iran and UNESCO regarding the establishment of the International Centre of Qanats and Historic Hydraulic Structures, the Islamic Republic of Iran has made its utmost efforts to implement its commitments and in this concern necessary equipments have been provided for the Centre. A report was presented on the activities of the center and their outcome, which were evaluated by the members. The members also discussed some other issues like Financial Resources and Fund Raising of the center.

6. Assessment of the Centre's Impacts

6.1 Science Impacts (Major contributions to the science, technology, education, and regional and/or international cooperation in the field of water)

Publications of ICQHS are playing an important role in enhancing public awareness about qanat system and rational exploitation of groundwater, at least in the host country, Iran.

6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)

Although ICQHS has been established recently, to date it could have made some progresses in disseminating knowledge and transferring technology through the following activities:

- *Training students: ICQHS set up the training center of Qanat where the traditional methods are handed down to tens of students learning how to protect and develop the system of Qanat.*
- *Documenting indigenous know how: ICQHS has sent out expeditions to gather traditional knowledge on Qanat through interviewing the elderly Qanat masters the last generation who are vanishing. The book Qanat from Practitioners' Point of View contains some of that information.*
- *Holding technical workshops: ICQHS periodically holds technical workshops for those who are involved in groundwater or Qanat-related issues. These events are aimed at incorporating the indigenous knowledge into the new methods of construction, preservation, rehabilitation and operation of Qanat systems. Through such workshops the participants can get familiar with the significant role the Qanats can play in sustainable groundwater exploitation, and also with the cultural and technical values the system of Qanat carries.*

6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)

ICQHS started some negotiations at governmental level which eventually led to an official agreement between the Iranian Ministry of Energy and Ministry of Agriculture. This agreement emphasizes the necessity of training on Qanat technology that the experts of both ministries should receive from ICQHS. Also this agreement stipulates that both ministries should allocate a fund to research projects on different aspects of Qanats, which would be done by ICQHS.

7. Future activities that will contribute directly to IHP and/or to WWAP

7.1 Operational Plan (2008-2009) (attach operational plan for 2008-09 if available)

ICQHS's future activities mostly pertain to research and training as follows:

a. *future training activities: ICQHS is in the process of organizing an International Training Course on Qanats (Karizes) for Islamic countries, in cooperation with Islamic Development Bank. The main objectives of the course are to:*

- *Disseminate world experiences on various aspects of Qanats;*
- *Incorporate the indigenous knowledge into the new methods of construction, preservation, rehabilitation and operation of Qanat systems;*
- *Turn Qanats into an interdisciplinary tool where the traditional know - how and the modern techniques work together;*
- *Acquaint experts with the importance of cultural and technical aspects of Qanat systems as well as the community life linked to these systems.*

b. *future research activities:*

- *Preparation of the Methodology of the Atlas of: in case this project would be successfully finished, we can make use of this methodology in extending the work to other areas in order to prepare the world atlas of Qanats.*

- *Introduction of modern technology to operation and maintenance of Qanats: this project examines how to apply the modern technologies in the construction and maintenance of the Qanats.*
- *A Survey on the Historical Effect of Qanat on the Scio-Political structures in Central Plateau of Iran*
- *the Role of Qanat in Settling the Human Communities and Creating the Agricultural Civilizations in Northern Khorasan*

7.2 Strategic Plan linked with IHP-VII (attach strategic plan for 2008-11 if available)

8. Annexes

8.1 List of publications released by the centre (there can be overlap with those listed in 2.2 above)

- *The book Qanat from Practitioners' Point of View*
- *The book A Survey on the Qanats of Bam from Engineering Point of View*
- *English version of the book A Survey on the Qanats of Bam from Engineering Point of View*
- *Country report of Qanats of Afghanistan, Iran and Pakistan*
- *The book Qanat of Zarch*
- *Proceedings of the workshop on Groundwater Artificial Recharge and Rainwater Harvesting in Arid and Semi – Arid Regions of Asia*
- *Proceedings of the first international training course on Qanat; A Multidisciplinary Approach to Integrating Traditional Knowledge with Modern Development*
- *Veins of Desert*

8.2 List of training courses conducted (there can be overlap with those listed in 2.3 above)

- *Workshop on Groundwater Artificial Recharge and Rainwater Harvesting in Arid and Semi – Arid Regions of Asia*
- *First international training course on Qanat; A Multidisciplinary Approach to Integrating Traditional Knowledge with Modern Development*
- *Training Course for Iraqi Experts*
- *Training course on qanat technology for Azerbaijani experts (from Nakhchivan)*
- *Training course for the qanat practitioners of Azerbaijan*
- *Training Course on "Restoration and Maintenance of Karez: Advanced Techniques in Planning, Methodology and Applications" for Iraqi Experts*

Format for Reports by UNESCO's Water-related Centres on activities related to the IHP in the period June 2008 – May 2010

1. Basic information on the Centre

Name of the Centre	Dundee IHP-HELP Centre for Water Law, Policy and Science, under the auspices of UNESCO (Category 2)
Name of Director	Professor Patricia Wouters
Name and title of contact person (for cooperation)	Professor Patricia Wouters
E-mail	p.k.wouters@dundee.ac.uk
Address	Peters Building University of Dundee DD1 4HN Scotland UK
Website	http://www.dundee.ac.uk/water/
Location of centre	city/town Dundee; country Scotland UK
Geographic orientation *	X global X regional
Year of establishment	
Focal Areas ♦	X groundwater X urban water <input type="checkbox"/> arid / semi-arid zones X humid tropics X droughts and floods <input type="checkbox"/> sediment transport and management X water and environment X ecohydrology X water law and policy X transboundary river basins/ aquifers X IWRM
Themes	<input type="checkbox"/> global and climate change <input type="checkbox"/> mathematical modelling X social and cultural dimensions of water X water education <input type="checkbox"/> other: (please specify) _____ X vocational training X postgraduate education X continuing education
Scope of Activities ♦	X research X institutional capacity-building X advising/ consulting <input type="checkbox"/> software development <input type="checkbox"/> other: (please specify) _____
Support bodies ¹	Scottish Government; University of Dundee; EU project work
Hosting organization ²	University of Dundee, Scotland, UK
Sources of financial support ³	University of Dundee; Research projects; Graduate teaching programme.
Existing networks and cooperation ⁴	UNESCO Centres
Governance	X Director and governing board <input type="checkbox"/> other: (please specify) _____

* check on appropriate box

♦ check all that apply

¹ please specify bodies that cover the operational costs of the centre, and other essential costs such as salaries and utility bills, and that provide institutional support to ensure centre's sustainability

² if different from support bodies

³ please specify sources of main budgetary and extrabudgetary funds to implement projects

⁴ please write international networks, consortiums or projects that the centre is part of, or any other close links that the centre has with international organizations or programmes, which are not already mentioned above

	Link to election of board members to the IHP Intergovernmental Council (IGC) and hosting country IHP National Committee
Institutional affiliation of director	Frequency of meetings: once every year(s) X Existence of UNESCO presence at meetings University of Dundee
Number of staff and types of staff	Total number of staff (full-time, or equivalent) : 6 FTE academics; 3 support staff; 3 Research Assistants; 2 post-docs; 10 PhD students Number of staff who are water experts: all academic staff Number of visiting scientists and postgraduate students: - 8 FT PhD students; 1 PT PhD student; various visiting researchers
Annual turnover budget in USD	£1M.

2. Activities undertaken in the framework of IHP in the period June 2008 – May 2010

- 2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII (Appendix-1) and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.

The Dundee IHP-HELP Centre is an interdisciplinary research and graduate teaching centre covering water law policy and science. The Centre is located in the Graduate School of Natural Resources Law, Policy and Management (University of Dundee), and offers a portfolio of graduate degrees (Masters and PhD levels) under the umbrella of its “**Water Law, Water Leaders**” (WLWL) programme. The degree courses on offer are delivered in executive-style modules (concentrated modules), primarily through our summer WLWL taught programme and include:

- LLM Water Governance and Conflict Resolution first cohort enrolled October 2008 – in partnership with UNESCO IHE-Delft;
- LLM Water Law validated summer 2008, first cohort enrolled January 2009
- MSc Water Resources Management and Law validated spring 2010 – in partnership with UNU INWEH. First cohort will begin January 2011.
- PhD (Enrolment, through an international recruitment, of 7 scholarship PhDs under start-up grant from Scottish Government; 2 post-doc researchers appointed under SRDG grant; Research Assistants appointed on research project work.)

The Dundee IHP-HELP Centre, through its research and Water Law, Water Leaders programme, seeks to contribute to the effective management of the world’s water resources in a way that ensures “water for all” and facilitates the development of a new generation of local water leaders.

- 2.2 Research activities that directly contributed to the IHP-VII and activities by WWAP
Please include research/applied projects outputs such as publications that directly contributed to the IHP-VII and WWAP objectives

The Dundee IHP-HELP Centre continues to contribute to a range of topics under the IHP-VII. Thus, most of the 5 research themes of IHP-VII are covered in some aspects – with a strong focus on River Basins & Aquifer Systems, water governance, water and life support systems, and water education. (See details in Annex 4 and 5). Under the IHP-VII thematic area one, the Dundee publications primarily focus on hydrological cycles, hydro hazards, groundwater systems through the focal areas (1.1, 1.3, 1.4, and 1.5). Under Thematic area two, the significant body of publications covering water governance demonstrates the Centre’s interdisciplinary research, covering diverse topics such as cultural, societal and scientific responses to river basin management, including addressing complex transboundary water management issues (focal areas 2.1 and 2.4).

Further, the Dundee IHP-HELP has a dedicated team of scientists researching on ecohydrology and catchment management issues (theme – 3). The **Water Law, Water Leaders programme** makes an important contribution to the water education theme of IHP-VII. (for more information, see www.dundee.ac.uk/water)

The Dundee IHP-HELP Centre's research projects under the EU framework programme also support many of the themes under IHP-VII; following is a summary of this work:

EU Funded Applied Research Projects:

- **LIVEDIVERSE (2009-2012):** This research project seeks to develop new knowledge on the interaction between livelihoods and biodiversity within the riparian and aquatic contexts. Our role is to seed engagement across civil society in the project. <http://www.livediverse.eu/> - Country Focus – (Vietnam, India, Costa Rica and South Africa)
- **STRIVER (2006-2009)** Strategy and methodology for improved IWRM - An integrated interdisciplinary assessment in four twinning river basins is a three year EC funded project under the 6th framework programme (FP6) STRIVER developed methodologies for Integrated water resources management (IWRM) in an Asian-European context. The project had a strong emphasis on local stakeholder involvement, enabling and supporting local capacity development and uptake." (<http://kvina.niva.no/striver/>)
- **BRAHMATWINN (2006-2009);** BRAHMATWINN enhanced capacity to carry out a harmonised integrated water resources management (IWRM) approach as addressed by the European Water Initiative in headwater river systems of alpine mountain massifs already impacted from climate change, and to establish transfer of professional IWRM expertise, approaches and tools based on case studies carried out in twinning European and Asian river basins. The project addresses all important IWRM issues in a balanced way, including conflict resolution in the trans-boundary Danube and Brahmaputra River Basins in Europe and South Asia respectively. <http://www.brahmatwinn.uni-jena.de/index.php?id=5314&L=2>
- **Assessing Climate Impacts on the Quantity and quality of Water (ACQWA)** ACQWA aims to assess the impacts of a changing climate, focusing on the quantity and quality of water originating in mountain regions, particularly where snow- and ice melt represent a large, sometimes the largest, stream-flow component. Our role in the project is to focus on the social and environmental impacts of climate change. (<http://www.acqwa.ch/>)
- **Groundwater and Dependent Ecosystems: New Scientific and Technological Basis for Assessing Climate Change and Land-use Impacts on Groundwater (GENESIS).** The objective of GENESIS is to integrate pre-existing and new scientific knowledge into new methods, concepts and tools for the revision of the Ground Water Directive and better management of groundwater resources. We focus on providing legal assessment of this Directive. http://www.bioforsk.no/ikbViewer/page/prosjekt/forside?p_menu_id=16904&p_sub_id=16859&p_dimension_id=16858&p_dim2=16859
- **Suez Research Contract:** Comparative analysis of governance in water services provision (sanitation and water supply) as part of a contract for Suez Environment. The focus of this contract is the need for transparency, public participation and access to justice for water consumers.

National/Regional Projects: (Scotland)

- **Tweed Basin. The Dundee IHP-HELP Centre** is working with the Tweed River basin forum to develop this as a HELP basin. This moves forward on a number of

fronts. *The Eddleston Scoping Study* (a tributary of the TWEED HELP basin) financed by the Scottish Govt. and SEPA through the Tweed Forum. Initiated in 2009 (and on-going) to set out a trans-disciplinary research framework linked with Natural Flood Management (IHP Focal Areas 1.1/ 1.2/ 1.3/1.4/2.4/ 3.1/3.2/3.3/3.4/4.1/4.4/5.1) (for more details, see Annexes 6 and 7 – Minutes of UK-IHP National Commission).

- *River Restoration on the Eddleston Water* (2010-12). Following on from the successful £38k Scoping Study managed by the Tweed Forum (see above in publications), the UNESCO team are now planning a three year project in which, following monitoring of surface and sub-surface water systems, a programme of river restoration and natural flood management measures will be deployed across the catchment. This work will be supported by an investment by the Scottish Government and SEPA of around £250k.
- *Invisible hazard: pluvial flooding in urban areas*, (with Donald Houston and Alistair Geddes - Geography). (2010-2012) This is an 18 month £87k project funded by the Joseph Rowntree Trust which explores the potential impact of increased pluvial (urban) flooding on vulnerable people and communities across the UK. The UKCP09 weather generator will be used to determine potential uplifts in 24 hour maximum rainfall and, at four sites, the resulting pluvial flooding will be modelled using state of the art inundation models. Indices of social deprivation in the targeted urban areas will then ascertain whether the socially most vulnerable will be disproportionately impacted.

Associate Programmes:

The Dundee IHP-HELP Centre has contributed to the IHP-VII Associate Programmes in a number of ways, including:

- Founding member of the International Flood Initiative (IFI) and contributing to the legal inputs under the IFI.
 - Water for Peace (PCCP) programme; Collaborated with UNESCO PCCP in the preparation and convening of the day-long transboundary waters workshop at the Stockholm World Water Week (August 2009).
 - ISARM programme - Professor Wouters is on the scientific committee for the December 2010 conference
 - Education, Training and Capacity Building across all the themes – Water Law Water Leaders, PhD programme
 - Collaborated with UNDP-CAPNET in preparing a training manual for Latin American water law.
 - Contributed to the Istanbul World Water Forum (Istanbul 2009), coordinating efforts with a number of UN bodies.
-
- **Contribution to WWAP**

Professor Patricia Wouters co-chaired the Legal Experts Group with Dr Stefano Burchi (an honorary Associate of the Dundee Centre). Professor Wouters and Dr Hendry convened conference calls, attended meetings and directed the contribution on the legal side, working actively with the WWAP team in the contribution of the legal inputs for the WWDR. Dr Sarah Hendry and Professor Wouters prepared, reviewed and edited the legal report and contributions to the WWDR (World Water Development Report) presented at Istanbul (2009). The Centre academic staff was actively involved in the preparation of the water law, policy and science contribution to the next WWDR and work closely with Olcay Unver and Bill Cosgrove in supporting the WWAP work.

2.3 Training activities that directly contributed to the IHP-VII and WWAP objectives

The Dundee IHP-HELP Centre continues to provide training in the area of water law, policy and science. Over the past two years, we can highlight our work in Africa, Latin America, and Europe and in the UK.

- Dr Michael Hantke-Domas conducted water law training in South Africa on issues related to transparency, building upon the research he presented at the Istanbul World Water Forum and seeking to address issues related to corruption, through legal regulatory frameworks.
- Dr Hantke-Domas gave inputs to prepare a UNDP-CAPNET training manual on water law that is now used across Latin-America. The work considered international and national water law and was aimed at supporting national governments in devising and implementing their water policies through robust legal and administrative frameworks.
- Week-long specialized training programme for a high-level delegation from Malawi, "Water Sector Reform – PPP Options & Transactions, and Regulatory Issues" (May 2010).
- Short course in Leadership for the Water Sector (summer 2009) under the umbrella of the Dundee Water Law, Water Leaders programme
- Dr Alistair Rieu-Clarke contributed to specialized training on transboundary water resources management at the International Boundaries Research Unit at University of Durham (23-24 July 2009). He will deliver further training this summer (2010) in Durham on a similar topic.
- Professor Chris Spray supports education, training and policy advice across Scotland and the UK.

3. Collaboration and linkages

- 3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies

UN linkages

- IHE-Delft;
- Brazil Hidroex UNESCO Centre, and
- the Regional Centre on Urban Water Management-Tehran. The RCUWM and Dundee will convene a joint symposium in Dundee on International Water Law (June 2010), which will attract a significant number of international speakers and delegates. (See Symposium programme, Annex 7).
- UNU-INWEH: a joined-up degree programme under the Dundee Water Law, Water Leaders umbrella; new MSc in Water Resources Management and Law validated spring 2010, in partnership with UNU INWEH, will have its first cohort of students in January 2011.

Research Networks

UK

- UK : Scottish Alliance for Geoscience, Environment and Society; Royal Society of Edinburgh (Vice Chair of Climate Change Inquiry;
- Scottish Executive/Scottish Government : (Flooding Issues Advisory Committee; Flooding Bill Advisory Group; Flood Risk Management Advisory Group) ;
- Macaulay Land use Research Institute (Aberdeen): Member of Governing Board and Trustee
- Member of Board of the New Institute: (merger of the Macaulay Land Use Research Institute and the Scottish Crop Research Institute.);
- UK Environmental Law Association:

EU

- EU Framework programmes (i.e. EC STRIVER Project, EC Brahmatwinn Project. EC LiveDiverse Project; EC Genesis Project).

International

- Professor Wouters is a member of Global Water Partnership Technical Experts Committee (GWP-TEC);
- Professor Wouters sits on the Global Agenda Council of the World Economic Forum
- Professor Werritty was a member of UN High Level Expert Panel on Water and Disasters (reported at the Fifth World Water Forum 2009 Ankara).
- Member of IUCN Commission on Environmental Law on transboundary waters matters
- Member of the Universities Partnership on Transboundary Waters, which works closely with UNESCO PCCP.

3.2 Participation in meetings related to the IHP and UNESCO (e.g., the UNESCO General Conference, the UNESCO Executive Board, the IHP Intergovernmental Council and/or other meetings organized by IHP)

The Dundee IHP-HELP Centre has participated in IHP and UNESCO meetings, including:

- IHP Intergovernmental Council (July 2008)
- HELP workshop on Governance in Guadiana, Portugal in June 2009.
- Global Evaluation Committee for the third call for membership of the HELP programme (Ecuador session 2009).
- Annecy HELP meeting (2008).
- UN IHP National Committee meetings (see Annexes)

3.3 Collaboration and networking with other UNESCO category 1 or 2 institutes/ centres

3.3.1 cross-appointment of directors of the category 1 or 2 institutes or centres on the governing board

The Dundee IHP-HELP Centre through its Governing Board involves directly a UNESCO IHP representative (Professor Shahbaz Khan sits on the Governing Board of the Dundee Centre), with provision in the statutes as well for UNESCO member state involvement. Professor Wouters has been invited to be on the board of the Regional Centre on Urban Water Management-Tehran. Professor Wouters sits on the International Advisory Committee of United Nations University Institute of Water, Environment and Health (UNU-INWEH).

3.3.2 exchange of information on activities such as training/educational materials, and funding opportunities

The Dundee IHP-HELP Centre regularly exchanges information on its activities, including a broad dissemination of its learning materials on-line. Dr Hendry is in regular contact with staff at UNESCO IHE-Delft and attended the Europe workshop of the water education network.

- New MSc in WRM & Law – Dundee Centre is a regional centre accredited by UNU-INWEH and accepts the UNU INWEH Diploma for entry with advanced standing. Professor Wouters, Dr Alistair Rieu-Clarke and Andrew Allan have been involved in UNESCO PCCP training and programmes in the past.
- Contribution to the University of Dundee MSc programme in the School of Geography.

3.3.3 exchange of staff, most notably professionals and students

- Collaborative degree programme with UNESCO IHE-Delft; students study in both Centres and Dr Hendry teaches as guest lecturer at UNESCO IHE-Delft.

- Dr Tom Ball participated in a workshop at the Poland UNESCO Centre on Eco-Hydrology.

3.3.4 implementation of joint activities, such as workshops, conferences, training programmes, joint projects, field visits, software and data sharing, knowledge exchange and publications

- Convened World Water Day event with support from UNESCO Scotland a HELP (22 March 2010), which was broadcast internationally.
- Professor Mike Bonell and Dr Sarah Hendry have a Scottish Carnegie grant to visit other UK HELP basins.
- Professor Wouters sits on the UNESCO Scotland committee and contributes also the UK UNESCO national commission programme.
- Hosted UNESCO Scotland meetings and works closely with the committee to promote UNESCO Scotland and UNESCO UK events.

3.4 Relationships with the UNESCO field and regional office whose jurisdiction covers the country of location

The Dundee IHP-HELP Centre has worked with regional UNESCO and UN offices, including engagements in Central Asia and Africa.

3.5 Relationship with the UNESCO National Commission and the IHP National Committee in the country of location and with other organizations of other countries

- Dr Hendry has attended the UK Committee for National and International Hydrology since 2008. This Committee is part of the UK's reporting mechanism to UNESCO for the IHP.
- Professor Wouters sits on the UNESCO Scotland Committee and contributes also the UK UNESCO National Commission Programme.
- Hosted UNESCO Scotland meetings and works closely with the committee to promote UNESCO Scotland and UNESCO UK events

3.6 Relationship with other UNESCO-related networks, such as UNESCO Clubs, ASPnet, and UNESCO chairs

The Dundee IHP-HELP Centre has supported the promotion of UNESCO chair appointments in Scotland and in the UK. Professor Wouters sits on the UNESCO Scotland body that puts forward UNESCO Chair appointments. Professor Wouters has worked with Professor Houria from Morocco, a UNESCO Chair, on her work on water rights.

4. Communication

4.1 Communication and knowledge dissemination activities undertaken in the framework of IHP

The Dundee IHP-HELP Centre is active in dissemination of its research and policy work. Several examples include:

- Hendry Sarah, "*A Little HELP for Good Water Governance: Catchment Management in the Tweed River Basin*", at the UNESCO-IHP HELP Seminar, Strengthening Water Governance For Sustainability, June 2009, Evora, Portugal.
- Hendry, Sarah, "*Integrated, Sustainable, Natural – A Scottish Perspective on the Floods Directive*", EURO-INBO International Conference on the Implementation of the European Water Framework Directive, Sibiu Romania October 2008.
- EU Brussels STRIVER symposium, where our research was awarded a prize for being the best interdisciplinary paper.

- Dundee convened and hosted a UNESCO HELP World Water Day, supported by UNESCO Scotland, which was a huge success, engaging local, regional and international stakeholders (22 March 2010).

4.2 Policy documents and advice

A significant number of policy briefs have been devised and published within the context of EU research projects. Following is an indicative list of some of that work:

- Wouters P.K., "Water Security: Global, regional and local challenges" for the National Commission on Security (May 2010), UK Government
- De Almeida, A.B., Portela, M.M., Machado, M., Begueria, S., Vicente, S., Lopez-Moreno, J., Lana-Renult, N., Garcia-Ruiz, J., Campbell, D. Rieu-Clarke, A., *The Tagus River Basin – Spain and Portugal*, STRIVER Policy Brief No. 19 <http://www.striver.no>
- Loures, F, Rieu-Clarke, A & Vercambre, M) *Everything you need to know about the UN Watercourses Convention* (WWF, Switzerland 2008)
- Nesheim I., McNeill D., Barton D.N., Beguería-Portugés S., Berge D., Bouraoui F., Campbell D., Gooch G. D., Grizzetti B., Joy K. J., Machado M., Manasi S., Nhung D. K., Paranjape S., Portela M. M., Raju, K.V., Rieu-Clarke, A., Saravanan V. S., Stålnacke P. and Taron, A., Comparative assessment of IWRM methods, STRIVER Technical Brief No. 13 <http://www.striver.no>
- Nesheim, I., Staalnacke, P., McNeill, D., Gooch, G.D., Nagothu, U.S., Barkved, L.J., Rieu-Clarke, *IWRM Recommendations and strategies*, STRIVER Policy Brief No. 22 (2009), <http://www.striver.no>
- Nhung, D.K., Gooch, G. & Rieu-Clarke, *Strategies and Recommendations for River Basin Management in the Sesan*, STRIVER Policy Brief No. 13 (2008), <http://www.striver.no>
- Rieu-Clarke, A., Campbell, D., Allan, A., Gooch, G.D., Nagothu, .S., Staalnacke, P, *Stakeholder Participation in the STRIVER Project*, STRIVER Policy Brief No. 21(2009), <http://www.striver.no>
- Rieu-Clarke, A. & Gooch, G.D., *Water Regimes in Transboundary Heavily Modified Rivers*. STRIVER Policy Brief No. 2 (2008), <http://www.striver.no>
- Allan, A., Rieu-Clarke, A. & Magsig, B, *Assessing Governance in the Context of IWRM*, STRIVER Policy Brief No. 8 (2008), <http://www.striver.no>

5. Update on Centre Operations

5.1 Membership of the Board of Governors between designated period

Under the Dundee UNESCO IHP-HELP statute, our Governing Board is currently comprised of: Chair, Professor Peter Downes (Principal and Vice-Chancellor, University of Dundee); Vice-Principal Professor Christopher Whatley; Dr Bill Cosgrove (WWAP); Dr John Francis (UNESCO Scotland); Dr Alan Sutherland (Scotland Water Industries Commissioner); Professor Shahbaz Khan (UNESCO IHP).

5.2 Key decisions made (attach minutes of meetings)

Minutes of meetings are available upon request. Major decisions focus on the need to achieve research excellence, deliver on UNESCO IHP objectives and accomplish financial sustainability. As part of the University of Dundee, we have a number of deliverables on the research, graduate teaching/training, and financial

sustainability fronts. We also have commitments to the Scottish Funding Council, which provided the significant start-up funding.

6. Evidence of the Centre's Impacts

- 6.1 Science Impacts (Major contributions to the science, technology, education, and regional and/or international cooperation in the field of water)

The Dundee IHP-HELP Centre contributes to science impacts on two levels: through its substantial body of research and also through its graduate teaching and training programme (under the umbrella of the Water Law Water Leaders programme). The list of publications and policy briefs referred to in this document provide evidence of some of the impact of our work.

- 6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)

The Dundee IHP-HELP Centre under the umbrella of its Water Law Water Leaders programme provides ongoing graduate teaching and training in the areas of water law, policy and science, in Dundee, across Scotland, the UK, and Europe and around the world. We work with sister UNESCO Centres, and UN bodies and EU framework partners to achieve knowledge transfer through our taught programmes and training sessions. As a direct result of these activities, we have influenced national water law and policy reform and set global policy agendas in a number of ways.

- 6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)

National Level

- Ongoing consultancy work requested by the UK Department for International Development and World Wildlife Fund Project to examine the *International Architecture for Transboundary Water Resources Management*. The Centre has been asked by the
- Expert Advice UK government to provide expert advice on global and national water security issues.
- Policy support to the Scottish government on European Union Water Framework Directive, and Floods Directive matters.

International level

- Provided Advice to WWF for ratification campaign around UN Watercourses Convention.
- Policy advice to the Mekong River Commission and Asian Development Bank relating to the governance of the Sesan River Basin.
- Professor Wouters sits on the GWP-TEC, and also on the World Economic Forum Global Agenda Council on Water Security, where she provides support for transboundary water law and policy issues, including water security.

7. Future activities that will contribute directly to IHP and/or to WWAP

- 7.1 Operational Plan (2010-2011) (attach operational plan for 2008-09 if available)

The Dundee IHP-HELP Centre will continue to support the work of the IHP and WWAP. In particular, our commitments in this respect are reviewed and validated by the annual meetings of the Governing Board. The 2010-2011 work plan will be discussed at the forthcoming Governing Board meeting set for September 2010. Attached in Annex 1 is a list of the Key Objectives of the Centre (under UNESCO Resolution and the Scottish

Funding Council). Over the past year, the Governing Board has considered our work plan (set out in our Scottish Funding council business plan) and approved the annual plans.

We anticipate contributing to the IHP and WWAP in the following ways:

- (i) Continued relevant research (with effective dissemination) on focal research topics in alignment with IHP themes and contributing to our core mission of "water for all" ;
- (ii) Continued contribution and relevant engagement on the cross-cutting IHP-HELP programme, including work on the Scottish Tweed HELP basin and our involvement with the UK, European and global HELP basins, especially in our research work and teaching and training;
- (iii) Further development of operational links with sister UNESCO Centres, including IHE-Delft, Brazil Hidroex and building on our collaboration with the Regional Centre on Urban Water Management-Tehran, and UNU-INWEH and other UN bodies, under the umbrella of our Water Law, Water Leaders programme;
- (iv) Continued contribution the WWAP, and in particular, to support the development of the next WWDR.
- (v) Striving to develop innovative research, to deepen our disciplinary expertise, and forging new pathways on interdisciplinary work in the areas of water law, policy and science and sharing and disseminating this research, working with first-class partners.
- (vi) Seeking research funding such that we can meet the imperatives of financial sustainability.

Some work-in-progress that will continue to go forward next year includes the follow-on work to Bonell, Mike, Hendry, Sarah Hendry and Ball, Tom, Editors. 2009. *Report of the Tweed Research Strategy meeting*. 51 pp. (available from the Centre for Water policy, Law and Science under the auspices of UNESCO, University of Dundee, Scotland, UK); and also *The Eddleston Scoping Study* (a tributary of the TWEED HELP basin) financed by the Scottish Govt. and SEPA through the Tweed Forum, initiated in 2009 (and on-going) to set out a trans-disciplinary research framework linked with Natural Flood Management. We will also build on the stakeholder work that we have developed under the range of EU research projects, which are ongoing.

7.2 Strategic Plan linked with IHP-VII (attach strategic plan for 2010-13 if available)

The Dundee IHP-HELP Centre continues to deliver on the business plan agreed with the Scottish Funding Council, which contained a 5-year plan of deliverables. These align with UNESCO IHP objectives and are validated annually through the meeting of the Centre's Governing Board.

8. Annexes

- 8.1 Annex 1 – Key Objectives of the Dundee IHP-HELP Centre
- 8.2 Annex 2 - List of publications
- 8.3 Annex 3 - List of training courses conducted (there can be overlap with those listed in 2.1 above)
- 8.4 Annex 4 - List of contributions to UNESCO IHP-VII (annotated list)
- 8.5 Annex 5 – UK contribution to UNESCO IHP-VII (incorporating Dundee IHP-HELP Centre contributions)
- 8.6 Annex 6 – UK-IHP national committee minutes (2009)
- 8.7 Annex 7 – UK-IHP national committee minutes (2008)
- 8.8 Annex 8 – International Water Law Symposium convened with UNESCO Centre - Regional Centre on Urban Water Management-Tehran (under the auspices of UNESCO)
- 8.9 Annex 9 – IHP-HELP World Water Day event convened at Dundee IHP-HELP Centre: online and interactive programme
- 8.10 Annex-10 Critical Intersections for Energy and Water Law: Exploring new challenges and opportunities; international conference co-convened with Dundee IHP-HELP Centre

Annex-1 – Key Objectives

UNESCO Resolution: Article 3 Objectives and functions

1. The objectives of the IHP-HELP Centre are:

(a) to provide a facility that promotes an interdisciplinary approach to addressing global water issues with a focus on poverty reduction and international development issues (including the United Nations Millennium Development Goals related to water), and, including water law (international, national and transnational water law) as an essential and integral element thereof;

(b) to provide the intellectual leadership necessary in achieving this approach and to establish a dedicated institution for the dissemination of relevant research and scholarship on the topic, available to the global water-concerned community worldwide and aimed at generating goodwill with the international community;

(c) to communicate legal expertise on global water issues for the HELP Programme of the UNESCO IHP, especially through the IHP-HELP Regional Coordinating Units, as well as to support the other water-related activities of IHP.

(d) to act as the Regional Coordinating Unit for the European HELP basins and proactively interact with other HELP Regional Coordinating Units.

2. The functions of the IHP-HELP Centre shall be to:

(a) design, develop and deliver educational and training activities related to its interdisciplinary approach to water-resources management, with a particular focus on poverty reduction and international development, including assisting States to achieve the United Nations Millennium Development Goals related to water;

(b) convene interdisciplinary scientific symposia and conferences at regional and international levels, as well as training workshops, with a particular focus on interfacing water law, policy and science and to developing capacity within nation-states worldwide;

(c) provide a focal point for HELP basins worldwide on issues related to water law and the interface between water law, policy and science issues;

(d) endeavour to establish the Spey Basin (Scotland) as a HELP basin for research and training within the IHP-HELP Centre's mandate of providing an interface between hydrological research and water policy and law; and act as liaison with related UK-based research programmes, such as CHASM-HELP (Catchment Hydrology and Sustainable Management), SNIFFER (Scotland and Northern Ireland Forum for Environmental Research), RELU (Rural Economy and Land Use Programme);

(e) develop new approaches to water resources management incorporating water law, policy and science as integrated components to address global water problems, with efforts also to support the development of a new generation of water leaders at the national level worldwide, familiar with the IHP-HELP Centre approach;

(f) provide a forum for think-tank meetings on water-related topics;

(g) provide expert input as required by UNESCO IHP; and

(h) collaborate proactively with other UNESCO HELP Regional Coordinating Units and IHP Water Centres.

3. The IHP-HELP Centre shall pursue the above objectives and functions in close coordination with UNESCO IHP, and in particular, the IHP-HELP Programme.

4. The IHP-HELP Centre shall carry out the above functions to the extent to which resources and international support can be mobilized.

Scottish Funding Council - Key objectives

1. To establish a global Centre of Excellence in water law, policy and science and enhance Scottish excellence in water-related research;
2. To enhance existing excellence in water law through the creation of a new Chair and a Senior Lectureship in Water Law, supported by PhD research studentships (a broader research base);
3. To enhance existing excellence in water science through the creation of a new Chair in Water Science, to serve the UNESCO HELP programme, supported by PhD research studentships;
4. To develop an operational model of engagement that enhances the integration of research and uptake of research across the disciplines of water law, policy and science (broadly defined, i.e. hydrology, life sciences, social sciences);
5. To focus on identifying means to assist States to address their water related challenges, including supporting developing countries to meet their Millennium Development Goals (MDGs) through research outputs and training developed and disseminated by the Centre;
6. To act as the Regional Coordinating Unit for the European UNESCO HELP basins and provide water law and policy input for the global HELP network of 67 basins;
7. To develop and implement the "Water Law - Water Leaders" LLM postgraduate programme, especially in developing country regions, e.g., Africa, Central Asia, South-east Asia;
8. To convene international symposia, including high-level meetings on relevant topics, featuring UNESCO HELP basins as developmental case studies for the integrated approach to water law, policy and science;
9. To develop a Scottish river basin as a model HELP basin for developing expertise on integrated water law, policy and science approaches to addressing basin-wide water resource management issues; to link the Scottish basin to other HELP basins which seek to integrate water law, policy and science;
10. To act as an international think-tank, bringing together researchers from Scotland and abroad for symposia and experts meetings to address the world's water resource management problems, with a particular focus on poverty reduction.

Annex-2 -List of Publications

Dundee IHP-HELP Centre for Water Law, Policy and Science under the auspices of UNESCO

Andrew Allan

Allan A., and Rieu-Clarke A., Good governance in the context of IWRM – moving from theoretical to practical considerations, *Irrigation and Drainage* (2010)

Allan A., Rieu-Clarke, A., Baggett, S., Gooch, G.D, "The Policy-Science Interface in Sustainable Water Management: Creating Scenarios Together with Stakeholders", in *Science, Policy and Stakeholders in Water Management* (Earthscan, London) (in Press), (2010)

Allan A., Flügel, W-A et al, Results of the BRAHMATWINN Project (Copernicus, forthcoming) (2010)

Allan A., Flügel, W-A, Sharma, N, . "Applied Geoinformatics for sustainable Integrated Water Resources Management (IWRM). First Results from the EU-project BRAHMATWINN" (Springer, forthcoming) (with et al) in [Title to be finalised] (2010)

Allan A., "The Role of Reasonableness in Assessing Equitable and Reasonable Use", *Ympäristöjuridiikka* (Finnish Society of Environmental Law) 1, 22, (2009)

Allan A, and Steyl, Ilse, "Encouraging Stakeholder Participation in River Basin Management: A case study from the Nura River in Kazakhstan", *12 U. Denv. Water L. Rev.* 209. (2008)

Allan A., Book review, Integrating watershed management – connecting people to their land and water (Gregersen, H., Ffolliott, P., Brooks, K.), *Mountain Research and Development* vol.28, no.3/4, , 337 (2008)

Allan, A., Campbell, D. & Rieu-Clarke, A., Assessing governance in the context of IWRM and transboundary rivers STRIVER Bulletin No. 3, November (2008), <http://www.striver.no>

Allan, A., Campbell, D., Gooch, G., Rieu-Clarke, A., Staalnacke, P., Nagothu, U.S., Final Stakeholder Analysis – stakeholder participation in the STRIVER Basins STRIVER Deliverable 4.2, <http://www.striver.no>

Allan, A. & Rieu-Clarke A., Relating Stakeholder Issues to IWRM/Governance Failings in Assam and Bhutan – Report as part of Deliverable 5.2 of EU FP7-funded BRAHMATWINN Project, <https://www.brahmatwinn.uni-jena.de/>

Mike Bonell

Bonell M., Hendry, Hendry S., and Ball, T., Editors. Report of the Tweed Research Strategy meeting. 51 pp. (available from the Centre for Water policy, Law and Science under the auspices of UNESCO, University of Dundee, Scotland, UK) (2009)

Howard, A., Bonell, M., Cassells, D.S., and Gilmour, D.A. Is rainfall intensity significant in the rainfall-runoff process within tropical rainforests of north-east Queensland? : The Hewlett regression analyses revisited. *Hydrological Processes*, (2009)

Koch K., Wenninger J., Ulenbrook S., and Bonell M., Electrical resistivity tomography (ERT) for identifying hillslope processes in the Black Forest Mountains, Germany. *Hydrological Processes* 23 (10): 1501-1513. (2009)

Bonell, M and Williams, J. A review of hydrology research within the open eucalypt woodlands of tropical semi-arid Central-North Queensland, Australia: a possible source of baseline information for the West African Sahel. *Sécheresse* 20(1): 31-47. *Science et changements planétaires / Sécheresse*. John Libbey Eurotext journal. (2009)

Bonell, M. and Callaghan, J. The synoptic meteorology of high rainfalls and the storm runoff response in the Wet Tropics. In: *Living in a Dynamic Tropical Forest Landscape* (The Wet Tropics Rainforests of Australia), Stork, N.E. and Turton, S, eds., , pp.23-46. Blackwell Publishing, Oxford. (2008)

Smith, J.W.N., Bonell, M., Gibert, J., McDowell, W.H., Sudicky, E.A., Turner, J.V. and Harris, R.C. Groundwater – surface water interactions, nutrient fluxes and ecological response in river corridors : Translating science into effective management. *Hydrological Processes* 22, 151 – 157. (2008)

Bonell, M. The role of the HELP programme. In : *Integrated Water Management : Practical Experiences and Case Studies*, Editors (Meire,P., Coenen, M., Lombardo, C., Robba,M. & Sacile,R.), NATO Committee on the Challenges of Modern Society, NATO Science Series, NATO Series IV : Earth and Environmental Sciences – Vol. 80, Brussels, Springer, pp. 247-261. (2008)

Soulsby, C., Neal, C., Laudon, H., Burns, D.A., Merot, P., Bonell, M., Dunn, S.M. and Tetzlaff, D. Catchment data for process conceptualization : simply not enough? *Hydrological Processes* 22, 2057-2061. (2008)

Geoff Gooch

Rieu-Clarke A., & Gooch G.D., 'Governing the Tributaries of the Mekong : The Contribution of International Law and Institutions to Enhancing Equitable Cooperation over the Sesan' *Pacific McGeorge Global Business & Development Law Journal* 22 (2) 193-224. (2010)

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Gooch, G.D. and Huitema D., 'Participation in Water Management. Theory and practice', in *The adaptiveness of IWRM; Analysing European IWRM research* by J.G. Timmerman, C. Pahl-Wostl, J. Möltgen, IWA Publishing, London UK, pp.27-45, (2008).

Gooch, G.D., Allan, A., Rieu-Clarke, A. & Baggett, S., *The Science-Policy-Stakeholder Interface in Sustainable Water Management: Creating interactive, participatory scenarios together with stakeholders*, in *Science, Policy and Stakeholders in Water Management*, Earthscan, London (2010).

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Sarah Hendry

Hendry S., 'Ownership Models for Water Services: Implications for Regulation' in Eds McHarg A. et al (eds) *Property Rights in Energy and Natural Resources Law* (Oxford University Press, forthcoming).

Hendry S., 'An Analytical Framework for Water Services Law – Comparative Approaches in Scotland and South Africa' *Desalination* 248 (1-3) 22-28, (2009)

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Hendry S., 'Water for Sale? Market Liberalisation and Public Sector Regulation in Scottish Water Services' *Utilities Law Review* 16 (4) 153-162, (2008)

Alistair Rieu-Clarke

Rieu-Clarke A., 'The Role of Treaties in Building International Watercourse Regimes: A Legal Perspective on Existing Knowledge' (forthcoming) *Water Policy*.

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Annex 3: List of Training Courses

- Dr Michael Hantke-Domas conducted water law training in South Africa on issues related to transparency, building upon the research he presented at the Istanbul World Water Forum and seeking to address issues related to corruption, through legal regulatory frameworks.
- Dr Hantke-Domas gave inputs to prepare a UNDP-CAPNET training manual on water law that is now used across Latin-America. The work considered international and national water law and was aimed at supporting national governments in devising and implementing their water policies through robust legal and administrative frameworks.
- Week-long specialized training programme for a high-level delegation from Malawi, "Water Sector Reform – PPP Options & Transactions, and Regulatory Issues" (May 2010).
- Short course in Leadership for the Water Sector (summer 2009) under the umbrella of the Dundee Water Law, Water Leaders programme
- Dr Alistair Rieu-Clarke contributed to specialized training on transboundary water resources management at the International Boundaries Research Unit at University of Durham (23-24 July 2009). He will deliver further training this summer (2010) in Durham on a similar topic.
- Hendry S Workshop *No Food without Water* DS3C Workshop on Sustainability University of Dundee November 2009.
- Hendry S and Rieu-Clarke A, Workshop *Water and Development* UNESCO Scotland Workshop, Edinburgh 18 March 2009.

Annex 4 - List of contributions to UNESCO IHP-VII (annotated list)

IHP	Focal Areas	Publications
<p>THEME 1: Adapting to the Impacts of Global Changes in River Basins & Aquifer Systems</p>		
	<p>Focal area 1.1 - Global changes and feedback mechanisms of hydrological processes in stressed Systems</p>	<p>Mike Bonell Howard, A., Bonell, M., Cassells, D.S., and Gilmour, D.A. Is rainfall intensity significant in the rainfall-runoff process within tropical rainforests of north-east Queensland? : The Hewlett regression analyses revisited. <i>Hydrological Processes</i>, (2009) Koch K., Wenninger J., Ulenbrook S., and Bonell M., Electrical resistivity tomography (ERT) for identifying hillslope processes in the Black Forest Mountains, Germany. <i>Hydrological Processes</i> 23 (10): 1501-1513. (2009) Smith, J.W.N., Bonell, M., Gibert, J., McDowell, W.H., Sudicky, E.A., Turner, J.V. and Harris, R.C. Groundwater – surface water interactions, nutrient fluxes and ecological response in river corridors : Translating science into effective management. <i>Hydrological Processes</i> 22, 151 – 157. (2008)</p>
	<p>Focal area 1.3 - Hydro-hazards, hydrological extremes and water-related disasters</p>	<p>Chris Spray Spray C., Ball T., & Rouillard J., Bridging the water law, policy, science interface: flood risk management in Scotland, <i>Journal of Water Law</i>, Special Issue, June (2010)</p> <p>Mike Bonell Bonell, M. and Callaghan, J. The synoptic meteorology of high rainfalls and the storm runoff response in the Wet Tropics. In: <i>Living in a Dynamic Tropical Forest Landscape (The Wet Tropics Rainforests of Australia)</i>, Stork, N.E. and Turton, S, eds., , pp.23-46.Blackwell Publishing, Oxford. (2008)</p> <p>Alan Werritty Ball, T, Werritty A, Hickey, K, Duck R W, Edwards A, Booth L Coastal Flooding In Scotland: Past, Present and Future. <i>Proceedings of Institution of Civil Engineers, ‘Breakwaters (2009)’</i>, Conference, Aberdeen, September (2009) Milne F D, Werritty A, Brown M J and Davies M C R A recent debris flow event and implications for hazard management, <i>Quarterly Journal of Engineering Geology and Hydrology</i>, 42, 51-60, (2009). flooding Werritty A et al., <i>Water and Disaster</i>, Report of the UN High level Expert Group to the 5th World Water Forum, Istanbul , May (2009) Dawson R J, Roche N, Ford A C, Barr S L, Hall J W, Werritty J, Ball T, Werritty A, Raschke M and Thurmer K, Measuring the effectiveness of non-structural flood risk management measures, <i>Proceedings of FLOODrisk08 International Conference</i>, Oxford, October (2008). Ball, T, Werritty A, Duck R W, Edwards A, Booth L, and Black Coastal Flooding in Scotland: A Scoping Study, Report to SNIFFER, Edinburgh, (2008) Thürmer K, Dawson R, Werritty A, Ball T, Hall J, Rasche M Roche N, Thürmer G, Werritty J Simulation of Flood Risk and non-structural Risk Management, CRUE Research Report No I-7, Effectiveness and Efficiency of Non-Structural Flood Risk Management Measures, CRUE Flooding ERA-NET, DEFRA, London (2008). flooding Penning-Rowell E C, Parker D, Harries T and Werritty A., Systematisation, evaluation and context conditions of structural and non-structural measures for flood risk reduction, CRUE Research Report No I-1, Effectiveness and Efficiency of Non-Structural Flood Risk Management Measures, ERA-NET, DEFRA and Scottish Government, London and Edinburgh. (2008), Werritty A, Houston D, Ball T, Jobe M, Black A R and Tavendale A., The social impacts of flooding in Scotland: a national and local analysis, <i>Proceedings of FLOODrisk08 International Conference</i>, Oxford (2008) Werritty A, Houston D, Ball T, Tavendale A, and Black A R Exploring the social impacts of flooding and flood risk in Scotland, <i>Scottish Executive</i>, Edinburgh, 150 p. (2007) McEwen L J and Werritty A ‘The Muckle Spate of 1829’: the physical and societal impacts of a catastrophic flood on the River Findhorn, Scottish Highlands, <i>Transactions of the Institute of British Geographers</i>, NS 32, 66-89. (2007) Werritty A, Houston D S, Ball, T, Tavendale A and Black A R Living with risk: the social impacts of flooding in Scotland, <i>Proceedings of Annual Flood Management and Coastal Defence Conference</i>, DEFRA/Environment Agency, York. (2007) Werritty A., Assessment of drivers: Scotland, in <i>Future Flood and Coastal Erosion Risks in the UK</i>, Thorne C R, Evans E P and Penning-Rowell E C (eds.), Thomas Telford, London, (2007) Werritty A, Living with floods: societal responses to changing flood risk in the 21st century, in <i>Les riudes: del desastre natural a la regeneracio ambiental.</i>. Batalla R J and Balaasch C (eds.) Institut d’Estudis Ilerdencs, Lleida, Spain, pp. 101-119, (2007).</p>
	<p>Focal area 1.4 - Managing groundwater systems’</p>	<p>Mike Bonell Smith, J.W.N., Bonell, M., Gibert, J., McDowell, W.H., Sudicky, E.A., Turner, J.V. and Harris, R.C. Groundwater – surface water interactions, nutrient fluxes and ecological response in river corridors : Translating science into effective management. <i>Hydrological Processes</i> 22, 151 – 157. (2008)</p>

	response to global changes	
	Focal area 1.5 - Global change and climate variability in arid and semi-arid regions	<p>Mike Bonell Bonell, M and Williams, J. A review of hydrology research within the open eucalypt woodlands of tropical semi-arid Central-North Queensland, Australia: a possible source of baseline information for the West African Sahel. <i>Sécheresse</i> 20(1): 31-47. Science et changements planétaires / Sécheresse. John Libbey Eurotext journal. (2009)</p>
THEME II: Strengthening Water Governance for Sustainability		
	Focal area 2.1 - Cultural, societal and scientific responses to the crises in water governance	<p>Geoff Gooch Rieu-Clarke A., & Gooch G.D., 'Governing the Tributaries of the Mekong : The Contribution of International Law and Institutions to Enhancing Equitable Cooperation over the Sesan' <i>Pacific McGeorge Global Business & Development Law Journal</i> 22 (2) 193-224. (2010) Rieu-Clarke, A. & Gooch, G.D., <i>The Science-Policy-Stakeholder Interface and Transboundary Water Regimes</i>, in Science, Policy, and Stakeholders in Water Management, Earthscan, London (2010) Gooch, G.D. and Huitema D., 'Participation in Water Management. Theory and practice', in <i>The adaptiveness of IWRM; Analysing European IWRM research by J.G. Timmerman, C. Pahl-Wostl, J. Möltgen</i>, IWA Publishing, London UK, pp.27-45, (2008). Gooch, G.D., Allan, A., Rieu-Clarke, A. & Baggett, S., <i>The Science-Policy-Stakeholder Interface in Sustainable Water Management: Creating interactive, participatory scenarios together with stakeholders</i>, in Science, Policy and Stakeholders in Water Management, Earthscan, London (2010). Gooch, G., Rieu-Clarke, A., Stalanacke, P Editors, <i>Strategy and Methodology for Improved IWRM: An Integrated Interdisciplinary Assessment in Four Twinning River Basins in Europe and Asia</i>, IWA Publishing, London (2010). Nesheim I., McNeill D., Barton D.N., Beguería-Portugés S., Berge D., Bouraoui F., Campbell D., Gooch G. D., Grizzetti B., Joy K. J., Machado M., Manasi S., Nhung D. K., Paranjape S., Portela M. M., Raju, K.V., Rieu-Clarke, A., Saravanan V. S., Stålnacke P. and Taron, A., <i>Comparative assessment of IWRM methods</i>, STRIVER Technical Brief No. 13 http://www.striver.no Nesheim, I., Stålnacke, P., McNeill, D., Gooch, G.D., Nagothu, U.S., Barkved, L.J., Rieu-Clarke, IWRM Recommendations and strategies, STRIVER Policy Brief No. 22 (2009), http://www.striver.no Nesheim, I., McNeill, D., Stålnacke, P., Sekhar, N. U., Grizzetti B., Allan, A. A., Barton D., Beguería-Portugés S., Berge D., Bouraoui F., Campbell D., Deelstra, J., García-Ruiz, J.M., Gooch G. D., Joy K., Lana-Renault, N., Lo Porto, A., Machado M., Manasi S., Nhung D. K., Paranjape S., Portela M. M., Rieu-Clarke, A., Saravanan V. S., Thaulow, H., Vicente-Serrano, S., <i>The first IWRM assessment report for the four case basins: Glomma, Tagus, Sesan and Tungabhadra Deliverable 5.1</i>, (2008) http://www.striver.no Nhung, D.K., Gooch, G.D., & Rieu-Clarke A., <i>Strategies and Recommendations for River Basin Management in the Sesan</i>, STRIVER Policy Brief No. 13 (2008), http://www.striver.no</p> <p>Patricia Wouters Tarlock D., and Wouters P., <i>Reframing the Water Security Dialogue</i>, <i>Journal of Water Law</i> (forthcoming) Wouters P., and Ziganshina D., <i>Tackling the Global Water Crisis: Unlocking International Law as Fundamental to the Peaceful Management of the World's Shared Transboundary Waters - Introducing the H2O Paradigm</i> in Quentin Grafton and Karen Hussey (eds) <i>Water Resources Planning and Management: Challenges and Solutions</i> (Cambridge University Press, forthcoming). Wouters P., <i>The Changing Dimensions of International Water Law</i>, Lectures for Chinese Academy of International Law (Sept 2006, Xiamen) to be published by Kluwer Law / The Hague Academy of International Law (work-in-progress). Wouters P., Vinogradov S., and Magsig B., <i>Water Security, Hydrosolidarity and International Law: A River Runs through It ...</i>, <i>Yearbook of International Environmental Law</i> 19 97-134. (2009) Wouters P., <i>Global Water Governance through Many Lenses</i>, <i>Global Governance</i> 14 (4) 523-34. (2008)</p> <p>Andrew Allan Allan A., "The Role of Reasonableness in Assessing Equitable and Reasonable Use", <i>Ympäristöjuriidikka</i> (Finnish Society of Environmental Law) 1, 22, (2009)</p> <p>Allan A., Rieu-Clarke, A., Baggett, S., Gooch, G.D., "The Policy-Science Interface in Sustainable Water Management: Creating Scenarios Together with Stakeholders", in <i>Science, Policy and Stakeholders in Water Management</i> (Earthscan, London) (in Press), (2010) Allan A, and Steyl, Ilse, "Encouraging Stakeholder Participation in River Basin Management: A case study from the Nura River in Kazakhstan", <i>12 U. Denv. Water L. Rev.</i> 209. (2008) Allan A., Book review, <i>Integrating watershed management – connecting people to their land and water</i> (Gregersen, H., Ffolliott, P., Brooks, K.), <i>Mountain Research and Development</i> vol.28, no.3/4, , 337 (2008) Allan, A., Campbell, D. & Rieu-Clarke, A., <i>Assessing governance in the context of IWRM and transboundary rivers</i> STRIVER Bulletin No. 3, November (2008), http://www.striver.no</p>

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	Focal area 2.4 - Water as a shared responsibility: managing water across geographical and social boundaries	<p>Andrew Allan</p> <p>Allan A., and Rieu-Clarke A., Good governance in the context of IWRM – moving from theoretical to practical considerations, Irrigation and Drainage (2010)</p> <p>Allan A., Flügel, W-A, Sharma, N, . “Applied Geoinformatics for sustainable Integrated Water Resources Management (IWRM). First Results from the EU-project BRAHMATWINN” (Springer, forthcoming) (with et al) in [Title to be finalised] (2010)</p> <p>Sarah Hendry</p> <p>Hendry S., 'River Basin Management and the Water Framework Directive: In Need of a Little HELP?' Journal of Water Law 19 (4) 150-6, (2008)</p> <p>Alistair Rieu-Clarke</p> <p>Rieu-Clarke A., 'The Role of Treaties in Building International Watercourse Regimes: A Legal Perspective on Existing Knowledge' (forthcoming) Water Policy.</p> <p>Allan A., and Rieu-Clarke A., 'Good governance in the context of IWRM – moving from theoretical to practical considerations, Irrigation and Drainage'. (2010)</p> <p>Rieu-Clarke A., and Gooch G.D., 'Governing the Tributaries of the Mekong : The Contribution of International Law and Institutions to Enhancing Equitable Cooperation over the Sesan' (2010) Pacific McGeorge Global Business & Development Law Journal 22 (2) 193-224.</p>
	Focal area 2.5 - Resolving the water and energy nexus	Dundee IHP-HELP Centre co-convened international conference with publications on Water/Energy Law, Critical Intersections in Energy and Water Law (Calgary, 2009).
THEME III: Ecohydrology for Sustainability	Focal area 3.1 - Ecological measures to protect and remediate catchments process	<p>Chris Spray</p> <p>Spray, Chris, 'Freshwater and wetlands' Chapter in UK National Ecosystem Assessment Report, UK (forthcoming).</p> <p>Spray, Chris, 'Scotland' Chapter in UK National Ecosystem Assessment Report, UK (forthcoming).</p> <p>Gilvear, Casa-Mule & Spray (submitted) Trends and issues in delivery of integrated catchment scale river restoration: lessons learned from a national river restoration survey within Scotland.</p> <p>Spray C., (in press) Targeted species management within a wider ecosystem approach. In: Species Management – Challenges and Solutions for the 21st Century. SNH.</p> <p>Mike Bonell</p> <p>Soulsby, C., Neal, C., Laudon, H., Burns, D.A., Merot, P., Bonell, M., Dunn, S.M. and Tetzlaff, D. Catchment data for process conceptualization : simply not enough? Hydrological Processes 22, 2057-2061. (2008)</p>
THEME IV: Water and Life Support Systems	Focal area 4.1 - Protecting water quality for sustainable livelihoods and poverty alleviation	
	Focal area 4.3 - Achieving sustainable urban water management	<p>Sarah Hendry</p> <p>Hendry S., 'Ownership Models for Water Services: Implications for Regulation' in Eds McHarg A. et al (eds) Property Rights in Energy and Natural Resources Law (Oxford University Press, forthcoming).</p> <p>Hendry S., 'An Analytical Framework for Water Services Law – Comparative Approaches in Scotland and South Africa' Desalination 248 (1-3) 22-28, (2009)</p> <p>Hendry S., 'Water for Sale? Market Liberalisation and Public Sector Regulation in Scottish Water Services' Utilities Law Review 16 (4) 153-162, (2008)</p>
	Focal area 4.4 - Achieving sustainable rural water management	<p>Alan Werritty</p> <p>Werritty A, Ball T, Spray C, Bonell M, Rouillard, J, Bowles, C and Moir H Restoration Strategy: Eddleston Water Scoping Study, Report to Tweed Forum, Melrose, (2010)</p>

THEME V Water Education For Sustainable Development		<ul style="list-style-type: none"> * Masters of Law (LLM) in Water law * Masters of Law (LLM) in Water Governance and Conflict Resolution * Executive Master of Business Administration (Exec MBA) International Water Management * Water Law Water Leaders Executive Programme * Doctor of Philosophy (PhD)
CROSS-CUTTING PROGRAMMES	HELP	All of the work on the Tweed river basin; contribution to UK HELP basins; contribution to European HELP basins; contribution to global HELP call;
ASSOCIATED PROGRAMMES:	International Flood Initiative (IFI)	Dundee IHP-HELP Centre is founding member of IFI; active contribution to water law and water science inputs to IFI programme; participant at IFI official launch at Stockholm Water Week (August 2009)
	Water for Peace: From Potential Conflicts to Cooperation Potential (PCCP)	Dundee IHP-HELP Centre contributes to transboundary water law education and research; tripartite arrangement with IHE-Delft/PCCP/Dundee on graduate LLM programme; collaboration with transboundary seminar day at Stockholm Water Week (August 2009). Contribution to the international water law topic.
	Internationally Shared Aquifer Resources Management (ISARM)	Dundee IHP-HELP Centre has provided international water law support for ISARM; Professor Wouters sits on Scientific Committee for ISARM conference (December 2010).
	Education, Training and Capacity Building across all the themes	<p>Dundee IHP-HELP Centre actively contributes to higher education (graduate degree programme) and training and capacity development programmes; including joined up programme with UNESCO IHE-Delft; UNESCO Brazil Hydroex engagement currently a work in progress; joint training programme with Regional Centre on Urban Water Management-Tehran; we also work with UNU-INWEH in this area.</p> <p>List of graduate degree programmes under the Water Law Water Leaders initiative:</p> <ul style="list-style-type: none"> * Masters of Law (LLM) in Water law * Masters of Law (LLM) in Water Governance and Conflict Resolution * Executive Master of Business Administration (Exec MBA) International Water Management * Water Law Water Leaders Executive Programme * Doctor of Philosophy (PhD)

Annex 5 – UK contribution to UNESCO IHP-VII (including Dundee IHP-HELP)

Overview of the Core Programme Themes of the Seventh Phase of the IHP (2008-2013)

WATER DEPENDENCIES: SYSTEMS UNDER STRESS AND SOCIETAL RESPONSES

Theme 1: ADAPTING TO THE IMPACTS OF GLOBAL CHANGES ON RIVER BASINS AND AQUIFER SYSTEMS

Focal area 1.1 - Global changes and feedback mechanisms of hydrological processes in stressed systems

Focal area 1.2 - Climate change impacts on the hydrological cycle and consequent impact on water resources

Focal area 1.3 - Hydro-hazards, hydrological extremes and water-related disasters

Focal area 1.4 - Managing groundwater systems' response to global changes

Focal area 1.5 - Global change and climate variability in arid and semi-arid regions

Theme 2: STRENGTHENING WATER GOVERNANCE FOR SUSTAINABILITY

Focal area 2.1 - Cultural, societal and scientific responses to the crises in water governance

Focal area 2.2 - Capacity development for improved governance; enhanced legislation for wise stewardship of water resources

Focal area 2.3 - Governance strategies that enhance affordability and assure financing

Focal area 2.4 - Managing water as a shared responsibility across geographical & social boundaries

Focal area 2.5 - Addressing the water-energy nexus in basin-wide water resources

Theme 3: ECOHYDROLOGY FOR SUSTAINABILITY

Focal area 3.1 - Ecological measures to protect and remediate catchments process

Focal area 3.2 - Improving ecosystem quality and services by combining structural solutions with ecological biotechnologies

Focal area 3.3 - Risk-based environmental management and accounting

Focal area 3.4 - Groundwater-dependent ecosystems identification, inventory and assessment

Theme 4: WATER AND LIFE SUPPORT SYSTEMS

Focal area 4.1 - Protecting water quality for sustainable livelihoods and poverty alleviation

Focal area 4.2 - Augmenting scarce water resources especially in SIDS

Focal area 4.3 - Achieving sustainable urban water management

Focal area 4.4 - Achieving sustainable rural water management

Theme 5: WATER EDUCATION FOR SUSTAINABLE DEVELOPMENT

Focal area 5.1: Tertiary water education and professional development

Focal area 5.2: Vocational education and training of water technicians

Focal area 5.3: Water education in schools

Focal area 5.4: Water education for communities, stakeholders and mass-media professionals

CROSS-CUTTING PROGRAMMES:

HELP

FRIEND

ASSOCIATED PROGRAMMES:

International Flood Initiative (IFI)

International Sediment Initiative (ISI)

Water for Peace: From Potential Conflicts to Cooperation Potential (PCCP)

Joint International Isotope Hydrology Programme (JIIHP)

Internationally Shared Aquifer Resources Management (ISARM)

Global Network on Water and Development Information in Arid Lands (G-WADI)

Urban Water Management Programme (UWMP)

World Hydrogeological Map (WHYMAP)

Education, Training and Capacity Building across all the themes

UK PARTICIPATION IN IHP-VII

IHP VII Themes and Focal areas	UK Participation/Contribution	Organisation	Coordination (x)
Theme 1:			
Focal area 1.1	Research on the Tweed HELP basin, Scotland, to refine knowledge of the efficacy of natural techniques in sustainable flood management, also to develop scenarios which couple land cover change vis a vis climate change impact on surface water-groundwater interactions across scales; Specific activities include headwater catchment flow monitoring and modelling the hydrological effects of river channel restoration. also relevant to 1.2, 1.4	Dundee UNESCO IHP-HELP Centre	
	Quantify land-surface/climate feedbacks at different scales using the Joint UK Land Environment Simulator (JULES); Focus of West Africa and northern India in WU-FP6 project, WATCH. <i>See also 1.2</i>	Centre for Ecology and Hydrology UK Met Office	
Focal area 1.2	Research into improved rainfall disaggregation methods, and impact on floods and water resources, particularly groundwater dominated systems in SE England	Imperial College London	
	Analyse to quantify and predict components of the current and future global water cycles and related water resources states. Evaluate their uncertainties and clarify overall vulnerability of water resources related to societal and economic sectors. Specific activities include: Continued development of an improved model for assessment of global and regional water resources (GWAVA). Application of GWAVA to assess impacts of changing climate and water demands across South America (EU FP6 project TWINLATIN), with ongoing assessments focusing on European (EU FP6 project SCENES) and global assessments (EU FP6 project WATCH). <i>See also 1.1, 1.3</i>	Centre for Ecology and Hydrology	
Focal area 1.3	PI for UK Flood Risk Management Research Consortium, and for 2 projects within the UK Flood Risk from Extreme Events programme. Specific research includes effects of rural land management on flooding, groundwater flooding, and new tools for urban flood management	Imperial College London	
	Dissemination of the results of the ECFP6 funded project BRAHMATWINN, enhancing capacity to carry out a harmonised integrated water resources management approach in headwater river systems of alpine massifs already impacts from climate change.	Dundee UNESCO IHP-HELP Centre	
	Assessing the science base for Natural Flood Management (required under recent Flood Risk Management (Scotland) Act 2009) in R Tweed HELP basin. Legal input into the WMO/GWP Associated Programme on Integrated Flood Management Assessing impact of climate change on pluvial flood risk	Dundee UNESCO IHP-HELP Centre	

	and vulnerable urban populations. Contribution to WMO HelpDesk for Integrated Flood Management. Dundee UNESCO IHP HELP to provide legal support to Member States through the helpdesk mechanism..		
	Quantify the social and economic impacts of floods and droughts, in light of anticipated or predicted changes in land-use and climate change. Activities include: Evaluation of the association between weather types and flood occurrence across Europe (EU COST733 Action). Analysis of river flow drought frequency, extend and spatial coherence, including the generation of a catalogue of hydrological and meteorological droughts across Europe (contributions under EU FP6 project WATCH). Development of national approach for assessing the impacts of climate change on high river flow across Britain, underpinning national policy on climate change for the Flood Management community. <i>See also 1.1, 1.2</i>	Centre for Ecology and Hydrology	
Focal area 1.4	Research into groundwater response to climate change in Chalk aquifers Member of scientific committee for UNESCO ISARM conference on transboundary aquifers providing legal input.	Imperial College London Dundee UNESCO IHP-HELP Centre	
	Continuing research in palaeohydrology and renewable/non-renewable resources and management and policy issues that relate to this focal area.	Oxford University	
	Research into the responses of European groundwater systems to climate change and land use impacts as part of FP7 project, GENESIS; also relevant to 2.2 and 3.4		
Focal area 1.5	Research into climate change effects in Yemen; Scientific Committee for Muscat Conference on Water Resources and Climate Change in the MENA region	Imperial College London	
Theme 2:			
Focal area 2.1	Co-convened Transboundary Water day-long seminar with UNESCO Paris at Stockholm World Water week involving broad range of global stakeholders; involved in several panels at the Stockholm Water Week including UNU-INWEH panel on shared Lakes and governance	Dundee UNESCO IHP-HELP Centre	
Focal area 2.2	Undertake and disseminate results of comparative studies into governance, legal regimes for good water governance, and indicators for governance, working with stakeholders on basin and global scale. Under FP6, BRAHMATWINN and STRIVER; under FP7, LiveDiverse, GENESIS. These projects build capacity and develop better legal and administrative frameworks.	Dundee UNESCO IHP-HELP Centre	
	Technical assistance to the Government of India to address the issues of intra-sectoral water demands and overall water resource planning and management (World Bank)	Centre for Ecology and Hydrology	
Focal area 2.3	Provide input to World Economic Forum through Global Agenda Council on Water Security on the economic importance of water so as to enhance financing in the sector (Dubai WEF summit; Davos Economic Summit)	Dundee UNESCO IHP-HELP Centre	
Focal area 2.4	Develop methods for assessing and strengthening governance arrangements at the international (transboundary) level, under FP6, BRAHMATWINN and STRIVER; under FP7, LiveDiverse.	Dundee UNESCO IHP-HELP Centre	

	Evaluate the role and relevance of the 1997 UN Watercourses Convention in strengthening the management of international watercourses as a shared responsibility, in collaboration with World Wildlife International and other international partners Provide expert advice to DFID and WWF-UK on review of international architecture for managing transboundary water resources. Provide expert advice to UK government on water security matters (Ministry of Justice and Cabinet)		
Focal area 2.5	Convened water law / energy law conference at University of Calgary, with U Cal McGeorge University to look at water/energy nexus in a number of watersheds around the world. Proceedings published.	Dundee UNESCO IHP-HELP Centre	
Theme 3:			
Focal area 3.1	Assessment of the capabilities of alternative land covers on the landscape hydrology through taking an integrated science perspective (surface water – groundwater-ecohydrology); this will be undertaken as part of the work in Theme 1 above	Dundee UNESCO IHP-HELP Centre	
	First qualitative estimates of the environmental impacts of scenarios of future climate and water demand at a pan-European scale (EU FP6 project SCENES)	Centre for Ecology and Hydrology	
	Ecology & conservation of East African soda lakes and fauna (sp. lesser flamingos).	University of Leicester	
Focal area 3.2			
Focal area 3.3			
Focal area 3.4			
Theme 4:			
Focal area 4.1	Research into the management of agrochemicals in a Scottish HELP basin, linked with the work in Theme 1 above.	Dundee UNESCO IHP-HELP Centre	
Focal area 4.2			
Focal area 4.3			
Focal area 4.4	PI of major experimental and modelling study on impacts of rural land management on flooding. Further development of integrated urban water management and on capacity building by implementation of publications produced and educational. Includes institutional strengthening of the African Municipal water companies in order to address the Millennium Development Goals.	Imperial College London	
Theme 5:			
Focal area 5.1	LLM in Water Governance and Conflict Management, taught at both Dundee UNESCO IHP-HELP Centre and UNESCO IHE, Delft. . LLM in Water Law, with part-time and full-time, blended learning modes and interim awards. MSc in Water Resources Management and Law with the United Nations University Institute for Environment and Health, fully validated to commence January 2011. Short course / CPD / training provision at tertiary and professional level. Provision of research degrees in water.	Dundee UNESCO IHP-HELP Centre	

	Further development of Masters programmes in water management.		
Focal area 5.2	Professional training on water regulation for Malawi delegation; devising a new multi-sector regulatory framework for water and energy.	Dundee UNESCO IHP-HELP Centre	
Focal area 5.3			
Focal area 5.4			
Cross-cutting programmes			
HELP	Regional Coordinator for European HELP Basins, seeking active engagement with the HELP agenda in UK and Europe.	Dundee UNESCO IHP-HELP Centre	
	Coordinator of two HELP Basins, the Welland (UK); Lake Naivasha (Kenya)	University of Leicester	
FRIEND	Active participation in a wide range of FRIEND initiatives, including: representation of UK interests on the Steering Committee of Euro-FRIEND, regional coordination of the FRIEND European Water Archive and representation on steering committees of HKH-FRIEND and Southern African FRIEND. Support and research contribution to other FRIEND initiatives worldwide. <i>See also 1.1, 1.2, 1.3</i>	Centre for Ecology and Hydrology	
	Coordination of NE FRIEND, Project 3, Large-scale variations in hydrological regimes	University of Birmingham	
Associated programmes			
International Flood Initiative (IFI)	<i>See also 1.3</i>	Centre for Ecology and Hydrology	
International Sediment Initiative (ISI)	Continuing membership of ISI Steering Committee and contribution to activities of ISI (Des Walling)	Exeter University	
Water for Peace: (PCCP)			
UNESCO-IAEA Isotope (JIIHP)			
Shared Aquifer (ISARM)	Scientific Committee for ISARM transboundary conference	Dundee UNESCO IHP-HELP Centre	
Global Network Arid Lands (GWADI)	Co-Chair of G-WADI	Imperial College London	X
	Actively involved in preparation of web material from earlier G-WADI activities and updating of the web-site. Participation in steering committee meetings and advising and responding to requests from UNESCO Paris. Exploration of growth of G-WADI activities in Africa	Oxford University	X
Education, Training and	Training needs assessment of staff responsible for hydrological data in Lake Victoria basin (Lake Victoria Basin Commission/World Bank). Capacity building of	Centre for Ecology and Hydrology	

Capacity Building across all the themes	hydrological staff in state ministries as part of Indian Hydrology Project (World Bank).		
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Annex 6: UK-IHP National Commission Meeting Minutes (2009)

Annual Meeting of the UK Committee for National and International Hydrology CEH Wallingford Friday 6th March, 2009 Minutes of meeting

Participants

Name Representing Initials

Alan Jenkins

(Chair)

Centre for Ecology and Hydrology & NERC AJ

Ian Gale British Geological Survey IG

Rod Smith Met Office RS

Richard Brown Scottish Environment Protection Agency (SEPA) and Scottish Executive

RB

Richard Davis Environment Agency (EA) RD

Noel Higginson Department of Agriculture and Rural Development, Northern Ireland (DARDNI)

NH

Frank

Farquharson

British Hydrological Society (BHS) FF

Ann Calver UK in WMO Commission for Hydrology (WMO-CHy) AC

Gwyn Rees

(Secretary)

Flow Regimes from International Experimental and Network Data (FRIEND)

GR

Sarah Hendry Hydrology, Environment, Life and Policy (HELP) and UNESCO Centre of Water Law, Policy and Science, Dundee

SH

Howard Wheeler Water and Development Information for Arid Lands (G-WADI) HW

James Dent British Water JD

John Chilton International Association of Hydrogeologists (IAH) JC

John Rodda JR

Apologies

John Goudie Department of the Environment, Food and Rural Affairs (DEFRA)

Jennifer Taylor Environment Agency (EA)

Brian Golding Met Office

Mike Whitehead Department of Transport (Highways Agency)

Guy Howard Department for International Development (DFID)

Ian Cluckie UK Committee of the International Association of Hydrological Sciences (IAHS)

Alan Gustard Flow Regimes from International Experimental and Network Data (FRIEND)

Pat Wouters Hydrology, Environment, Life and Policy (HELP) and UNESCO Centre of Water Law, Policy and Science, Dundee

Mike Edmund Water and Development Information for Arid Lands (G-WADI)

Des Walling International Sedimentation Initiative (ISI)

David M Harper UK interests in UNESCO Ecohydrology projects

Minutes of meeting

1. Welcome, introductions, apologies and adoption of agenda

AJ welcomed participants to CEH.

2. Minutes of last meeting and matters arising

Item 3.5 (DFID engagement)

GR reported that Guy Howard (DFID) had intended to attend this meeting but was unable to at the last minute and had sent his apologies.

AJ reported that he and others had met with Peter Landymore in Paris during the UNESCO-IHP Intergovernmental Council meeting in June, but there had been little contact since. He also informed that there was opportunity for engagement through

the UK National Committee for UNESCO.

HW reminded the meeting of DFID's contribution to the Ecosystems Services for Poverty Alleviation (ESPA)¹ initiative, of which water was a significant component. He himself is on the Steering Group.

Item 7.15 (IFI)

AJ reported that Thomas Kjeldsen (CEH) was contributing to the IFI.

All other actions done or covered at this meeting.

3. UK Committee for National and International Hydrology

3.1. Terms of reference

GR reported that he had received no further comments on the TOR since the previous meeting. The TOR were therefore adopted (*Annex 1*)

3.2. Review of membership (*Annex 2*)

JC informed that he had agreed to attend this meeting to represent IAH but that nobody had been formally appointed to the Committee. He agreed to raise the issue with the IAH UK Chapter. **Action: JC**

GR reported that Alan Gustard, in a written submission, had offered his resignation from the Committee as FRIEND Rep' and had nominated GR as his replacement on this Committee and as UK Rep' on the European FRIEND Steering Committee. The Committee formally thanked Alan for his contribution to UKCNIH and the UNESCO-IHP, and endorsed his nomination of GR to both committees.

FF suggested Colin Fenn be approached to join the Committee as CIWEM Rep'. AJ agreed to approach Mr Fenn. **Action: AJ**

AJ agreed to follow-up on the invitations previously extended to UKWIR, WaterUK....

Action: AJ

1 ESPA: <http://www.nerc.ac.uk/research/programmes/espa/>

4. News from Departments and Agencies*

4.1 DEFRA

No report received

4.2 DFID

GR summarised an e-mail received from Guy Howard (*Annex 3*)

IG welcomed the apparent increase in opportunities emerging from DFID.

AJ referred to ESPA as a further example of this.

HW outlined progress within ESPA.

4.3 Scottish Executive & SEPA

Report presented by RB (*Annex 4*).

4.4 DOE (NI)

No report received.

NH informed that the DOE(NI) should now be referred to as Northern Ireland Environment Agency (NIEA). GR to correct. **Action: GR**

4.5 DARDNI- Rivers Agency

NH outlined staffing arrangements within the Rivers Agency.

He announced the launch of the Rivers Agency's Flood Risk Mapping website, and that real-time hydrometry data will soon be available for some 20 gauging stations.

NH also reported on the hydrometric review of NI undertaken by Jacobs, the final report of which would be available by the end of March.

A surge-tide/flood monitoring system was also being developed.

4.5 NAW

No report received

4.6 EA

Report presented by RD (*Annex 5*)

HW informed that a review of CFMPs had highlighted deficiencies in information and guidance relating to groundwater flooding. The review had also assessed impacts of land use management practices on flood risk.

HW suggested that modelling work conducted with the NERC-funded FREE programme would be useful for EA catchment management.

AC drew attention to the website of the EA-Defra Flood and Coastal Erosion programme.

JR expressed concern hydrology and water resources did not feature in any of the 5 themes of the EA's new national strategy. RD acknowledged the concern and suggested that they would be part of themes 1 and 4.

FF agreed with JR, adding that BHS were concerned that hydrology was increasingly being marginalised as a discipline within the EA and that this would be detrimental to the recruitment and retention (r&r) of suitably qualified technical staff.

JD commented that r&r of qualified staff was a problem for the whole industry. RB concurred, adding that retention was particularly once staff had completed training. AC pointed out that data licensing, between EA and other departments, agencies and research institutes, continued to be a major problem, and appealed for somebody within the EA to resolve this difficulty as a matter of urgency. The Committee agreed. RD to alert the EA of these concerns. **Action: RD**

4.7 Met Office (MO)

Report presented by RS (*Annex 6*)

HW and AC both asked how the MO Forecasting Centre would engage with EA's local operations. RS explained that the MO and EA were working closely together on how the new system would work.

HW asked how radar technology was being developed.

RS described that a strategic plan was being developed for "next generation" weather radar.

RB pointed out that radar coverage was a problem in northern Scotland.

AJ asked if Earth Observation offered a solution.

RS explained accuracy was a problem with EO data but MO were looking at it.

HW described work being undertaken in the USA using EO data, and suggested that such data might be particularly useful in developing countries.

4.8 NERC (CEH)

Report presented by AJ (*Annex 7*)

4.9 NERC (BGS)

Report presented by IG (*Annex 8*)

4.10 British Water

Report presented by JD (*Annex 9*)

5. News from the British Hydrological Society (BHS)

Report presented by FF (*Annex 10*)

HW informed that the new Hydrology Research journal would very much welcome "practitioner papers".

NH asked if the "Guide to Chartered Status" was available of the BHS website.

FF confirmed it was.

JD suggested that attaining relevant competencies was difficult for staff working in organisations not directly involved in hydrology.

FF informed that the Guide gave examples of the type of experience that would be acceptable.

HW commented that the BHS travel support for young research was very useful.

6. UK contribution to the UNESCO-IHP

6.1. General

AJ informed that he had attended the IHP bureau meeting in March 2008, and that he had led the UK delegation to the Intergovernmental Council Meeting in Paris in June. Reports of both meetings are now available on the IHP website, <http://www.unesco.org/water/>.

6.2. IHP Projects

FRIEND

Report presented by GR (*Annex 11*)

AJ reiterated that UK continues to play a leading role in FRIEND worldwide despite receiving no support from DFID.

HW expressed disappointment that DFID does not do more to help UK participation in projects such as FRIEND, HELP and G-WADI, adding that relatively small amounts do go a long way.

JC pointed-out that it was very difficult to get small amount of funding from DFID, even though benefits often far outweigh the small financial inputs.

HELP

Report presented by SH (*Annex 12*)

AJ queried whether the Thames had been adopted as a HELP basin. SH thought no paperwork had been received for the Thames. AJ to investigate status of this.

Action: AJ

(Update: Prof. Shahabaz Khan has now confirmed the adoption of the Thames as a HELP basin)

SH said she and Mike Bonnell were considering an UK-HELP workshop, for coordinators of HELP basins in the UK.

JR suggested such a meeting might coincide with the Inter-Celti hydrology symposium, which Andrew Black is due to convene.

AJ welcomed the appointment of Prof. Shahabaz Khan as new global coordinator of HELP in UNESCO and concurred that his limited budgetary allocation for the biennium needed to be addressed. AJ to raise with UNESCO. **Action: AJ**

G-WADI

Report presented by HW (*Annex 13*)

JD asked if G-WADI was considering schemes that had been degraded over time as potential areas for irrigated development.

HW explained that such issues were implicitly considered.

JD suggested the G-WADI be linked to the MAR website. HW suggested a link also to the HELP website. AJ suggest a link to FRIEND too, adding that it might be useful to identify the linkages between such programmes and identify opportunities for collaboration. HW and AJ agreed to approach UNESCO for some seed-corn money to convene a joint workshop. **Action: HW & AJ**

JR asked if Cathalac played a role in G-WADI. HW agreed that Cathalac would provide opportunity to engage Latin America in the project.

ISI

Report from Des Walling was tabled (*Annex 14*)

IFI

No paper. AC informed IFI links to WMO's Associated Program on Flood Management (APFM)

Ecohydrology

Report from David Harper was tabled (*Annex 15*)

HW commented that these initiatives could also link to G-WADI.

6.3. UNESCO Centre of Water Law, Policy and Science, Dundee

Report presented by SH (*Annex 12*)

AJ congratulated SH and her colleagues on such good progress being made.

6.4. UK representation on committees; sub-committees; task forces; etc.

GR appealed to participants to keep him informed of UK participation on IHP committees, sub-committees and task forces. **Action: All**

6.5. Progress of IHP-VII (2008-2014)

AJ invited all to provide input to a table on UK involvement in IHP (*Annex 16*), which would be forwarded to UNESCO. He suggested the completed table would also be useful to illustrate UK participation to DFID and the UK National Commission

Action: All

7. National Commission for UNESCO

Report presented by AJ (*Annex 17*)

7.1. UK Government Department Contact List

AJ asked participants to inform him of relevant contacts with UK government departments, so that the UKNC list can be accurately updated (*Annex 17A*). **Action: All**
It was pointed out that big gaps still existed between UK government departments and the UK delegation in Paris.

IG asked whether UKCDS should be included. AJ to check with the Commission.

Action: AJ

7.2. E-Bulletin

All were informed of the UKNC E-bulletin and were invited to contribute news items.

Action: All

7.3. Update on activities

JR suggested UKNC might convene a symposium at Royal Society on Advances in UNESCO Natural Sciences. HW suggest Gordon Conway might open. AJ agreed to raise with the Chair of UKNC. **Action: AJ**

8. UK contribution to WMO Hydrology and Water Resources Programme

Report presented by AC (*Annex 18*)

In addition to her report, AC stated the UK had contributed to several WMO initiatives, such as, JD's contribution to a flood forecasting manual, GR's to a low flow estimation manual, Jon Finch's to a manual of evaporation estimation.

HW said he too was involved with a GEWEX working group.

9. UK contribution to the International Association of Hydrological Sciences (IAHS)

No report submitted.

10. UK contribution to the International Association of Hydrogeologists (IAH)

JC reported on the IAH Executive meeting in Paris and of IAH's intention to improve linkages with the IHP. He welcomed that fact that it was getting easier to identify points of-

contact within IHP. He explained that 3-strands of the IAH were UK-led (aquifer management, trans-boundary aquifer management, and the commission on climate change and groundwater). JC in his new role was keen to encourage the UK chapter of IAH to be more outward looking.

11. Links with other organisations (e.g. GWP)

JD reported he had contributed to the GWP South Asia forum on climate change and agriculture last year.

SH informed that Pat Wouters was on a GWP Experts Group (see *Annex 12*).

12. Forthcoming events/planned activity/new initiatives

Events:

- World Water Forum, Istanbul, Turkey, 16-22 March 2009
- Annual Waterwise Water Efficiency Conference 2009, 15-16 April, Oxford
- IHP Region 1 meeting, Washington, 24-25 September 2009
- Sixth World FRIEND Conference, Fez, Morocco, 25-29 October 2010.

New Initiatives:

MAR-Net (Managed Aquifer Recharge Network)

IG introduced this new item, which is further described in the BGS paper (*Annex 8*). He reported that a formal proposal had been submitted to UNESCO, to establish MAR-NET on a more formal basis. To-date, the initiative had received little financial support with progress delivered on the back of other projects. He invited the Committee to support the initiative.

The committee agreed. AJ to write a formal letter of support. **Action:AJ**

AJ said support could also be sought from IHP Region I, who are meeting in Washington DC later this year and suggested that IG approach Johannes Cullmann (Germany) to ask MAR-Net to be added as an agenda item there. **Action:IG**

JC suggested IG approach DFID, who recently undertook of water storage.

JR further suggested IG made a presentation at the next IHP Intergovernmental Council meeting.

13. Any other business

No AOB

Annex 7: UK-IHP National Commission Meeting Minutes (2009)

Annual Meeting of the

UK Committee for National and International Hydrology

CEH Wallingford

Tuesday 19 February, 2008

Minutes of meeting

Participants

Name	Representing	Initials
Alan Jenkins (Chair)	Centre for Ecology and Hydrology & NERC	AJ
Ian Gale	British Geological Survey	IG
Rod Smith	Met Office	RS
John Goudie	Department of the Environment, Food and Rural Affairs (DEFRA)	JG
Richard Brown	Scottish Environment Protection Agency (SEPA) and Scottish Executive	RB
Jennifer Taylor	Environment Agency (EA)	JT
Frank Farquharson	British Hydrological Society (BHS)	FF
Ann Calver	UK in WMO Commission for Hydrology (WMO-CHy)	ANC
Sarah Hendry	Hydrology, Environment, Life and Policy (HELP) and UNESCO Centre of Water Law, Policy and Science, Dundee	SH
Mike Edmunds	Water and Development Information for Arid Lands (G-WADI)	ME
James Dent	British Water	JD
David M Harper	UK interests in UNESCO Ecohydrology projects	DMH
Alec Boksenberg	Chair, United Kingdom National Commission for UNESCO	AB
John Rodda	CEH Fellow	JR
Gwyn Rees	Secretary	GR

1. Welcome, introductions and apologies

AJ welcomed participants to CEH.

Apologies were received from: Denis Peach (British Geological Survey), John Mitchell (Met Office), Brian Golding (Met Office), Peter Jones (National Assembly for Wales), Noel Higginson (Department of Agriculture and Rural Development, Northern Ireland), Des Walling (International Sedimentation Initiative), Mike Whitehead (Department of Transport (Highways Agency)), Alan Gustard (Flow Regimes from International Experimental and Network Data), Ian Cluckie (UK Committee for the International Association of Hydrological Sciences).

2. Adoption of agenda

The Agenda was adopted without change.

3. Minutes of last meeting and matters arising

Item 2: CHASM. AJ said he had e-mailed Ender O'Connell twice but with no response

Item 4: JT reported that the WISKI User Group had met. The Group involves each of the UK's hydrometric measuring authorities.

Item 5: DFID engagement. AJ reported there had been no progress, although a DFID representative was to have attended this meeting. AB agreed better engagement needed and invited Committee members to provide suggestions on how.

Action: all

AB also recommended the Committee seek to engage with the UK representative for UNESCO in Paris.

Action: AJ

Item 8: UK ERB Representative. AJ reported there had been no response to the invitation in BHS Circulation for someone to become an UK ERB rep'.

4. UK Committee for National and International Hydrology

4.1 Terms of reference (Annex 1)

AJ introduced the draft Terms of Reference (Annex 1) and invited comments, especially with respect to "National Responsibilities".

AJ clarified that the Committee has no formal remit from UK government.

AB asked if the Committee was recognised by UNESCO as a National Committee of the International Hydrological Programme (IHP). AJ confirmed that it was.

AJ invited Committee members to send comments/suggestions to GR.

Action: all

AB enquired whether the Committee was involved in international activities. AJ explained that the Committee has strong links with UNESCO (as a National Committee for the IHP) and WMO, which involved participation at UNESCO Regional meetings (e.g. Region 1 meeting) and the nomination of UK representatives to various committees, task forces and panels within the science programmes of UNESCO/IHP. AJ informed that he himself was a member of the IHP Bureau. He added this Committee, however, has limited contact with other UN water-related programmes.

AB suggested it would be useful to engage with other UN programmes.

AJ agreed and suggested DFID might help facilitate such interactions. FF suggested DFID might use this Committee to disseminate policy. AJ to approach DFID to discuss how the Committee might help DFID and vice versa.

Action: AJ

JR commented that UNESCO/IHP and WMO did indeed provide route into UN Water. He reminded participants that the Committee had led the UK launch of the International Decade for Action "Water for Life" with a conference at the Royal Geographical Society in London in March 2005.

4.2 Review of membership (Annex 2)

ME asked if membership, as shown in Annex 2 was current. GR confirmed it was.

IG suggested a representative of the International Association of Hydrogeologists (IAH) be invited to join the Committee. This was agreed. AJ to invite an IAH representative.

Action: AJ

Any further suggestions for new members should be sent to GR .
all

Action:

5 News from Departments and Agencies (written summaries annexed)

5.1 DEFRA (JG) Report (Annex 3) to be submitted.

JG reported that DEFRA have been dealing with EU Floods Directive and its transposition into UK law. A joint research programme with the EA has been established. There has been yet more organisational changes in DEFRA and the programme structure is under review. The "Making Space for Water" programme is still on-going, which will take outcomes of the Pitt Review into account. Reservoir safety work is continuing as is activity in integrated urban drainage. Results of the latter are due end of March and will feed into policy development recommendation by Autumn.

Hydrological aspects of Risk Mapping are being developed with EA. Results of studies into the influence of catchment land-use on flood risk are due soon. Climate change research continues.

ANC commented that DEFRA website notifications on consultations were useful.

JG invited anybody interested in any of the notifications to let him know.

Action:

all

5.2 EA (JT) Report tabled (Annex 4)

JT highlighted main points from the EA report. With respect to flooding, EA had been heavily involved in managing recent floods events and had contributed to several reviews (e.g. The Pitt Review), including one of their own which had resulted in a new action plan. The EA is actively looking at how to improve mapping of floods, especially what can be done with respect to the representation of groundwater flooding. Good progress is being made on the review of the hydrometric network in England and Wales. EA is working hard on in-house hydrological training, to build capabilities and improve staff retention

AJ commended the EA report, and commented that many aspects could be recommended for application in other countries.

IG acknowledged that staff retention is a general problem, and asked if courses were available externally.

JT described the EA's e-based training, which includes a 2-day foundation and other specialist courses (e.g. maths and stats for hydrologists). The EA is scoping more advanced training. Some courses might be available externally.

JD asked if the reduced number of university courses had affected EA recruitment.

JT thought there had been no apparent effect, but EA was seeking to engage more with universities.

AJ informed that CEH and EA were meeting next week to discuss staff exchanges.

JT explained that the EA trying identify the skills needs of the organisation and staff exchanges was one approach being considered

AJ suggested the EA might consider international exchanges.

ME asked if does EA have interest in international research.

JT said that the EA's focus was primarily national, although they do have an EU and International Relations section.

ANC asked who in the EA she should contact concerning WMO issues. JT suggested that David King might be the best initial contact but agreed to find out. **Action: JT**

5.3 SEPA (RB) Report tabled (Annex 5)

RB reported highlights from the SEPA report. There recently has been much interest in coastal flooding, and as of last year, a national Coast-Watch system had been established. There was no significant fluvial flooding to report, but a flood warning system was being developed in the north east region. From April Scottish Executive will assign SEPA as body responsible for the active dissemination of flood information. Europe Flood Directive has resulted in a lot of work and revision of existing flood legislation. From a hydrometric perspective, SEPA is continuing its expansion of the river gauging network. There is much interest in hydrometry due to small hydro and the push for renewables. SEPA has adopted WISKI as the basis for its Hydrological Information Management System and SODA for data and acquisition. An internal review has resulted in streamlining of water resources management in SEPA, with 6 management units reduced to 4, but one emerging specifically on hydrometry. John Anderson heads the hydrometry unit. Recruitment and retention is a serious concern for SEPA/>

5.4 Met Office (RS) Report tabled (Annex 6)

RS described MO work on rainfall forecasting, and their input to the Pitt Review. The MO is seeking to develop better links with EA. MO models appear to be performing relatively well, some underestimation of radar rainfall high intensity events. MO is moving towards the implementation of 5 km models, also probability based forecasts using ensembles approach, blending of probabilistic forecasts with numerical predictions for seamless now-casting and short-term (few days) forecasting.

JG asked if wind-farms affected weather radar.

RS said an on-going review of the weather radar network would be considering this question.

JG asked if wind-farms had impact on local climates (e.g. flooding intensity, increased wind speeds)?

RS thought there may be limited local effects but nothing of regional significance.

JD asked if the MO was looking into the use of local radar in urban area, to improve predictions of urban flooding.

RS explained that siting of radar was a sensitive problem, particularly near conurbations; the resolution of existing radar products has very much improved, which probably obviates the need for denser networks.

RB commented there were (radar) coverage problems in Scotland, due to topography and coastal area, and some inaccurate estimates had been problematic with respect to fluvial flooding. He asked how could the network be improved in Scotland.

RS thought SEPA would be involved, as would water companies, in any improvement in Scotland. He suggested RB contact Malcolm Hitchins.

5.5 NERC-CEH (AJ) Report tabled (Annex 7)

AJ described the new NERC science strategy, "Next Generation Science for Planet Earth", a new funding mechanism for NERC science. The science is to be arranged in themes, and theme leaders have recently been appointed. CEH meantime is developing its new science strategy, "Integrated science for changing world", which includes 6 high-level science objectives. AJ outlined two new notable initiatives: Source to Sea; River Lambourn Observatory.

GR briefly outlined CEH activity in the wake of the 2007 summer flooding, which has included the production of the National Hydrological Monitoring Programme report, "The summer 2007 floods in England and Wales – a hydrological appraisal" by Terry Marsh and Jamie Hannaford.

ME enquired whether CEH was continuing its monitoring in Plynlimon.

AJ confirmed that hydrometric monitoring will continue but that chemical monitoring is likely to reduce as CEH efforts move toward lowland monitoring. The site will however continue to contribute to the UK Acid Waters Monitoring Network, which CEH now co-funds.

5.6 BGS (IG) Report tabled (Annex8)

IG informed that BGS had appointed a new Executive Director, Dr. John Ludden; Prof. Denis Peach has been made Chief Scientist. BGS too were responding to the NERC new strategy, with water science being reviewed across the organisation. Outcomes of the review included recommendations for more interdisciplinary work and improved collaborations with CEH, universities, etc. The review has also called for better connections within BGS between the "fluids" disciplines (e.g. oils, carbon sequestration, nuclear radiation-pathways, water). There is emphasis too on improving BGS' international status and renewed focus on shallow environment, engineering geology, and environmental aspects of geology.

5.7 British Water (JD)

JD presented the UKTI document, "International trade strategy for water sector" (Annex 9), which outlines support initiatives that promote UK trade with foreign countries; e.g. trade missions (to countries or funding agencies (e.g. ADB, WB)), seminars to help companies to bid for work with UN agencies, etc.

JD described a British Water initiative, AquaEuropa, which attempts to bring together similar from across Europe (like BW) and act as a portal for the water sector.

AJ informed JD of the WSS Technology Platform, set up by EC, which provides opportunities for links between such organisation. AJ to supply JD with further details.

Action: AJ

With their representatives absent, no reports were presented (or tabled) from: DFID; Scottish Executive; DOE(NI); DARDNI; NAW; Water UK.

6 News from the British Hydrological Society (FF) Report tabled (Annex 10)

FF described the role of BHS, which is now 25 years old. He reported that the Privy Council was not amenable to increasing the number of chartered bodies and that BHS was now working with ICE and CIWEM to establish how hydrologists might attain professional status. He informed that BHS has joined with Nordic Hydrology to form a new journal, "Hydrology Research", the first issue was published in January 2008.

7 UK contribution to the UNESCO-IHP

7.1 IHP Activity

7.1.1 FRIEND (GR) Report tabled (Annex 11)

GR outlined UK's leading role in, and its contributions to, FRIEND initiatives around the world.

AB asked how useful UNESCO had been in facilitating FRIEND.

GR explained that UNESCO traditionally has provided money to establish new initiatives and support attendance at meetings, workshops and conferences, with some money

provided directly from Paris, but most via Regional Hydrologists. He added that UNESCO support was particularly important for supporting FRIEND initiatives in developing regions, such as, southern Africa, west and central Africa, the Hindu-Kush Himalayan region and in the Caribbean.

7.1.2 HELP (SH) Report tabled (Annex 12)

SH informed the Committee that Pat Wouters (University of Dundee) was Regional Coordinator of HELP in Europe, but that there had been little progress until recently. She said that Pat was keen to develop activity, first in the UK and then Europe. There is to be a Regional Coordinators meeting in Paris in May, which SH will attend. (All the European HELP basins have been asked for information regarding their activities for this meeting.) There was an international workshop on wetlands in Annecy in January 2008, co-hosted by SILA (Syndicat Mixte du Lac Annecy, the Lake Annecy basin organisation) and by UNESCO-IHP, attended by Siegfried Demuth. SH and DMH both attended that meeting at which Siegfried Demuth reiterated his support for HELP within the context of the aims of the IHP.

AJ added that there had been Global HELP meeting in Johannesburg, South Africa, in November '07 and that the IHP Secretariat was keen to see progress in HELP.

AB informed that PW had expressed concerns on how little assistance HELP had recently received from UNESCO, and that he had spoken to UNESCO on her behalf. He suggested greater pressure is needed to encourage greater support to HELP.

AJ agree to take-up this concern with UNESCO.

Action: AJ

DMH informed that he had nominated the Welland as a HELP basin (the Welland is an operational basin from UNESCO perspective) but that he didn't know of any other UK HELP basins. He urged better coordination of HELP activity within the UK. He added that endorsement was helpful for small-scale initiatives such as that in the Welland.

SH said that a regional workshop for the UK HELP basins had been suggested by DMH and that the Dundee UNESCO Centre planned to take this forward was planned, and asked if the Committee would be able to support the workshop and send a representative.

AJ clarified that the Committee has no budget at its disposal to provide financial support, but it can provide endorsement of the initiative and would be able to send a representative.

7.1.3 G-WADI (ME) Report tabled (Annex 13)

ME presented a 3-yr report on G-WADI and acknowledged the support the project had received from UK Permanent Delegation in Paris, which had helped facilitate workshops, web-base materials, etc. . He added much progress, particularly in developing countries, had been achieved through the NSF-funded SAHRA initiative at the University of Arizona. Various workshops and meetings have taken place in India, China and Syria. Meetings are planned in Santiago, to bring Latin America into the initiative, and Africa next year. ME suggested there was potential to develop G-WADI in HELP basins. He thought DFID might be encouraged to further contribute to the G-WADI initiative.

AB encouraged ME to continue to lobby DFID, the UK Permanent Delegate in Paris (Peter Landymore) and his Deputy, Andreas Westerwinter.

AB further encouraged AJ to establish links with Peter Landymore.

Action: AJ

7.1.4 ISI Report submitted (Annex 14)

Des Walling's ISI report was circulated. There were no comments or questions.

7.1.5 IFI

AJ admitted that he didn't know of any UK involvement within IFI and said we would ask UNESCO for more information on the initiative. **Action: AJ**

ANC informed that WMO were involved through an associated programme.

7.1.6 Ecohydrology (DMH) Report submitted (Annex 15)

DMH commented that although ecohydrology was supposedly a cross-cutting theme within IHP, it was somewhat isolated. He suggested much closer links need to be developed with other parts of the programme.

AJ said he was interested in DMH's proposal for a workshop: perhaps it could focus on HELP basins and be part of the aforementioned HELP regional workshop. He said the Committee was happy to endorse such a workshop.

AJ suggested a link to MAB sites too, but it was difficult to know what sites are in MAB. AB concurred, there is a clear need to link to MAB.

AJ thought it would be good to convene an UK workshop, and take messages to UNESCO. ME suggested the workshops could link to G-WADI too!

SH and DMH agreed to pursue these ideas in setting-up a joint workshop.

Action: SH & DMH

7.2 UNESCO Centre of Water Law, Policy and Science, Dundee (SH) (Annex 12)

SH reported the Centre was now up and running, with a full staff complement. She formally invited the Committee to convene its next meeting in Dundee.

AJ thanked SH for the invitation but explained that the make-up of the Committee meant that logistically, and financially (for most), it was easiest if meetings continued to be held at Wallingford.

7.3 UK representation on committees; sub-committees; task forces; etc.

GR confirmed the outcomes of the Committees nominations in 2006: Des Walling elected to governing board IRCTES; Jim Hall was not elected to advisory board of ICHARM; David M Harper was elected to governing board for ERCE; AJ was elected to the IHP Bureau elected from Region 1.

AJ reported on the UNESCO IHP Region 1 meeting that was held in Turkey in September 2007. This had resulted in various recommendations to the Bureau, e.g. the Secretariat should assume greater responsibility for IHP Themes and the dissemination of the science; IHP7 themes should be mapped at regional and global scales; IHP6 should be evaluated quickly.

7.4 Progress of IHP-VII (2008-2014)

GR described the Implementation Plan of IHP7 and invited Committee members to contribute to Pro-forma Table A1 & A2 (circulated), to give indication of UK interest in IHP (by April). **Action:**

all

AB suggested a draft of the Tables be copied to DFID and Peter Landymore, to encourage dialogue. A copy to the National Commission would be useful too.

Action: AJ

AJ informed the Committee of the IHP Inter-Governmental Council meeting on 9-14 June and invited participants to join the UK delegation.

AB recommended that Peter Landymore be invited to join the meeting.

Action:

AJ

7.5 UK National Commission for UNESCO

AB described the main objective of the National Commission were to advise government, and civil society, about, and how to engage with, UNESCO... and help reform UNESCO such that it reflects government objectives on science, education, peace and the attainment of MDGs...

AJ informed the Committee of his involvement in the Commission's Working Group on International Science Programmes (ISPs), which is made up of the UK's (ISP) National Committees in the UK and has been looking at developing synergies between the Committees. For example, a pilot project has been identified on impact of climate change on coastal ecosystems, which would bring together hydrology, geology, oceanography, biology, ecology in suitable MAB bio-reserves. Pilot project may be conducted in SW England (e.g. Tamar), and East Africa (possibly Malindi-Watama, Kenya/Tanzania).

DMH informed there was already a HELP basin in Tanzania; and several inland in Kenya. Also the North Devon coast was a MAB bio-reserve. He also informed that Welland and Nayvasha were part of the TWINBAS initiative.

8 UK contribution to WMO Hydrology and Water Resources Programme

ANC drew the contrast between UNESCO (research) and WMO (operational) and said that UK was more a "donor" of best practice to lesser developed within WMO. She informed that reorganisation at WMO had resulted in a Hydrological Water Research *branch*, part of Climate Protection and Adaptation *section* in the Climate and Water department. Next meeting of the WMO Commission for Hydrology (CHy) is to be held in November 2008, she herself is on the Working Group for the new plan. Inputs from the Committee were welcome. There is also an Executive Council meeting June, 2008. The CHy operates OPACHE expert panels, involving several UK hydrologist, but resources limited to do work, and not all experts contribute equally.

JR enquired about WHYCOS.

FF commented that WHYCOS was not going well. JD suggested a lack of commitment in some countries was a problem.

ANC said that WHYCOS was now being integrated with WIGOS and said she would provide further details.

Action: ANC

JT asked how much WMO are tapping-in to on-going initiatives in member countries, e.g. the work programmes of EA and SEPA.

ANC agreed to consider the EA strategy in planning of the next phase of CHy

Action: ANC

8 UK contribution to the International Association of Hydrological Sciences

No discussion

9 Planned activities

GR informed the committee of a Waterwise event in Oxford in March.

JR informed the committee of the Inter-Celtic Colloquium in St Andrews, July (date).

FF informed the committee of BHS National Symposium, Exeter (date)

11 Committee links with other organizations/initiatives

11.1 Global Water Partnership

JD described the GWP: a body focussing on governance and institutional strengthening in IWRM, and suggested a possible role for DFID in providing more support to operational aspects of the GWP.

FF reminded the Committee that GWP had been quite generously supported by DFID in the past, but DFID tended focus on governance not technical aspects.

11.2 Others

IG informed the Committee of the IAH-MAR commission, (Manage Aquifer Recharge), which looking at using reclaimed water. Its last meeting was in Nov 2007, in Phoenix, Arizona, the next will be in Abu Dhabi in 2010.

JR mentioned that the World Water Assessment Programme is moving to Perugia. The next report focuses on climate change and water. Lead-authors and contributors have been identified. The water chapter is to be led by Denis Hughes, Rhodes University, South Africa. The report is due to be published at the 5th WWF in Istanbul in 2009.

12 Any other business

No AOB.

13 Next meeting

This time next year. AJ to confirm.

Action: AJ

Annex 8: International Water Law Symposium with Regional Centre on Urban Water Management-Tehran (under the auspices of UNESCO)

International Law and Transboundary Freshwaters Symposium and Workshop 2010

Global, regional and national strategies for promoting security and sustainability within a rapidly changing world – Water for All

June 21-24, 2010

IHP - HELP Centre for Water Law, Policy & Science under the auspices of UNESCO, University of Dundee, UK

Joint Organiser: Regional Centre on Urban Water Management-Tehran (under the auspices of UNESCO)

...International law provides the only available framework for order and stability.

Sir Arthur Watts KCMG QC, 2000

International law related to transboundary freshwater serves three basic functions: (1) it defines and identifies the legal entitlements and rights and obligations tied to water use, providing the prescriptive parameters for its development; (2) it provides a framework for ensuring the continuous integrity of the regime, i.e. through monitoring, regulation, compliance, stakeholder participation, dispute avoidance and settlement; and (3) it allows for rational modifications of the existing regime, in order to be able to adapt to the constantly changing needs and circumstances.

The purpose of the symposium will be to explore these three functions of international law within the context of existing and potential challenges faced by transboundary basins (rivers, lakes and aquifers) throughout the world. The symposium will benefit from the collective knowledge and expertise of world-renowned speakers, all of whom have a 'real world' focus.

Key Questions:

- What is international water law and how does it promote regional peace and security?
- How do international legal frameworks support national decision making related to transboundary water resources planning and management?
- Who is entitled to use transboundary freshwater resources – why and how?
- How does international law reconcile competing claims over transboundary freshwaters?
- What diplomatic strategies and tactics can nation-states employ to secure the best legal outcomes possible in light of their transboundary water interests?

Who should attend?

The symposium will benefit anyone concerned with the world's international watercourses, especially water resources experts, lawyers and non-lawyers, practitioners - including civil servants, policy makers, regulators and water suppliers - as well as academics, who wish to gain fresh insights into how international law can contribute to addressing existing and future challenges over the world's transboundary freshwater resources.

Symposium Chairs

Professor Patricia Wouters, Professor of International Water Law and Director of the IHP - HELP Centre for Water Law, Policy & Science under the auspices of UNESCO, has published, lectured and worked around the world on international water law and developed a globally renowned research team that also specializes in comparative national water law and the regulation of water services.

Dr Homayoun Motiee is an Associate Professor in the Power and Water University, I.R. Iran and the Director of the UNESCO Regional Centre on Urban Water Management (RCUWM)-Tehran. Dr Motiee received his Ph.D. in civil engineering, hydraulic structures from Insa University, France (1996) and holds a post doctorate in water resources engineering from Guelph University, Canada (2005).

Dr Alistair Rieu-Clarke, LLB, LLM, PhD is a Senior Lecturer at the IHP - HELP Centre for Water Law, Policy & Science under the auspices of UNESCO. An expert on measuring the effectiveness of transboundary water governance regimes, his research focuses on governance and water resources management and involves case studies in Bhutan, Cambodia, China, Costa Rica, India, Portugal, South Africa, Spain and Vietnam.

Symposium Presenters

Professor Dan Tarlock joined Chicago-Kent University in 1981 and is an internationally recognized expert on environmental law and the law of land and water use. He received his bachelors and law degrees from Stanford University, is a member of the California bar, and is one of three US special legal advisers to the NAFTA Commission on Environmental Cooperation.

Dr Roberto Lenton is the former Chair of the Technical Committee of the Global Water Partnership. He is currently the Chairperson of the Inspection Panel of the World Bank.

Greg Shapland has been a member of Research Analysts in the Foreign and Commonwealth Office since 1979. He is currently Deputy Head of Research Analysts and Research Counsellor for the Middle East and North Africa. He has particular responsibility for research and analysis on Iraq and regional issues (including Arab human development, security, disarmament and water).

Dr Sergei Vinogradov's main field of expertise includes international environmental law, international law of natural resources, law of the sea, as well as environmental and natural resource law of Russia and the CIS. He is a member of the Water Resources Committee of the International Law Association and of the global Commission on Environmental Law.

Flavia Rocha Loures, JD., works in the field of environmental law and policy, first as an environmental attorney and professor in Brazil, and more recently as Senior Programme officer for WWF - the global conservation organisation - in the USA. Her focus is on the codification and development of international water law and on the implementation of water-related international conventions.

DAY 1 • Monday 21st June 2010

9:00 Coffee and Registration

9:30 Welcome • *Principal Professor Pete Downes, Professor Patricia Wouters and Dr Alistair Rieu-Clarke, University of Dundee* •

Dr Homayoun Motiee, Director of RCUWM

10:00 - 10:45 Coping with uncertainty and promoting security – the value and function of international law related to freshwater resources • *Professor Patricia Wouters*

10:45 - 11:00 Break

11:00 - 12:30 Keynote lecture *continued*

12:30 - 13:30 Lunch

13:30 - 14:30 Integrated Water Resources Management and Transboundary water issues • *Dr Roberto Lenton*

14:30 - 15:30 Contemporary legal challenges at the basin level – examples from the Nile and the Aral Sea • *Musa Abseno & Dinara Ziganshina*

15:30 - 16:00 Break

16:00 - 17:00 What's in it for me? – group exercise

This exercise will provide an opportunity for participants to exchange ideas on what they wish to get out of the symposium

Facilitators • *Dr Alistair Rieu-Clarke & Bjørn-Oliver Magsig*

17:00 - 17:30 Wrap-up day one • *Professor Patricia Wouters & Dr Alistair Rieu-Clarke*

17:30 - 18:30 The Journal of Water Law Reception, Special Issue, Promoting Water for All, Current Issues of International, National and Transnational Water Law

DAY 2 • Tuesday 22nd June 2010

9:00 - 9:30 Introduction to day two

9:30 - 10:30 How does international law reconcile competing claims over transboundary water resources? • *Dr Sergei Vinogradov*

10:30 - 11:00 Break

11:00 - 12:30 Keynote lecture *continued*

Wrap-up day two • *Dr Alistair Rieu-Clarke*

12:30 - 13:30 Lunch

13:30 - 19:00 Excursion • Trip to historic coastal city of St Andrews

DAY 3 • Wednesday 23rd June 2010

9:00 - 9:15 Introduction to day three

9:15 - 10:30 Implementing the principle of equitable and reasonable utilisation – what role for procedural rules? • *Alistair Rieu-Clarke*

10:30 - 11:00 Break

11:00 - 11:30 Keynote lecture *continued*

11:30 - 12:30 Global strategies for promoting security and sustainability – the 1997 UN Watercourses Convention and Draft Articles on Transboundary Aquifers • *Flavia Loures*

12:30 - 13:30 Lunch

13:30 - 15:00 Group exercise

Facilitators • *Dinara Ziganshina & Bjørn-Oliver Magsig*

15:00 - 15:30 Break

15:30 - 17:00 Group exercise continued

17:00 - 17:15 Wrap-up day three • *Professor Patricia Wouters & Dr Alistair Rieu-Clarke*

18:00 - 20:00 Reception & Symposium Gala Dinner

After Dinner Speaker • *Dr John Francis, Deputy Chair, UNESCO-Scotland* • 'UNESCO - A Watery Reflection'

DAY 4 • Thursday 24th June 2010

9:00 - 9:15 Introduction to day four

9:15 - 10:30 Managing conflict over transboundary freshwaters and coping with change – the role of institutions and dispute settlement mechanisms? •

Professor Dan Tarlock

10:30 - 11:00 Break

11:00 - 12:30 Keynote lecture continued

12:30 - 13:30 Lunch

13:30 - 14:00 Progression routes for continuing professional development: the Postgraduate Certificate and the Masters in Water Law, LL.M., (optional session)

14:00 - 14:50 International diplomacy: what can it contribute to resolving international water disputes? • *Greg Shapland*

14:50 - 15:30 Question & Answer session, providing an opportunity for the participants to pose further questions to the speakers, as a result of issues that may have arisen during the symposium

15:30 - 16:00 Workshop wrap up and closing remarks

16:00 Sir Alan Langlands Water Leaders Prize award

The IHP - HELP Centre for Water Law, Policy & Science under the auspices of UNESCO reserve the right to change the advertised presenters and agenda without prior notice to registered delegates.

SIR ALAN LANGLANDS WATER LEADERS PRIZE

Sir Alan Langlands is a former Principal of the University of Dundee and we are proud to announce that he will be awarding a Water Leaders Prize to an outstanding alumnus of the IHP - HELP Centre for Water Law, Policy & Science under the auspices of UNESCO, as part of the Symposium.

Conference Registration Information

Registration fee

Places are limited and early booking is highly recommended.

The attendance fee for the symposium will be £1600 per delegate.

A discounted early bird rate is available at £1440 if booking is secured by 1st May 2010.

Registered student or not-for-profit Non-Governmental Organisations special rate: £800.

Further information and to reserve your place, contact: Daniel Gilbert

IHP - HELP Centre for Water Law, Policy & Science

(under the auspices of UNESCO)

tel +44 (0) 1382 386478

fax +44 (0) 1382 388671

email d.gilbert@dundee.ac.uk

or to reserve your place online, please complete the online registration form at:

<http://www.dundee.ac.uk/ad/globalwater>

Conference venue

The Symposium week will take place on the University of Dundee's main campus in the West End of the city and conveniently located with respect to the city's airport, train station and hotels.

For accommodation bookings please visit:

<https://www.conferencebookings.co.uk/delegate/DNDIWL2010>

Travel

Dundee has its own airport and train station and can also be reached easily from Edinburgh airport. Transport will be provided for the Pitlochry excursion. Local travel can be made by foot, bus or taxi.

Full details of the venues and maps will be sent to all registered delegates.

Cancellation

Cancellations must be received in writing no later than 1st May 2010 in order to be eligible for partial refund. Substitutions for registered participants may be made at any time, but we would appreciate prior notification.

Annex 9
Dundee IHP-HELP Centre
World Water Day:
online and interactive
22 March 2010, 1300-1630 GMT

On World Water Day, 22 March 2010 - which this year communicates messages on water quality, ecosystems and human well-being - the Dundee UNESCO Centre for Water Law, Policy and Science will host an interactive online event focused on Hydrology, Environment, Life and Policy (HELP) river basins in Scotland.

Mike Bonell heads the Dundee UNESCO HELP programme team. The University of Dundee will lead discussions with respect to the Tweed; and the Macaulay Institute will provide comparisons regarding the Dee. There will also be an international comparison of the Tweed and Thames HELP river basins. The focus throughout will be the interface between land use and water management, and an agenda for effective river basin management in Scotland.

The Policy Context

Chris Spray, Dundee UNESCO Centre for Water Law, Policy and Science (conference chair), giving policy context, purpose and objectives.

Shahbaz Khan, Chief of Water and Sustainable Development section, UNESCO Division of Water Sciences.

Andrew Panter, Scottish Natural Heritage on Valuing the Natural Environment. The River Basins

Susan Cooksley, Macaulay Institute, on the Dee HELP basin.

Simon Langan, Macaulay Institute, on stakeholder engagement within the Dee basin (to be confirmed).

Nicola Bissett, Tweed Forum, on the Tweed HELP basin

Tom Ball, Dundee UNESCO Centre for Water Law, Policy and Science, comparing Tweed HELP basin with that of the Thames and beyond.

Focus on Water Quality and Flooding Martin Marsden, SEPA, on water quality and regulation.

Lisa Webb, Land Use Policy Officer (Water) RSPB Scotland, on water quality and birdlife.

David Green, Scottish Borders Council, on flooding.

Summary by conference chair Chris Spray On World Water Day, 22 March 2010 - which this year communicates messages on water quality, ecosystems and human well-being - the Dundee UNESCO Centre for Water Law, Policy and Science will host an interactive online event focused on Hydrology, Environment, Life and Policy (HELP) river basins in Scotland.

Peters Building

University of Dundee

Dundee DD1 4HN

Contact: Daniel Gilbert

T: +44 (0) 1382 386478

F: +44 (0) 1382 388671

E: d.gilbert@dundee.ac.uk

To attend the event in Dundee, email Daniel Gilbert. To participate in the event online, please register online at <http://worldwaterdaydundee.eventbrite.com/>. We will stream the event live to the web, and provide an interactive "live blog" throughout the afternoon. Go to: www.be2camp.com/page/world-water-day-workshop.

World Water Day:

online and interactive

22 March 2010, 1300-1630 GMT

Critical Intersections for Energy & Water Law: Exploring New Challenges & Opportunities

Preliminary Program

May 20-21, 2009
Calgary, Alberta

“To a water expert,
looking ahead is like the view
from a locomotive,
10 seconds before the train wreck.”

Dr. David Schindler, Killam Memorial Professor of Ecology, University of Alberta

The production, transmission and consumption of both energy and water are governed by often extremely complicated legal systems. As worldwide demand for both energy and water rises in the face of the current global economic crisis and ever-increasing environmental constraints, it is timely for a critical reexamination of the role that law plays in promoting the sustainable development and use of these fundamental resources.

The University of Calgary Faculty of Law (Alberta) and the Pacific McGeorge School of Law (Sacramento, California), together with their partners from the Tsinghua University (Beijing, China), and the UNESCO Centre for Water Law, Policy & Science, University of Dundee (United Kingdom), invite legal academics, practitioners, business leaders, and regulatory officials to a multi-national conference exploring vital new intersections of energy and water law. The global impact and potential influence of a conference of this nature is significant. Now scheduled for May 20 and 21, 2009 in Calgary, Alberta, the hub of Canada's energy sector, the conference will explore the domestic and transnational intersections of energy and water law regimes. Conference presenters will address such broad questions as:

- What are the key (legal) issues in the energy/water nexus and how do they articulate at international, regional and national levels of engagement?
- Within any one given nation, how well do the often separate legal regimes interact? Between nations and across political borders, how do differences in legal regimes affect investment, development and consumption decisions?
- What opportunities/challenges do the laws governing one of these resources pose for the sustainable development and use of the other, either domestically or transnationally?
- Will a change in the laws governing one of these resources pose unintended consequences to the sustainable development and use of the other, either domestically or transnationally?
- What opportunities exist for greater coherency or integration between legal systems, either domestically or transnationally, with a specific focus on the energy/water nexus?
- What are the relevance and role of law (energy/water) within the new economic order and what specific challenges arise within this context?
- How should the new administration and Congress in the United States address these important issues?

Critical Intersections for Energy & Water Law: Exploring New Challenges & Opportunities

Presenters (Partial Listing)

As of January 26, 2009, confirmed presenters and their topics include:

- **Melinda Harm Benson**, Department of Geography, University of New Mexico
Integration of Adaptive Management Approaches by Resource Management Agencies in the United States: Implications for Energy Development in the Interior West
- **Kathleen Callison**, Law Offices of Kathleen Callison (Tumwater, Washington)
Water Use in Geothermal Energy Development: Real World Challenges, Regulatory Conflicts and Barriers, and Possible Solutions
- **Allan Ingelson**, Haskayne School of Business, University of Calgary
Coalbed Methane Production and Coal Mining in the Flathead Drainage Basin – An International Transboundary Water Dispute
- **Robin Kundis Craig**, Florida State University College of Law
Water Supply, Desalination, Climate Change and Energy Policy
- **Arlene Kwasiak**, Faculty of Law, University of Calgary
Environmental Flows and Athabasca Oil Sands Development
- **Stephen McCaffrey**, Pacific McGeorge School of Law
Energy, Water, Law and the Nile Basin Negotiations
- **Richard Paisley**, Global Transboundary International Waters Initiative, University of British Columbia
Energy, Water & Downstream Benefits
- **John Ruple** and **Robert Keiter**, Institute for Clean and Secure Energy, University of Utah
Water Resources and Oil Shale Development in the Western United States
- **Nidhi Srivastava**, The Energy & Resources Institute (New Delhi)
Federal Challenges to a Synergy Between Water and Energy Law: An Indian Perspective
- **A. Dan Tarlock**, Chicago-Kent College of Law
United States Water Policy in the Era of River Restoration and Energy Independence: Navigating the “Icy Currents”
- **Steven Weissman**, Center for Law, Energy & The Environment, University of California (Berkeley)
The California Public Utilities Commission’s Pilot Program to Explore the Nexus of Energy Efficiency and Water Conservation
- **Pat Wouters**, UNESCO Centre for Water Law, Policy & Science, University of Dundee
Promoting Regional Peace and Security Through Water/Energy Law and Policy – Responding to Global Challenges in Difficult Times

Additional presenters are still being solicited and confirmed.

Papers and other proceedings will be published after the conference by the University of Calgary's *Journal of Energy and Natural Resources Law* and the Pacific McGeorge *Global Business & Development Law Journal*.

For further information, or to propose an additional paper, contact either:

Professor Alastair R. Lucas
Faculty of Law, University of Calgary
MFH 4361, 2500 University Drive N.W.
Calgary, Alberta, Canada T2N 1N4
(403) 220-7111
alucas@ucalgary.ca

or **Professor Gregory Weber**
Director, Institute for Sustainable Development,
Center for Global Business & Development
Pacific McGeorge School of Law
3200 Fifth Avenue, Sacramento, CA USA 95817
(916) 739-7228
gweber@pacific.edu

Format for Reports by UNESCO's Water-related Centres (category 1 and 2) on activities related to the IHP in the period June 2008 – May 2010

1. Basic information on the centre

Name of the Centre		International Research and Training Center on Erosion and Sedimentation (IRTCES)
Name of Director		Prof.Dr. Kuang Shangfu
Name and title of contact person (for cooperation)		Prof.Dr. Hu Chunhong, Secretary General and Deputy Director
E-mail		huch@iwhr.com (CC: chliu@iwhr.com)
Address		20 Chegongzhuang West Road, Beijing 100044
Website		http://www.irtces.org
Location of centre		city/town Beijing country China
Geographic orientation *		<input checked="" type="checkbox"/> global <input type="checkbox"/> regional
Year of establishment		1984
Themes	Focal Areas	<input type="checkbox"/> groundwater <input type="checkbox"/> urban water <input type="checkbox"/> arid / semi-arid zones <input type="checkbox"/> humid tropics <input type="checkbox"/> droughts and floods <input checked="" type="checkbox"/> sediment transport and management <input checked="" type="checkbox"/> water and environment <input type="checkbox"/> ecohydrology <input type="checkbox"/> water law and policy <input type="checkbox"/> transboundary river basins/ aquifers <input checked="" type="checkbox"/> IWRM <input type="checkbox"/> global and climate change <input checked="" type="checkbox"/> mathematical modelling <input type="checkbox"/> social and cultural dimensions of water <input checked="" type="checkbox"/> water education <input type="checkbox"/> other: (please specify) _____
	Scope of Activities *	<input checked="" type="checkbox"/> vocational training <input checked="" type="checkbox"/> postgraduate education <input checked="" type="checkbox"/> continuing education <input checked="" type="checkbox"/> research <input checked="" type="checkbox"/> institutional capacity-building <input checked="" type="checkbox"/> advising/ consulting <input type="checkbox"/> software development <input type="checkbox"/> other: (please specify) _____
Support bodies ¹		Ministry of Water Resources, China
Hosting organization ²		
Sources of financial support ³		Ministry of Water Resources, UNESCO, IRTCES service rendered
Existing networks and cooperation ⁴		<ul style="list-style-type: none"> ● World Association for Sedimentation and Erosion Research (WASER) ● World Association Of Soil & Water Conservation (WASWAC) ● Network of Regional Water Knowledge Hub in Asia-Pacific Region ● Network of Asian River Basin Organization ● International Association of Hydraulic

* check on appropriate box

¹ please specify bodies that cover the operational costs of the centre, and other essential costs such as salaries and utility bills, and that provide institutional support to ensure centre's sustainability

² if different from support bodies

³ please specify sources of main budgetary and extrabudgetary funds to implement projects

⁴ please write international networks, consortiums or projects that the centre is part of, or any other close links that the centre has with international organizations or programmes, which are not already mentioned above

	<p>Engineering and Research (IAHR)</p> <ul style="list-style-type: none"> ● International Association of Hydrological Science (IAHS) ● Universiti Teknologi Mara (UiTM), Malaysia ● National Centre for Computational Hydrosience and Engineering of the University of Mississippi (NCCHE), USA ● National Hydroelectric Power Corporation LTD. (NHPC), India ● ICHARM, Japan ● Elsevier
Governance	<input checked="" type="checkbox"/> director and governing board <input checked="" type="checkbox"/> other: (please specify) International Advisory Council Link to election of board members to the IHP IGC and hosting country IHP National Committee Frequency of meetings: once every <u>2</u> year(s) <input checked="" type="checkbox"/> Existence of UNESCO presence at meetings
Institutional affiliation of director	Ministry of Water Resources, China
Number of staff and types of staff	total number of staff (full-time, or equivalent) : 17 number of staff who are water experts: 13 number of visiting scientists and postgraduate students: 2
Annual turnover budget in USD	0.6 million USD

2. Activities undertaken in the framework of IHP in the period June 2008 – May 2010

- 2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP- VII and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.
N/A
- 2.2 Research activities that directly contributed to the IHP-VII and activities by WWAP
Please include research/applied projects outputs such as publications that directly contributed to the IHP-VII and WWAP objectives

1) Contribution to the World Water Development Report 3 (WWDR3) IRTCES has made contributions to the Chapter 2 of the 3rd Edition of the UN World Water Development Report' with reports of "Report of changing in water and sediment loads of rivers in China" and "Report of Wrapping dams in China".

2) Pilot case study on "Variation in Runoff and Sediment Load in the Pearl River Basin and Its Cause"

IRTCES carried out this case study in the purpose of contribution to the ISI project for increasing awareness of global changes in runoff and sediment loads, promotion of sustainable management of water and sediment resources and to adaption to new challenges in water management in the next decades. Main topics of the pilot study included (1) Description of the Pearl River Basin (2) Variation in Runoff and Sediment Loads in Major Rivers of the Pearl River Basin (3) Variation Characteristics of Runoff and

Sediment Loads in the Pearl River Basin (4) Cause of Variation in Runoff and Sediment Loads in the Pearl River Basin.

3) Pilot case study on "Utilization of Sediment Resource in the Lower Yellow River"

IRTCES is jointly undertaking to implement pilot case study on "Utilization of Sediment Resource in the Lower Yellow River" in close cooperation with UNESCO Office in Beijing, the relevant ministries, departments and commissions responsible for Integrated Water Resources Management in Yellow River Basin. Main topics of the pilot study included (1) Sediment resource in the Yellow River; (2) Sediment utilization in the main channel of the Lower YR; (3) Sediment utilization in irrigation districts along the Lower YR; and (4) Sediment utilization in the Yellow River Delta.

- 2.3 Please include research/applied project outputs such as publications that directly contributed to the IHP-VII and WWAP objectives

Please refer to publications listed under section 8.1.

- 2.4 Training activities that directly contributed to the IHP-VII and WWAP objectives

International Advanced Training Workshop on Integrated River Basin Management, July 27 - August 3, 2009

The workshop was sponsored by the International Sediment Initiative (ISI) of UNESCO-IHP and the Ministry of Water Resources of China, and co-sponsored by the World Association for Sedimentation and Erosion Research (WASER) and the Chinese National Committee for UNESCO-IHP. 51 participants from 18 countries including Afghanistan, Australia, Bangladesh, DPRK, Hungary, India, Iran, Indonesia, Myanmar, Mongolia, Nepal, Romania, Sri Lanka, Sudan, Uganda, Uzbekistan and China attended the training workshop. The general objectives of the training workshop focused on theory of integrated river basin management, water resources management, water and soil conservation, knowledge of river ecology and methods restoration, as well as experience and information exchange. In addition, IWRM Guidelines at River Basin Level as new training materials were introduced by the secretariat of NARBO on the invitation of UNESCO. Through lectures, exchanges and one-day Lab. study the participants have improved their professional theory and knowledge of integrated river basin management, get much latest concepts and techniques, and information as well as establish linkage among participants.

3. Collaboration and linkages

- 3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies

1) International Sediment Initiative (ISI) Technical Secretariat at IRTCES

IRTCES much involved in the organization, collaboration, communication and services works for following successful ISI activities.

- The UNESCO-IHP- ISI Ad Hoc meeting, in Bern, April 29, 2008 during the "International Workshop - Erosion, Transport and Deposition of Sediments".
- The 6th International Sediment Initiative Steering Committee Meeting (ISI SCM) and Workshop on Global Change Impacts and Role of ISI Beijing, China from November 5 to 7, 2008.

- A Core Member Meeting of the UNESCO-ISI Steering Committee, Switzerland on March 5, 2010.
- Co-sponsored Workshop on 'Sediment Problems and Sediment Management in Asian River Basins', Hyderabad, India, September 7-8, 2009
- International Advanced Training Workshop on Integrated River Basin Management, July 27 - August 3, 2009
- Maintaining and updating the ISI website and ISI Information System, with 275 pieces of news, 62 pieces of coming events, 11 conference proceedings, and 88 technical reports and papers;
- Compiling and editing 9 issues of electronic quarterly newsletter on sediment issues in the period of June 2008-May 2010, and circulating it to the ISI-SC members and a wide range of experts;

2) Secretariat of World Association of Erosion and Sedimentation (WASER)

IRTCES also serves as secretariat of World Association of Erosion and Sedimentation (WASER). The objectives of the WASER shall be: 1) to promote the study and development of the science of erosion and sedimentation interpreted in its widest sense; and 2) to foster the application and dissemination of knowledge of in the field of erosion and sedimentation, so a lot of activities were conducted:

- As the official Journal of both IRTCES and (WASER), the quality of the International Journal of Sediment Research (IJSR) has been further improved. The Journal was also added to the Web of Science in 2008.
- The Association is continuing to grow and now has over 342 members.
- WASER co-sponsored a number of very successful international symposia and workshops, mainly included (i) The 3rd International Conference on Estuaries and Coasts (ICEC-2009) held in Sendai, Japan from Sept.14 -16, 2009. (ii) The International Workshop on Sediment Problems and Sediment Management in Asian River Basins, held in Hyderabad, India, from September 7 - 8, 2009.

3) Active participation in the activities of regional networks, such as Network of Regional Water Knowledge Hub in Asia-Pacific Region and Network of Asian River Basin Organization (NARBO). The IRTCES played important role in promotion of knowledge generation and dissemination as international and regional knowledge hub for erosion and sedimentation in water basin in Asian Pacific region.

4) Signing bilateral agreements with the Universiti Teknologi Mara (UiTM), Malaysia, the ICHARM, UNESCO Water related center, and etc.

3.2 Participation in meetings related to the IHP and UNESCO (e.g., the UNESCO General Conference, the UNESCO Executive Board, the IHP Intergovernmental Council and/or other meetings organized by IHP)

- The UNESCO-IHP- ISI Ad Hoc meeting, in Bern, April 29, 2008
- "International Workshop - Erosion, Transport and Deposition of Sediments" in Bern, April 29, 2008.
- Seminar on Impact of Climate Change on Water Resources organized in the Ministry of Water Resources of China (MWR) by the Chinese National Committee for IHP on May 26, 2008.
- The 6th International Sediment Initiative Steering Committee Meeting (ISI SCM) and Workshop on Global Change Impacts and Role of ISI Beijing, China from November 5 to 7, 2008.
- A Core Member Meeting of the UNESCO-ISI Steering Committee, Switzerland on March 5, 2010.
- The 17th Regional Steering Committee (RSC) Meeting for the UNESCO International Hydrological Programme for Southeast Asia and the Pacific (UNESCO-IHP SEAP) Wuhan, China, November 5-6, 2009

- As a resource person to give a keynotes at International training workshop on reservoir sedimentation control, Teheran, Iran, October 19-21, 2009
- UNESCO Workshop of Climate Change and its Adaptive Strategies for Water Resources Management, one of the special sessions of the Forth International Yellow River Forum, was held in Zhengzhou, China on October 22, 2009

3.3 Collaboration and networking with other UNESCO category 1 or 2 institutes/ centres

- IRTCES has signed the MOU with International Centre for Water Hazard and Risk Management (ICHARM, Japan) on September 18 2009.
- International Research Center on Karst and International Centre on Space Technologies for Cultural and Natural Heritage visited IRTCES for future cooperation on September 22, 2009 and January 29, 2010.

3.3.1 cross-appointment of directors of the category 1 or 2 institutes or centres on the governing board
Not yet

3.3.2 exchange of information on activities such as training/educational materials, and funding opportunities

- Exchange of information on activities with International Center for Hazard and Risk Management (ICHARM)
- Training materials have been uploaded in IRTCES's websites for information exchanging.
- Exchange visits between IRTCES and UNESCO category II centers in China for discussion and activities related the capacity building.

3.3.3 exchange of staff, most notably professionals and students
Not yet

3.3.4 implementation of joint activities, such as workshops, conferences, training programmes, joint projects, field visits, software and data sharing, knowledge exchange and publications

- The 3rd International Conference on Estuaries and Coasts (ICEC-2009) was held successfully in Sendai, Japan on Sept.14-16, 2009. The ICEC-2009 was organized by the International Research and Training Center on Erosion and Sedimentation (IRTCES) and Tohoku University, and co-sponsored by UNESCO, International Association of Hydraulic Engineering and Research (IAHR), International Association of Hydrological Sciences (IAHS), World Association for Sedimentation and Erosion Research (WASER), IAHR Asian and Pacific Division (IAHR-APD) and Japan Society of Civil Engineers (JSCE).
- 3rd US-China Workshop on Advanced Computational Modeling in Hydroscience and Engineering was held in USA in May, 2010 2008 according to the work plan under MOU between IRTCES and The NCCHE (National Center for Computational Hydroscience and Engineering) at the University of Mississippi.

3.4 Relationships with the UNESCO field and regional office whose jurisdiction covers the country of location

IRTCES keeps closed and good cooperative relationship with UNESCO Office Beijing.

- 3.5 Relationship with the UNESCO National Commission and the IHP National Committee in the country of location and with other organizations of other countries

Chinese National Commission for UNESCO and Chinese National Committee for IHP provided guidance to IRTCES in capacity building and development of IRTCES and also gave full supports to IRTCES activities.

- 3.6 Relationship with other UNESCO-related networks, such as UNESCO Clubs, ASPnet, and UNESCO chairs
N/A

4. Communication

- 4.1 Communication and knowledge dissemination activities undertaken in the framework of IHP

- Organizing Seminar on Global Climate Change and Water (IRTCES, April 17, 2009). Dr. Szöllösi-Nagy, DADG of UNESCO and Dr. Wang Hao, Academician of CAE made presentations.
- Organizing Seminar on Integrated River Basin Management under Global Climate Change (Beijing, July 29, 2009). Prof. W.R. Erdelen, ADG of UNESCO, Prof. Liu Changming, Academician of CAS, Prof. M. Spreafico, Chairman of the UNESCO-IHP-ISI SC, and Prof. Wang Zhao-Yin, Chairman of IRTCES Advisory Committee made presentations.
- Attending "International Workshop - Erosion, Transport and Deposition of Sediments" and made presentations in Bern, April 29, 2008.
- Attending Seminar on Impact of Climate Change on Water Resources organized in the Ministry of Water Resources of China (MWR) by the Chinese National Committee for IHP and made presentations on May 26, 2008.
- Attending the 17th Regional Steering Committee (RSC) Meeting for the UNESCO International Hydrological Programme for Southeast Asia and the Pacific (UNESCO-IHP SEAP) and made presentation in Wuhan, China on November 5-6, 2009
- As a resource person to give a keynotes at International training workshop on reservoir sedimentation control, Teheran, Iran, October 19-21, 2009
- Attending UNESCO Workshop of Climate Change and its Adaptive Strategies for Water Resources Management, one of the special sessions of the Forth International Yellow River Forum, and made presentations in Zhengzhou, China on October 22, 2009
- Organizing International Advanced Training Workshop on Integrated River Basin Management. July 27 - August 3, 2009
- Organizing 3rd International Conference on Estuaries and Coasts (ICEC-2009) held in Sendai, Japan from Sept.14 -16, 2009

- 4.2 Policy documents and advice

5. Update on Centre Operations

- 5.1 Membership of the Board of Governors during designated period

Board of Governors:

IRTCES is administrated by a Board of Directors, which is appointed by the Ministry of Water Resources, P. R. of China. The Secretary General presides over the routine work of IRTCES. The Board consist one director and three deputy directors.

Prof. Dr. Kuang Shangfu, Director

Prof. Dr. Hu Chunhong, Deputy Director and Secretary General

Prof. Dr. Gao Zhanyi, Deputy Director

Prof. Ning Duihu, Deputy Director

IRTCES' Advisory Council:

During designated period (2006-2010) 13 members including one representative of the Chinese Government, one representative of the Director General of UNESCO, six members elected by the IHP Intergovernmental Council and five members selected by the Government in consultation with the Director-General of UNESCO.

(UNESCO)	Dr. Andras Szollosi-Nagy; Deputy Assistant Director General, Secretary of the International Hydrological Programme, UNESCO
(MWR)	Mr. Liu Zhiguang, Deputy Director General of the Department of International Cooperation, Science and Technology, Ministry of Water Resources, P. R. China
(Group1)	Prof. Des Walling, President of WASER and Professor of the University of Exeter, UK
(Group2)	Prof. Zurab D. Kopaliani, Roshydromet State Hydrological Institute, Russia
(Group3)	Dr. Roberto Pizarro Tapia, Professor of the Universidad de Talca, Chile
(Group4)	Mr. Djoko Legono, Gajah Mada University Indonesia
(Group 5a)	Prof. Francis Mutua, Professor, Water and Climate, University of Nairobi, Kenya
(Group 5b)	Prof. Abdalla Abdelsalam Ahmed, UNESCO Chair on Water Resources, Sudan
(China)	Prof. Wang Zhaoyin, Chairman, Advisory Council of IRTCES, Prof. of Tsinghua University
(China)	Prof. HAN Qiwei, IWHR, China
(China)	Prof. DOU Xiping, NHRI, China
(China)	Prof. LI Wenxue, YRCC, China
(China)	Prof. TAN Ying, IRTCES, China

5.2 Key decisions made (attach minutes of meetings)

First Advisory Council meeting was held in November 2008. The meeting minutes can be seen as Annex II

6. Evidence of the Centre's Impacts

6.1 Science Impacts (Major contributions to the science, technology, education, and regional and/or international cooperation in the field of water)

- 1) To act as the Secretariat for the International Sediment Initiative including hosting and coordinating the implementation of projects relevant to sediment, sustainable water management, and water-environment and ecology.
- 2) To launch and publish the quarterly international journal of the International Journal of Sediment Research. The Journal was added to the Science Citation Index (SCI) by Thomson Scientific making part of the elite group of international journals. This is effectively the only journal that draws together the many different contributing disciplines and focuses on the field of erosion and sedimentation. It serves a very important role for the international scientific community within the field of erosion and sedimentation.
- 3) To develop the World Association for Sedimentation and Erosion (WASER) . IRTCES play a leading role in the field of erosion and

sedimentation in the world. This provides a good platform for all scientists and engineers to exchange scientific and technical information and promote cooperation and development of research on erosion and sedimentation.

- 4) To create regular scientific exchange mechanism, such as highly successful series of International Symposia on River Sedimentation and International Conference on Estuaries and Coasts at three yearly intervals. The published proceedings represent an impressive record of ongoing developments in the field of erosion and sedimentation and the global distribution of venues has proved invaluable in facilitating the growth of international exchange and collaboration in the field of erosion and sedimentation.
- 5) Development and established free accessed Database of Global River Erosion and Sedimentation.
- 6) Accomplished over 20 research projects in the fields of river and reservoir sedimentation, fluvial process, soil erosion control, river basin management and eco-environmental protection.
- 7) Responses of IRTCES evaluation can be for reference as Annex 2.

6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)

- 1) As international knowledge hub for erosion and sedimentation in river basins, IRTCES has been invited to be member of APWF-Knowledge hub network and Network of Asian River Basin Organization.
- 2) Lots of knowledge products (International Journal of Sediment Research, lecture notes, proceedings, and various related publications) could be provided to meet the demands of countries suffered from erosion and sedimentation problems.
- 3) International training courses, workshops, seminars have been conducted regularly. Through these activities, update concepts, knowledge, technology and good practices could be disseminated to participants for improving water resources management in their area.
- 4) Responses of IRTCES evaluation can be for reference as Annex 2.

6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)

- 1) Nine issues of Gazette of River Sediment in China has been edited by IRTCES since 2000 for collection and analysis of erosion and sedimentation data in main river systems in the country. It provided valuable observation data for governmental decision makers in considering river regulation, water resources management and investment.
- 2) Database of Global River Erosion and Sedimentation has been established for releasing related data, publication and information of world rivers for policy makers and researchers.

7. Future activities that will contribute directly to IHP and/or to WWAP

- 7.1 Operational Plan (2010-2011) (attach operational plan for 2008-09 if available)

Current IRTCES Operational Plan is attached as Annex 1. Detail future activities are:

Sponsoring the 11th International Symposium on River Sedimentation; September, 2010 in South Africa

Organizing the International Training Workshop: Water and Soil Conservation and Eco-construction in 2011

ISI website and ISI Information System construction and improvement

Database example for ISI Information System: Database of runoff and sediment loads of main rivers in China

7.2 Strategic Plan linked with IHP-VII (attach strategic plan for 2008-11 if available)

Same as Annex 1

8. Annexes

8.1 List of publications released by the centre (there can be overlap with those listed in 2.2 above)

- Chen Jianguo, Zhou Wenhao, Sun Gaohu ,Behaviors of water and sediment transport in wide channel reach and their influences upon narrow channel reach in the Lower Yellow River,J.of sediment research,2008(1).
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8.2 List of training courses conducted (there can be overlap with those listed in 2.3 above)

International Advanced Training Workshop on Integrated River Basin Management, July 27 - August 3, 2009

8.3 Annex 1

Minutes of the first Meeting of the 7th IRTCES Advisory Council

8.4 Annex 2 Responses of IRTCES Evaluation

- ISI Steering Committee support for the evaluation of IRTCES
- Evaluation of IRTCES by Prof. Des. Walling
- Evaluation of IRTCES by Prof. José Zúñiga
- Evaluation of IRTCES by Prof. Rollin Hotchkiss
- Evaluation of IRTCES by Prof. Dr. Dou Xiping

Minutes of the first Meeting of the 7th IRTCES Advisory Council

Time: November 6, 2008

Venue: International Research and Training Center on Erosion and Sedimentation (IRTCES), Beijing, China

Participants:

Members of Advisory Council:

Wang, Zhao-Yin - Tsinghua University, Beijing, China
 Walling, Desmond E. - University of Exeter, Exeter, UK
 Zurab D. Kopaliani - Roshydromet State Hydrological Institute - St Petersburg, Russia
 Djoko Legono - Fakultas Teknik UGM - , Indonesia
 Abdalla Abdelsalam Ahmed - UNESCO-CWR, Sudan
 Francis Mutua, University of Nairobi, Kenya
 Pizarro, Roberto, Universidad de Talca, Chile (not present)
 Dou, Xiping, NHRI, China
 Li, Wenxue, YRCC, China
 Tan Ying, IRTCES, Beijing, China
 Han Qiwei, IWHR, China (not present)

Officials of the United Nations Educational, Scientific and Cultural Organization (UNESCO):

Anil Mishra - UNESCO/Division of Water Sciences, Paris, France
 R. Jayakumar - UNESCO/ Office Beijing, China
 Liu, Ke (assistant of R. Jayakumar) - UNESCO/ Office Beijing, China

Ministry and IRTCS staff:

Liu, Zhiguang - Ministry of Water Resources, Beijing, China
 Hu, Chunhong - IRTCES, Beijing, China
 Hao, Zhao - Ministry of Water Resources, Beijing, China
 Liu, Guangquan - Department of Information - IRTCES, Beijing, China
 Wang, Yangui - Department of Research and Training - IRTCES, Beijing, China
 Liu, Cheng - Department of Research and Training - IRTCES, Beijing, China
 Fan, Zhao - Department of Management - IRTCES, Beijing, China
 Shi, Hongling - Department of Research and Training - IRTCES, Beijing, China
 Liu, Xiaoying - Department of Information - IRTCES, Beijing, China
 Tong, Yuling - IRTCES, Beijing, China
 Zhang, Yanjing - Department of Research and Training - IRTCES, Beijing, China

International Experts and member of International Sediment Initiative (ISI) as observers:

Spreafico, Manfred - University of Berne - Berne, Switzerland
 Brils Jos - Deltares / TNO - Utrecht,- The Netherlands
 Bruk, Stevan - Belgrad, Serbia
 Golosov, Valentin - Moscow State University, Moscow, Russia
 Di Silvio, Giampaolo - Universita degli Studi di Padova - Padova, Italy
 Julien, Pierre - Colorado State University Fort Collins, USA
 José Alberto Zúñiga, Instituto Costarricense de Electricidad (ICE), San José, Costa Rica
 Hotchkiss, Rollin H. - Brigham Young University, Provo, Utah, USA
 Yazdandoost, Farhad - Water Research Institute, Tehran, Iran
 Robarts, Richard - National Water Research Institute, Ontario, Canada
 Moattassem El Qotb - Research Institute NWRC, Egypt

Rapporteur

De Souza, Fabio Teodoro - Tsinghua University - Beijing, China

Topics Discussed:

During the 7th IRTCES Advisory Council Meeting, ten topics were listed, and participants discussed choosing randomly each topic proposed:

- 1 Role of IRTCES in sediment research.
- 2 Service as a sediment information center and database.
3. Coordination of sediment research in the world and China.
4. Training programs and Platform of training courses.
- 5 Development of the International Journal of Sediment Research.
- 6 New problems and new directions of sediment research.
- 7 Relationships of UNESCO and ISI.
- 8 Cooperation of IRTCES with organizations and institutions.
- 9 Secretariat of WASER and ISRS.
- 10 Finance of IRTCES.

Summary of Comments, Opinions and Suggestions:

Most of these topics are related and dependent each other. This summary intends to show the most important conclusions gathered during the discussion concerning to the training programs; new directions of sediment research; and the relationship IRTCES, UNESCO, ISI and other organizations.

The majority of the members exposed the difficulty in obtaining fund in order to bring people for the training program offered by IRTCES, in China. Training is very important, becomes part of skill formation, but it is difficult to get sponsor for long trips. They proposed an agreement involving corporation to support the design of regional centers for training courses, in different countries all over the world, increasing the number of trained people. The members also suggested that these centers might offer other facilities besides the training courses, including video-courses and several materials from different topics. Moreover, it was concluded that training is important with research, and they are topics related each other.

In this way, all the members proposed new directions of sediment research, including an intensification of the network among international institutes, information exchange, capacity building and technology development. They commented that the whole world is moving internationally far away, from national to international purposes.

A strong collaboration with international institutes might bring up positive enhancements. For example, the International Journal of Sediment Research (IJSR) is an important frame to connect international institutions by sharing their experiences. There was a discussion about implementing the articles available on the internet, and also about creating different categories for downloading according to different subject and kind of readers. The IJSR journal is unique in Sediment field; various case studies around the world are easily shown on the journal, attracting the interest in articles published by different regional centers of research, and intensifying the information exchange. Members endorsed that sharing information might be a good policy to introduce and create networks. They suggested advancing in an international platform to exchange data through the web and establishing interactions among different institutes. Focusing on the idea of globalization, different countries could contribute with local expertise, using experiences in GIS, erosion, deposition, contamination models, etc. An important contribution could be obtained putting together knowledge from several researches in different parts of the world, and putting all information on the web. These interactions could influence directly at the process of capacity building, by integrating sponsors for clinic training courses, workshops, conferences and other related activities, as well as the development of technology. The ability to develop technology could start promoting the research developed in the Sediment field into other areas.

In this context of collaboration, members discussed the relationship IRTCES, UNESCO, ISI and other organizations. As of 1984, IRTCES has been an important research center in sediment field and conducting several activities. A lot of projects have been developing in several places and in different areas of erosion and sedimentation. A new compiled book of sedimentation, containing data from 2003 to 2006, for the Three Gorges Project, and translated to English, is ready to be published. The Website WASER <www.waser.cn>, managed by the IRTCES, is a very important vehicle to associate institutions. Some members proposed that platform like WASER could be implemented in regional branches and they suggested contacting responsible headquarters. The IRTCES

has close relationship with UNESCO and Chinese Government (Ministry of Water Resources of China). These both institutions have been giving important contributions to the IRTCES in sediment researches. A new agreement signed in November 2005, reinforced the collaboration of Chinese Government, UNESCO, and IRTCES, in sediment studies. This collaboration has been very important to promote global studies and to integrate different agencies, associations and institutes from several countries. The UNESCO is an institution which has been responsible for contacting societies in hydraulic processes, promoting scientific consortiums, managing journals and other publication structures, organizing conferences and scientific forums, besides other important roles.

A possible link between UNESCO and ISI was highlighted by the participants. They suggested a meeting between both parts to discuss how could be integrated common interests, such as web-publications, scientific forums, scientific consortiums, development resources, and so on. In addition, some members suggested that IRTCES could benefit a lot by collaborating with a World Bank institute for water. Also, they proposed an association between IRTCES and regional institutions from different countries, such as Sudan, Kenya, Iran, Malaysia, Indonesia, Russia, and others in South America. The idea is centered on contacting the local bureau of UNESCO (regional offices) and trying to establish a network with responsible institutes. For example, for Sudan, should be contacted the UNESCO regional office from Cairo. For Kenya, collaboration also could be obtained from regional bureau travel. Although, members emphasized that some tasks are very important to succeed financially research projects, such as collecting information, coordinating, and establishing strategies focusing on key areas and diversities of research. They proposed that participants of the Advisory Council Meeting, might intermediate on the process to negotiate with UNESCO management and regional institutions.

In summary, members concluded that training courses are very important and should continue, but must be investigated new ways to promote training programs around the world. It is costly to send experts to China and sometimes it is very difficult to find financial resources. They also proposed a new model for training courses, promoting different ways of training including exciting activities, and consequently, increasing the number of trained people. Moreover, it was concluded that is necessary some issues to enhance the international corporation in different features of sediment research. These issues comprise in intensifying the network among international institutes, information exchange, capacity building and technology development. An international collaboration could provide additional information to regional research centers, and possibly filling their gaps of knowledge by sharing data. It was suggested a confection of a guideline for sediment management, and a standard methodology for data collection and analysis. Members also concluded that IRTCES might intensify its collaboration with international institutes. Collaboration might be established by intermediating partners, such as UNESCO, ISI, Chinese Government and other institutions.

ISI Steering Committee support for the evaluation of IRTCES

Our opinions are related to the following functions of IRTCES:

- A. To promote the scientific research on erosion and sedimentation (including sediment transport theory, fluvial and coastal and reservoir sedimentation, sedimentation engineering, soil erosion, soil and water conservation, environmental and ecological impacts of sedimentation).

We cannot adequately judge this purpose because we lack the sufficient information to do so. We understand that there is a general plan. We would welcome the opportunity to review the IRTCES research strategy if it were made available to us.

However, we commend IRTCES for their critical role in developing and promoting the highly successful International Journal of Sediment Research (IJSR), and in launching the World Association of Erosion and Sedimentation Research (WASER).

- B. To provide technical advisory services and to create mechanisms for the exchange of scientific and technical information on the results of research among experts in various countries.

Again, we do not have enough background and information to provide any meaningful input.

- C. To act as the Secretariat for the International Sediment Initiative including hosting and coordinating the implementation of projects relevant to sediment, sustainable water management, and water-environment and ecology.

First of all, the ISI Steering Committee members believe that the decision to house the ISI Secretariat within ITRCES was an excellent decision. We note the following benefits:

1. The ISI Secretariat provides strong support in organizing meetings and workshops around the world and is organizing such events in China in an appropriate way.
2. The ISI Secretariat and IRTCES have done an excellent job in setting up, operating, and maintaining the ISI Information System. The importance of the Information System is borne out by the many hits to the ISI webpage.

- D. To coordinate international cooperative research activities and to establish laboratory and research centers in order to provide facilities for laboratory and field work for experts from other countries.

To our knowledge, we are not aware of coordinated international research activities or projects undertaken by IRTCES. However, we are pleased to note that IRTCES has established collaborative agreements with several organizations and agencies around the world. In particular, IRTCES, along with five other organizations, was a charter member of the International Coordinating Committee on Reservoir Sedimentation (ICCORES), whose purpose was to help coordinate research activities. Laboratory access is provided to IRTCES at Tsinghua University and at the IWHR facilities. IRTCES has the ability to perform field research at the Jingjiang River Experimental Station.

- E. To organize international training courses, symposia or workshops on special subjects and international study tour and lecturing activities.

The IRTCES has been very successful in conducting these activities. In particular, we commend IRTCES for playing a major role in the organization and carrying out of the prestigious ISRS series of conferences. The topics for training have been and continue to be appropriate for the mission of IRTCES. For the future it is

recommended that IRTCES promote the development of innovative training delivery methods in addition to the successful face-to-face training that has been a hallmark of the initial years. Such methods may include extensive use of videoconferencing, webinars, instructional simulations and other means. We recommend a subcommittee be formed with experts in training delivery methods to help IRTCES formulate an updated training plan.

As a minor point, we recommend that all facilities open to short course or meeting participants be wireless accessible.

Apart from the specific missions evaluated above, we recommend that IRTCES consider instituting, in a pilot plan during the next few years, for an exchange of scientists with other Category II centers. For example, one or more IRTCES scientists might be stationed at another UNESCO Category II location for a period of months, while receiving scientists from the same facility. We believe that such exchanges will expose scientists from multiple countries, disciplines, and backgrounds to new ideas for performing and carrying out research. They will likely also learn how to improve operations in their own centers.

Respectfully submitted by the Chairman of the ISI Steering Committee, 07 of November 2008, Beijing, China

Evaluation of IRTCES by Prof. Des. Walling

I am pleased to respond to the invitation of Professor Hu Chunhong, Secretary General of IRTCES, to submit comments relating to the activities of IRTCES in the field of erosion and sedimentation. I

would like to focus particularly on the role of IRTCES in promoting international cooperation, interchange and exchange, within the broad field of erosion and sedimentation. There can be no doubt that IRTCES has an outstanding record in this area and that it must be seen as a leading player in the international arena. Four areas can be highlighted in this context. These are:

1. Its role in launching and developing the International Journal of Sediment Research, which through its recent association with Elsevier and its admittance to the Thomson/Reuters SCI index list must clearly be seen as being well on the way to becoming a leading international journal in the field. This is effectively the only journal that draws together the many different contributing disciplines and focuses on the field of erosion and sedimentation. It serves a very important role for the international scientific community within the field of erosion and sedimentation and I am confident that the journal will continue its upward trajectory and will soon be widely recognised as a key journal in the field.
2. Its role in providing the Technical Secretariat for the UNESCO International Sedimentation Initiative. Since taking on this role, IRTCES has made major strides in raising the profile and international visibility of ISI. In particular, the ISI Website now represents an extremely valuable and highly important resource for the international community. It draws together information on recent and forthcoming activities in the field of erosion and sedimentation, and provides access to a wide range of literature and related material, as well as providing links to other relevant sites.
3. Its role in founding and developing the World Association for Sedimentation and Erosion Research (WASER). IRTCES played a leading and key role in the founding and launching of WASER in 2004 and it continues to provide invaluable support by serving as the Secretariat of the Association. It provides both the Secretary General and Treasurer of the Association and without the financial support of IRTCES, both direct and indirect, the Association would face major problems. The International Journal of Sediment Research, which as indicated above is published by IRTCES, has been designated the official journal of WASER and this again provides important support for the Association.

4. Its role in serving as the permanent Secretariat for the highly successful series of International Symposia on River Sedimentation. These started back in 1980 and have continued at three yearly intervals. The next Symposium will be held in Stellenbosch, South Africa, in September 2010. The published proceedings represent an impressive record of ongoing developments in the field of erosion and sedimentation and the global distribution of venues has proved invaluable in facilitating the growth of international exchange and collaboration in the field of erosion and sedimentation. Again the linking of the Symposia series to WASER has provided a valuable contribution to raising the profile of the Association.

To these specific activities must be added the highly important work of IRTCES in publishing the China Gazette of River Sedimentation, which now makes key information on Chinese rivers available to the international community, in providing international training courses and study tours in the field of erosion and sedimentation and in undertaking a successful programme of research, which has made an important and effective contribution to advancing understanding within the field, as well as facilitating the exposure of the important contribution of Chinese scientists to the international community. IRTCES must be seen as highly successful in fulfilling its intended functions and objectives.

Evaluation of IRTCES by Prof. José Zúñiga

Regarding to IRTCES evaluation, it had been shown the accomplishment of all tasks that the institute was supposed to carry out for instance in terms of research, training and development of the web page, including also a database links. This is something that really has to be acknowledged.

However, in terms of projection and training, I consider that it has to be done an effort in those areas in order to position IRTCES as a leading agent in the field of erosion and sediment around the world. For instance, it can be increased the cooperation agreements between countries, institutions or even Regional Unesco offices with ITRCES. Also in the training area it is necessary to explore different methods for example: as I mentioned during the meeting, to send experts to different Unesco regions for regional training courses or e-learning courses when a face to face course is not possible and distant parts of the world can be reached this way. There is an example in doing this by COMET project (<http://www.meted.ucar.edu/>). Besides, it could be useful to establish the possibility to develop conferences and training through video conferences. By doing this, interactions would become very active and then relevance of IRTCES will grow too. Other fields like research can be also strengthened incorporating studies in different regions of the world under IRTCES cooperation and advise. With all those connections, database and information exchange will become easier too.

Evaluation of IRTCES by Prof. Rollin Hotchkiss

Face- to- face training, whether at Beijing or at sites around the world, should continue. BUT I encourage IRTCES to consider new and innovative ways to SUPPLEMENT fact-t-face training. This will help IRTCES remain relevant in the training aspect of their mission.

For example, training may also be accomplished using (1) videoconferences, (2) CDs of materials viewed by trainees, (3) Computer simulations developed for particular topics, (4) Webinars and others.

I urge IRTCES to form a subcommittee to (1) investigate alternatives to face-to-face training and (2) conduct some pilot training using these new methods.

Thanks you. Rollin Hotchkiss

Evaluation of IRTCES by Prof. Dr. Dou Xiping

Since established in 1984, IRTCES has played a very important role in sedimentation training, research and international academic activities.

IRTCES has organized the International Conference on River Sedimentation for ten times and International Conference on Estuaries and coasts for three times. The series of conferences provided the scholars all over the world to exchange the last word.

IRTCES has also organized many training courses. Some famous scholars are invited by IRTCES giving lectures. A lot of researchers, especially young persons, acquired the knowledge of sedimentation further.

IRTCES has applied himself to the key projects. The sedimentation is an important problem in Three-Gorge Project. IRTCES organized the feasibility study and demonstrability of TGP related to sedimentation problem and several institutes and universities have taken part in the research work for more than twenty years.

All of the work mentioned above incarnates the function of IRTCES. IRTCES has been promoted sediment research not only in China, but also in worldwide.

Format for Reports by UNESCO's Water-related Centres on activities related to the IHP in the period June 2008 – May 2010

1. Basic information on the centre

Name of the Centre		IRTCUD – International Research and Training Centre for Urban Drainage
Name of Director		Prof. Dr. Cedo Maksimovic
Name and title of contact person (for cooperation)		Ljiljana Jankovic, Dipl. Eng
E-mail		irtcud@hikom.grf.bg.ac.rs
Address		Bulevar Kralja Aleksandra 73 P.O.Box 35-42; 11120 Belgrade Serbia
Website		http://hikom.grf.bg.ac.rs/Frames.htm
Location of centre		city/town Belgrade country Serbia
Geographic orientation *		<input checked="" type="checkbox"/> global <input type="checkbox"/> regional
Year of establishment		
Themes	Focal Areas ♦	<input checked="" type="checkbox"/> groundwater <input checked="" type="checkbox"/> urban water <input type="checkbox"/> arid / semi-arid zones <input type="checkbox"/> humid tropics <input checked="" type="checkbox"/> droughts and floods <input type="checkbox"/> sediment transport and management <input checked="" type="checkbox"/> water and environment <input type="checkbox"/> ecohydrology <input type="checkbox"/> water law and policy <input type="checkbox"/> transboundary river basins/ aquifers <input checked="" type="checkbox"/> IWRM <input type="checkbox"/> global and climate change <input checked="" type="checkbox"/> mathematical modelling <input type="checkbox"/> social and cultural dimensions of water <input checked="" type="checkbox"/> water education <input type="checkbox"/> other: (please specify) _____
	Scope of Activities ♦	<input checked="" type="checkbox"/> vocational training <input checked="" type="checkbox"/> postgraduate education <input checked="" type="checkbox"/> continuing education <input checked="" type="checkbox"/> research <input checked="" type="checkbox"/> institutional capacity-building <input checked="" type="checkbox"/> advising/ consulting <input checked="" type="checkbox"/> software development <input type="checkbox"/> other: (please specify) _____
Support bodies ¹		Faculty of Civil Engineering, University of Belgrade
Hosting organization ²		
Sources of financial support ³		
Existing networks and cooperation ⁴		IRTCUD network of regional centres: <ul style="list-style-type: none"> • Centre for the Cold Climates (Trondheim, Norway) • Centre for Humid Tropics (Porto Alegre, Brazil) • Centre for Arid and Semiarid Climates (Cairo, Egypt) • RCUWM – Tehran, Iran CUWs (Centres for Urban Water)

* check on appropriate box
♦ check all that apply

¹ please specify bodies that cover the operational costs of the centre, and other essential costs such as salaries and utility bills, and that provide institutional support to ensure centre's sustainability

² if different from support bodies

³ please specify sources of main budgetary and extrabudgetary funds to implement projects

⁴ please write international networks, consortiums or projects that the centre is part of, or any other close links that the centre has with international organizations or programmes, which are not already mentioned above

Governance	X director and deputy (acting) director X other: Link to the hosting country IHP National Committee Frequency of meetings: once every year x Existence of UNESCO presence at meetings (occasional)
Institutional affiliation of director	
Number of staff and types of staff	total number of staff (full-time, or equivalent) : <u>32</u> (Host Institution – Institute of Hydraulic and Environmental Engineering number of staff who are water experts: <u>29</u> number of visiting scientists and postgraduate students: <u>40</u>
Annual turnover budget in USD	cca 30.000

2. Activities undertaken in the framework of IHP in the period June 2008 – May 2010

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII (Appendix-1) and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.

Postgraduate studies in Water Resources and Environmental Management, in a framework of EDUCATE project, started in December 2007. The EDUCATE! project (Building the Future of Transnational Cooperation in Water Resources in South East Europe) was implemented in a framework of the EU INTERREG CADSES programme.

The idea of the project was initiated within and supported through UNESCO's Reconstruction of Scientific Cooperation in SEE Programme. Initial idea came from the event organized by UNESCO-Europe, Venice, 24th -27th February 2001. Two workshops were held afterwards - one in UNESCO HQ, Paris, from 30rd June to 1st July 2002, and one in the University of Belgrade, 19th – 20th November 2004 resulted in gathering of partner universities ready for collaboration in the transnational programme.

The overall objective of the project is to assist the regional transnational cooperation on Water Resources Management and Environmental Protection. This is achieved by shaping the future policy makers, while at the same time providing training for current environmental policy makers through the postgraduate educational programme and training courses for government officials and industry. The project aims towards a long-term, continuous professional capacity building which will form the basis for long-term collaboration in the area and ultimately lead to a more integrated region.

The project partners involved in the project are the following:

- National Technical University of Athens, Greece – School of Civil Engineering and School of Chemical Engineering
- University of Ljubljana, Faculty of Civil and Geodetic Engineering, Slovenia
- Technical University of Civil Engineering Bucharest, Romania
- University of Belgrade, Faculty of Civil Engineering, Serbia
- IRTCUD, Serbia

The postgraduate course in Water Resources and Environmental Management is a flexible, distance learning programme based on both – e-learning and traditional way of lecturing. The students gather at their host university several times during the course: introductory week at the

beginning of the course, examination for each thematic area, at a half of the course for definition of thesis and at the end of the course for presentation of thesis. Lectures and tutorials are developed in English. Duration of the course is two calendar years.

The course programme is organized as a pedagogic continuum and consists of four thematic areas:

- Thematic Area 1 presents introduction of the course and is focused on scientific background in water resources and ecology
- Thematic Area 2 targeted on integrative concepts of urban water management, including water supply and storm and waste waters
- Thematic Area 3 includes issues of catchment and environmental management by utilizing hydro-informatics tools, including distributed hydrologic models, advanced optimization and geostatistics
- Thematic Area 4 focuses on policy, legislation, decision-making and environmental assessment with an emphasis on the Water Framework Directive (WFD), as well as on other advanced topics

A research thesis comes as a follow up of the thematic areas.

In addition to the postgraduate course, a number of seminars on additional specialized topics are available to professionals from Government and Industry (held in the neighboring countries Romania and Slovenia).

The first generation completed the studies in December 2009 when presentation of theses was organized in Belgrade, Serbia. Currently the second and the third generations are participating in the studies.

Accreditation process for the particular studies at the University of Belgrade has been COMPLETED and the next (fourth) generation of students has just started to "attend".

2.2 Research activities that directly contributed to the IHP-VII and activities by WWAP

Please include research/applied projects outputs such as publications that directly contributed to the IHP-VII and WWAP objectives

Because of the lack of space in Belgrade (well known problem being addressed) IRTCUD activities are "decentralized" among the cooperating partners with strong coordination role of Prof. Ćedo Maksimović.

Project and activities being carried out through ITRCUD network partners are related / include topic from the Thematic areas 1.3, 4.3. and 5.2. of the IHP VII. For example IRTCUD (Belgrade) team members are included in the UK based mega-project FRMRC2 (Floor Risk Management Research Consortium 2), under the topic Urban Flooding. The methodology for automatic Urban catchment GIS based delineation developed in Belgrade has been adopted and adapted as UK industrial standard.

Project "Risk in implementation of EU Water Framework Directive in Republic of Serbia, financed by Serbian Ministry of Science and Technological Development" fits into Thematic area 2. The project analyses single steps related to implementation of the Directive taking into account multiple uncertainties in interpretation of data and information on various processes, such are demographic, social, economic, industrial, municipal, and others.

2.3 Training activities that directly contributed to the IHP-VII and WWAP objectives

Training activities in progress and those applied for are relevant to all of the Theme 5 items: 5.1., 5.3 and 5.4. of the IHP VII. The main training/education activity is the above mentioned postgraduate course EDUCATE which also includes a series of short training courses for professionals from ministries (Romania) and water industry and

environmental services (Slovenia). The key products which have been initiated by IRTCUD in cooperation with IHP Secretariat are the deliverables of the IHPVI major project Integrated Urban Water Management (Urban Water book series and its educational component (UWETTT) which is yet to be finally edited and adopted by UNESCO IHP Secretariat and made available to the international water community. The other training activities include participation of the IRTCUD staff in lecturing in the other UNESCO category 2 centres' activities related to urban drainage / urban water.

These include lecturing in the activities organized by

- *RCUWM* - Tehran (Prof. Prodanović lecture in Pakistan),
- *Humid Tropic center in Kuala Lumpur* (Prof. Maksimović's lecture in KL),
- *ERCE –Łodz* (Prof. Maksimović's lecture in several courses),
- *IRTCUD – Humid Tropics in Porto Alegre* (Joint outreach activities Prof. Carlos Tucci and Prof. Maksimović's lecture for São Paulo's Drainage Master Plan),

3. Collaboration and linkages

3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies

From its establishment IRTCUD activities were done through cooperation with UNESCO and other UN organizations (UNEP, UNDP, and UNIDO), professional institutions (IAHR, IAWPRC, IAHS), World Meteorological Organization (WMO), universities and research institutions all over the World.

IRTCUD has a role of global coordinator of the regional IRTCUD Centres for the Cold Climates (Trondheim, Norway), Humid Tropics (Porto Alegre, Brazil) and Centre for Arid and Semiarid Climates established in the Regional Center of Research and Studies of Water Ethics (Cairo, Egypt). Because of IRTCUD (Belgrade)'s lack of space most of activities had to be "decentralized".

Within a framework of INTERREG III Programme, IRTCUD is involved in the network of four SEE countries working together on the project "Building the Future of Transnational Cooperation in Water Resources in South East Europe". Initially the network included partners from all former Yugoslav republics, Bulgaria, Romania, Greece, Albania, Turkey and Cyprus. The initial activity of the network is the above mentioned EDUCATE programme in which the following partners took place: Greece (National Technical University of Athens), Romania (Technical University of Bucharest), Slovenia (University of Ljubljana) and Serbia (University of Belgrade and IRTCUD).

IRTCUD members were the initiators and were either direct organisers or sponsors / book editors of all of the the UDM (Urban Drainage Modelling) series of 8 international conferences which are held every three years under auspices of the Joint Committee for Urban Drainage of IAHR (International Association for Hydraulic Research and IWA (international Water Association). The last two of the conferences in the series were held at in Melbourne, Australia (2006) and in Tokyo, Japan (2009). The next one will be directly organised by IRTCUD and will be held in Belgrade in 2012.

3.2 Participation in meetings related to the IHP and UNESCO (e.g., the UNESCO General Conference, the UNESCO Executive Board, the IHP Intergovernmental Council and/or other meetings organized by IHP)

Throughout the IHPVI programme IRTCUD and its cooperating centres were instrumental in running the major IHPVI project "Integrated Urban Water Management" with 9 sub-projects from which the series of Urban

Water books has emerged. During this period IRTCUD representative was a regular participant and contributor to the IHP Intergovernmental Council and/or other meetings organized by IHP. IRTCUD assisted IHP Secretariat and the local initiators in creation of the RCUWM, regional Urban Water Management Centre.

IRTCUD members (Prof. Cedo Maksimovic, Prof. Dusan Prodanovic and Ms. Ljiljana Jankovic) participated in the UNESCO Final Symposium of IHP6 Programme: IHP International Symposium on "New Direction in Urban Water Management" held at UNESCO Headquarter, Paris, from 12th to 14th September 2007.

IRTCUD member (Prof. Jovan Despotovic) participated in the 19th session of the Intergovernmental Council of the IHP, held in UNESCO Headquarters in Paris from 5th to 9th July 2010. During the Session Prof. Despotovic was elected as a Vice-Chairperson of the Intergovernmental Council.

3.3 Collaboration and networking with other UNESCO category 1 or 2 institutes/ centres

3.3.1 cross-appointment of directors of the category 1 or 2 institutes or centres on the governing board

Prof Maksimović has been appointed as a member of the Governing Board of ERCE (European Regional Centre for Ecohydrology) in Łodz, Poland.

3.3.2 exchange of information on activities such as training/educational materials, and funding opportunities

Training and educational material has been exchanged with RCUWM and ERCE.

IRTCUD has a successful cooperation with the UNESCO-IHE in Delft. Several activities were organized jointly. The latest one is the (ongoing preparation) for joint application of Erasmus Mundus project in which part of the EDUCATE project could merge with some of IHE's education activities which are planned to lead to joint accreditation and awarding of joint MSc (or equivalent) degrees.

3.3.3 exchange of staff, most notably professionals and students

Staff has been exchanged with ERCE and RCUWM.

3.3.4 implementation of joint activities, such as workshops, conferences, training programmes, joint projects, field visits, software and data sharing, knowledge exchange and publications

Both RCUWM and ERCE were very active partners in implementation of the IUWN major IHPVI project. IRTCUD collaborated with RCUWM in organization of several training courses. IRTCUD assisted The Humid Tropical Centre in KL in origination of two training courses and provided lecture for both.

3.4 Relationships with the UNESCO field and regional office whose jurisdiction covers the country of location

Regretfully several attempts to engage the UNESCO Regional Bureau for Science and Technology in Venice in IRTCUD activities failed one after the other. Only the first one (Creation of the SEE network of Urban Water Management was done with assistance of that office but that was during Mr. Pierre Lassere's coordination of this activity). All later attempts failed one after the other. The officer in charge (Mr. Philippe Pypaert) was "busy" and did not attend any of the meetings to which he was invited (in Belgrade and Paris), no support was provided to the project applied for,

simply there was no positive reaction from that office to IRTCUD's initiatives. He seemed to have been busy in running some other agenda. Much better cooperation was performed with the Office in Montevideo (Maria Donoso) (organization of several joint events in Brazil and one on Mexico) and with the New Delhi (Bhau Neupanu) with whom two joint events have been organized and finally office in Cairo which assisted joint organization of one workshop and an event for creation of the unit for Urban Drainage in arid and semi arid region.

3.5 Relationship with the UNESCO National Commission and the IHP National Committee in the country of location and with other organizations of other countries

The cooperation with the National Commission for cooperation with UNESCO (which operates within the Ministry of Foreign Affairs was correct and fruitful. Although the Commission had not resources to provide financial support to the Centre, it provided a lot of logistic and administrative support to the Center especially in the phase of its re-establishment.

Serbian National Committee for cooperation with IHP was established in May 2010 under the umbrella of the National Commission. Vision of the National Committee is to enhance cooperation with IHP relying on professional capacities of Serbian experts in water sector and priorities of UNESCO in which water remains the most important issue. The National Committee has ten members of whom two come from IRTCUD (Prof. Marko Ivetic and Prof. Jovan Despotovic). The president of the National Commission is IRTCUD member (Prof. J. Despotovic).

The cooperation with the previous National Commission for cooperation with UNESCO was very bad (almost non-existent). For a number of years the Commission was "privatized" and there was not means of pursuing IRTCUD's agenda through the Commission. The situation has changed after the recent creation of the new Commission which is more cooperative and supportive.

However the big problem of the "lack of space / infrastructure" remains to be dealt with. IRTCUD has no proper office space to work from. The Faculty of Civil Engineering through the Institute of Hydraulic and Environmental Engineering provides the "basics" / share of space and staff. The Faculty has made available about 250 m² of the space in a cellar which is the need for complete refurbishment. Several attempts to get funding from the relevant central (Republic of Serbia) and local government (Belgrade City Council) failed. It remains to be seen if the most recent promise of the Minister of Science (and also deputy Prime Minister) Mr. Djelić will result in fruition.

IRTCUD local coordinator, Prof. Marko Ivetic, is a president of the Scientific committee on soil, water and air research of the Ministry of Science and Technological Research. Prof. Ivetic is also a member of Committee for Climate Change Research.

3.6 Relationship with other UNESCO-related networks, such as UNESCO Clubs, ASPnet, and UNESCO chairs

Although there were no concrete actions (bilateral project) with the centres, IRTCUD has had contacts and occasional "encounters" such as:

- As a member of the UNESCO Water related "family" occasional meetings with UNESCO chairs took place
- Permanent links exist with the UNESCO IHE Institute for Water Education

4. Communication

4.1 Communication and knowledge dissemination activities undertaken in the framework of IHP

The most significant activities were carried out within the IHPVI project "Integrated Urban Water Management", The Urban Water related training

system (UWETTT) has been developed and made available. Details are presented elsewhere in this report.

4.2 Policy documents and advice

- IRTCUD representative was a member of the Committee which advised the Ministry of the Environment of Republic of Serbia on the new Environmental law
- City of Belgrade has adopted a strategy for functioning of Belgrade sewerage system in irregular and extreme conditions based on the Study done by IRTCUD (directed by Prof. Dejan Ljubisavljevic)
- IRTCUD has been involved in the strategic project related to integrated water resources management in the city of Belgrade, financed by the City of Belgrade called "Blue Regulative". The first phase was finished in 2009 and the second phase is ongoing.

5. Update on Centre Operations

5.1 Membership of the Board of Governors between designated period

Director: Prof. Dr. Ćedo Maksimović

Local Coordinator: Prof. Dr. Marko Ivetić

Programme Coordinator: Ljiljana Janković

Unfortunately the creation of the Board of Governors which was planned after the Centre's restart did not materialize, because of the tardiness (delay) in refurbishment of the office and research space which is still waiting for the formal approval and funding from the Ministry of Science and Technological Development (Mr. B. Djelic)

5.2 Key decisions made (attach minutes of meetings)

- The decision on the official "restart" of the Centre during the International Workshop on the Reactivation of the IRTCUD Network held in Belgrade from 14th to 16th of March 2002. By the decision IRTCUD reassumed its role as a global coordinator of the regional IRTCUD Centres for the Cold Climates (Trondheim, Norway), Humid Tropics (Porto Alegre, Brasil) and of the intended Arid and Semiarid Climates Regional Center. Meeting Report is enclosed.
- Official visit of the UNESCO DG (Mr Koichiro Matura) on 4th May 2004. Representatives of IRTCUD presented organization of the IRTCUD Network, principal achievements, publications issued, current initiatives in IHP VI programme and others. Problem of inadequate office space and possibilities for refurbishment of cellar space at the Faculty of Civil Engineering, University of Belgrade were presented. Photographs taken during the meeting are enclosed.

6. Evidence of the Centre's Impacts

6.1 Science Impacts (Major contributions to the science, technology, education, and regional and/or international cooperation in the field of water)

- The Urban Pluvial Flood Modelling methodology originated in IRTCUD in 90-ies of the last century and recently developed by IRTCUD/CUW/Imperial College London team has made the major breakthrough at the international scene. The AOFD methodology officially tested and approved by UKWIR (UK Water Industry Research)
- Expertise in GIS support for hydroinformation systems and urban water systems developed in IRTCUD has been widely used in specific projects in Serbia and also in the region. As an example, it was used in the following projects:
 - GIS based improvement of distributed hydrological model of the Drina river: Development of GIS routines for automatic generation of SWAT input data files based on DEM, river, cover and network of meteorological stations (Ministry of Agriculture, Forestry and Water Management, Serbian Government)

- Hydroinformation system "Vlasina" – hydrological simulation model: Development of hydrological simulation model for Vlasina hydro system using GIS tools based on 3DNet-Catch module (Hydro power plant Djerdap, Serbian Electropower Company)
 - Modelling of urban groundwater systems originated in IRTCUD has been used in the project "Urban groundwater systems management UGROW-an advanced simulation and modeling tool" which resulted in a book published in a framework of IHP 6 programme. IRTCUD member (Dr. Milos Stanic) is a coauthor of the chapters "UGROW-the Urban GROundWater modelling system" and "UGROW applications – Case Studies"
 - Analysis of the effects of the water transfer through the tunnel Fatnicko Polje-Bileca reservoir on the hydrological regime of Bregava River in Bosnia and Herzegovina (Electropower Company of Republic of Srpska)
- 6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)
- IRTCUD/CUW coordinated development of UWETTT is available to UNESCO
 - Training of Trainers Workshop on Integrated Urban Water Management, Lahore, Pakistan, May 2007. Jointly organized by: PCRWR, RCUWM) – Tehran, UNESCO-IHP, UNESCO Tehran and UNICEF
 - Short course on Urban GROundWater (UGROW) Modelling System held at UNESCO Paris, 11th September 2007: Analysis of Interaction of Urban Water Systems with Groundwater Aquifer: A case study of the Rastadt City in Germany.
 - Cooperation with Hungarian Chamber of Engineers aiming at continual education of professionals from water field. Ongoing.
 - Short training courses for professionals from ministries (Romania) and water industry and environmental services (Slovenia) in a framework of EDUCATE. Started in 2007, ongoing
 - Short courses organized together with Association for Water Technology and Sanitary Engineering, aiming at continual education of professionals from water field. Ongoing.
 - Series of training courses for professionals on contemporary methods for design of systems for protection of rain water, aiming at continual education of professionals from water field. Jointly with Serbian Chamber of Engineers. Organized in several regional centers of the Chamber in Serbia. Ongoing.
- 6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)
- IRTCUD started project for the City of Belgrade "Integrated Management and Protection of Water Resources in Municipality of Belgrade" (Blue Regulative). The project is founded on EU Framework Directives and presents the most important legal instrument in water management field that is based on integrated environmental management and compatibility with development of economy, agriculture, water resources, transport, fishery, energy, trade and others.
 - IRTCUD was involved in the Study regarding functioning of Belgrade sewerage system in irregular and extreme conditions. City of Belgrade has adopted the strategy for functioning of Belgrade sewerage system in irregular and extreme conditions based on this Study

7. Future activities that will contribute directly to IHP and/or to WWAP

7.1 Operational Plan (2010-2011) (attach operational plan for 2008-09 if available)

Operational plan for period 2010-2011 is based on core IRTCUD activities, specifically with those linked with programme themes of the seventh phase of IHP. The plan could be summarized as follows:

a) Continued coordination and running of EDUCATE postgraduate study:
The study currently has three generation of students of whom one generation will finish the study by the end of 2010 following presentation of thesis. New generation of students started on September 25th, 2010. In total 40 students have been enrolled in the study.

Also, short training courses for professionals from ministries and water industry and environmental services are available in a framework of EDUCATE.

b) Joint application with UNESCO –IHP for ERASMUS MUNDUS:

Following very successful cooperation between IRTCUD and the UNESCO-IHE in Delft, joint application of Erasmus Mundus project is being prepared. In this project part of the EDUCATE project could merge with some of IHE's education activities which are planned to lead to joint accreditation and awarding of joint MSc (or equivalent) degrees.

c) Preparation for the 9th UDM (to be held in 2012 in Belgrade):

Next Urban Drainage Modelling conference will be organized in Belgrade as a tribute to Prof. Maksimovic who has been the spiritus movens of the whole UDM conference series that started back in 1986 in Dubrovnik, former Yugoslavia, UDM conference topics are traditionally related to modelling urban drainage systems and interactions with other urban water systems and urban/suburban environment. The conference is designed to bring together specialists, researchers and practitioners, to exchange experience, demonstrate present potentials, improve the reliability of urban drainage modeling and to set-up the stage for its future developments. The topics are:

- Data issues (data availability, reliability and uncertainty; climate change and urban drainage systems, hydroinformatic support to urban drainage modeling, etc.)
- Modelling (urban stormwater and flood analysis; model and parameter identification and propagation of uncertainty; urban runoff quality, etc.)
- Applications (urban floods forecasting; interaction of pluvial and fluvial floods in urban areas; rainfall forecast; etc.)
- Management (stormwater and urban drainage management; risk analysis in urban drainage management; outlook for the urban drainage future; etc.)
- Special topics (UDM under extreme conditions; urban hydro-ecology and urban amenities; performance trends, indicators and life span assessment; etc.)

d) Continued upgrade of the Urban Flooding Modelling and Prediction System (in cooperation with CUW/Imperial College London);

e) Attempt to finally resolve the problem of the lack of office / research space:

Finding of solution for financing of the space at the Faculty of Civil Engineering University of Belgrade that will be used for IRTCUD needs. This issue is crucial for success of all planned activities and will enable expansion of current operations.

f.) Cooperation with other UNESCO category 2 centres;

Cooperation with UNESCO category 2 centres will continue in the future. It is seen through participation of IRTCUD members in work of other centres (Prof. Maksimovic is a member of the Governing Board of European Regional Centre for Ecohydrology), exchange of training/educational materials, joint application for projects, participation in workshops and conferences. For example participation in the 12th Conference on Urban Drainage that will be held in Porto Alegre, Brasil, in September 2011.

g) Projects that will be implemented in the period in question:

- Scientific management of urban ground water based on GIS technique (National Scientific Funding of Serbia), Prodanovic, D.
- Assessment of environmental impacts of urban wetlands with using recycle water (National Scientific Funding of Serbia), Ivetic, M.
- MORE – Monitoring and Modelling of Rivers and Reservoirs - physical, chemical, biological and morpho-dynamic parameters, (Serbian Ministry of Science and Technological Development)
- Strategic project related to integrated water resources management in the city of Belgrade, financed by the City of Belgrade called "Blue Regulative".

h) Continual education for professionals dealing with IHP THEMES
 IRCUD organizes international conference "Regional Rainfall 2010" together with Serbian Academy for Sciences and Arts. The conference will be held in Belgrade from 3rd to 5th of November 2010. Aim of the Conference is presentation of the latest experiences and initiation of a discussion on possibilities of their application within the region, in order to obtain more efficient measures and procedures for flood control. Also, the conference should initiate a discussion on flood protection management plans.

Conference topics:

- Rainfall measurements, data processing and radar observations
- The Balkans' rainfalls characteristics of. Climate change
- Rainfall characteristics influence upon hydraulic structures
- Motor and pedestrian traffic safety during severe rainfall events and floods
- Flood protection, storm runoff quality and quantity in urban areas
- Planning and design of storm drainage systems. Standards and legal issues

7.2 Strategic Plan linked with IHP-VII (attach strategic plan for 2010-13 if available)

Not yet available, It will strongly depend on the success (or failure) to get the support from the Ministry for the refurbishment of the cellar space at the Faculty of Civil Engineering.

However, The emphasis in this period will be on the activities related to the **Theme 5: WATER EDUCATION FOR SUSTAINABLE DEVELOPMENT** of the IHPVII.

In particular on the 2 focal areas as follows:

- Focal area 5.1: Tertiary water education and professional development (EDUCATE and ERASMUS MUNDUS – with UNESCO IHP, Delft and
- Focal area 5.4: Water education for communities, stakeholders and water and environmental professionals

8. Annexes

8.1 List of publications released by the centre (there can be overlap with those listed in 2.3 above)

8.1.1 **Nine books** (four more to follow) published in the Urban Water Series initiated within the IHPVI, Series editors Č. Maksimović and J.A. Tejada-Guibert, starting with the book: "Data Requirements for Integrated Urban Water Management". T.D. Fletcher and A. Deletić, ed. Book Series, Series ed. C. Maksimovic and Tejada-Guibert, J.A., Taylor and Francis, ISSN 1749 0790,

8.1.2 Maksimović, Č., Prodanović, D., Boonya-aroonnet, S., Leitão, J. P., Djordjević, S., and Allitt, R. (2009). Overland flow and pathway analysis for modelling of urban pluvial flooding. *Journal of Hydraulic Research*, 47(4):512-523.

- 8.1.3 J. P. Leitaó, S. Boonya-aroonnet, D. Prodanović and C . Maksimović (2009) *The influence of digital elevation model resolution on overland flow networks for modelling urban pluvial flooding*, *Water Science & Technology—WST*, 60.12
- 8.1.4 *Urban Water in Japan*”, Hooememeuer, F., ed. *Urban Water Book Series*, Series ed. Č. Maksimović, Taylor and Francis, June 2008,
- 8.1.5 Prodanović D.(2007) *.Fluid Mechanics for Civil Engineering Students*. Faculty of Civil Engineering University of Belgrade
- 8.1.6 Kapor, R. (2008), *Hydraulics*. Faculty of Civil Engineering University of Belgrade
- 8.1.7 Jovanovic, M. (2007), *River Training Works – River Hydraulics and Morphology*, Faculty of Civil Engineering University of Belgrade
- 8.1.8 Despotovic, J. (2009), *Storm Water Channeling*. Faculty of Civil Engineering University of Belgrade,
- 8.1.9 Editors: Kapor,R. and Ivetic, M. (2009), *Proceedings of 15th Council of Serbian Association for Hydraulics Research*. Faculty of Civil Engineering University of Belgrade
- 8.1.10 Despotovic,J., Jovanovic, Z., Plavsic, J. (2009). *Drainage of bridges in urban areas*. *Gradjevinski calendar 2009*, Union of Engineers and Technicians of Serbia
- 8.2 List of training courses conducted (there can be overlap with those listed in 2.1 above)
- Postgraduate studies in Water Resources and Environmental Management , EDUCATE – Jointly with National Technical University of Athens, Greece, University of Ljubljana, Slovenia, Technical University of Civil Engineering Bucharest, Romania and University of Belgrade, Serbia. Started in 2007, ongoing
 - Short training courses for professionals from ministries (Romania) and water industry and environmental services (Slovenia) in a framework of EDUCATE. Started in 2007, ongoing
 - Short course on Urban GROundWater (UGROW) Modelling System , UNESCO Paris,
 - Joint training course on Urban Drainage with the University of Calabria, Italy, 15 June 2010
 - Training of Trainers Workshop on Integrated Urban Water Management, Lahore, Pakistan, May 2007. Jointly organized by: PCRWR, RCUWM) – Tehran, UNESCO-IHP, UNESCO Tehran and UNICEF
 - Several training courses on implementation of 3DNet software in Serbian companies
 - Short training courses on contemporary maintenance of water supply and sewerage systems. Jointly with Association for Water Technology and Sanitary Engineering
 - Series of training courses for professionals on contemporary methods for design of systems for protection of rain water. Jointly with Serbian Chamber of Engineers. Organized in several regional centers of the Chamber in Serbia.

Appendix-1

Overview of the Core Programme Themes of the Seventh Phase of the IHP (2008-2013) WATER DEPENDENCIES: SYSTEMS UNDER STRESS AND SOCIETAL RESPONSES

Theme 1: ADAPTING TO THE IMPACTS OF GLOBAL CHANGES ON RIVER BASINS AND AQUIFER SYSTEMS

Focal area 1.1 - Global changes and feedback mechanisms of hydrological processes in stressed systems

Focal area 1.2 - Climate change impacts on the hydrological cycle and consequent impact on water resources

Focal area 1.3 - Hydro-hazards, hydrological extremes and water-related disasters

Focal area 1.4 - Managing groundwater systems' response to global changes

Focal area 1.5 - Global change and climate variability in arid and semi-arid regions

Theme 2: STRENGTHENING WATER GOVERNANCE FOR SUSTAINABILITY

Focal area 2.1 - Cultural, societal and scientific responses to the crises in water governance

Focal area 2.2 - Capacity development for improved governance; enhanced legislation for wise stewardship of water resources

Focal area 2.3 - Governance strategies that enhance affordability and assure financing

Focal area 2.4 - Managing water as a shared responsibility across geographical & social boundaries

Focal area 2.5 - Addressing the water-energy nexus in basin-wide water resources

Theme 3: ECOHYDROLOGY FOR SUSTAINABILITY

Focal area 3.1 - Ecological measures to protect and remediate catchments process

Focal area 3.2 - Improving ecosystem quality and services by combining structural solutions with ecological biotechnologies

Focal area 3.3 - Risk-based environmental management and accounting

Focal area 3.4 - Groundwater-dependent ecosystems identification, inventory and assessment

Theme 4: WATER AND LIFE SUPPORT SYSTEMS

Focal area 4.1 - Protecting water quality for sustainable livelihoods and poverty alleviation

Focal area 4.2 - Augmenting scarce water resources especially in SIDS

Focal area 4.3 - Achieving sustainable urban water management

Focal area 4.4 - Achieving sustainable rural water management

Theme 5: WATER EDUCATION FOR SUSTAINABLE DEVELOPMENT

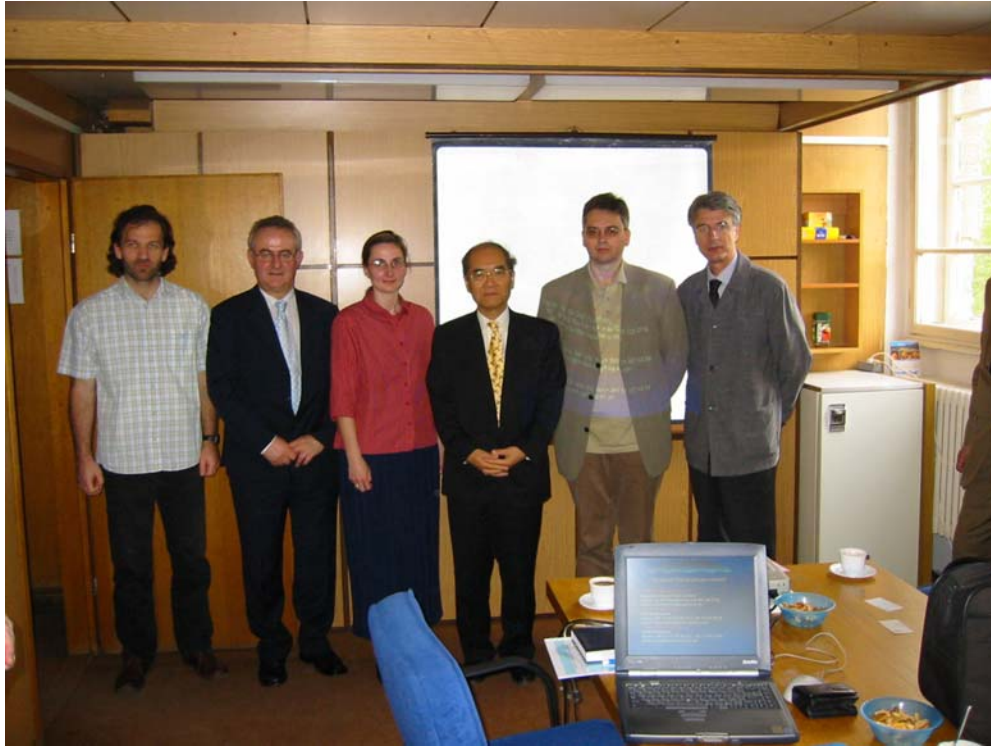
Focal area 5.1: Tertiary water education and professional development

Focal area 5.2: Vocational education and training of water technicians

Focal area 5.3: Water education in schools

Focal area 5.4: Water education for communities, stakeholders and mass-media professionals

**Visit of Mr Koichiro Matsura, Director General of UNESCO
4th May 2004, IRTCUD Belgrade**







**INTERNATIONAL WORKSHOP ON THE REACTIVATION OF
THE IRTCUD NETWORK AND PRE-DONORS CONFERENCE
ON URBAN WATER MANAGEMENT**

Belgrade 14-16 March 2002

Executive Summary

This report presents the result of the International Workshop on Reactivation of IRTCUD (International Research and Training Centre for Urban Drainage) Network and Pre-donors Conference on Urban Water Management which was held in Belgrade between 14th and 16th March 2002. The Workshop was attended by 50 participants from 13 countries. The aims of the Workshop was setting up the stage for reactivation of the IRTCUD network and putting together attractive proposals in Urban Water Management area. The project proposals were screened in the Workshop and they are submitted to UNESCO for possible fund raising in the planned donors' conference. Twenty one project proposals were presented during the Workshop, and only those which "passed the screening tests" have been included in this final document together with several projects prepared afterwards taking into account recommendations given at the Workshop. Included in this document are the Meeting Report and project proposals with their original codes (numbers). The projects initiated in this document are complementary to the 9 core urban water management projects adopted by the UNESCO IHPVI programme. The organisers of the Workshop sincerely hope that the projects will attract funding and their result will contribute to solving some of the burning issues of urban water in both developing and developed countries.

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Contents

MEETING REPORT.....	5
ANNEX 1 - FINAL LIST OF PARTICIPANTS.....	9
ANNEX 2 - URBAN WATER PROJECT PROPOSALS	12
Proposal 1: Optimal water resources management for large urban areas	14
Proposal 2: Leakage management for water distribution systems in developing, developed and countries in transition	23
Proposal 3: Advanced hydroinformatic tool for management of complex interactions in urban flooding.....	33
Proposal 4: Top-Down Assessment of Changed Urban Aquatic Ecosystems	42
Proposal 5: Stakeholder Awareness and Inclusion of Sustainability concepts into decision making processes for INtegrated urban water systems (SAISIN).....	51
Proposal 6: Integrated Water Quality and Quantity Monitoring and Data Management in Sub-Tropical and Tropical Regions	65
Proposal 7: Measures for Controlling Urban Runoff at Source in Tropical and Sub-Tropical Climates	76
Proposal 9: Strengthening of Co-operation in South East European Countries for Capacity Building in Urban Water Management	81
Proposal 10: Strengthening the Activities at The Field and Training Laboratories in Urban Drainage in Cold Climates	98
Proposal 12: “Mathematical Models for Urban Drainage under Different Climatic Conditions: Case Studies and Applications.”	119
Proposal 13: Identification of sensitive zones in Central and Eastern part of the Danube catchment.....	123
Proposal 14: Urban Water protection education in the South Eastern Europe.....	130
Proposal 16: Generic water, drainage and sanitation systems for urban areas in developing countries.....	139
Proposal 17: E-IUWS: Extended International Course on Integrated Urban Water Systems	147
Proposal 18: Benchmarking of Urban Water Management Systems in transitional countries with special regard to data structures and institutional strengthening	154
Proposal 20: The Use of Water Systems for Sustainable Tourism Development.....	163

Proposal 21:	Sustainable water use in newly developed areas	174
Proposal 22:	Integrated models for urban water scenario planning	190
Proposal 23:	Integrated Water Quality Modelling in Distribution Systems.....	199
Proposal 24:	Urban Drainage and Stormwater Management in Developing Countries - Development and Dissemination of Training Material	217

**INTERNATIONAL WORKSHOP ON THE REACTIVATION OF
THE IRTCUD NETWORK AND PRE-DONORS CONFERENCE ON
URBAN WATER MANAGEMENT**

Belgrade 14-16 March 2002

MEETING REPORT

General

1. The workshop, held at the Faculty of Civil Engineering of the University of Belgrade, with the exemplary support of the local organizing committee had over 40 participants representing 13 countries and a number of international governmental organizations, non-governmental organizations and academic institutions. Annex 1 contains the list of participants.
2. The participants at the workshop agreed that the following outcomes resulted from the meeting:
 - The International Research and Training Center on Urban Drainage (IRTCUD), which was established under the auspices of UNESCO, has effectively been reactivated in the original host city of Belgrade, reassuming its role as global coordinator of the regional IRTCUD Centers for the Cold Climates (Trondheim, Norway), Humid Tropics (Porto Alegre, Brasil) and of the intended Arid and Semiarid Climates Regional Center.
 - The creation of the IRTCUD/CUW Network for the South Eastern European countries has been assessed as highly desirable. The presence of the representatives of 8 countries of the sub-region at the workshop underscored this initiative. The network will play a significant in the developing the appropriate approaches and tools to address the specific urban water problems of the region and in providing technical and scientific support for the training and technology transfer activities. The facilities that will be readied in Kotor will be central to the training efforts.
 - The Workshop screened over 21 concrete proposals for urban water research, management and training and awareness raising projects, a number of them specifically for the SEE sub-region and many others of a global scope and for other regions. The Workshop has analyzed the proposals indicating, when required, the modifications that are desirable to constitute consistent and complete proposals for presentation at donors conferences. The proposals will be finalized and submitted in the near future by the proponents and resubmitted to UNESCO and IRTCUD. Furthermore several other possibilities for future proposals were identified.

Meeting procedure

3. On 14 March 2002, the meeting began with the official opening by Professor B Coric, Dean of the Faculty of Engineering and introductory remarks to set the objectives of the meeting by Dr Alberto Tejada-Guibert and Professor Cedo Maksimovic. This was followed by presentations which described the facilities available to individuals and institutions who had submitted project proposals. In the afternoon of the first day of the meeting (14 March) presentations were given by each project co-ordinator; 16 projects were described, and others were submitted later to bring the total number of project proposals considered by the meeting to 21. The 21 proposals appear in Annex 2.
4. To end the first day, there was discussion about how participants could best be divided into Working Groups to discuss individual projects in greater depth. It was decided to adopt two Working Groups. Working Group 1 was chaired by Professor Richard Ashley

of the University of Bradford, UK, and Working Group 2 by Professor Robin Clarke of the Instituto de Pesquisas Hidraulicas, Porto Alegre, Brasil.

5. On 15 March, the Working Groups assembled to discuss projects in depth. Working Group 1 considered 9 projects (and overlaps with each of the others), and Working Group 2 considered 14 projects; there was some overlap (that is, some projects were discussed by both groups, which provided a comparison between the critical standards of the two groups). In addition, late-submitted projects were also considered, one by Working Group 1 and 3 by Working Group 2.
6. Part of the afternoon of the second day of the Meeting (15 March) was spent in preparing reports giving the views expressed by the two Working Groups on their respective projects. Later in the afternoon, a plenary meeting was held at which Working Group rapporteurs and chairmen reported on each project, and comments were received more widely from people on projects other than those discussed in the Working Group in which they had participated.

General comments on the Working Group reports.

7. For those projects that had been discussed by both Working Groups, there was generally good agreement between the opinions expressed.
8. Both Working Groups felt that all project proposals should place greater emphasis on the need for appropriate educational material (in the form of CD's slides, training courses) as a 'deliverable' to be produced at the end of the project.
9. Likewise, both Working Groups would have liked to see more information on project budgets, and how these were structured. However, it was also recognized that many projects were still in preparation, and it became evident that some projects would need to be modified and perhaps combined; thus at the next and final stage of submission of project proposals, the essential budget information will be supplied.
10. The duration of some projects was long, the longest duration envisaged being ten years for a study of how to quantify, for monitoring purposes, fragments of ecosystems that result from urbanization. Ecological studies of this kind are necessarily long, because of the need to take account of natural fluctuations in population densities and the variation due to inter-specific interaction; however, the Working Groups also recognized that fund donors will not look kindly on projects of ten-year duration, and it was therefore suggested that long-term projects be broken down into components with three-year durations wherever possible.
11. The discussion revealed that three areas in particular were not considered by any of the project proposals submitted. These were: (a) recycling; (b) groundwater in the urban context; (c) conceptual models for integrated water management. Identification of these three areas is important because it suggests the need for further project proposals in these areas.

Specific comments on project proposals.

12. The comments by the Working Groups on individual projects are appended (see Annex 3) and they will not be reproduced here. All discussion was very constructive, and

significant omissions (typically, references to literature not previously known by the project coordinator) will go far to strengthen the cases for project funding.

13. It was agreed that project coordinators would profit from the Working Group comments and would produce revised submissions, which would be sent to UNESCO by the end of the second week in April 2002 at the latest.

**INTERNATIONAL WORKSHOP ON THE REACTIVATION OF
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Belgrade 14-16 March 2002

ANNEX 1 - FINAL LIST OF PARTICIPANTS

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Belgrade Workshop, 14-16 March 2002

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**INTERNATIONAL WORKSHOP ON THE REACTIVATION OF
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ANNEX 2 - URBAN WATER PROJECT PROPOSALS

Executive Summary

Annex 2 contains twenty project proposals. Twenty one project proposals were presented during the International Workshop on Reactivation of IRTCUD Network and Pre-donors Conference on Urban Water Management held in Belgrade between 14th and 16th March 2002. The Working Groups established at the Workshop analysed submitted project proposals and adopted recommendations for appropriate amendments that should be incorporated into the proposals.

After the Workshop total of seventeen project proposals presented at the Workshop were revised and resubmitted. Four proposals have been withdrawn. In addition to the revised proposals, three new proposals suggested at the Workshop have also been accomplished and are included in this report.

The aim of these project proposals is to attract international funding in the urban water area. The organisations interested in potential funding of one or more project will have an opportunity to work together with IRTCUD and project proponents in further elaboration of the proposal so that it matches interests of all parties involved.

Possible co-funding can be organised through UNESCO, Water Science Division.

The officer in charge at UNESCO is:

Dr Jose Alberto Tejada-Guibert (email: Ja.tejada-guibert@unesco.org)

Additional information can be obtained from and interest for co-funding expressed to:

IRTCUD – International Research and Training Center for Urban Drainage

Faculty of Civil Engineering

P.O. Box 895

11 000 Belgrade

Serbia

Tel./ fax + 381 11 321 8530

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Proposal 1: *Optimal water resources management for large urban areas*

Project title:	<i>Optimal water resources management for large urban areas</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	<i>Mainly 4 and 8 Others 1, 2, 5, 9</i>
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	
Project proposer	<i>Prof. D. Koutsoyiannis / Dr N. Mamassis</i>
Partners in the project (consortium – network – form at least two different countries)	<i>Greece and any other country with complex urban water resource system. Companies, organizations and local authorities in the field of water resources management could participate in the project</i>
Supporting partners (cash and in kind)	
Objective:	<ul style="list-style-type: none"> • <i>Optimization of complex, multi-purpose water resource systems for urban areas in order to increase the performance of the system</i> • <i>Incorporating new technologies (Telemetric and Internet applications)</i> • <i>Usage of the procedures and results for educational purposes</i>
Brief description*: *(Attach a separate Case for support - up to 3 pages)	
Implementation strategy:	<ul style="list-style-type: none"> • <i>Analysis of the specific hydrosystem characteristics and objectives</i> • <i>Configuration of the system model and adoption of the selected technologies and software to the specific application</i>
Implementation mechanism	<ul style="list-style-type: none"> • <i>Consultations with local authorities</i>
Expected results	<ul style="list-style-type: none"> • <i>Increase of the safe yield of a given water resource system</i> • <i>Improvement of the system reliability</i> • <i>Cost effective operation would save economical resources</i>

	<ul style="list-style-type: none"> • <i>Dissemination of new technology</i>
Deliverables and availability	<ul style="list-style-type: none"> • <i>Software applications for water resources management</i> • <i>Study of the installation of telemetric hydrometeorological networks</i> • <i>Internet applications for educational purposes and public awareness</i> • <i>Short courses on the use of software</i>
Target beneficiary groups	<i>Urban water managers, urban water research and professional community</i>
Geographical location of the beneficiaries	<i>Capitals of Balkan countries (two to be specified)</i>
Project duration	<i>24 months</i>
Proposed project coordinator (attach a brief CV)	<i>Prof. D. Koutsoyiannis</i>
Proposed project budget:	220.000 EURO
a. Equipment	<i>20.000</i>
b. Travel and subsistence	<i>30.000</i>
c. Personal costs	<i>100.000</i>
d. Dissemination	<i>50.000</i>
Other (overhead)	<i>20.000</i>
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)	<i>The Athens Water Supply and Sewage Company is expected to participate and provide additional funding and expertise</i>

Case for Support

Proposed project title: *Optimal water resources management for large urban areas*

Brief description

The application of an existing Decision Support System (DSS) for the optimal water resources management of large urban areas is proposed. The DSS will be configured for selected complex, multipurpose water resource systems for large urban areas. The main objective of the proposal is the optimisation of the operation in order to increase the performance of the system. Furthermore new technologies (Telemetric and Internet applications) will be incorporated and the procedures and results will be used for educational purposes.

The DSS consists of software and hardware that is organised to perform some or all of the following functions: collection, processing, storage, transmitting, and dissemination of data that represent user information.

The core of the DSS is its database, which is designed so that it is flexible and easily extensible. It consists of several tables, which store measured and synthetic time series, stage-discharge curves, sediment discharge curves, measuring stations and instruments, reservoirs, dams, boreholes, irrigation and water demand data, aqueducts, water treatment plants, pumps, basins and rivers, multimedia for all these entities, synthetic data generation parameters, simulation scenarios, and numerous other types of information. The integration of all data used by the DSS components in a single database facilitates the exchange of information between them and enables the rapid development of future applications. A tool for database access and for the analysis and manipulation of time series called *Hydrognomonas* can be used.

A Geographical Information System (GIS) is also part of the DSS, storing and visualising spatial data and developing spatial software applications. The GIS component is important because it is able to present data and results in a comprehensive way that facilitates the understanding of their meaning. The geographical information that is presented includes: components of the water resource system (reservoirs, dams, aqueducts, pumping stations and water treatment plants), surface and groundwater hydrology (general topographic information, digital elevation models, watershed areas, hydrological measuring stations, aquifers, wells and boreholes) and geographical information related to water quality.

An automated telemetric system is used in the DSS, because it can provide data of high reliability, without delay, and less costly than conventionally measured data. Peripheral telemetric stations are to be located near the main reservoirs and transfer automatically or semi-automatically important hydrological data to the central system. The data collected will include stage and discharge data from the main stream of each river basin, water level data in the reservoirs, rainfall data and meteorological

data. The data collection procedure is to be initiated periodically by the central telemetric system. All data will be stored in the database for immediate use by other systems.

Hydronomeas, the main tool of the DSS, is a software system which utilizes powerful optimisation techniques for simulating complex multipurpose reservoir systems and for determining the optimal water resources management policy. It is applicable to a wide range of hydrosystems, incorporating natural, operational, environmental and other restrictions and giving answers to questions such as the following:

- What is the maximum total withdrawal from the hydrosystem, for a given hydrologic regime and a given reliability level?
- What is the minimum failure probability in achieving a given set of operational goals, for a given hydrologic regime?
- What is the minimum cost to achieve a given set of operational goals, for a given hydrologic regime and a given reliability level?
- What are the consequences of modifications in the hydrosystem (e.g., construction of new projects) and the impacts of different management policies or hydroclimatic scenarios?
- How could the system respond to unusual events such as aqueduct damages or an unusual increase of water demand for a specific period?

The optimisation of a hydrosystem with a very high level of reliability, such as water supply systems, demands that the system simulations must be carried out for time horizons of many years. For such horizons, deterministic forecasts of hydrological variables such as reservoir inflows, rainfall and evaporation are impossible and only a probabilistic approach is meaningful. The methodology followed implies the use of a comprehensive stochastic framework that generates synthetic series, either in simulation or forecast mode, by the *Castalia* model. The synthetic time series are statistically consistent with the historic ones.

Several components related to the DSS will be available through the Internet. This includes the DSS results, telemetrical data and a digital library. All material will also be used for educational purposes and for the public awareness.

Curriculum Vitae: Demetris Koutsoyannis

Demetris Koutsoyannis

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1995- Assistant Professor, Department of Water Resources, Faculty of Civil Engineering,
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1990-95 Lecturer, Department of Water Resources, Faculty of Civil Engineering, National
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1979-90 Research Assistant, Department of Water Resources, Faculty of Civil Engineering,
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Engineering employment

1986- Consulting Engineer in hydrologic, hydraulic works and water resources engineering.
1982-85 Faculty member, BIOMETER Ltd (consulting company for wastewater treatment).
1981-83 Faculty member, METER Ltd (consulting company for hydraulic, structural and surveying
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1978-85 Consulting Engineer, co-operating with Greek and International companies for hydraulic,
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1978-81 Faculty member, Polytechniki Co. (consulting company for hydraulic, structural and surveying engineering).

Experience record

Teaching Experience

Over twenty years experience in teaching undergraduate courses in *Engineering Hydrology*, *Stochastic Hydrology*, *Water Supply and Sewerage Systems*, and *Sediment Transport* in the Faculty of Civil Engineering (and temporarily in the Faculty of Surveying and Rural Engineering) of the National Technical University of Athens. Also, teaching courses in *Hydrometeorology*, *Advanced Hydrology*, and *Water Resource Systems Optimisation* in the postgraduate programme *Water Resources Science and Technology* (commenced since 1998-99). Supervision of over 40 diploma theses of graduating students, 6 postgraduate theses and 3 doctoral theses.

Research experience

Research in the areas of hydrological modelling (particularly in rainfall modelling), stochastic hydrology (particularly in disaggregation models), analysis of hydrosystems, water resources engineering and management, and hydroinformatics. Participation in 27 research projects, in 9 of them as project leader and in other 9 as principal investigator. 22 publications in scientific journals, 71 publications and presentations in conferences and workshops, 3 books, 12 series of educational notes, 2 university theses and 58 research project reports (180 publications in total).

Engineering experience

Participation in 43 engineering studies, 11 of which are concerned with the hydrologic design of dams in Greece (for hydro-electric energy, water supply and irrigation), 19 with hydrologic and/or hydraulic design of hydraulic works in Greece (water supply, sewerage, flood protection, irrigation), and 5 in water resources management and environmental impacts. Structural design of several buildings and special constructions. Surveying Engineering in the framework of several public and private works. Contribution in 60 technical reports of engineering studies.

Professional societies membership

- International Association of Hydrological Sciences (2000).
- British Hydrological Society (1999)
- New York Academy of Sciences (1995).
- American Geophysical Union (1993).
- European Geophysical Society (1993).
- Greek Association for Water Resources Management (1990).
- International Association for Hydraulic Research (1984).
- Technical Chamber of Greece (1978).
- Greek Society of Civil Engineers (1978).

Editorial Activities

- Associate editor, *Journal of Hydrology*, January 2000 to present
- Reviewer, *Hydrology and Earth Systems Sciences*, 1998 to present
- Reviewer, *Journal of Hydrology*, 1994 to present
- Reviewer, *Water Resources Research*, 1992 to present, Editor's Citation for Excellence in Referring 2000

- Reviewer, Technica Chronica, 1990 to present
- Reviewer, Water Resources Management, 1989 to present
- Reviewer, Journal of Geophysical Research – Atmospheres, 1995-96

Other biographical data

Languages Greek, English

Computer skills Programming languages Pascal, Object Pascal, C, BASIC, Visual BASIC, FORTRAN. Operating systems MS-DOS, MS-WINDOWS, UNIX. Office automation applications. Mathematical applications.

Military record Seaman, Hellenic Navy, Greece (1984-86).

Registration of biographical data Biographical data are included in the editions "Who's Who in the World" (2001) and "Who's Who in Science and Engineering" (1998/99).

Curriculum Vitae: Nikos Mamassis

Biographical data

Name	Nikos Mamassis
Birth info	Athens, Greece, 4 July 1960
Nationality	Greek
Professional Certification	Surveying Engineer
Employment	Department of Water Resources, School of Civil Engineering, National Technical University of Athens,
Position	Teaching and research assistant
Contact info	Heroon Polytechniou 5, GR-157 80 Zographou, Greece, tel. +30(10)772 2843, fax +30(10)772 2853, e-mail nikos@itia.ntua.gr

Other data

Languages	Greek, English, Spanish
Computer skills	Programming languages: Pascal and Visual BASIC. Operating systems MS-DOS, MS-WINDOWS, UNIX.. Geographical Information Systems

Education and degrees conferred

1978-85	School of Surveying Engineering, National Technical University of Athens
1991-97	Doctor thesis in the School of Civil Engineering, National Technical University of Athens (Doctor Engineer degree in 1997; title of thesis: <i>Rainfall analysis by weather type</i>)

Teaching Experience

Over ten years experience in teaching undergraduate courses in *Engineering Hydrology* in the School of Civil Engineering of the National Technical University of Athens. Also, teaching courses in *Hydrometeorology* and *Advanced Hydrology* in the postgraduate programme *Water Resources Science and Technology* (commenced since 1998-99)

Research experience

Research in the areas of hydroinformatics, hydrological modelling, analysis of hydrosystems, and water resources engineering and management. Participation in 20 research projects and more than 20 publications in journals and conferences.

Engineering experience

Participation in 15 engineering studies.

Some chosen publications

- Nalbantis, I., N. Mamassis, and D. Koutsoyiannis, Le phenomene recent de secheresse persistante et l' alimentation en eau de la cite d' Athenes, *Publications de l'Association Internationale de Climatologie, 6eme Colloque International de Climatologie*, editeur P. Maheras, Thessaloniki, Septembre 1993, 6, 123-132, Association Internationale de Climatologie, Aix-en-Provence Cedex, France, 1993.

- Koutsoyiannis, D., N. Mamassis, and E. Foufoula-Georgiou, Rainfall modelling for AFORISM, *Workshop for the presentation of the research project A comprehensive forecasting system for flood risk mitigation and control*, Bologna, Italy, June 1994, University of Bologna, 1994.
- Mamassis, N., and D. Koutsoyiannis, Influence of atmospheric circulation types in space-time distribution of intense rainfall, *Journal of Geophysical Research-Atmospheres*, 101(D21), 26267-26276, 1996.
- Koutsoyiannis, D., and N. Mamassis, The scaling model of storm hyetograph versus typical stochastic rainfall event models, *24th General Assembly of the European Geophysical Society, Geophysical Research Abstracts*, Vol. 1, The Hague, April 1999, 769, European Geophysical Society, 1999.
- Koutsoyiannis, D., and N. Mamassis, On the representation of hyetograph characteristics by stochastic rainfall models, *Journal of Hydrology*, 251, 65-87, 2001.
- Mantoudi, K, N. Mamassis, and D. Koutsoyiannis, A simple water balance model using a geographical information system, *26th General Assembly of the European Geophysical Society, Geophysical Research Abstracts*, Vol. 3, Nice, March 2001, European Geophysical Society, 2001.

Proposal 2: *Leakage management for water distribution systems in developing, developed and countries in transition*

Project title:	<i>Leakage management for water distribution systems in developing, developed and countries in transition</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	Integrated urban water system interactions (Number 4)
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	
Project proposer	Prof. Dragan Savic (University of Exeter, UK)
Partners in the project (consortium – network – form at least two different countries)	Prof. Godfrey Walters (University of Exeter, UK), Prof. Angus Simpson and Martin Lambert, University of Adelaide (Australia), Prof. Marko Ivetic, University of Belgrade, (Yugoslavia), Prof. Bryan Karney, University of Toronto (Canada) Prof. Bruno Brunone and Marko Ferrante, University of Perugia (Italy), Prof. Cedo Maksimovic and David Butler, Imperial College (UK)
Supporting partners (cash and in kind)	Research Councils in partner countries, private water companies from developed countries and governments
Objective:	To effectively manage leakage from water distribution networks in developing and developed countries
Brief description*: *(Attach a separate Case for support - up to 3 pages)	See attached project description.
Implementation strategy:	Research and educational activities
Implementation mechanism	Collaborative research and appropriate educational/communication means
Expected results	Methodologies and techniques for managing leakage
Deliverables and availability	See attached project description
Target beneficiary groups	Engineering and management institutions in charge of water supply systems in developing and developed countries
Geographical location of the beneficiaries	Developing and developed countries including countries in transition.
Project duration	3 years

Proposed project coordinator (attach a brief CV)	Prof. Dragan Savic
Proposed project budget: e. Equipment f. Travel and subsistence g. Personal costs h. Dissemination Other (specify)	The request for funding is for \$992,600 (details given in the accompanying case for support). The minimum required funds for the proposal to proceed will be of the order of \$250,000.
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)	Matching funding from industry and research councils

Case for Support

LEAKAGE MANAGEMENT FOR WATER DISTRIBUTION SYSTEMS IN DEVELOPING, DEVELOPED AND COUNTRIES IN TRANSITION

Prepared by:

Prof. Dragan Savic	University of Exeter	d.savic@exeter.ac.uk
Prof. Godfrey Walters	United Kingdom	
Prof. Angus Simpson	University of Adelaide	asimpson@civeng.adelaide.edu.au
Dr Martin Lambert	Australia	
Prof. Marko Ivetic	University of Belgrade Yugoslavia	eivetic@ubbg.etf.bg.ac.yu
Prof. Bryan Karney	University of Toronto Canada	karney@civ.utoronto.ca
Prof. Bruno Brunone	University of Perugia	brunone@egeo.unipg.it
Dr Marco Ferrante	Italy	
Prof. Cedo Maksimovic	Imperial College	c.maksimovic@ic.ac.uk
Prof. David Butler	United Kingdom	
Dr Ronnie McKenzie	WRP, Water Resources Planning and Conservation, South Africa	ronniem@wrp.co.za

Introduction

Maintaining a reliable water supply and protecting aquatic resources through adequate management are essential to support all aspects of human life as well as dependent ecosystems. Whilst the use of water varies because of different climates, cultures, habits, economies and natural conditions, many countries face the challenge of coping with limited water resources, in terms of both quantity and quality. In particular, sustainable delivery of water services has been identified as a key challenge. In addition, there is an existing financing shortfall across the whole water sector of both capital investment to reach all the currently unserved people and investment for the operation and maintenance of existing infrastructure (DFID, 2001). Moreover, the demands of population growth and urbanisation (especially in developing countries) is placing even greater stress on existing services and will continue to do so over the foreseeable future.

In many water distribution systems a significant percentage of water is lost going from source works to treatment plants and to consumers. According to the International Water Association (IWA), the amount of lost or "unaccounted for" water (UFW), where leakage is the major cause, is typically in the range of 20 to 30% of production with values of 40 to 50% being all too typical in older networks of cast iron or asbestos cement pipe, even in developed countries. The level of unaccounted for water in many water supply systems in developing countries is often very high, with cities such as Metro Manila and Dhaka quoted at 50%, Jakarta in 1992 at 54%, Delhi and Seoul at 40% and Hong Kong at 34%. In addition, Jordan has an estimated leakage of 59% (UN, 1998). A recent study of 10 water utilities in Africa, commissioned by the Water Utility Partnership (WUP), reported UFW figures of up to 59%, yet many people are not served, most of who are poor (WUP, 2000). In the past, no one with less than 20% unaccounted-for water was particularly concerned. The utilities who were asking for help were losing 30, 40 or 50% (Heim 1979). Well-managed utilities have less than 15%

unaccounted-for water (Pilzer 1981). However, leakage losses can be much higher - up to 75% in Albania, for example - but the heavy expense of tracing and repairing leaks can act as a disincentive to remedying these. In addition to environmental and economic losses caused by leakage, leaky pipes pose a public health risk as leaks are potential entry points for contaminants if a pressure drop occurs in the system. Moreover, leaky pipes represent a substantial energy cost, with the percentages of lost water generally representing a lower bound of the amount of lost power, with all the environmental, greenhouse gas and economic consequences this implies (Colombo and Karney 2002).

Leakage detection has long been a common focus of the developed countries. However, in developing and countries in transition the focus has been on *developing new sources of supply*. As the costs of developing new sources, constructing new water storages, energy for pumping, water treatment and distribution have risen over the last 20 years, water utilities have been forced to re-evaluate the costs of leakage. Repair of detected leaks has led to a substantial decrease in unaccounted-for water. Saving such wasted water is more cost effective than building new reservoirs, pumping stations, and the infrastructure to develop new water sources. In addition, there are no associated adverse environmental consequences of reducing unaccounted-for water. The economic and environmental benefits, especially in water-short communities, are obviously enormous. Introduction of an effective non-intrusive method to enable detection of the condition of a water distribution network would replace expensive leak surveys testing. Detection of leaks, when they are small in size, will lead to cost savings in terms of both decreased water loss and a decrease in the cost of repair (especially if a catastrophic failure with severe property damage is avoided).

In virtually all countries there has been a lack of adequate investment in underground infrastructure. Even where assets were installed they have not been managed pro-actively but on a crisis basis and, as a result, long term benefits are often not considered and investment may be misdirected. The gathering of information relating to the condition and performance of underground pipelines or parts of the network is not simple. Millions of dollars could be saved in implementing best placement of pressure measurement sites for leakage detection. Many have estimated the capital cost of rehabilitating water distribution systems in the USA alone to be in the range of \$US75 to \$110 billion over the next 20 years.

Economic pressure, increased environmental awareness, concern over public health risk and simply the need to conserve water motivate water system operators to implement leakage management programmes. In attempts to detect such leakage a wide range of techniques has been developed. These have had varying success often involving substantial staff-power, excavation of water mains and diversion of supplies. Traditional field-survey methods are both costly and time consuming. Water operators require a quick, cost-justified, large-scale method of identifying areas of actual leakage.

The major issues include:

- (i) How much water leaks from the distribution system – water audits?
- (ii) How do we best educate water operators, policy makers and the general public about sustainable water use, and in particular, leakage issues?
- (iii) How can leakage be identified i.e. innovative leakage detection techniques (e.g., inverse transient analysis).
- (iv) Economic and management issues, e.g., what is the economic level of leakage?
- (v) Assessments and improvements in energy efficiency.
- (vi) Socio-economic issues.
- (vii) Identifying the various causes of unaccounted for water (UFW) other than leakage, such as commercial losses.

Project Objectives

This project aims to provide leakage management tools that will reduce water wastage and provide educational material about leakage and demand management to enable local operators (public or private) to effectively manage their distribution system. The tools and educational materials will be developed during the project to allow easy adjustments for the local conditions in countries at a different level of development (i.e., developing, developed and countries in transition).

Specific Objectives:

- To develop tools for guiding users through the process of developing metering strategies and optimisation.
- To develop novel cost-effective leakage detection techniques which will not require aerial and ground inspections but will be able to find leaks (underground or under water) that might not be detected by conventional inspections.
- To produce didactic material, including innovative educational multimedia software and telematic applications, and run training programmes for selected target groups in various social, economic and geographical conditions.
- To facilitate capacity building by using the tools and didactic material developed in the project.
- To disseminate good practices of reducing UFW in water supply systems, using a variety of dissemination pathways such as workshops, conferences and other appropriate media for the research outputs.

Metering Strategies and Optimisation

Reliable metering of all water volumes should and must be an integral component of water supply, water demand management and loss determination. The most important part of determining how much water is being lost in a system is to accurately quantify the volume of water that is entering that system. Metering of water abstracted at the sourceworks, treatment works production, imported and exported water, input volumes and inflows to distribution systems is essential for water balance calculations.

The purpose of considering metering strategy and optimisation is to develop a holistic, effective, efficient and sustainable programme to achieve the following aims:

- improved metering coverage
- higher confidence in meter data
- improved accuracy of the water balance determination for a network
- improved prioritisation of active leakage analysis and control
- improved focus on areas of the network requiring rehabilitation investment
- improved accountancy practices with associated cost recovery and improved water delivery
- improved demand management.

Educational Issues and Capacity Building

Water supply and distribution are generally more problematic in urban areas because of the complexity of the infrastructure and the proximity of the population. Moreover, urban-water management decisions must be part of a wider set of strategic choices regarding consumer protection, environmental management, urban planning and socio-economic development, involving a wide variety of stakeholders and many interactions.

Barriers to the sustainable management and use of water are often non-technical, and arise from the social, economic and institutional context. Water resources and water services are often under-priced when compared to the cost of provision; institutional arrangements are poorly adapted to sustainable

use/management goals; water operators, the general public and policy makers are often poorly informed of one another's priorities; externalities, such as depletion, degradation or pollution of water resources are not fully accounted for in decision making processes; assessment of groundwater intrusion potential of leakage and related health risks, etc.

A comprehensive training and awareness campaign is required to allow for developing of understanding of leakage management (goals and processes), for developing of the sense of ownership and for capacity building. There is also a need to identify socio-technical bottlenecks where professional education and training programmes need to specifically target water operators (public or private). The aim is to ensure that best technologies and management methods are developed, understood and applied, including at the level of small-scale operators. A key objective of capacity building will be to promote adoption of best practices in utility management, which may include commercialisation of water services as a way of enhancing good value for money while improving water coverage.

Innovative Leakage Detection Techniques

Good practice in utility management requires that water losses are kept to a minimum. Cost effective methods of identifying leakage should therefore be developed. Transient analysis and solving inverse problems are essential to the development of lower cost, innovative and new methods for leak detection. A transient in a pipeline system occurs when a variation in pressure and velocity of the flow is caused by a change, for example by a valve shutting or opening. Through correctly interpreting the pressure time-history at the measurement sections, it is possible to extract the information carried by the reflected pressure waves on discontinuity characteristics, such as leak location and size (Brunone 1999; Brunone and Ferrante 2001). Inverse transient analysis involves computing the status (e.g., leaks) and the parameters (e.g., pipe roughnesses) of the network (Liggett and Chen 1994; Simpson and Vitkovsky 1997; Nash and Karney, 1999; Vitkovsky et al. 2000 and Kapelan et al. 2000). The objective is to match the field and/or experimentally measured pressures with the pressures computed by the numerical transient model.

Inverse transient analysis has the potential to automate the inspection and maintenance of pipelines. The use of inverse transient methods will largely eliminate the necessity for aerial and ground inspections for leaks and will be able to find leaks (underground or under water) that might not be seen by aerial and ground inspections. The new methods will provide sophisticated leak detection techniques and will build on work already being undertaken at the University of Adelaide (Australia), University of Exeter (UK), University of Toronto (Canada), University of Perugia (Italy) and Imperial College (UK).

Deliverables

Developing Countries	Developed Countries
1) A best practice methodology for water auditing in developing countries, including improved metering coverage, higher confidence in meter data, improved accuracy of water balance approaches, improved prioritisation of active leakage analysis and control.	1) A holistic methodology for water auditing, improved metering coverage, higher confidence in meter data, improved accuracy of water balance approaches, improved prioritisation of active leakage analysis and control, improved focus on areas of the network requiring rehabilitation investment.
2) Methodologies for considering social, economic and institutional influences on water distribution leakage management, including capacity building and developing of the sense of ownership.	2) Methodologies for considering social, economic and institutional/regulation influences on water distribution leakage management.
3) Low-cost leak detection techniques considering locally available resources.	3) Innovative and cost-effective leak detection techniques based on numerical, experimental and field investigations.
4) Didactic material based on best management practice methodologies applicable to developing countries.	4) Didactic material, including innovative educational multimedia software and telematic applications.

Management and Resources

Management of the project will be the ultimate responsibility of Professor Savic. The project steering committee will consist of all leading collaborators. The committee will meet every six months although the advice and assistance of individual members will be sought where necessary between these meetings.

Support is requested for a three-year programme of research to develop methodologies and educational tools. This multi-discipline, multi-centre project, which necessarily involves active research collaboration and with an ambitious dissemination programme, requires a significant management input. A post-doctoral research associate at Exeter University will fulfil this requirement on a day-to-day basis.

The complexity of the work requires a mixture of post-doctoral (1x) and PhD student (5x) inputs in all institutions. Funds are therefore requested for 36 months to complete the work. Past experience has shown that truly collaborative projects of this type require substantial travel and subsistence funding in order that staff at the collaborating institutes can spend the necessary time working together. Significant travel and subsistence budgets are therefore requested.

a. Financial resources required

	Total \$US
Staff	486,200
Travel and subsistence	187,200
Dissemination	50,000
Equipment	26,100
Sub-total	\$749,500
Indirect Costs (Overheads at 50%)	243,100
Total	\$992,600

References

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- Brunone, B., and Ferrante, M. (2001). Detecting leaks in pressurised pipes by means of transients. *J. of Hydraulic Research*, IAHR, vol. 39 (5), 539-547.
- Colombo, A, and Karney, B. (2002). Energy and Costs of Leaky Pipes: Toward a Comprehensive Picture, *Journal of Water Resources Management and Planning*, in press.
- Department for International Development (DFID, 2001): *Addressing the water crisis: Healthier and more productive lives for poor people, Strategies for achieving the international development targets*, London, UK, March 2001.
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- Kapelan, Z., D.A. Savic, G.A. Walters (2000) Inverse Transient Analysis in Pipe Networks for Leakage Detection and Roughness Calibration, *Water Network Modelling for Optimal Design and Management*, CWS 2000, Centre for Water Systems, Exeter, UK, pp. 143-159.
- Nash, G.A., and Karney, B.W. (1999). "Efficient Inverse Transient Analysis in Series Pipe Systems." *Journal of Hydraulic Engineering*, ASCE, 125(7), July, 761-764.
- Liggett, J. A. and Chen, L.-C. (1994). "Inverse Transient Analysis in Pipe Networks." *Journal of Hydraulic Engineering*, American Society of Civil Engineers, 120, No. 8, August, 934-955.
- Pilzer, J.E. (1981) "Leak detection case histories." *Journal AWWA*, Nov. 565-567.
- Simpson, A.R., and Vitkovsky, J.P. (1997). "A review of pipe calibration and leak detection methodologies for water distribution networks." 17th Federal Convention, Australian Water and Wastewater Association, March, 680-687.
- United Nations (UN, 1998): *Towards efficient water use in urban areas in Asia and the Pacific*, UN, New York, 1998.
- Vitkovsky, J.P., Simpson, A.R. and Lambert, M.F. (2000). "Leak detection and calibration of water distribution systems using transients and genetic algorithms." Invited paper: *Journal of Water Resources Planning and Management*, American Society of Civil Engineers, Vol. 126, No. 4, July/August, 258-262.
- Water Utility Partnerships (WUP, 2000): *Status of reforms of the water and sanitation sector in Africa*, Report of findings of a study on the reform of the water sector in Africa carried out by OXERA for WUP, 2000.

Curriculum Vitae: Dragan Savic

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DOB: 22 April 1960

Education:

- PhD, 1987-1990, University of Manitoba, Winnipeg, Canada (Civil Engineering)
- M.Sc, 1984-1987 (part-time) University of Belgrade, Belgrade, Yugoslavia (Civil Engineering)
- Dipl. –Ing, 1978-1983, University of Belgrade, Belgrade, Yugoslavia (Civil Engineering)

Membership of Professional Association:

- Chartered Engineer (CEng), UK
- Member of the Chartered Institution of Water and Environmental Management (CIWEM)
- Member of the British Hydrological Society (BHS)
- Member of the International Water Resources Association (IWRA)
- Member of the International Association of Hydrological Sciences (IAHS)
- Member of the International Association of Hydraulic Research (IAHR)
- Member of the International Water Association (IWA)
- Member of the American Geophysical Union (AGU)

Employment History:

- January 2001 to present: Professor of Hydroinformatics, University of Exeter, UK.
- January 1994-December 2000: Research Fellow/Lecturer/Senior Lecturer, University of Exeter, UK.
- April 1991-December 1993: Lecturer, University of Novi Sad, Yugoslavia

- April 1991-December 1993: Project Manager, Energoprojekt Consulting Group, Belgrade, Yugoslavia.
- October 1990-March 1991: Hydraulic/Hydrologic Engineer, KGS Group, Winnipeg, Canada.
- September 1987-Sept 1990: Research/Teaching Associate, University of Manitoba, Winnipeg, Canada.
- November 1983-August 1987: Junior/Senior Engineer, Energoprojekt Consulting Group, Belgrade, Yugoslavia

Publications:

Co-author of 1 book, 1 book chapter, over 150 papers in refereed journals and conference proceedings, and co-editor of 2 conference proceedings.

Research Funding Received:

Recipient of over £1M in research funding since 1994.

Journal Editorial Board Membership:

- Associated Editor, Journal of Water Resources Planning and Management, American Society of Civil Engineering (ASCE), 2000-present.
- Water International (quarterly peer-reviewed journal of the IWRA), 1999-present.
- Journal of Hydroinformatics (the official journal of the IAHR and IWA), 1999-present.
- Acta Hydrotechnica 2001-present.

Research Grant Review:

- Reviewer, Engineering and Physical Sciences Research Council, UK
- Reviewer, Australian Research Council
- Reviewer, National University of Singapore
- Reviewer: US Civilian Research and Development Foundation
- Reviewer: Australian CRC for Water Quality and Treatment

External Examining:

- Examiner, PhD by research, Imperial College, UK.
- Examiner, PhD by research, Lancaster University, UK.
- Examiner, PhD by research, The University of Central Queensland, Rockhampton, Australia (3 candidates)
- Examiner, PhD by research, The University of Adelaide, Adelaide, Australia (3 candidates).
- Examiner, PhD by research, The University of New South Wales, Australia (1 candidate).

Proposal 3: *Advanced hydroinformatic tool for management of complex interactions in urban flooding*

Project title:	<i>Advanced hydroinformatic tool for management of complex interactions in urban flooding</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	Integrated urban water system interactions (4)
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	The project is a follow-up action of the IHP V programme Theme 7 and UN programme on the analysis of potential effect of climate changes and variability on urban infrastructure systems
Project proposers	Dr Slobodan Djordjevic and Prof. Cedo Maksimovic
Partners in the project (consortium – network – from at least two different countries)	Dr. S. Djordjevic, Dr. D. Prodanovic, Dr. M. Stanic, Dr. M. Ivetic (University of Belgrade, Yugoslavia), Prof. D. Savic (University of Exeter, UK), Prof. C. Maksimovic (Imperial College, UK), Dr. A. Deletic (University of Aberdeen, UK), Dr. I. Ribarova (University of Sofia, Bulgaria) Additional partners include potential beneficiaries from water companies, planners,
Supporting partners (cash and in kind)	In kind support expected from the city of Belgrade, Aberdeen and Banja Luka
Objective	To develop an advanced tool applicable for dealing with complex interaction in urban drainage networks, including flood management and reduction of flood and health hazard risk
Brief description* *(Attached is a Case for support)	See attached project supporting material. This project is linked to the project No. 11. In the sense that the project 11 will use the tools developed in this project, develop the additional modules pertinent to specific conditions of humid tropical climate test and apply them in pilot cases. The project will also produce educational material
Implementation strategy	The initial research activities will clarify the concepts of the modules, the tool developed will be tested in selected case studies, potential beneficiaries will be involved for the analysis of feedback, and will be involved in trial implementation of the tools in the cases which experience frequent floods caused by local storms
Implementation mechanism	Collaborative target oriented research and appropriate educational/communication means, incorporation of the risk of flooding, assessment of consequences and interactions with beneficiaries in the development phase.

Expected results	Improvement of the flooding risk assessment methodologies, more accurate design and management of systems, broader acceptance of physically based models, healthier environment																		
Deliverables and availability	Software package, tested in selected cases, instructions for application, trained group of specialists, methodology applied by consultants, environmental agencies, planners, insurance companies. Package available to project partners and beneficiaries who take an active role in the development of the tool.																		
Target beneficiary groups	Municipal organizations responsible for integrated urban water management, and consulting firms																		
Geographical location of the beneficiaries	Developing and developed countries including countries in transition.																		
Project duration	2.5 years																		
Proposed project coordinator (attach a brief CV)	Dr Slobodan Djordjevic (brief CV enclosed) The project will be managed by the Steering Committee, consisting of the representatives of the participating academic institutions and of the representatives of selected beneficiaries																		
Proposed project budget: a. Equipment b. Travel and subsistence c. Personal costs d. Dissemination Other (specify)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">a. Equipment</td> <td style="text-align: right;">30 000 Euros</td> </tr> <tr> <td>b. Travel and subsistence.....</td> <td style="text-align: right;">45 000</td> </tr> <tr> <td>c. Personal costs.....</td> <td style="text-align: right;">235 000</td> </tr> <tr> <td>d. Dissemination...(5 Workshops).....</td> <td style="text-align: right;">65 000</td> </tr> <tr> <td>e. Data acquisition (high resolution).....</td> <td style="text-align: right;">40 000</td> </tr> <tr> <td>f. Training of specialists (9 countries)..</td> <td style="text-align: right;">86 000</td> </tr> <tr> <td>g. Project management</td> <td style="text-align: right;">38 000</td> </tr> <tr> <td></td> <td style="text-align: center;">=====</td> </tr> <tr> <td></td> <td style="text-align: right;">Total534 000 Euros</td> </tr> </table>	a. Equipment	30 000 Euros	b. Travel and subsistence.....	45 000	c. Personal costs.....	235 000	d. Dissemination...(5 Workshops).....	65 000	e. Data acquisition (high resolution).....	40 000	f. Training of specialists (9 countries)..	86 000	g. Project management	38 000		=====		Total534 000 Euros
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f. Training of specialists (9 countries)..	86 000																		
g. Project management	38 000																		
	=====																		
	Total534 000 Euros																		
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)	In kind contribution expected from selected beneficiaries, municipalities, water companies, environmental agencies																		

Case for Support

Project Proposal: Advanced Hydroinformatic Tool for Management of Complex Interactions in Urban Flooding

Partners

Dr. Slobodan Djordjevic (University of Belgrade, Yugoslavia, edjordjs@hikom.grf.bg.ac.yu)

Dr. Marko Ivetic (University of Belgrade, Yugoslavia)

Dr. Dusan Prodanovic (University of Belgrade, Yugoslavia)

Dr. Milos Stanic (University of Belgrade, Yugoslavia)

Dr. Ana Deletic (University of Aberdeen, UK),

Prof. Cedo Maksimovic (Imperial College, UK),

Prof. Dragan Savic (University of Exeter, UK),

Dr. Irina Ribarova (University of Sofia, Bulgaria)

Project Description

When the capacity of a sewer system is exceeded, e.g. where rainfall is heavier than the “design storm” or urbanization has increased, pipe flow is pressurized, the water flows out from the piped system to the streets, and/or the inlets cannot capture all the runoff. In the simulation model, buried structures and pipelines, together with surface channels, make a multiply looped network involving a complex interaction of flows. Secondly, it is well known that, regardless from possible flooding, the quality of the first flush urban runoff water can be rather pure even for rainfall which takes place after only few days dry period. Furthermore, depending on whether the drainage network is a combined sewerage, or it consists of separate systems for collection of storm water and waste water, the quality of flooding water may or may not be strongly influenced by the complexity of interactions between the flow in buried pipelines and surface channels. Finally, once the runoff reach the recipient (lake, river or sea), pollution of the recipient, on the one hand, is a result of the input (outflow from waste water treatment plants, combined sewer overflows, first flush and possibly the pollution brought in by the flooding water), and on the other hand it is a result of complex biological, chemical and mixing processes, i.e. of numerous interactions of various substances.

Meaningful management of the described processes requires tools that can simulate them by solving the equations of appropriate mathematical models and that can handle large amounts of data describing tens of thousands of surface and network elements. The lack of majority of existing computer models is that they are oriented towards the modelling of one or only a few particular stages, whereas the important interactions, which are part of a complex integrated problem, are usually neglected.

The tool which will be developed in the proposed project will comprise a number of advanced technologies, based on long-time experience in software development, design and analysis of systems of various size and complexity, as well as in both laboratory and field measurements. Some of the related problems are elaborated in the sequel.

The informatics technologies, dealing with all kind of data, are in high level of development. New sources of data are now available with developed tools, and full control over data accuracy, aging, degradation through transformation is achieved, together with data linkage between different sources. The development of hydroinformatics system that integrates existing numerical models with newly developed informatics will be done. The tools will be developed for the numerical model data preparation stage, that are using available data to generate the new information and model parameters. Geographical information system (GIS) technology will be widely used in the informatic model, its components, layers with input data and newly created information, program modules for surface flow analysis and subcatchment delineation, as well as in modules for calculation of parameters specific for some urban drainage simulation model.

Existing hydroinformatic tools are still only used for data input and visualization of results, whereas their GIS components are not much more plotting scanned maps in the background. One of the ideas of the proposed project is to put the emphasis on using of GIS technology as an *analytical tool* for various purposes, such as: fitting and scaling of georeferenced maps, creation of detailed DEM and cover image, DEM- and cover-based delineation, calculation of subcatchment parameters, advanced 3D visualization in real-time using scanned maps overlapped on DEM with addition of cover image, detection of depressions and others, determination of flow paths on the terrain etc.

The numerical model for simulation of interaction between flows in buried pipe and surface channels will be based on simultaneous solving of (i) node continuity equations, (ii) energy equations for nodes and channel ends and (iii) the full equations of flow through channels and structures. By eliminating some of the unknowns, the Preissmann method will be applied to reduce all the equations to a system of equations for node levels, solved by the conjugate gradient method after converting a sparse node matrix into a row-indexed sparse storage form. This procedure will be the core of the model -- it will enable the introduction of all other stages. The equivalent elements will be used to replace several inlets linking the surface and underground nodes. Various cases of relations between piezometric heads at adjacent nodes and terrain level will be analyzed which determine the flow direction between the surface and the sewer system. Procedures will be described for the simulation of manhole cover loss, basement flooding, the representation of street geometry, and the distribution of runoff hydrographs between surface and underground networks. All these procedures will be built into the simulation model. This model has no restrictions in terms of system size and configuration, nor in terms of hydraulic conditions – supercritical flow, surcharging and street flooding are simulated by advanced concepts.

There are only a few known studies in which the existing simulation models were used for analyzing of dual drainage in a manner close to the one proposed. Those applications suffered from oversimplified treatment of inlets. The improvement proposed here is twofold: to take inlet capacity in the account (for regular flow direction from the street to the sewer system), and to treat the outflow from the sewer to the street as flow through the opening, ie. not as the weir flow as it was done in the mentioned usage of existing models.

The model of suspended solids discharge from impervious areas during storm events will be developed and incorporated into the sewer network flow model. It will continuously simulate two major processes of different time scales: solids build-up at impervious surfaces between two storm events, and solids wash-off from the surfaces during storm events. The wash-off process will be divided into three sub-processes to be modelled consecutively.

Transport and mixing processes in the recipients, as well as biological and chemical processes will be modelled by advanced turbulence models and numerical techniques.

Objective

The project objective is to develop an advanced tool applicable for dealing with complex interactions in urban drainage networks. All mentioned methodologies will be incorporated into a tool comprising graphical interface with numerous functions for import, processing and export of maps and data, GIS analytical routines and simulation model and results' previewers. The tool is to be used for analysis of

existing systems under performance, long-term assessment of water quality and interference of flooding with the traffic.

Target beneficiary groups

Municipal organizations responsible for integrated urban water management and consulting firms in developing and transitional countries.

Project duration

The project is planned for 2 years period.

Management

Project will be managed and coordinated by Dr. Slobodan Djordjevic.

Budget

Apart from the faculty researchers listed above, it is planned to engage one post-doctoral fellow, three doctoral and two graduate students, as well as two software developers. Resources required are:

Stuff	450,716
Travel	90,000
Dissemination	25,000
Equipment	65,000
Sub-total	630,716 USD
Indirect costs	238,884
Total	869,600 USD

Work address:	Private:
Faculty of Civil Engineering	Svetozara Markovica 15
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Curriculum Vitae: Slobodan Djordjevic

Date of Birth 30th July, 1959

Objective A dynamic hydraulic engineer with extensive experience in development and application of original numerical methods and software, analysis and design of complex systems, projects' assessment, organization of technical meetings and teaching different subjects, personally committed to improvement of welfare of the society, protection of the environment and international understanding.

Qualifications University of Belgrade, Faculty of Civil Engineering

- B.Sc. Degree at the Hydraulic Engineering Department (1984).
- M.Sc. Degree at the Hydraulic Engineering Department (1988).
- Doctoral Degree at the Hydraulic Engineering Department (2001).

Work Experience 2001 – onwards Faculty of Civil Engineering, Belgrade

Assistant Professor

- I lecture undergraduate and graduate courses in Environmental Engineering, Fluid Mechanics and Hydraulics.

1991 – 2000 Faculty of Civil Engineering, Belgrade

Research and Teaching Assistant

- I have been working on a number of different water-related projects in Yugoslav cities Kladovo, Novi Sad, Belgrade, Pazova, Ruma and Sabac.
- I developed or was a member of a team that developed various specialized software for modelling of water flow and quality in urban infrastructure systems, rivers and lakes, and for application of GIS in water resources.
- I published about forty papers, four of which in international journals.
- I have been a member of programme committees of two internet conferences (www.dhi.cz/ICUDI , www.ekoing.hr/konferencija). I

actively took part in preparation and organization of numerous international scientific/technical meetings held in Portoroz, Dubrovnik, Belgrade and Novi Sad.

- I worked as a World Bank consultant for flooding issues in FR Yugoslavia.
- I participated (with presentations) in various expert meetings such as NATO ASI on Coping with Floods (Erice, 1993), TEMPUS Course on GIS (Belgrade, 1991), COMETT Group (Budapest, 1989) and IRTCUD courses.
- I regularly gave tutorials, organized exams and partially lectured seven undergraduate courses and two graduate courses.

1990 (January – June) The Florida State University, Tallahassee

Visiting Research Associate

- At the Supercomputer Computations Research Institute (SCRI) I developed hydrodynamic model of the St. Johns River in Central-East Florida.
- I also worked on the inclusion of advanced open-boundary conditions in 3D lake flow model based on large-eddy simulation approach.
- I gave a lecture on my M.Sc. thesis research within the SCRI Seminar.

1985 – 1989 Faculty of Civil Engineering, Belgrade

Research Associate

- I participated in several hydraulic engineering projects in Belgrade, Obrenovac and Lenart.
- I conducted extensive experimental investigation of unsteady mass transport in open channel flow, both in laboratory conditions and in the field (on the Sava River), and also developed original simulation model, results of which were published in several international journals.

1983 (July – September) University of Technology, Delft

Student Trainee

- I developed a computer code, which was later used for interpretation of dynamic measurements (from the vessel) of water quality in the Maas River.

1982 (June – September) Jaroslav Cerni Institute for Water Resources, Belgrade ,

Course Technical Assistant

- I was responsible for various technical issues in the International Course on Water Resources Engineering (for engineers from developing countries) organized by the Dutch Government and the

Jaroslav Cerni Institute.

Languages

Mother tongue Serbian (Serbo-Croatian). I speak and write English easily and I have basic understanding of French and of all other South-Slavic languages.

Professional institutions

Member of International Association of Hydraulic Research (IAHR).
Member of International Research and Training Centre for Urban Drainage (IRTCUD)
Member of Yugoslav Society of Mechanics (YSM).

Travelling

I traveled to about thirty countries. I have a full, clean driving license.

Marrital status

I am married and I have two sons (born in 1994 and 1996).

Sports

I play basketball and tennis.

Nationality

Yugoslav (Serbian).

Projects and Publications

Selected project reports, technical papers and lecture notes:

Reports

- *Dispersion in the Dutch Part of the River Maas (the Netherlands), 1983.*
- *Hydrometry and Water Temperature Measurements Near the Outflow from the Obrenovac Thermal Power Plant (Serbia), 1987.*
- *Hydraulic Analysis of the Sewerage System in Lenart (Slovenia), 1989.*
- *One-Dimensional Hydrodynamic Model of St. Johns River (USA), 1990.*
- *Preliminary Design Project of Kladovo Storm Sewer System (Serbia), 1995.*
- *Preliminary Design Project of Storm Sewer System of Klisa, Mali Beograd, Veliki rit and Sever IV Catchments in Novi Sad (Serbia), 1996.*
- *Hydraulic Analysis of the Existing Condition of the Trunk Sewer in Nova Pazova (Serbia), 1998.*
- *Peer review of series of sewerage projects for the City of Sabac and City of Novi Sad (Serbia), 1998-2001.*
- *Flood Risks in FR Yugoslavia, 2000.*

Papers and Lecture Notes

- **S. Djordjevic** and M. Radojkovic, An accurate solution of one-dimensional convective transport equation, *Zeitschrift fur angewandte Mathematik und Mechanik*, 1986, Vol. 66, No. 3.
- **S. Djordjevic**, J. Petrovic, C. Maksimovic and M. Radojkovic, Experimental tracer investigations in a compound laboratory channel, *HYDROCOMP '89*, Dubrovnik, 1989.
- **S. Djordjevic**, Digital requirements for urban drainage models, *TEMPUS Training Course: Application of GIS in Urban Drainage*, Belgrade, 1992.
- **S. Djordjevic**, M. Ivetic, C. Maksimovic and A. Rajcevic, Modelling of surcharged flow in storm sewers with water exchange through the inlet openings, *HYDROCOMP '92*, Budapest, 1992.
- **S. Djordjevic**, Mathematical model of unsteady transport and its experimental verification in a compound open channel flow, *Journal of Hydraulic Research*, Vol. 31, No. 2, 1993.
- C. Maksimovic, J. Elgy, L. Fuchs, D. Prodanovic and **S. Djordjevic**, Gluing routines for matching standard GIS packages with simulation and design models for water projects, *UDT '94*, Moscow, 1994.
- **S. Djordjevic**, D. Prodanovic, J. Despotovic, J. Petrovic and A. Sotic, A preliminary design of Kumodraz urban drainage system – First phase, *HYDROINFORMATICS '98*, Copenhagen, 1998.
- **S. Djordjevic**, Modelling of flow in sewer systems, *IRTCUD Workshop Sustainable Urban Drainage Development*, Novi Sad, 1998.
- **S. Djordjevic**, D. Prodanovic and C. Maksimovic, An approach to simulation of dual drainage, *Water Science and Technology*, Vol. 39, No. 9, 1999.

Proposal 4: *Top-Down Assessment of Changed Urban Aquatic Ecosystems*

Project title:	<i>Top-Down Assessment of Changed Urban Aquatic Ecosystems</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	(2) Processes and interactions in the urban water cycle
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ...other (specify))	
Project proposer	Prof. Carlos E.M. Tucci and Prof. David da Motta Marques, Instituto de Pesquisas Hidráulicas Universidade Federal do Rio Grande do Sul -Brazil.
Partners in the project (consortium – network – form at least two different countries)	Prof. Thomas. Crisman and Prof. William R. Wise, Department of Environmental Engineering Sciences at the University of Florida; Researchers at local Universities; Partners from the state and municipal water resources and environmental agencies; Potential partner the URBAN LTER site in USA.
Supporting partners (cash and in kind)	In cash expected from the National Council for Scientific and Technological Development, and National Water Authority if approved by peer review under a specific program; In kind support expected from the state Government and city of Porto Alegre.
Objective:	Develop an assessment protocol on system level for new urban aquatic ecosystems.
Brief description* *(Attached is a Case for support)	Urbanisation changes aquatic ecosystems, and may destroy them completely. Where destruction is not complete, the effect of urbanisation often results in systems in which entire sections of a river become canalised or drastically modified, interspersed with stretches where the original system only partly remains. Most of the ecological processes are lost or new and unknown characteristics are produced. Traditional approaches to impact assessment use the loss of habitats, community structure and functions, extinction and abundance at population level, and toxicity at individual level. But since aquatic ecosystems in urban environments can only rarely be maintained as they were before urbanised development began, new communities arise. A new approach, focused on ecosystem level

	<p>indicators, is needed to provide the basis for management of urban water, and to provide a framework for policy decisions. In addition to considering community and ecosystem structures, the approach needs also to take account of other factors such as hydrology/dynamics, drainage structures, and urban artefacts such as impervious surfaces, and areas devoted to parks. The application is than related to space management. This new approach should also aim to be less data-intensive.</p> <p>SEE ATTACHED PAGES FOR DETAILS</p>
Implementation strategy:	<p>Workshops to establish the research framework and identification of key issues followed by field work and development of assessment procedures and reporting;</p> <p>Follow-up seminars.</p>
Implementation mechanism	<p>Development of long term research on processes using a multidisciplinary team</p> <p>Develop joint research activities with state and municipal water resources and environmental agencies, University of Florida, and possibly with URBAN LTER/USA.</p>
Expected results	<p>Define and quantify metrics and associated processes, and small models in urban aquatic ecosystems;</p> <p>General system indicators that integrate a wide number of stress and degradation factors</p>
Deliverables and availability	<p>Technical reports;</p> <p>Small models, Indices; Manuals of implementation;</p> <p>Database for different types of new urban aquatic ecosystems;</p> <p>Trained personnel</p>
Target beneficiary groups	<p>Municipal and state urban and environmental planners, managers and scientists. NGOs.</p> <p>Urban areas with changed urban aquatic ecosystems in need of support for management.</p>
Geographical location of the beneficiaries	<p>South America, Brazil and MERCOSUL Countries.</p>
Project duration	<p>3 years.</p>
Proposed project coordinator (attach a brief CV)	<p>Prof. Dr. Carlos E.M. Tucci. A steering committee with representatives of the academic institutions and municipal and state water and environmental agencies will help to manage the project.</p>
Proposed project budget:	
a. Equipment	a. Equipment.....150,000 US\$
b. Travel and subsistence	b.Travel and subsistence..... 25,000
c. Personal costs	c.Personal costs..... 120,000
	d.Dissemination (4workshops) 25,000

<p>d. Dissemination Other (specify) supplies</p>	<p>e. Image & data acquisition 25,000 f. Training of specialists (MERSOSUL) ... 15,000 g. Project management 40,000</p>
<p>Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)</p>	<p>Formal agreement with local environmental protection and water resources agencies to joint development.</p>

Case for Support

TOP-DOWN ASSESSMENT OF CHANGED URBAN AQUATIC ECOSYSTEMS

Carlos Tucci and David da Motta Marques

Instituto de Pesquisas Hidráulicas, Universidade Federal do Rio Grande do Sul

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Urban River and Stream Changes

Inefficient development of land combined with poor management practices tends to induce urbanisation patterns which change aquatic ecosystems, and even destroy them completely. Where destruction is not complete, the effect of urbanisation often results in systems in which entire sections of a river become canalised or drastically modified, interspersed with stretches where the original system only partly remains.

Water resource Integrity in Urbanised Areas

Water resource integrity is understood as the integrated result of complex and interrelated factors in a dynamic sequence (Karr et al., 1986). The five major factors, are: flow regimes, chemical variables, biotic factors, energy sources and habitat structure, with their physical, chemical and biological components (Fig.1). Together, they influence and determine the integrity of surface water resources (Yoder, 1995).

The result of inappropriate land use is that these principal factors are differently affected by human activities, causing reduced water retention, more rapid runoff, soil erosion associated with increased pollutant load, changes from particulate organic matter to mostly dissolved cloacal organic matter, the spread of parasitism and disease, and changes to physical structure. As a consequence of these changes, many ecological processes are lost or replaced by others, and unknown characteristics are introduced to these water bodies.

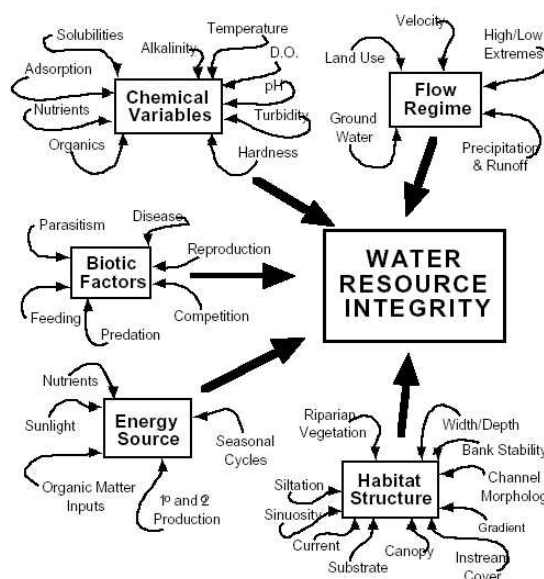


Figure 1. Five major factor that determine the integrity of surface water resources (modified from Karr, 1987).

The dynamic nature of interactions between the factors means that systems variation is both possible and expected, due to natural and anthropogenic stressors. Known spatial and temporal patterns of processes and state variables that are observed to occur along the streams and rivers are lost.

Emergent Urban Aquatic Ecosystems

Emergent ecosystems are the result of ecosystems modifications imposed by man, and they may not be recognisable by current monitoring and valuing procedures. Degradation is caused by an array of factors in addition to traditional chemical and biological contamination. Degradation starts upstream with changes in the watershed, and is combined with changes to stream corridors and to the structure and dynamics of stream channels. The combination of these alterations influences one of the major factors with potential undetected effects on water quality (Karr, 1991a). This new kind of system may have new or additional characteristics besides those already known for natural ecosystems. The rate of change from a reference stream to the new system may be complex in form, either being progressive or occurring above an unknown threshold.

Traditional approaches to assessing the impacts of change and control is administration-dominated and uses chemical and physical criteria (Brasil, 1986), and whole effluent toxicology to verify impairment of water resources integrity. It requires that full account be taken of different water uses and of the need to preserve the integrity of water communities. The presumption is that the attainment of administrative goals set by legislation will ensure environment improvement (Yoder, 1995) and maintenance of the system integrity.

The Top-Down Assessment Approach

Environmental changes also can be assessed using the loss of habitats, different levels of bioassessment, including community structure and functions, extinction and abundance at population level and toxicity at individual level. Cairns et al. (1993) suggest two ways to assess the environment at community and ecosystem level. In the "bottom-up" approach, laboratory data are used to model natural systems. The second approach, called "top-down", is based on direct measurement of ecosystems, followed by diagnostic searching for source and cause of any problem.

However since aquatic ecosystems in urban environments can only rarely be maintained as they were before urbanised development began, new structures and communities arise. An approach, focused on measurable and reliable attributes such as community/ecosystem level, taking in account the five major factors indicators, is needed to provide the basis for management of urban water, and to provide a framework for policy decisions. Links between hydrology/hydrodynamics, habitat characteristics, watershed indicators/indices and certain communities need to be qualified, quantified (/metric/multimetric), and simply modelled. These simple indices and models are indicators with the potential to characterise a new system or parts of it.

What these new characteristics are, and how they can be identified (by theoretical considerations and field data) is the first step in the work proposed. The same applies to pattern changes, which may indicate that a point of no return has been reached, and that a new kind of system has come into being. Simple descriptive equations and statistical modelling are needed to quantify the emergent characteristics and associated patterns. How far the new system is from a reference site based on comparing habitat, hydrology/hydrodynamics, water chemistry and biological measure is also necessary to qualify the shift to the new set up. As the characteristics are at the top end of the organisation scale, it is expected that less effort is necessary to gather representative data, in comparison with regular water chemistry, community, population, species and ecotoxicological indicators. Of course the indication power is compatible with the organisation level, higher means less specific and long term indication. In addition to considering community and ecosystem structures, the approach needs also to take account of other factors such as associated hydrology/dynamics, drainage structures, and urban artefacts such as impervious surfaces, and areas devoted to parks. Also the

uncertainties in results must also be considered in the analysis and modelling process, especially for biological indicators.

Application and Users

Water resources are subjected to federal, state and county laws and managed by environmental agencies on these three levels. Any activity that leads to environment changes is subject to environmental impact studies. Federal water resources law (Brasil, 1997) has established the watershed as the management unit, and has ruled that quantity and quality must be considered together. This is to say that quality is an aquatic ecosystem matter. All management actions on aquatic systems are directed to support this principle. Management actions to take back the legal land area parallel to river and streams in urban areas are unthinkable due to economic restrictions related to land value, and land recovery costs. The current local public administration approach is the implementation of corridors along less damage urban water bodies.

Direct results of the proposed Project will be procedures showing how to follow urban aquatic ecosystem changes, how to assess eventual degradation towards new systems, what sort of management may result, and how verify management actions. Local environmental agencies (state and county) are key players in the research group. Specific partners are managers and researchers.

The application is then related to space management, how to detect changes, and how to measure and evaluate the new systems. This new approach should also aim to be less data-intensive.

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Curriculum Vitae: CARLOS EDUARDO MORELLI TUCCI

1. AREAS

- Hydrology and Hydraulics
- Simulation of water resources systems
- Urban water management

2. DEGREES

- Civil engineer from Federal University of Rio Grande do Sul (1971);
- MSc in Civil Engineering /Water Resources Federal University of Rio Grande do Sul, (1975);
- Doctor of Philosophy, PhD, Civil Engineering Department, Colorado State University, USA, 1978.

3. ACADEMICS ACTIVITIES

- full professor of Hydromechanics and Hydrology Department of the Institute of Hydraulic (IPH) Research of Federal University of Rio Grande do Sul (UFRGS);
- adviser of many Master theses and PhD dissertations in the Water Resource and Sanitary Engineering graduate program of IPH/UFRGS
- former head of the Water Resource and Sanitary Engineering graduate program of IPH/UFRGS.

4. RESEARCH ACTIVITIES

- researcher funded by CNPq (National Research Council of Brazil) and consulting for research from other State and Federal Agencies in Brazil and South America;
- Manager of Water Resource Research Fund of Brazil support by Science and Technology Ministry;
- Resource person of South America Technical Advisory Committee of Global Water Partnership
- Main editor of the Brazilian Water Resource Journal;

- Coordinator of research activities in Urban Water Management and other Hydrology projects in IPH/UFRGS

5. OTHER ADMINISTRATIVE ACTIVITIES

- former president of ABRH, Brazilian Water Resources Association (1993-1995);
- Head of Hydrology sector of IPH/UFRGS.
- Vice-President of IAHS International Association of Hydrological Science

6. CONSULTING ACTIVITIES

- Developed many projects on water resources within Brazil and more widely throughout South America;
- Consultant for companies and government organizations such as: ANA – National Water Agency; Itaipu Bi-national; ANEEL – National Electric Energy Agency; and many others.

7. HONORS

- Medal of Civil Defense of Rio Grande do Sul State in 1985
- Best book on Science and Technology of 1994 in the Book Editor Society of Rio Grande do Sul for Hydrology Science and Application.

8.PUBLICATIONS

Publications totals	
Type	Amount
Books	10
Books chapters	30
International Journals	15
National Journals	55
Symposium and Seminars	85
Institutions publications	32
Master and PhD	2
Total	229

Curriculum Vitae: DAVID DA MOTTA MARQUES

Biologist, took his Undergraduate Degree at Pontifical Catholic University of Rio Grande do Sul, his Master Degree in Ecology at Federal University of the Rio Grande do Sul (UFRGS), both in Brazil, and his PhD degree in Environmental Engineering at Imperial College of Science and Technology/University of London. Currently he is Associate Professor and researcher at Instituto de Pesquisas Hidráulicas (IPH) of the Universidade Federal do Rio Grande do Sul State (UFRGS), Brazil. Teaches and supervises, at MSc and PhD levels, in the Water Resources and Environmental and Sanitary Engineering Graduation Course and in the Ecology Graduation Course, both at UFRGS. His areas of interest and research are Aquatic Ecosystems Ecology/Wetlands and Applied Ecology to Water Resources.

One of his current research projects is on urban water quality, part of the Assessment and Control of Environmental Impacts Promoted by Urbanisation project, funded by the National Council for the Scientific and technological development (CNPQ-FINEP). Also develops research in subtropical wetlands and he is the scientific co-ordinator (PI) for Site 7-Taim Hydrological System, Brazilian Long Term Ecological Research sites programme (a member of ILTER). In this context has proposed basic rules to operate this hydrological system to settle the requirements for environmental conservation and rice production. Part of his research is on constructed wetlands to control water quality and basic techniques to establish aquatic macrophyte stands.

He is past member and co-ordinator for the Committee of Research Instituto de Pesquisas Hidráulicas, past member of the Committee of Graduation Studies at Water Resources and Environmental and Sanitary Engineering Graduation Course and at Ecology Graduation Course. He is also a past council member of the Federal Council of Biology (a professional regulatory institution), and a past president for the Southern Region Council of Biology.

Also he is affiliated to professional associations such as Society of Wetland Scientists (SWS), International Association of Theoretical and Applied Limnology (SIL) and Brazilian Association of Water Resources (ABRH), being past Director of Publications for this last one. Currently is the president for the Brazilian Limnology Society.

Proposal 5: *Stakeholder Awareness and Inclusion of Sustainability concepts into decision making processes for INtegrated urban water systems (SAISIN)*

Project title:	<i>Stakeholder Awareness and Inclusion of Sustainability concepts into decision making processes for INtegrated urban water systems (SAISIN).</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	Focal area (3.5): <i>Urban and Rural settlement.</i> Objective: Multidisciplinary interactions, transfer of knowledge and technology, training programmes for water managers, urban planners and sanitary specialists. Topic areas: 4. Integrated urban water system interactions; 8. Socio-economic and institutional aspects; and 9. Urban water education, training and technology transfer
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, other (specify))	UNESCO IHP-VI (water management components)
Project proposer	Professor Richard Ashley (Pennine Water Group, UK; Universities of Bradford & Sheffield).
Partners in the project (consortium – network – from at least two different countries)	Prof D Butler (Imperial College London, UK); Prof D Savic (University of Exeter, UK); Professor P-S Mikkelsen (Dk); Professor Peng DanCong (Xi'an University of Architecture and Technology, China); Professor M Brumaru (Cluj TU, Romania); Dr R Matos LNEC (Portugal); Elvani Cani (Foundation for urban integration, Albania); Dr G Geldof (Tauf BV, Holland); Dr P Banovec (University of Ljubljana, Slovenia); Dr J Parkinson (GHK International, UK); Dr K Gupta (IIT Madras, India); Dr A Ab-Ghani (University Sains Malaysia, Penang, Malaysia); Prof T Stewart (University of Cape Town, South Africa)
Supporting partners (cash and in kind)	Municipal/water companies in partner countries (e.g. Bradford MDC; Xi'an Municipal Authority in China; RAJAC (water company, Cluj Region, Romania); Ove Arup (UK).
Objective:	Inform all of the stakeholders in urban water systems about sustainability concepts and how these may be incorporated into decision-making processes in order to make more sustainable and hence cost-beneficial decisions in relation to urban water
Brief description*: *(Attach a separate Case for support - up to 3 pages)	See attached

Implementation strategy:	<ol style="list-style-type: none"> 1. Workshops to establish awareness and needs in transitional and developing countries (investigate stakeholders and existing decision support processes, constraints and institutional models). 2. Develop software and other media based support tools for increasing awareness of sustainability concepts and how these may be better included into decision making for integrated urban water systems. These tools will be in a variety of forms to suit the various stakeholder levels. 3. Case study and scenario planning application (real projects)
Implementation mechanism	Via collaborative municipal and local organisations through application to case study areas in transitional and developing countries.
Expected results	New paradigms for all stakeholder groups: greater stakeholder awareness; methodologies to promote behavioural change (where required); illustration to stakeholder groups of consequences of behaviour and likely project implementation effects.
Deliverables and availability	Software, guidebook and other media based methodologies. Widely available worldwide.
Target beneficiary groups	Legislators-professionals (engineers, scientists, planners, lawyers etc.) – commercial/retailers – local/regional government - NGOs – general public
Geographical location of the beneficiaries	Worldwide, but focused on developing and transitional countries
Project duration	4 years
Proposed project coordinator (attach a brief CV)	Richard Ashley
Proposed project budget:	\$1.4M
e. Equipment	a. \$100k
f. Travel and subsistence	b. \$400k
g. Personal costs	c. \$500k
h. Dissemination	d. \$400k
Other (specify)	
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind).	10%

Case for Support

Stakeholder Awareness & Inclusion of Sustainability Concepts into Decision-making Processes for Integrated Urban Water Systems (SAISIN¹)

Prepared by: Prof R Ashley **Pennine Water Group (Universities of Bradford & Sheffield), UK**

Prof Peng DanCong Xi'an University of Architecture & Technology, China

Prof D Butler Imperial College of Science, Technology & Medicine, UK

Prof D Savic University of Exeter, UK

Dr P Banovec University of Ljubljana, Slovenia

Prof P-A Malmqvist Chalmers Technical University, Sweden

Prof M Brumaru Cluj Technical University, Romania

Dr K Gupta IIT Madras, India

Dr A Ab-Ghani University Sains Malaysia, Malaysia

Prof Theo Stewart University of Cape Town, South Africa

Prof P S Mikkelsen Technical University of Denmark

Dr J Parkinson GHK International, UK

Dr G Geldolf Tauw BV, The Netherlands

Municipal *Bradford City Council (UK),*

Other example collaborators Xi'an Municipal Authority(China), RAJAC (water company Cluj, Romania), Ove Arup (UK)

Introduction

Effective Integrated Water Management (IWM) is an aspiration for all those engaged in water service provision. This is a key component of the World Water Vision and the way in which aspirations for water equity may be realised (e.g. Cosgrove and Rijsberman, 2000; Maksimovic and Tejada-Guibert, 2001). It is also a primary water-security target (e.g. ASCE/UNESCO, 1998) and a major component in the requirements of the EU Water Framework Directive (2000/60/EEC). Part of the vision includes the promotion of sustainability of water systems and full accountability for their interaction with other systems. A major problem is the elusive nature of the concept of sustainability, the definition of sustainability principles, and how to translate these into action within an IWM perspective. In developing countries, such concepts are perhaps deemed 'luxuries' where the provision of water services is currently inadequate; with difficulties relating particularly to different perceptions and understanding of what ideas about 'sustainability' mean in practice. In many developing countries a rapidly growing urban population and increase in demand for water/wastewater services leads to ever-increasing local and regional and environmental problems. However, it is widely accepted that the wholesale transfer of the prevailing concepts and technologies from the more developed countries to such areas is inappropriate and unsustainable. The prescriptive approaches to option generation widely adopted by the water industries in more developed countries lack scope for flexibility, creativity and innovation. Technologies that have been shown to be *more sustainable* are often not feasible solutions to urban water problems as a result of legislative and institutional constraints (Gilmour *et al.*, 2002). Ironically, it may be that such technologies can be more easily adopted in

¹ The name for the common Indian antelope

transitional and developing countries, where the environmental performance of urban water systems is much poorer, and regulatory targets less developed.

The commitment to giving stakeholders and the general public wider access to information and the opportunities to influence decisions affecting urban development is becoming a recurring policy theme. In the EU for example, in accordance with the Aarhus Convention² and the inclusion of people in the processes required under the Water Framework Directive, the facilitation and encouragement of greater public involvement is advocated for all of the principal actors in the decision support process. It is recognised that '*development*' cannot be measured simply in terms of the final outcome or decision taken; the process of decision-making itself is vitally important in satisfying a basic tenet of '*sustainability*'. The need for better support for decision-making processes and the development of new tools is identified in a number of initiatives (e.g. Wrisberg *et al.*, 2002; DETR, 2000). There have been a number of attempts to develop such methodologies and tools, although few have so far attempted to explicitly inform decisions about selecting the *most* sustainable solution, i.e. to integrate the components and directly address '*sustainability*' (e.g. EA, 1998; Hoffman *et al.*, 2000).

The SWARD project

In the UK, the *Sustainable Water industry Asset Resource Decisions* (SWARD) project has provided a suite of tools of direct use to industry, whereby the water service providers can more effectively include the principles of sustainability within their decision-making processes (Ashley *et al.*, 2002a). In Sweden, Denmark and South Africa, similar approaches are being taken (Hellstrom *et al.*, 2000; Mistra, 2001; Hoffman *et al.*, 2000; Stewart *et al.*, 2001). The SAWRD project was undertaken by a multi-disciplinary team from five universities, assisted by industry partners in Scotland, England, Romania and Australia. The project has Developed a structured decision support process that guides the user and other stakeholders through the incorporation of sustainability assessment in the decision making process. The outcomes from the UK SWARD project include:

- Development of *Decision Mapping* techniques that allow current decision-making processes and information flows to be systematically identified (Bouchart *et al.*, 2002);
- Review of *decision support processes* (DSPs) and potential support tools;
- Production of a *Guidebook* (> 400 pages) containing a seven-phase framework that can be used to explicitly incorporate sustainability considerations into decision-making procedures.
- Development of a *generic set of sustainability criteria* that can be used to support a wide range of decision types related to new and existing infrastructure and services (Foxon *et al.*, 2002);
- Demonstration of the use of the Guidebook via a wide range of *case study examples* (Ashley *et al.*, 2002b).

Workshops were run with environmental and water industry professionals from India, the UK and Romania as part of the project. The information gathered illustrated: the different interpretations of '*sustainability*' displayed by people from different economies; the importance placed on its various components; and how cultural attitudes toward sustainability differ widely. This has posed new research questions as to: how all stakeholder levels can be made more aware of sustainability principles; how these can be included into decision making processes in a context-appropriate manner; and, how the SWARD framework might be transferred to other institutional and cultural situations.

The SAISIN project

The project will examine use of the SWARD decision support processes and further develop these as a means to promote and inform discussion between stakeholders and encourage social learning in several countries. This is important as key decision-makers often display a poor understanding of the issues involved in the management of urban water systems, particularly with regard to issues such as

² UN/ECE, *Convention on Access to Information, Public Participation in Decision-Making & Access to Justice in Environmental Matters*, COM (2000) 839 Final 2000/0331 (COD). 18.10.2001.

externalities and the transferability of environmental problems. There is a widely acknowledged need to extend the technology-driven tradition of water and wastewater management to an integrated perspective where sustainability concerns are fully incorporated into decision-making processes. However, what is manageable, adaptive, and realistic will vary depending on a particular country's economy, natural environmental conditions, and socio-cultural history. At the citizen level, methodologies developed to enable greater ownership and inclusion must be sensitive to established religious, cultural, and socio-political norms. This need for a *context-appropriate* approach to the inclusion of sustainability concepts within urban water system planning and investment is one of the primary drivers for the SAISIN project. Although the outcomes of the project would be of use worldwide, SAISIN will focus specifically on transitional European and less developed economies. The research project will review and be informed by research methodologies previously developed for technology and knowledge transfer in waste- and stormwater management (UNEP, 2000).

The project will develop support tools in a variety of forms to suit different stakeholder levels and differing cultural contexts. For the more technologically competent countries involved in the project it is envisaged that computer interactive systems will be developed for general stakeholder use (i.e. politicians and general public). However, software will not necessarily be an appropriate medium in many of the less developed countries, and alternative tools will also be explored. Although computer technology has an ever increasing impact on the opportunities arising to communicate and involve different stakeholders, the same innovations may also lead to the increasing exclusion of some stakeholders, even within more developed areas of the world. The project team has experience of raising awareness in schools, community groups and at householder level, via media including flash-cards; interactive questionnaires, focus groups, competitions, displays, leaflets and guidebooks. In addition computer games, videos, and even TV presentations have been produced. Although it is expected that the latter may have limited appeal in developing countries, they will be valuable in transitional economies. It is recognised that the approach to be taken requires both top-down and bottom-up initiatives, as in the past many attempts to develop more sustainable urban water systems have focussed on stakeholder participation at the bottom or more 'grass-roots' level, rather than ensuring the full integration of water industry and other professionals. The need for greater inclusion applies to those in positions of power as much as those members of the public being asked to become more involved in decision making processes for more sustainable urban water systems, and the philosophy of participation must be expressed at all levels. As well as community responsibility (e.g. Participatory Rural Appraisal), water and planning professionals and politicians have to develop new capacity and skills, and organizational cultures need to change to allow the facilitation and maintenance of more transparent, adaptable and responsive institutional arrangements. The sorts of problems that may arise are exemplified by the situation in Bharatpur, India, where recommendations for sensible incremental improvements in sanitation have been resisted by the professionals in charge of the services (Colin and Brocklehurst, 2002).

SAISIN project aim:

- *“Inform all of the stakeholders in urban water systems about sustainability concepts and how these may be incorporated into decision-making processes in order to make more sustainable and hence cost-beneficial decisions in relation to urban water.”*

Other objectives

- Transfer appropriate knowledge and technology to allow the inclusion of sustainability concepts into decision-making processes; Develop 'best practice' recommendations as to how to define how urban water systems can contribute to sustainable development;
- Develop concepts and methods for stakeholder participation that are culturally sensitive; Facilitate the acceptance of new paradigms for all stakeholder groups; Raise awareness of sustainability issues in relation to urban water objectives and raise the quality of communication on these issues; Share understanding of the physical systems, perception issues and mental frames;
- Allow and strengthen new forms of dialogue between stakeholders and decision makers through the use of multi-criteria techniques; Determine what forms of participation are appropriate at what

stage and at what level of urban water system planning; Develop methods that allow for clear definitions of the decision context and the boundaries of participation at different levels;

- Build on earlier work to develop methodologies to promote behavioural change (where required);
- Develop and disseminate interactive learning tools where appropriate; Deliver guidance on the future design of tools and media;
- Demonstrate the most cost-effective methods of facilitating full stakeholder involvement;

Tasks

- Review the effectiveness of multi-criteria, and other decision aiding methods; Data will be gathered from national, regional, local and organizational initiatives, along with research findings from SWARD and other European projects;
- Run workshops to establish awareness and needs in transitional and developing countries;
- Investigate methods of engagement, from information giving to open dialogue, and assess where the different methods may be appropriately employed;
- Develop and implement educational programmes on sustainable integrated water management at all levels of society that illustrate to stakeholder groups the consequences of individual and collective behaviour and the likely effects of project implementation;
- Develop software and other media based support tools for increasing awareness of sustainability concepts and how these may be better included into decision making for integrated urban water systems, using appropriate cultural references, and integrating and respecting indigenous knowledge;
- Undertake a range of case studies (real projects) examining different decision scenarios for integrated urban water systems in a range of different economic and social circumstances; One case study will involve Xi'an Municipal Authority in China, with data from an ongoing research project (supported by the Chinese Ministry of Science and Technology) utilised as part of the project, another will be based in India and a third will be sought if the proposal is developed further;
- Design effective models to: assess the effectiveness of the results achieved in the case studies; provide feedback on the quality of criteria and data analysis methods; and facilitate better implementation of the results of SAISIN;
- Undertake local training programmes for water managers, urban planners and sanitary specialists to demonstrate how: to provide evidence of the cost-effectiveness of the approach; to build in flexibility; to ensure that adequate resources are allowed for in the decision making process; to investigate 'process' capacities – differences in perceptions, in languages and culture - and ability to engage in or manage new institutional structures required; and to facilitate outreach to other community members not directly involved in the decision making process;

Outputs

- A published framework for including sustainability concepts into decision-making processes at organizational, local, regional, national and international levels containing guidelines to ensure context-appropriate application;
- Establishment of regional networks of sustainability specialists that can produce continuously adapting training, advice, run integrated workshops and produce literature for water professionals;
- A SAISIN website giving users access to a collection of case studies, methods, outputs, recommendations & references in a range of languages;
- Learning tools: context-specific tools will be developed, using appropriate cultural, ethnic & social references (this will involve translation of materials);

- Organisation and delivery of international workshops on facilitating awareness and inclusion of sustainability concepts into decision making processes for integrated urban water systems;
- Publication of academic papers and technical articles on research findings.

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Curriculum Vitae:	Richard Martin ASHLEY (DoB 2 July 1948)
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CV and supporting information June 01

<i>Current Position</i>

Professor of Urban Water, Department of Civil & Environmental Engineering, University of Bradford, West Yorkshire, Bradford BD7 1DP

Professor Richard Ashley heads the Pennine Water Group (PWG) at the University of Bradford. He partners Professor Adrian Saul at Sheffield University, who heads the PWG there. The PWG is a multi-disciplinary specialist centre for water and wastewater research funded by EPSRC via the 'Platform Grant' scheme, and is one of only 4 international centres of excellence in water research in the UK. Collectively the PWG members have more than 20 years experience researching environmental and water systems across all discipline boundaries. Professors Ashley and Saul have between them published more than 300 papers, and PWG has in excess of £5m research income. Studies cover multi-disciplinary aspects of water and wastewater systems, natural environment impacts, decision-support, asset management and sustainable development. PWG has a range of computational models, extensive laboratory facilities and leads field studies in this area in the UK.

Academic & Professional qualifications/memberships

1972 BSc Civil engineering (2:1 Hons) Thames Polytechnic

1980 MPhil (thesis: 'Forces on cylinders in relative fluid motion') Thames Polytechnic

1984 Member Chartered Institution of Water & Environmental Management

1988 Chartered Engineer: Member Institution of Civil Engineers

1989 Member International Association on Water Quality (now IWA)

Recent professional activities

- Member Editorial Board journal 'Urban Water'. 1998 –
- External examiner MEng/MSc Civil and Environmental Engineering Liverpool University 1998 - 2001
- Contributor to IWA publication '*urban drainage glossary*' to be pub. 2002
- External reviewer for USEPA manual 'Innovative Urban wet weather flow management systems' 1998
- Professional Reviewer CIWEM 1999 -
- Member advisory group to Water UK 'bag-it-and-bin it' steering group 1999 - 2000
- Member of the EU COST 624 group on integrated operation of wastewater systems 1999-
- Contributor to USEPA book on 'wet weather flows' 2002
- Junior Vice-President Yorkshire Branch, Institution of Civil Engineers. 2001 –
- Member core team producing IWA Manual of Performance Indicators for Wastewater Services 2001-

Commercial research contracts – since 1999

- 1999 - 2000 UKWIR project on rodents and their control in sewer systems £110,000
- 1999 – 2000 West of Scotland Water - study of gross solids in sewers £30,000
- 1999 East of Scotland Water – public awareness campaigns £30,000
- 1999 West of Scotland Water – as above £30,000
- 2000 – 2001 UKWIR project on interaction between in-sewer storage and treatment plant performance £20,000
- 2002 - Yorkshire Water – Performance of Screens £170,000

Academic research contracts – since 1998

- 1998-2001. Utilisation of invert traps for the management of sediments in combined sewers. 3 partner project (+Liverpool, Sheffield). Collaboration with University of Malaysia, Aalborg, and Lyons and WRC. (Lead researcher). £87,000
- 1998-2001 WITE project on ‘multi-Criteria decision making for sustainable water systems’ EPSRC/Water Authorities/others (Lead researcher), with Imperial College, Heriot-Watt University) £103,000.
- 1999-2000 EPSRC: Public Understanding of Research grant £23,000
- 2000 – 2003 EPSRC: The acoustic measurement of sewer roughness £197,000
- 2001 – 2003 EPSRC: SEWNET network for sewer related research £53,000
- 2001 – 2005 EPSRC: Pennine Water Group Platform grant centre £220,000
- 2003 – 2005 EPSRC: Whole Life Cost of Sewer Systems £78,000

Misc.

- 1998- Sewer solids management in Pittsburgh sewer system USA for Camp Dresser & McKee £5,000+
- 1999- EU Tempus/Tacis project with Ukraine and Finland for environmental education and research £30,000
- 1999- University of Los Andes – wastewater system in Bogota £3000 +
- 1999 Leverhulme Trust personal Research Fellowship £14,750
- 2000-2001. Anglo-French Alliance programme – sewer sediments £3000

Publications etc.

- More than 170 papers/research reports presented/published/or to be presented/ in press (see attached).
- Referee for a number of journals: Water Research; American Society of Civil Engineers (journal of Environmental Engineering); Proceedings of the Institution of Civil Engineers; Water Science and Technology, Urban Water (member of editorial board).
- Principal Editor/author for forthcoming IWA Scientific & Technical Report on Sewer Solids (ISBN 1900222914).

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NATO ASI Series, Partnership sub-series, 2. Environment – Vol.45. *Environmentally*

devastated areas in River Basins in Eastern Europe. (Ed. Buekens A., Dragalov V.). Springer-Verlag pp9-27

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Sanitary waste disposal via the solid waste route is definitely more sustainable than flushing (1999).

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Developing mass balances for sanitary solids in sewers for use in life cycle assessment (1999)

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Proposal 6: *Integrated Water Quality and Quantity Monitoring and Data Management in Sub-Tropical and Tropical Regions*

Project title:	<i>Integrated Water Quality and Quantity Monitoring and Data Management in Sub-Tropical and Tropical Regions.</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	(1) Data requirements management for integrated urban water management.
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	
Project proposer	Prof. Carlos E.M. Tucci and Prof. David da Motta Marques, Instituto de Pesquisas Hidráulicas Universidade Federal do Rio Grande do Sul -Brazil.
Partners in the project (consortium – network – form at least two different countries)	Prof. Thomas. Crisman and Prof. William R. Wise, Department of Environmental Engineering Sciences at the University of Florida; Researchers at local Universities; Partners from the state and municipal water resources and environmental agencies; Potential partner the URBAN LTER site in USA.
Supporting partners (cash and in kind)	In cash expected from the National Council for Scientific and Technological Development, and National Water Authority if approved by peer review under a specific program; In kind support expected from the state Government and city of Porto Alegre.
Objective:	Develop an integrated package of monitoring units and data management for urban waters with real time data gathering and organisation, public display, and associated citizen volunteer monitoring programme.
Brief description* *(Attached is a Case for support)	Urbanisation changes aquatic ecosystems, and can cause them to disappear completely where major infrastructure works are constructed to control water quality and water dynamics. In the urban context, the monitoring of water quality, and of water dynamics, is a basic activity that is invariably

	<p>neglected or not done properly, resulting in incomplete data bases that serve little purpose, containing data for which it is not possible to relate water quantity with water quality. One factor leading to this situation is the absence of real-time monitoring systems. Current practice is strongly based on an analysis of water in the laboratory, and data collection does not take account of the hydrology/dynamics in an urban setting. It is evident that this current practice is biased towards collection of water samples under 'base flow' conditions, and does not take account of storm events; furthermore, there is no collection of data that combine water quantity and quality in real time. Custom-made systems are very expensive, but off-the-shelf equipment can be integrated in a way to form a basic monitoring network to measure water quality and quantity under different hydrological and dynamic conditions, and linking in real time the collection and organisation of a data base. The data gathered by such a network keeps track of current processes in these new aquatic systems, and yield reliable data to assist both short and longer-term management. It is also possible to keep the community informed and involved in the monitoring programme through monitoring programmes that makes use of community volunteers. The proposed systems aggregates new capabilities to the current network which is based on sparse sampling, especially on urban waters.</p> <p>SEE ATTACHED PAGES FOR DETAILS</p>
<p>Implementation strategy:</p>	<p>Workshops to identify key issues, monitoring equipment in the market and lay out of the monitoring unit, equipment adaptation/development, on-line active data base development, and integration software;</p> <p>Implementation and test case associated with key users;</p> <p>Follow-up seminars.</p>
<p>Implementation mechanism</p>	<p>Development of long term monitoring of urban water processes using a multidisciplinary team, and data acquisition and display on real time associated with management;</p> <p>Development of a parallel simple monitoring framework for citizens.</p>
<p>Expected results</p>	<p>Develop a functional monitoring unit, composed of off-the-shelf equipment, and integrated through</p>

	<p>specific developed software and hardware, capable of data collection, data transmission, data organisation and data display in real time;</p> <p>Produce data packages under specific climate conditions;</p> <p>Develop a concurrent small citizen volunteer monitoring programme;</p> <p>Local environmental protection agency takes over the system and aggregates to regular monitoring network.</p>
Deliverables and availability	<p>Technical reports on the monitoring unit;</p> <p>Guidelines for use;</p> <p>Developed equipment blue prints</p> <p>Integration software;</p> <p>Web accessible data base with specific data packages for managers and planners;</p> <p>Availability of treated data through the web for citizens control;</p> <p>Citizens Volunteers Monitoring Manual.</p>
Target beneficiary groups	<p>Municipal and state urban and environmental planners, managers and scientists;</p> <p>Equipment and software companies;</p> <p>Services companies;</p> <p>Urban areas with no reliable monitoring system of basic water quality and quantity to support management based on local conditions;</p> <p>Volunteer support.</p>
Geographical location of the beneficiaries	South America, Brazil and MERCOSUL Countries.
Project duration	2 time 3 years.
Proposed project coordinator (attach a brief CV)	Prof. Dr. Carlos E.M. Tucci. A steering committee with representatives of the academic institutions and municipal and state water and environmental agencies will help to manage the project.
Proposed project budget:	
a. Equipment	a.Equipment.....600,000 US\$
b. Travel and subsistence	b.Travel and subsistence..... 25,000
c. Personal costs	c.Personal costs..... 120,000
d. Dissemination	d.Dissemination (6workshops) 25,000
	e.Image&data acquisition 25,000

Other (specify) supplies	f. Training of specialists (MERSOSUL) ... 15,000 g. Project management 40,000
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)	Formal agreement with local environmental protection and water resources agencies to joint development.

Case for Support

INTEGRATED WATER QUALITY AND QUANTITY MONITORING AND DATA MANAGEMENT IN SUB-TROPICAL AND TROPICAL REGIONS

Carlos Tucci and David da Motta Marques

Instituto de Pesquisas Hidráulicas, Universidade Federal do Rio Grande do Sul
Av. Bento Gonçalves, 9500, Cx.P. 15029, CEP 91501-970, Porto Alegre-RS, Brazil;
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Urban Processes and Water Quality

Urbanisation changes aquatic ecosystems, and can cause them to disappear completely where major infrastructure works are constructed to control water quality and water dynamics. In the urban context, the monitoring of water quality, and of water dynamics, is a basic activity that is invariably neglected or not done properly, resulting in incomplete data bases that serve point purposes, containing data for which it is not possible to relate water quantity with water quality. One factor leading to this situation is the absence of real-time monitoring systems.

Currently the water resources quality analysis is based on chemical standards leading to homogenisation of water quality in completely different aquatic ecosystems (Motta Marques, 1998). Water quality is seen as a management obedience to laws, such as the resolution CONAMA No.20/86 that classifies and specifies water uses in Brazil (Brasil, 1986), which regulates the matter directly and indirectly. However, urban streams/rivers due to chronic wastewater discharges and corridor destruction are neglected and considered beyond regulation. Under this unwritten rule permits are not issued for urban streams and rivers, as they are the *natural* recipients of untreated waters and solids residues. The consequences are that stream channels become shorter, streams consist mainly of wastewater, and liquid flow is impaired by solid residues leading to flooding.

The complexity and extension of the aquatic systems in countries of MERCOSUL shows different kinds of water and rivers/streams patterns (Motta Marques, 1998). The wise use of water resources of a specific region is not a spontaneous process. In fact it demands a strategy based on deep knowledge of hydrology, biotic and economic mechanisms of that region/watershed (Zalewski et al., 1997; Petts et al., 1995).

The recent federal law that established the national policy for water resources (Brasil, 1997) has changed the panorama and the concept of water quality. This is applied to urban water resources as well. The Federal Law 9433/97 sets the watershed as the basic management unit, leading the water resources issue to be approached as systems, essentially terrestrial systems (landscape uses including urbanisation) and aquatic systems (structure, functions, patterns). Now it is mandatory to consider jointly all qualitative and quantitative aquatic factors, leading to the management of the environment and land uses. Water quality and quantity can not be altered and must be considered in the watershed setting. Permits to use and allocate flow reinforces the coupled quality/quantity, since the permits aim to ensure the water quality and quantity control of water. Uses that hold the potential to alter the water regime and quality of a water body are subjected to permit.

Water Monitoring in Urban Areas

The current practice is strongly based on an analysis of water in the laboratory, and data collection does not take account the hydrology/dynamics in an urban setting. It is evident that this current practice is biased towards collection of water samples under *base flow* conditions, and does not take account of storm events. Furthermore, there is no collection of data that combine water quantity and quality in real time.

Current efforts (Tucci and Motta Marques, 1998-2002) have shown that isolated monitoring it is not enough to show the dynamicity of urban rivers/streams or what is left of them after a bad land management. In this research, different urban watersheds submitted to different kinds of occupation and land development did show extremes in terms of water quantity and quality patterns. Events timing, association with watershed activities, such as urban solids collection, pavement typology and land occupation, chemicals washout, and specific communities and processes are not properly accounted. However if the current tendency to take water quantity and quality as part of a system for management purposes it is evident that a new monitoring approach is needed.

Although water quality is frequently discussed taking in account several variables an approach cost-benefit is always the choice since high resolution may not be necessary and hence is very expensive. There are no specific rules under the current laws specifying the kind of monitoring needed since each goal demands a taylor made system. Each system then should consider a plethora of objectives and characteristics watershed and ecosystem specific. The idea of system is an another key issue for the resource monitoring design, data production and information generation. A great deal of monitoring systems activities is related with data gathering, how to effect a measure and how to deal with data. In most of the situation the reason for monitoring is not well understood or considered. The relation between data collecting and the objectives to achieve are diffuse for most of the situations which adds costs and suspicion to the very existence of monitoring activities or obligations.

Environmental and water resources laws dictate the aims to be achieved by the monitoring activities. The organised society may also dictate specific goals for any particular systems since public hearings are a major tool in local environmental issues, in a concerted action with the environmental agencies. Based on current data gathering these same agencies can add additional objectives based on economic and statistics restrictions due to lack of proper funding. The compilation of all kinds of purposes allows de formulation of monitoring criteria. For most of the local cases monitoring programmes do not held relationships as is the case to improve the capability to understand the systems under analysis or even allow data mining and a meta-analysis of data.

Those activities related with monitoring area discrete in operational and informational categories.

The water quality and water resources integrity is a function of the natural hydrological variation and the impact of human activities, both factors controlled by the law of chances (Sanders, et al., 1983). The understanding of the relationship between water quality variables and water quality/systems integrity is complex and a key factors for resources management. Variables used in monitoring are classified as random or stochastic processes. Values of random variables as a function of time, space or both (spaces and time series), and that series and cycles are not repeated. The separation of periodic and stochastic aspects from the available data series and generation relationships between indicators are the main duties of a monitoring system (Sanders, et al., 1983). This process generates the necessary information for resources management.

From the major five factors that control the water resources integrity the hydrology/hydrodynamic functions are the forcing functions. The random variable *water quantity* can take different formats (e.g., level, flow, and permanency) and is the main (primary or basic random variable. Chemical, biological and habitat variables are the associated variables. Levels and flows are not homogeneous and vary systematically in space and time. As chemical, biological and habitat variables are associated with water quantity it is possible to forecast the existence of some basic relationships to explain the behaviour of these variables and identify some patterns. These relationships are primary products for the management and the check of management actions.

Processes can generate patterns in aquatic systems. The relation cause-effect between processes and patterns is complex since some patterns can be the result of multiple processes. Additionally, scales can affect the cause-effect relationships. Patterns are regularly considered dependent variables and associated or lightly connected with processes (independent variables). Any monitoring systems aims to solve the processes pattern relation, which is a difficult task considering indirect causation, chain of causation or cause changes through scales (Fisher, 1994). In situations of limited space-time scales the correspondence between causes and individual patterns are reasonable. However, for longer periods (or a larger space, such as a watershed, controlled by disturbs) pattern and process are highly variable. It is necessary to identify the patterns spatial and temporal borders and the causes of transition between them and not which processes control the patterns of interest (Fisher, 1994; Fisher and Grimm, 1991). The existence of processes with variable patterns in space and time implies that *water quality* is dynamic and also different for each position in the watershed and stream/river stretch, which is very much evident in badly urbanised watersheds. It is evident that the aquatic systems structures and patterns changes with time, are dynamic, and *quality* regions are identifiable This leads towards an area specific resources management approach.

A Monitoring Systems for Water Resources in Urban Areas

Taking in consideration land uses and misuse, legal demands and citizens demands a very specific and intense monitoring systems is the case if usable information is to be produced. Intense data gathering in time in space is needed due to the water quality being a stochastic process and space variation. Uncertainty is a key element in the data generated and to be considered by managers.

Basic components of the proposed system are logging equipment and a basic data logging and analytical tool. Equipment with water quantity and quality measuring capabilities and real time transmission capability are to be included and integrated. An on-line active data bank to receive in-coming data from these equipments is the support for data collecting and data analysis. The analytical capabilities of the system is complemented by a series of analytical tools to statistically model the data, model river/streams stretches or river/streams and associated man-made structures. Also included are simple display tools for general public and advanced users from the municipal and state environmental and water resources agencies. One additional capability is the use of analytical tools on-line. This capacity allows for decentralised data analysis and centralised data gathering and data quality assurance.

Application and Users

Custom-made systems are very expensive, but off-the-shelf equipment can be integrated in a way to form a basic monitoring network to measure water quality and quantity under

different hydrological and dynamic conditions, and watershed use, linking in real time the collection and organisation of data in a data base. Once organised the data can be displayed or treated with specifically developed software or available algorithms for statistical modelling and by numerical models. The data gathered by such a network keeps track of current processes in these new aquatic systems, and yield reliable data to assist both short and longer-term management. Also it is possible to use specific models to generate reports on the behaviour of specific rivers/stream stretches or the combination of river/streams channel and man made structures. It is also aimed to keep the community informed and involved in the monitoring programme through monitoring programmes that makes use of community volunteers.

Municipal and state environmental and water resources agencies and their personnel need an integrated system for real time data gathering and analysis. The concept of aquatic systems analysis, as forwarded by the water federal law (Brasil, 1997) can be analysed, allowing for well supported decisions.

The proposed systems aggregates new capabilities to the current network data gathering witch is based on sparse sampling, especially on urban waters.

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Curriculum Vitae: CARLOS EDUARDO MORELLI TUCCI

1. AREAS

- Hydrology and Hydraulics
- Simulation of water resources systems
- Urban water management

2. DEGREES

- Civil engineer from Federal University of Rio Grande do Sul (1971);
- MSc in Civil Engineering /Water Resources Federal University of Rio Grande do Sul, (1975);
- Doctor of Philosophy, PhD, Civil Engineering Department, Colorado State University, USA, 1978.

3. ACADEMICS ACTIVITIES

- full professor of Hydromechanics and Hydrology Department of the Institute of Hydraulic (IPH) Research of Federal University of Rio Grande do Sul (UFRGS);
- adviser of many Master theses and PhD dissertations in the Water Resource and Sanitary Engineering graduate program of IPH/UFRGS
- former head of the Water Resource and Sanitary Engineering graduate program of IPH/UFRGS.

4. RESEARCH ACTIVITIES

- researcher funded by CNPq (National Research Council of Brazil) and consulting for research from other State and Federal Agencies in Brazil and South America;
- Manager of Water Resource Research Fund of Brazil support by Science and Technology Ministry;
- Resource person of South America Technical Advisory Committee of Global Water Partnership
- Main editor of the Brazilian Water Resource Journal;

- Coordinator of research activities in Urban Water Management and other Hydrology projects in IPH/UFRGS

5. OTHER ADMINISTRATIVE ACTIVITIES

- former president of ABRH, Brazilian Water Resources Association (1993-1995);
- Head of Hydrology sector of IPH/UFRGS.
- Vice-President of IAHS International Association of Hydrological Science

6. CONSULTING ACTIVITIES

- Developed many projects on water resources within Brazil and more widely throughout South America;
- Consultant for companies and government organizations such as: ANA – National Water Agency; Itaipu Bi-national; ANEEL – National Electric Energy Agency; and many others.

7. HONORS

- Medal of Civil Defense of Rio Grande do Sul State in 1985
- Best book on Science and Technology of 1994 in the Book Editor Society of Rio Grande do Sul for Hydrology Science and Application.

8. PUBLICATIONS

Publications totals

Type	Amount
Books	10
Books chapters	30
International Journals	15
National Journals	55
Symposium and Seminars	85
Institutions publications	32
Master and PhD	2
Total	229

Curriculum Vitae: DAVID DA MOTTA MARQUES

Biologist, took his Undergraduate Degree at Pontifical Catholic University of Rio Grande do Sul, his Master Degree in Ecology at Federal University of the Rio Grande do Sul (UFRGS), both in Brazil, and his PhD degree in Environmental Engineering at Imperial College of Science and Technology/University of London. Currently he is Associate Professor and researcher at Instituto de Pesquisas Hidráulicas (IPH) of the Universidade Federal do Rio Grande do Sul State (UFRGS), Brazil. Teaches and supervises, at MSc and PhD levels, in the Water Resources and Environmental and Sanitary Engineering Graduation Course and in the Ecology Graduation Course, both at UFRGS. His areas of interest and research are Aquatic Ecosystems Ecology/Wetlands and Applied Ecology to Water Resources.

One of his current research projects is on urban water quality, part of the Assessment and Control of Environmental Impacts Promoted by Urbanisation project, funded by the National Council for the Scientific and technological development (CNPQ-FINEP). Also develops research in subtropical wetlands and he is the scientific co-ordinator (PI) for Site 7-Taim Hydrological System, Brazilian Long Term Ecological Research sites programme (a member of ILTER). In this context has proposed basic rules to operate this hydrological system to settle the requirements for environmental conservation and rice production. Part of his research is on constructed wetlands to control water quality and basic techniques to establish aquatic macrophyte stands.

He is past member and co-ordinator for the Committee of Research Instituto de Pesquisas Hidráulicas, past member of the Committee of Graduation Studies at Water Resources and Environmental and Sanitary Engineering Graduation Course and at Ecology Graduation Course. He is also a past council member of the Federal Council of Biology (a professional regulatory institution), and a past president for the Southern Region Council of Biology.

Also he is affiliated to professional associations such as Society of Wetland Scientists (SWS), International Association of Theoretical and Applied Limnology (SIL) and Brazilian Association of Water Resources (ABRH), being past Director of Publications for this last one. Currently is the president for the Brazilian Limnology Society.

Proposal 7: *Measures for Controlling Urban Runoff at Source in Tropical and Sub-Tropical Climates*

Project title:	<i>Measures for Controlling Urban Runoff at Source in Tropical and Sub-Tropical Climates</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	(4) Integrated urban water system interactions: Complementarity among urban water services; (7) Urban aquatic habitats in integrated urban water management
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	
Project proposer	Instituto de Pesquisas Hidráulicas Universidade Federal do Rio Grande do Sul -Brazil
Partners in the project (consortium – network – form at least two different countries)	-IHP National Committees -Researchers at local Universities -Water resources and environmental agencies
Supporting partners (cash and in kind)	-National Council for Scientific and Technological Development; -National Water Authority
Objective:	Develop a package of simple artifacts and guidelines to control run-off in urban properties.
Brief description	Major environmental changes in urban areas lead to a wide range of infrastructures to control water quality and water dynamics. Lack of knowledge of processes and planning results in poor investment, both because natural systems are destroyed and because subsequent effort is needed to solve the new problems that poor planning causes. Furthermore, decisions on investments to upgrade damaged systems are always overshadowed by the need for investment in new areas. Nevertheless, improvements to current drainage systems can be achieved by the use of small-scale localised artefacts. These artefacts include guidelines on how to make use of local settings (example: how to reduce runoff from a house yard). There is the need to develop and implement small structures such as permeable surfaces to pavements and minor roads, underground micro-reservoirs in the yards of buildings, small integrated wetlands in gardens to reduce pollutant loads, infiltration trenches, and water re-use schemes for activities requiring water of lower quality. These devices are conceived from an environmental standpoint, where the quick removal of the excess water is not the main goal, trying, instead, to increase its value in the urban space, through well integrated and multifunctional devices. The design

	methodology will be based on the development of new technologies and on the adaptation of techniques originally developed for temperate climates to tropical and subtropical climates, including equipment and materials, as well as design and operational criteria. Design criteria must emerge for management purposes on localised settings. Aspects related to functioning conditions (such as rainfall magnitude and antecedent soil moisture), devices efficiency, preferential flow, costs, and limitations of use will be assessed and discussed. Rainfall data from urban areas will be obtained, from new and from existing rainfall gauging stations.
Implementation strategy:	Multidisciplinary working group.
Implementation mechanism	-Development of multi-institutional research on integrated local control measures; -Integration workshops based on the experimental work developed.
Expected results	Generate low-cost procedures to control quality and quantity of run-off locally.
Deliverables and availability	-Technical reports with designing protocols; -Guidelines for local management of run-off; -Availability of documentation through the web; -Demonstration studies.
Target beneficiary groups	-Water and environmental professionals from the public and private sectors; -Urban areas with structural problems and chronic problems with run-off in need of support for management based on local setting/citizen approach.
Geographical location of the beneficiaries	South America.
Project duration	4 years.
Proposed project coordinator (attach a brief CV)	Joel Avruch Goldenfum.
Proposed project budget:	
a. Equipment	100,000
b. Travel and subsistence	25.000
c. Personal costs	200.000
d. Dissemination	25.000
Other supplies	100.000
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)	Formal agreement with local environmental protection and water resources agencies to joint development.

Case for Support

Urban Water Management Component of the IHP-VI (July 26, 2002)

Activity No. 4: Integrated urban water system interactions

Proposed Co-Ordinator: Joel A. Goldenfum

Title:

Measures for Controlling Urban Runoff at Source in Tropical and Sub-Tropical Climates

Context

Climatic conditions in tropical and sub-tropical climates submit cities and towns to more frequent floods, with damages aggravated by socioeconomic factors. There is a measure of negative convergence in these conditions and factors which impair and burden the management of urban floods compared with management in temperate climates.

Urban drainage control measures must be approached from an environmental standpoint, and should be based on the appropriate management of urban impacts on the hydrologic environment. The approach is complex and includes engineering, sanitary, ecological, legal and economic technical aspects, besides requiring a much closer connection to the design and management of urban spaces. The hydrological cycle is a key element to define urban sanitation and drainage.

The use of technical solutions aiming to reduce the impact of urbanization is, in general, at initial stages of research and development, being seldom applied neither in public nor in private works. In the great majority of situations, the devices and equipment developed under temperate climates are applied to tropical conditions, with small or even no modifications.

Improvements to current drainage systems can be achieved by the use of small-scale localised artefacts. There is the need to develop and implement small structures such as permeable surfaces to pavements and minor roads, underground micro-reservoirs in the yards of buildings, small integrated wetlands in gardens to reduce pollutant loads, infiltration trenches, and water re-use schemes for activities requiring water of lower quality. In this work, such structures are studied, discussing its advantages, disadvantages and applicability to tropical countries and also to socioeconomic conditions.

Project Details

Compensatory devices of the urbanisation effects will be systematically tested. The main goal to be achieved by the use of this type of solution is to keep maximum water flows in urbanised areas at values equal or below the pre-development runoff. This research aims to allow a better knowledge of the physical processes that control flow in the studied devices, allowing the development of design criteria adapted to Brazilian (and South American) conditions.

The project will be developed as a multi-institutional research on integrated local control measures, including . the IPH-UFRGS (Instituto de Pesquisas Hidráulicas da Universidade Federal do Rio Grande do Sul), from Porto Alegre, Brazil together with IHP National Committees, researchers at local Universities and also local environmental protection and water resources agencies.

Experimental source control devices (such as infiltration trenches, detention reservoirs and pervious pavements) will be built and continuously monitored at the IPH area, reproducing usual functioning conditions for Brazilian cities. The devices will be instrumented, allowing continuous measurement of

water level and inflow and outflow fluxes. Devices operating in real conditions in urban areas will also be gauged. Numerical simulation models will be used to test physical hypothesis trying to describe the behaviour of the monitored structures.

The results will be discussed with professional from all institutions involved, by means of integration workshops based on the experimental work developed.

Product

Design criteria must emerge for management purposes on localised settings. Manuals describing these criteria will be produced and will become available to be used by local designers.

Aspects related to functioning conditions (such as rainfall magnitude and antecedent soil moisture), devices efficiency, preferential flow, costs, and limitations of use will be assessed and discussed. This discussion will be submitted for publishing by technical and scientific journals, and it will be also presented at scientific meetings.

Rainfall data from urban areas will be obtained, from new and from existing rainfall gauging stations. A database will be developed and made available in an INTERNET site.

Curriculum Vitae: JOEL AVRUCH GOLDENFUM

POSITION: Professor Adjunto at Universidade Federal do Rio Grande do Sul (UFRGS).

GRADUATION: Civil Engineering, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, dez/1983 (final average 9,210).

MSc: Civil Engineering / Water Resources. Instituto de Pesquisas Hidráulicas (IPH) at the Universidade Federal do Rio Grande do Sul (UFRGS), jul/1991.

PhD: Civil Engineering/ Hidrology, Imperial College of Science, Technology and Medicine, University of London, Londres, Grã-Bretanha, maio/1996.

PROFISSIONAL AND ACADEMICAL EXPERIENCE:

Field of work: Civil Engineering – Hydrological Modelling, Hydrological Regionalisation, Flood Control, Urban Hydrology, Erosion and Sedimentation, Unssaturated Flow, Uncertainty in Hydrossedimentological Processes

Professor at the Departament of Hidromechanics and Hydrology of the Instituto de Pesquisas Hidráulicas - UFRGS, since December/89 at Undergrad and PostGrad levels.

Revisor of the Revista Brasileira de Recursos Hídricos and of the Journal of Hydrology. Representante Regional da ABRH no Estado do Rio Grande do Sul.

Consultant Engineer of 05 private companies and national agencies.

Engineer at PETROBRÁS (mar/84 a mar/85).

Engineer at Magna Engenharia Ltda. (abr/85 a mar/88).

SCIENTIFIC AND TECHNICAL PRODUCTION

5 papers in scientific journals

28 papers presented in scientific meetings

3 technical books published

10 chapters published in technical books

3 softwares developed

5 MSc Supervisions concluded

1 PhD Supervision concluded

63 participations as MSc or PhD examinor

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Proposal 9: *Strengthening of Co-operation in South East European Countries for Capacity Building in Urban Water Management*

Project title:	<i>Strengthening of Co-operation in South East European Countries for Capacity Building in Urban Water Management</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	Project is compatible with the group of projects 5 of the IHP Integrated urban water modelling and management under specific climates: humid tropics(HT), arid and semiarid climates (ASA), cold climates (CC) and temperate climates (TC)
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	The project fits into priorities of the UNESCO ROSTE strengthening the scientific and professional co-operation in the South East Europe, UNEP's (IETC) regionalisation policy and UNEP's priorities in having strong local expertise in the future projects .
Project proposer	SEE Network on Urban Water Management, IRTCUD - Belgrade, IRTC UW-BG, Sofia, CUV-BL, Banjaluka, CUW-UK, London, Alternative academic network, Belgrade
Partners in the project (consortium – network – from at least two different countries)	IRTCUD/CUW SEE Network with 10 units in: 6 former YU republics (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, FR Yugoslavia (Serbia and Montenegro), FYR of Macedonia, Greece, Romania, Slovenia, Turkey)
Supporting partners (cash and in kind)	Local partners and (hopefully) national governments (in kind and cash support)
Objective:	To establish a regional community of strong partners working under common professional and scientific principles, capable of undertaking complex urban water related projects of regional and multilateral character.
Brief description*: *(Attach a separate Case for support - up to 3 pages)	The network will work in accordance with the UNESCO IHP core programme (currently IHP VI Focal area 3.5) The principal areas of activities: - Improving acceptability of paradigm shift in the field of integrated UWM in the SEE region - Development and application of appropriate tools for sustainable UW systems (demand managed drinking water, waste water and storm water management-decentralized, small scale, urban streams and groundwater in urban areas, including environmental and socio-economical issues) - Support to implementation of legal and institutional framework relevant to UWM in SEE

	<p>countries (countries in transition)</p> <ul style="list-style-type: none"> - Mastering, spreading and implementing the integrated UWM concept in regional water resources Master Plans - Remediation of the bottleneck through capacity (human resources) development for sustaining UWM in SEE region at all levels by fostering the IRTCUD/CUW network - Strengthening the scientific and professional co-operation, share of expertise and resources among the participants for achieving the above goals, addressing the most urgent local and trans-boundary issues.
Implementation strategy:	Development of the sense of “ownership of the methodology” among the network members, Transferring the methodology to the end users
Implementation mechanism:	Series of multidisciplinary projects of the regional and multilateral nature
Expected results:	<ul style="list-style-type: none"> - Multilingual Codes of practice for various urban water subsystems developed and tested - The innovative methodology applied in pilot cases - The paradigm shift (IUWM) based on the sustainability principles gradually replaces the conventions practice - Education of end users in applying of the sustainable urban water management principles - Assistance to local and national governments on the innovative technologies in water and environmental sector.
Deliverables and availability:	<ul style="list-style-type: none"> - Multilingual Codes of practice approved by the national professional associations and relevant governmental bodies (available in bookshops) - Series of training courses run by the Network training team (available to end users at nominal charge) - Internet based training programmes and literature (available to registered users) - Demo sites and “success stories” (public domain)
Target beneficiary groups:	<ul style="list-style-type: none"> - Professional community in urban water (planners, designers, consultants, governmental service, environmental agencies) - Academic institutions and professional associations

Geographical location of the beneficiaries:	Central and South East Europe: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, FR Yugoslavia (Serbia and Montenegro), FYR of Macedonia, Greece, Romania, Slovenia and Turkey.
Project duration:	4 years
Proposed project coordinator: (attach a brief CV)	Prof. Cedo Maksimovic (CV enclosed)
Proposed project budget: a. Equipment 6 % b. Travel, subsistence 14% c. Personal costs 42% d. Development of tools and joint projects (data,etc) 15% e. Publishing, dissemination 14 % f. C-ordination and management 9%	3.5 mil.\$ spread over 10 partners in four years Tentative break down: a. 210 000 \$ b. 490 000 \$ c. 1 470 000 \$ d. 525 000 \$ e. 490 000 \$ f. 315 000 \$
Possible contribution to the project by beneficiary or form other sources (both cash and in-kind):	About 15 %

Case for Support

STRENGTHENING OF CO-OPERATION IN SOUTH EAST EUROPEAN COUNTRIES FOR CAPACITY BUILDING IN URBAN WATER MANAGEMENT

Prepared by:

Prof. Čedo Maksimović Coordinator of the IRTCUD/CUW c.maksimovic@ic.ac.uk
Network

Partners

ALBANIA - Mrs Violeta Kola (Polytechnical University of Tirana – Faculty of Civil Engineering, Tirana, Albania)

BOSNIA AND HERZEGOVINA - Mr Boris Jandrić (Faculty of Architecture and Civil Engineering, Banja Luka, Bosnia and Herzegovina)

BULGARIA - Prof. Roumen Arsov (University of Architecture, Civil Engineering and Geodesy, Sofia, Bulgaria)

CROATIA - Prof. Jure Margeta (Faculty of Civil Engineering, Split, Croatia)

FR YUGOSLAVIA - Prof. Čedo Maksimović (Faculty of Civil Engineering, Belgrade, FR Yugoslavia)

FYR OF MACEDONIA – Prof. Cvetanka Popovska (Faculty of Civil Engineering, Skopje, FYR of Macedonia)

GREECE - Dr Demetris Koutsoyiannis and Dr Nikos Mamassis (National Technical University, Athens, Greece),

ROMANIA - Prof. Ioan Bica (Technical University of Civil Engineering, Bucharest, Romania),

SLOVENIA - Dr Primož Banovec (Faculty of Civil Engineering and Geodesy, Ljubljana, Slovenia)

TURKEY – Prof. Sedat Kabdasli (Technical University, Istanbul, Turkey)

Introduction

During the recent years urban water has emerged as an important discipline of applied science, expected to provide answers to the growing number of technical, environmental, socio-economical and management problems in urban areas in both developed and developing countries. Over half of the global population is projected to live in urban areas and this number is increasing at an unprecedented pace, especially in developing countries. More than one billion people in the world do not have access to safe drinking water while 2.4 billion do not have elementary sanitation. This situation is likely to worsen in the coming decades due to looming water crises, possible adverse effects of land use and climate changes and variations. Urban water is becoming a burning issue at a global scale. The world is not prepared to handle the forthcoming unpredictable interaction of problems that include a variety of technical, environmental, social, economic and sustainable development issues, several of which are linked to the globalisation process. There is an evident lack of expertise, institutional and legal frameworks across the globe with the capability of identifying and applying the appropriate approaches by which the problems can be tackled at the source.

Water supply and distribution, and wastewater and stormwater management are generally more problematic in urban areas because of the complexity of the infrastructure and the vulnerability of the population to poor services. Additionally, the problems of interaction of surface and groundwater with urban streams, coastal water, abandoned cultural heritage need to be addressed.

Region of South East Europe has variety of problems regarding urban water issues. Most of the countries in the region (Former Yugoslav republics, Romania, Bulgaria, Turkey and Albania) have faced severe deterioration of physical and institutional framework of the systems. Despite significant effect of the international community (European Union, World Bank, etc.) the progress made is very slow and in some cases the rehabilitation systems are to deteriorate because of the:

- lack of consistent strategy and programmes to tackle the problems in their integral form
- lack qualified staff with updated knowledge based on the environmental sustainability
- outdated rehabilitation and management technology
- lack of links with complementary disciplines such as cultural heritage rehabilitation, environmental management, tourism development etc.
- lack of quality and reliable data
- institutional and legal weakness

This project will address the above problems bringing together the leading academic and professional institutions and experts from the countries participating in the network and the institutions from donor countries, creating the network for share of expertise and fast grasping of modern technologies that will raise the competitiveness of the community of young scientist and professionals in SEE. In this way the capacity of the participating countries for long term development of these systems and management of not only urban water and environmental affairs, but also in the complementary disciplines such as sustainable tourism development, food production, urban amenities and alike. This will be done through a range projects and complementary starting with capacity building, running special training programs for young specialist who will have access to up-to date knowledge and technologies and work together with the specialists from the other countries in selected pilot projects.

Project Objectives

This project aims to gather partners from the SEE region for establishing strong network of research and professional institutions and experts capable of undertaking advanced research and development projects, developing a new generation of problem solving tools and able to transfer them to the appropriate training programme and complex projects for coping with the specific problems of the SEE region. The projects will have regional and multilateral character. The methodology applied will be compatible with the recent innovations in the relevant disciplines of applied science. The emphasis in this project will be placed on the implementation of the EU environmental and water directives and institutional and legal development concepts.

The network will work in accordance with the UNESCO IHP core programme (currently IHP VI Focal area 3.5) and will be complementary to it. More precisely the network members will cater for research, development, training (capacity building), institutional strengthening in the following areas:

- improvement of data acquisition methodologies, data quality, reliability and availability
- innovative technologies coping with water scarcity, availability and demand management in urban areas
- development of problem solving tools (models, decision aiding) for water supply, wastewater & stormwater systems, ground water in urban areas, urban streams and urban amenities
- interactions with natural environment, ecosystems, cultural heritage, tourism development and
- socio-economical interactions, support to governmental and municipal authorities

- training, capacity building, awareness raising, creation of sustainability environment

The project fits into priorities of the UNESCO ROSTE strengthening the scientific and professional co-operation in the South East Europe, UNEP's (IETC) regionalisation policy and UNEP's priorities in having strong local expertise in the future projects in SWW & SWM (Sustainable Wastewater and Stormwater Management).

Geographical Coverage

The network of focal points will be established in 10 target countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, FR Yugoslavia (Serbia and Montenegro), FYR of Macedonia, Greece, Romania, Slovenia and Turkey. Other countries that have been invited to assist are: Austria, Finland, France, FR Germany, Italy, Japan, Norway, The Netherlands, Sweden and UK. The network will be open for co-operation with other countries. The co-ordination unit will be at IRTCUD/CUW, created by the resolution of the UNESCO General Conference and re-established at the Belgrade Workshop, April 2002. It is located at the Faculty of Civil Engineering, Belgrade, Yugoslavia. Training programmes (dissemination and capacity building) will be run in each of the focal point in 10 participating countries, training of the trainers (selected representatives from the participating countries) will be carried out using the facilities such as Training Centre in the city of Kotor (Montenegro) which on the UNESCO list of cities of the significant cultural heritage.

Pilot projects will be selected so that they cover the most important aspects of the implementation of the innovative technologies. Each of the participating country will be expected to contribute with the concrete development and training programme in selected (agreed) areas.

Project Actions, Means and Benefits

The project actions will include:

- creation of the efficient network: means of communication, co-ordination, management, knowledge gathering, strategic planning, establishment of the common core of "knowledge base",
- establishing the focal points and core of experts in and from each partners' country
- the core of experts will select local experts for each partner's country who will implement programs developed by the core,
- undertaking research (applied science), development projects and knowledge generation in selected urban water related areas
- running training courses (training of trainers) will be organised in order to educate the leading national young professionals involved in planning, decision-making and utilisation of urban water and environmental systems so that they can serve as trainers in their countries
- translation of key literature to local languages and gathering of the common sample cases, data and development of the common problem solving methodologies
- initiation of bilateral and regional pilot project on specific complementary problems
- preparation for joint bidding for international and regional projects

The **principal areas of activities in this particular project** are:

- "in the house" capacity building for mastering contemporary expertise in Integrated Urban Water Management and complementary disciplines
- development of joint data bases and region specific Urban Water and Environmental vulnerability diagnostic procedure
- research and development of new generation of problem solving tools and applying them in jointly formulated local, national, regional and multilateral projects

- exercising the “paradigm shift” actions and training programs at national and regional level

The project is attractive especially for young professionals who can easily adopt and be ready to implement new technologies. Involvement of young people in the project will open new job opportunities in newly created local markets (water and environment), decrease unemployment in the region, alleviate social tension, and will consent young people living abroad to return to their home countries. As a “by-product”, new methodologies will be implemented in the complementary disciplines such as eco-tourism, cultural heritage rehabilitation (resolving the negative aspects of water interactions), public health improvement and alike.

Expected Project Results

Expected project results are:

- The SEE based network of IRTCUD/CUW established with focal points in each of the 10 countries
- Multilingual Codes of practice for various water and environmental subsystems, based on the local research results and approved by the national professional associations and relevant governmental bodies (available in bookshops)
- The innovative methodology based on high level of informatic support applied in pilot cases
- The paradigm shift (IUWM - Integrated Urban Water Management) based on the sustainability principles gradually replaces the conventional (unsustainable) practice
- Series of training courses run by the Network training team (available to end users)
- Internet based training programmes and literature (available to registered users)
- Demo sites and “success stories” (public domain)
- Assistance to local and national governments on the innovative technologies in water and environmental sector.

Target beneficiary groups

- Scientific (academic) and professional community (planners, designers, consultants, governmental service, environmental agencies) in urban water and complementary environmental areas
- Academic institutions and professional associations
- Local and national governments (ministries, municipalities, water companies)
- General public (awareness raising)

Management and Resources

Management of the project will be co-ordinated with the IRTCUD's International Advisory Board. The project will be managed by the Steering Committee to which each of the 10 participating country nominates one representative, plus the representatives of UNESCO. Funding organisations (donor countries) will be offered a seat in the Steering Committee. The day to day project operational management will be carried out by IRTCUD management team lead by the project co-ordinator - Professor Čedo Maksimović.

Budget

Each of the participating partners is supposed to bring in its own resources and in kind contribution (space, administrative support, local links etc)

In addition to providing the basic infrastructure for the co-ordination unit in Belgrade and training centre in Kotor, the project will provide support to the participating partners in terms of communication equipment and common core of software.

Support from the donors is requested for a four-year programme of the network creation, inception activities, running of the development and training programme, initiation and running of pilot projects, developing and implementation of the methodologies and educational tools and creation of conditions for network's sustainability. After the four years period the network is expected to become self-sustained.

Financial resources required:

	Amount (Euro)
Equipment	210 000
Travel and subsistence	490 000
Personal costs	1 470 000
Development of tools and joint projects	525 000
Publishing, dissemination	490 000
Co-ordination and management	315 000
Total	3 500 000

References

- Reconstruction of Scientific Cooperation in South East Europe, Proceedings of the International Conference of Experts, Edited by P. Lasserre and S. Anguelov, Published by UNESCO ROSTE, Venice 2001
- Marseille Statement, International Symposium "Frontiers in Urban Water Management: Deadlock or Hope?", Marseille, France, 18-20 June 2001
- Frontiers in Urban Water Management: Deadlock or Hope, Edited by C. Maksimovic and J.A. Tejada-Guibert, Published by IWA Publishers, 2001

Curriculum Vitae: Čedo Maksimović

Personal data

Date of birth: 28th February 1947

Place of birth: Glamočani, Srbač, Bosnia and Herzegovina, Yugoslavia

Parents: Father Teodor, Mother Zorka

Marital status: Married: wife Kovinka, economist

Children: 2 daughters: Ivana and Biljana

Citizenship: Yugoslavia

Home address: 44 Hanover Steps, London W2 2YG, UK

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Civil and Environmental Engineering, London SW7 2BU, UK

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Education and degrees

Elementary school: (8 years): 1954 - 1962 in Srbač, Yugoslavia

Secondary school: Technical college - (4 years): 1962 - 1966 in Belgrade

University: Faculty of Civil Engineering: Department of Hydraulic Engineering Belgrade
(5 years programme: 1966 - 1971)

Postgraduate course: MSc course (2 years) and MSc thesis: Effect of Turbulence on Local Scour -
University of Belgrade, (1976)

DSc (PhD) thesis: Preparatory phase in UK (Hydraulics Research Station - Wallingford, DAMPT
Cambridge, Department of Civil Engineering University of Newcastle upon Tyne,

Thesis: Effect of Polymer Solutions on Development and Characteristics of a Boundary Layer and on
Drag Reduction, presented at the University of Belgrade 1981

Teaching and research positions held between 1971 and 2000

Subjects: Fluid Mechanics, Hydrometry - Measurements in Water Engineering and Urban Drainage
at the Faculty of Civil Engineering - Belgrade

1971-1973 Research Associate (hydraulic laboratory, scale models, hydraulic structures etc.)

1973-1981 Teaching and research assistant (Fluid Mechanics, Fundamentals of Water
Engineering, Computer Programming)

1981-1988 Associate Professor (Fluid Mechanics, Hydrometry, Urban Drainage)

- 1988-1996 Professor (Fluid Mechanics, Hydrometry, Measurements in Water Engineering, Urban Drainage,)
- 1996-present Visiting Professor, Imperial College, London (lecturing at UG and MSc courses, supervising MSc and PhD students and coordination of contracted research)

Managing positions:

- 1981-1983 Deputy Director of the Institute of Hydraulic Engineering (41 employees)
- 1983-1987 Manager of the Institute of Hydraulic Engineering (43 employees)
- 1987-1991 Vice-Dean of the Faculty of Civil Engineering (220 employees)
- 1987-1989 Coordinator of IRTCUD - UNESCO sponsored International Research and Training Centre on Urban Drainage (establishment of the Centre, business development, initiation of projects, international networking, coordination of research)
- from 1989 Director of IRTCUD/IRTCUW network (research, training and technology transfer, coordination of research projects, development of training tools, organization of international scientific meeting, training courses, publishing)

Current positions:

- Visiting Professor (Professorial Research Fellow) - EWRE - Environmental and Water Resources Engineering Section, Department of Civil Engineering, Imperial College of Science, Technology and Medicine, London, UK ewre-www.cv.ic.ac.uk
- In charge of IRTCUD System - UNESCO sponsored International Research and Training Centres on Urban Drainage in Belgrade with Regional sub-centres: for Tropical Climates - Sao Paulo, Brazil, for Cold Climates - NTNU/SINTEF Trondheim, Norway and for Arid Climates - under formation in the Middle East with CUW-UK Technology Transfer Unit in London UK. Co-operation with WMO, UNEP, UNDP,
- Editor in Chief of URBAN WATER The International Journal Published quarterly by Elsevier Science – Oxford UK (www.urbanwater.net)
- Chairman of the NGO “6E&6I” (6Es are: Expertise spreading in Environment, Energy, Economy and Education through Evolutionary approach in 6Is: Innovations, Informatics, Interactions, Institutions, Instrumentation aiming at International standards) fostering creative multidisciplinary

Languages: - in addition to mother tongue (Serbian or Serbo-Croat)

(S - Speaking, W - Writing, R - Reading and Understanding, L - Lecturing)

English (S, W, R, L), French (S, R, - fair), German (S, R, -fair), Russian (S, R,)

- fair understanding of other Latin originated languages: Italian, Spanish, Portuguese, Romanian,

and fair understanding and speaking of the other slavonic languages: Bulgarian, Czech, Macedonian, Polish, Slovak, Slovenian, Ukrainian.

Membership in International Scientific Committees and Working Group:

WMO (World Meteorological Organization) - WMO Rapporteur on Operational Hydrology in Urban Areas (1993- 1996),

IAHR/IAWQ Joint Committee on Urban Drainage - International Working Group on Data and Models (chairman of the IWGDM 1984 -2000), and Chairman of the Mediterranean Group for Urban Hydrology,

Editor and Member of Editorial Board of International Journals:

URBAN WATER -Co-Editor-in-Chief, Elsevier (initiated and launched)

WATER RESOURCES MANAGEMENT, Kluwer Academic Publishers, (Editorial Board Member)

Prizes Awards and Recognition

Three awards of the “Jaroslav Cerni” fond for the best achievements in the undergraduate and MSc course at the Faculty of Civil Department of Hydraulic Engineering, Belgrade Yugoslavia

IAHR <http://www.iahr.nl> Lecturer of the year 2001 award:

Major fields of research and professional activities

Applied fluid mechanics, hydraulics, hydrology, hydrometry, water resources and environmental engineering :

- urban water infrastructure systems, water supply systems, demand management, surface runoff - urban drainage and its interaction with ground waters and infrastructure systems, source control, integrated urban water systems' operational management of environmentally sensitive systems
- GIS and remote sensing applied in urban water infrastructure systems,
- metrology (reliability and accuracy of measurements in hydrodynamics) in open channels, urban and natural catchments, pressurized systems, network analysis, diagnosis of water balance and leakage in networks,
- turbulence, transport processes, diffusion and dispersion, pressure fluctuations, drag reduction, fluid-structure interaction,
- flow measuring instrumentation
- development of multimedia training tools and running training programmes,
- international projects (concepts, initiation, management, training and technology transfer)

International lecturing and training

Applied hydrodynamics in water supply and urban drainage, merging measurements with advanced modelling of urban water systems, GIS in urban waters, applied metrology in water resources systems, informatic support, sensitivity analysis of model parameters, new technologies in demand management of water supply systems.

Lecturing and training done in the following countries: Austria, Belgium, Brazil, Bulgaria, Canada, Czechoslovakia, Egypt, Estonia, Finland, France, Germany, Greece, Holland, Hungary, India, Iran, Italy, Japan, Norway, Malaysia, Malta, Palestine, Poland, Taiwan, Turkey, Spain, Sweden, Switzerland, UK, and USA, Yugoslavia (all republics ex-YU).

Internationally accepted software products

Several software products conceptualized and supervised are present in the international academic community:

- UDM - International data bank on rainfall-runoff modelling,
- UDM-Italiana - Italian National Data Bank on Rainfall and Runoff,
- EBEMUS - educational software for training in sensitivity analysis of rainfall-runoff modelling,

Research projects in UK (after 1996)

1. CIRA (UK) - RP555 Construction Industry Research and Information Association project:
SUSTAINABLE URBAN RUNOFF MANAGEMENT
2. EPSRC (UK) - Engineering and Physical Sciences Research Council project (Fellowship):
Modelling the Management of Street Surface Contaminants in Urban Runoff (till January 1998)
3. EPSRC (UK) The major WITE project: Monitoring, Modelling & Leakage Management in
Water Distribution Networks, (started October 1998)
4. EPSRC (UK) Inverse Transient Analysis in Pipe Networks for Leakage Detection Quantification
and Roughness Calibration (Started July 1999)
5. UNEP - IETC - Osaka- Environmentally Sound Waste Water and Storm Water (CUW-UK
project)
6. EU LIFE project: Sustainable rehabilitation of urban environmental systems (exercised through
ICON and UZRS - Institute for Urban Planning, Banja Luka, Republic Srpska 1998-2001)
7. EU LIFE project: Local Institutional Capacity Development in Environmentally Sensitive Areas
(LICENCE) (to be exercised through ICON and UZRS - Institute for Urban Planning, Banja Luka,
Republic Srpska for 2002-2005)

Selected international research projects (accomplished earlier) - coordination or participation

1. COMETT 2 (EC) Project 4991-Cb: Advanced Computer Techniques for Urban Storm Drainage
2. UNESCO/IHP IV M.3.3.b. Project: Urban Runoff and Drainage in Different Climate: Tropical,
Arid or Semi-arid and Cold
3. UNESCO/IHP IV M.3.3.a. Project: Integrated Water Management in Urban Areas
4. WMO project: Operational Hydrology in Urban Conditions
5. Bilateral Project: Surface Runoff Water Quality (with University of Lund, Sweden)
6. TEMPUS Project (EU) - coordinator, 2424-91: Upgrade of Engineering Curricula in Advanced
Information Systems for Environmental Improvement in Hydraulic Engineering
7. TEMPUS Project (EU) 266-90 (coordination of one theme): Environmentally Sound River Basin
Development
8. CALWARE (EU - Techware) Project: Computer Aided Learning in Water Resources
(participation in the sub-project: Urban Drainage)
9. Master Drainage Plan for Upper Tiete River – Sao Paulo, Brazil

10. Real Time Control in Storm Drainage systems with large underground storage- Strategic technological development, Toshiba, Japan (1999-2000)

Books authored and co-authored:

A. Books authored and co-authored, published by international publishers

1. C. Maksimovic and B. Jaksic (2001) (Editors and authors): Sustainability of Water and Environmental Systems Rehabilitation, Proceedings of the LIFE International Conference, Banja Luka 22-24 September
2. C. Maksimovic, J. A. Tejada-Guibert, (editors and authors) *Frontiers in Urban Water Management -Deadlock or hope*, Book published by International Water Association 2001
3. J. A. Tejada-Guibert and C. Maksimovic (editors) *Frontiers in Urban Water Management - Deadlock or hope*, Proceedings of the Workshops held at the UNESCO Symposium, Marseille June 2001, Published by UNESCO/IHP, Technical documents in Hydrology No.45
4. L. Bentsson, J. Milina, V.Lobanov, C. Maksimovic, J. Marsalek, M. Viklander, (2001) *Urban Drainage in Cold Climate*, (Edited by S. Sveinung, J. Milina, S. T. Thorolfsson), Vol. 1 of the UNESCO Series: *Urban Drainage in Specific Climates*, Editor-in-Chief : C. Maksimovic
5. B. P. F. Braga, Jr. A. Canholi, N. Campana, M. N. Desa, P. S. Dias, R. Frenlich, J. Gofdenfum, J. Kalman, C. Maksimovic, M. F. A. Porto, M. R. La Porto, C. E. M. Tucci, A. L. L. de Silovoira, A. Villanuova (2001), *Urban Drainage in Humid Tropics* (Edited by C. E. M. Tucci) Vol. 2. 1 of the UNESCO Series: *Urban Drainage in Specific Climates*, Editor-in-Chief : C. Maksimovic
6. A. Al-Abdulali N. Carmi T. Hanna C. Maksimovic M. Nouh, A. Al-Quarch A. Al-Shamsy J. Simons (2001) *Urban Drainage in Arid and Semi Arid Climates*, (Edited by M. Nouh), Vol. 3 of the UNESCO Series: *Urban Drainage in Specific Climates*, Editor-in-Chief : C. Maksimovic (In press)
7. *Hydroinformatics in Planning, Design, Operation and Rehabilitation of Sewer Systems* (1998) (editor and co-author) ASI Series, Edited by J. Marsalek, C. Maksimovic, E. Zeman and R. Price, Published by Kluwer,
8. M. Vignolles, E. Woloszyn, J. Niemczynowicz, C. Maksimovic, J. Marsalek: *Rain and Floods in Our Cities* (author and chief editor) - World Meteorological Organization, Geneva, Switzerland, 1996
9. F. Calomino, C. Maksimovic, B. Molino: *Urban Drainage* (editor and author),, *Experimental Catchments in Italy* Printed by Editoriale Bios, Italy 1995.
10. C. Maksimovic, M. Radojkovic: *Fundamentals and Application of Urban Storm Drainage* (IRTCUD series of lecture notes for the international training courses, Printed by the Int. Centre for Water Resources -Perugia Italy) 1992
11. A. Ichikawa and C. Maksimovic (authors and editors) *Urban Runoff and Its Reduction* (editor and author) - in Japanese-.Published by Kashima Publishers, Tokyo, 1988
12. C. Maksimovic and M. Radojkovic: *Urban Drainage Catchments*. Published by Pergamon Press, Oxford, 1986

B. Books authored and co-authored, published in Yugoslavia

1. C. Maksimovic: *Merenja u hidrotehnici (Measurements in Water Engineering)* (1993), Publ. by Faculty of Civil Engineering, Belgrade,
2. C. Maksimovic, A. Spoljaric, S. Djordjevic, D. Prodanovic, A. Tomanovic (1993): *Zbirka zadataka iz Mehanike fluida - Solved Problems in Fluid Mechanics*, Publ. by Faculty of Civil Engineering, Beograd
3. G. Hajdin, C. Maksimovic, M. Ivetic, A. Spoljaric (1990): *Solved Problems for Student Practicals in Fluid Mechanics*, Publ. by Naucna knjiga, Beograd,
4. D. Obradovic, M. Radojkovic, C. Maksimovic: *Primena racunara u komunalnoj hidrotehnici - (Computer Aided Design of Water Supply and Sewer Systems)*, (1989) Publ. by Gradjevinska knjiga, Belgrade,
5. C. Maksimovic: *Hydrodynamic Measurements and Data Processing (IRTCUD lecture notes for the international training courses on water engineering)*

Books edited and co-edited:

1. *Frontiers in Urban Water Management - Deadlock or Hope* (2001), Proceedings of the UNESCO Symposium, (Edited by C. Maksimovic and J. A. Tejada-Guibert) Marseille, France, 18-21 June,
2. *Developments in Urban Drainage Modelling*, (1999), Special Issue of the *Water Science and Technology*, Vol. 39, Number 9 ISSN 0273-, Editors D. Butler and C. Maksimovic
3. *Developments in Urban Drainage Modelling*, 2 Volumes (1998) Proc. of UDM'98 Conference, London, September, Edited by D. Butler and Maksimovic
4. *Water Supply Systems - New Technologies*, (editor), ASI Series, Edited by C. Maksimovic, F. Calomino, J. Snoxell, Published by Springer, 1996
5. *Remote Sensing and GIS in Urban Waters*, (1995) Proc. of the Sec. Int. UDT Conference, Moscow, Russia, Edited by C. Maksimovic, J. Elgy, V. V. Dragalov
6. *HYDRINFORMATICS '94* (1994) Proc. of the First International Conference on Hydroinformatics, Delft, Holland (2 Volumes), Edited by A. Verwey, A. W. Minns, V. Babovic and C. Maksimovic, Published by Balkema, Rotterdam,
7. *Interaction of Computational Methods and Measurements in Hydraulics and Hydrology* (1992) editor. Proceedings of the Int. Conf. HYDROCOMP '92, Budapest, Hungary, Edited by J. Gayer, O. Starosolszky and C. Maksimovic, Published by Water Resources Research Centre (VITUKI)},
8. *New Technologies in Urban Drainage* (1991) Proceedings of Int. Conf. UDT'91, Dubrovnik, Yugoslavia, 1991, Edited by C. Maksimovic Published by Elsevier Applied Science, London,
9. *Computational Modelling and Experimental Methods in Hydraulics* (1989) Proceedings of Int. Conf. HYDROCOMP '89, Dubrovnik, Yugoslavia, 1989 Edited by C. Maksimovic and M. Radojkovic, Published by Elsevier Applied Science, London,
10. *HYDROSOFT '86* (1986) Proceedings of the Second International Conference on Hydraulic Engineering Software, Southampton, U.K. Edited by M. Radojkovic, C. Maksimovic, and C.A. Brebbia, Published by Springer-Verlag, Berlin Heidelberg and CML Publications, Southampton,
11. *Urban Drainage Modelling* (1986) Proceedings of the International Symposium on Comparison of Urban Drainage Models with Real Catchment Data UDM '86, Dubrovnik, Yugoslavia Edited by C. Maksimovic and M. Radojkovic, Published by Pergamon Press, Oxford,

12. HYDROSOFT '84 (1984) Proceedings of the International Conference on Hydraulic Engineering Software, Portoroz, Yugoslavia Edited by C.A. Brebbia, C. Maksimovic and M. Radojkovic, Published by Elsevier Applied Science, Amsterdam
13. EUROMECH 130 Symposium on Turbulent and Diffusion and Dispersion in Open Channels, (editor) Preprints of the proceedings - Belgrade, 1980 Edited by K. Hanjalic, S. Bruk, C. Maksimovic

1. Papers in journals and chapters in books:

1. C. Maksimovic: Reducing Drag for Dam Construction. Water Power and Dam Construction, Vol. 30, pp. 53-58, London, 1978
2. Maksimovic, M. Radojkovic: Computer Aided Design of Storm Sewer Systems (in Serbian: Projektovanje sistema kisne kanalizacije racunarima). Chapter in the Civil Engineering Calendar
3. Published by the Association of Civil Engineers and Technicians, Belgrade, 1988
4. C. Maksimovic, M. Radojkovic: Computer Aided Modelling of Urban Storm Drainage Systems. Journal of Sanitary Engineers and Technicians of Poland, 1986
5. D. Prodanovic, A. Spoljaric, M. Ivetic, C. Maksimovic: Dynamic Characteristics of a Pressure Measuring System. Chapter in the book: Measuring techniques in Hydraulic Research. Edited by
6. Wessels. Publ. by AA. Balkema, Rotterdam, 1986
7. C. Maksimovic, S.T. Thorolfsson: Effect of Regional Climate Conditions on Rainfall-Runoff Process in Urban Catchments: The Case of Snowy Surfaces. IAHS Publications No. 191, 1990
8. C. Maksimovic, L. Buzek, J. Petrovic: Corrections of Rainfall Data Obtained by Tipping Bucket Raingauge, Atmospheric Research, Vol. 27(1-3), 1991
9. M. Simic, C. Maksimovic: A Novel of Tipping Bucket Raingauge with Variable Centre of Gravity Position. Journal of Environmental Hydrology, Vol I. No. 3. 1993
10. M. Simic, C. Maksimovic: Effect of Siphon Control on Dynamic Characteristics of a Tipping Bucket Rain Gauge, Hydrological Sciences Journal, Vol. 38, 6 December 1993
11. C. Maksimovic, L. Fuchs, D. Prodanovic, J. Elgy: Full Scale Application of Standard GIS Packages with Urban Storm Drainage Simulation Software". in German Journal: Kurier Abwasserung;, 1995
12. J. Elgy, C. Maksimovic, D. Prodanovic, Using Geographical Information Systems for Urban Hydrology, IAHS Publ. no 211, 1993
13. C. Maksimovic: Measurements of Turbulence and Diffusion (in Serbian: Merenje turbulencije i difuzije). Transactions of the Academy of Sciences of BiH, Sarajevo, 1979
14. M. Milojevic, C. Maksimovic: Measurements of Waste Water Quantity (in Serbian: Merenje kolicina otpadnih voda). Chapter in the The Civil Engineering Calendar, Belgrade, 1986
15. C. Maksimovic (co-author): Problem Assessment in Present Urban Water Management. International Workshop, UNESCO/IHP M-3-3a Project: The Use, Planning and Treatment of Water and wastewater in Urban Areas. Chapter in the publication: Ecosystem Approach to Water Resources Management in Urban and Surrounding Areas, Essen, 1992
16. C. Maksimovic (co-author): Education and Training. International Workshop, UNESCO/IHP M-3-3a Project: The Use, Planning and Treatment of Water and Wastewater in Urban Areas. Chapter in the publication: Ecosystem Approach to Water Resources Management in Urban and Surrounding Areas, Essen, 1992

17. C. Maksimovic: Measurements of Rainfall and Runoff in Experimental Storm Drainage Catchments. Chapter in the book: Urban Drainage, Experimental Catchments in Italy, 1995
18. C. Maksimovic, M. Ivetic: Calibration and Verification of Urban Drainage Models by UDM Data Base. Monografias 10: Inundaciones y Redes de Drenaje Urbano. Edited by J. Dolz, M. Gomez, J.P.
19. Martin. Publ. by Universitat Politecnica de Catalunya, Barcelona, 1992
20. C. Maksimovic: Review on the Special Aspects of the Application of Real Catchments Data. 5th ICUSD, Post-conference Publ. (in Japanese), Osaka, 1990
21. C. Maksimovic, M. Radojkovic: Decrease of Peak Flows in Urban Drainage Practice. Chapter in "Urban Runoff and Its Reduction" (in Japanese). Edited by A. Ichikawa and C. Maksimovic. Published by
22. Kashima Publishers, Tokyo, 1988
23. M. Radojkovic, C. Maksimovic: Recent Tendency in the Development of the Modelling of Urban Storm Drainage. Chapter in: "Urban Runoff and Its Reduction" (in Japanese). Edited by A. Ichikawa and C. Maksimovic. Published by Kashima Publishers, Tokyo, 1988
24. V. Vukmirovic, C. Maksimovic, J. Petrovic: Measurements and Analysis of Rainfall in Urban Drainage. Publication: New Technologies Applied to Design and Renovation of Sewer Systems. Edited by Cabrera Publ. by Universidad Politecnica de Valencia, 1993
25. C. Maksimovic Measurement of Runoff Quantity, Chapter in the book: Rain and Floods on Our Cities, WMO, Geneva, Switzerland, 1996
26. C. Maksimovic: Measurements Methods for Diagnosis and Rehabilitation of Existing Systems, in Water Supply Systems - New Technologies, 1996, Elsevier,
27. Application of GIS in Analysis and Design of Water Supply Systems, in Water Supply Systems - New Technologies, 1996, Elsevier
28. International Framework for Training of Specialists for Water Supply Systems, The Status and Problems to be Solved, in Water Supply Systems - New Technologies, 1996, Elsevier
29. A. Tomanovic, C. Maksimovic: Improved Modelling of Suspended Solids Discharge from Asphalt Surfaces During Storm Event, Water Science and Technology, Vol. 33, No 4-5, pp 363-369, 1996
30. A. Deletic, C. Maksimovic and M. Ivetic, Modelling of Storm Wash-off of Suspended Solids from Impervious Surfaces, J. of Hydraulic Research, (IAHR) 35(1), pp 99-119, 1997
31. A. Deletic, C. Maksimovic, Evaluation of Water Quality Factors in Storm Runoff from Paved Areas, Journal of Environmental Engineering ASCE, Vol. 124, No. 9. September 1998, paper. 10815
32. C. Maksimovic: Differences in Urban Flood Mitigation between the Developed and Developing Countries, Stockholm Water Front, No 2. May 1999
33. C. Maksimovic, D. Butler, N. Graham, Emerging Technologies in the Water Industry, In Water Industry Systems: Modelling and optimization applications, (edited by D. Savic and G. Walters), October 1999. Published by Research Studies Press
34. C. Macropoulos, D. Butler, C. Maksimovic: GIS supported evaluation of source control applicability in urban areas, Water Science and Technology, Vol 39, Number 9 ISSN 0273-, p. 209-216
35. S. Djordjevic, D. Prodanovic, C. Maksimovic: An Approach to simulation of dual drainage, Water Science and Technology, Vol 39, Number 9 ISSN 0273-, p. 95-104

36. D. Butler, C. Maksimovic (1999) Urban Water Management – Challenges for the next Millennium . Progress in Environmental Sciences, Vol 1. No. 3.
37. Jankovic-Nisic, B., C. Maksimovic, D. Butler, N. J. D. Graham, (2001), Use of Flow Meters for Managing Water Supply Networks, Accepted for the Journal of Water Resources, Planning and Management, ASCE

Papers in Scientific and Professional Meetings:

Over 185 papers published

Proposal 10: *Strengthening the Activities at The Field and Training Laboratories in Urban Drainage in Cold Climates*

Project title:	<i>Strengthening the Activities at The Field and Training Laboratories in Urban Drainage in Cold Climates</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	The project is compatible with the group of projects of the IHP Integrated urban water modeling and management under specific climates: humid tropics(HT), arid and semiarid climates (ASA), cold climates (CC) and temperate climates (TC)
Compliance with program frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	UNESCO
Project proposer	Sveinn T. Thorolfsson Norwegian University of Science and Technology. NTNU. Trondheim. Norway. CUW - CC
Partners in the project (consortium – network – form at lest two different countries)	Sweden (Swedish Agricultural University (SLU)) and Iceland
Supporting partners (cash and in kind)	1) Department of Environmental and Hydraulic Engineering, NTNU, 2) Trondheim Municipality, 3) Bergen Municipality, 4) SINTEF, 5) NHR and 6) NORVAR – Norway. 7) NVE. 8) Norwegian Research Council (NFR). <u>NFR- application at 15. June 2002.</u>
Objective:	To establish a regional community of strong partners working under common professional and scientific principles, capable of undertaking complex projects of regional and multilateral character and Strengthening the Research and Training activities in Countries with Cold Climate.
Brief description*: *(Attach a separate Case for support - up to 3 pages)	Internationalization of the ongoing research and training activities at Risvollan Urbanhydrological field laboratory in Trondheim.
Implementation strategy:	Based on the ongoing activity in Risvollan (20 ha). It is to be expanded 2002/203 to cover also the surrounding urban area, Fredlybekken (550 ha) with a combined sewer system. An ongoing MSc – research project, finished June 2002, plus an PhD-research on “Urban Snow Melt Processes and Runoff Modeling” (USMPRM).
Implementation mechanism	Workshop on data needs, reliability and availability Links with 2K2C project (new generation models)

Expected results	Establishing and running an internationally attractive field laboratory for Urban Drainage in Cold climate. Training materials in English
Deliverables and availability	To be discussed
Target beneficiary groups	Researchers, trainers and professional Engineers working on Urban Drainage in Cold Climate Areas.
Geographical location of the beneficiaries	The Cold Climate Regions of the World: Scandinavia, Russia, Japan, Canada USA, Alpine part of Europe, Iceland and others i.e. Chile
Project duration	4 years 2003 – 2006*
Proposed project coordinator (Attach a brief CV)	Sveinn T. Thorolfsson
Proposed project budget:	Year 2003 2004 2005 2006
a. Equipment	Costs i NOK:
b. Travel and subsistence	175.000,- 45.000,-
c. Personal costs	65.000,- 40.000,- 40.000,- 40.000,-
d. Dissemination	495.000,- 495.000,- 495.000,- 495.000,-
Other (specify):	10.000,- 15.000,- 20.000,- 28.000,-
Training courses:	
	NOK/yr 45.000,-
	About 20%
	There will be considerable contributions from NTNU to the project.*).

All costs in NOK (1 EUO = 8 NOK)

The project proposer dispose and run a fully equipped urban hydrological research station at Risvollan i Trondheim, Norway in cooperation with the Municipality of Trondheim and NVE. I have conducted MSc- research there since 1984 and PhD-research from 1990.

Through the winter 2001/2002 the research have been upgraded to cover studies on the processes governing the snowmelt runoff, and for us in Mid-Norway the most important "Rain-on-snow" events. This project is aimed to expand the study to cover the surrounding area, Fredlybekken 550 ha, discharging combined sewer overflow into Nidelva River in Trondheim. Thorolfsson et al 1996, found that the

CSO into Nidelven was twice as high in winter than in the summer time. Floods are more common in the wintertime, but we have no tools or knowledge on, how to estimate these floods. Pollution accumulated in snow is an other question to be answered, but will not be covered by this project.

*) The project coordinator Sveinn T. Thorolfsson, will be on Sabbatical for one year in 2004/ 2005, working partly (600 hours) on this project.

Case for Support

SPECIFIC PROBLEMS IN URBAN DRAINAGE THROUGH THE WINTER IN AREAS WITH COLD CLIMATE

Sveinn T. Thorolfsson

Department of Hydraulic & Environmental Engineering, The Norwegian University of Science and Technology (NTNU). N-7491 Trondheim, Norway

Sveinn.Thorolfsson@bygg.ntnu.no

DESCRIPTION

This project deals with the challenges in urban drainage through the winter in areas with cold climate. The low temperatures and the snowfall cause problems to the urban runoff that is highly affected by: 1) frost penetration, 2) frozen ground, 3) snow on ground, 4) rain-on-snow, 5) snowdrift, 6) snow redistribution and 7) snow removal.

Problems are also caused by frost heave and freezing in pipes, ice on ground surfaces, clogging of gutters and inlets, icing in manholes and in storm sewers and ice in open watercourses. Subsequent melting and freezing can give runoff periods causing runoff problems.

The major and the minor drainage systems must be able to cater for the winter runoff conditions. The temperature in the wastewater conveyed to the treatment plants are low, less than +5 C°. The operation of runoff control facilities and sewage treatment plants is changed, causing problems to combined sewer overflows (CSO), overloading of wastewater treatment plants and discharging pollution.

A research on the urban runoff through the winter is ongoing at Department of Hydraulic and Environmental Engineering at NTNU, including:

1. Improvements of the urban snowmelt runoff computation method.
2. The processes governing the snowmelt runoff.
3. An improved method for estimation of the snow covered area (SCA)
4. An improved method for estimation of the snow water equivalent (SWE)
5. A collection of reliable urban hydrological data for the winter periods in CC

An UNESCO endorsed IRTCUD – CC (International Research and Training Center in Cold Climate (IHP VI) is to be reactivated. Training and education within urban drainage in cold climate is to be focused.

The activities and the research are supported by end-users like: Municipality of Trondheim, Municipality of Bergen, Municipality of Fredrikstad and Municipalities of Steinkjær, Norway and the Municipalities of Reykjavik and Akureyri in Iceland.

The overall objective of this particular research will be to identify solutions for urban stormwater management that are applicable for cold climate regions, like Scandinavia, including Norway, European Alpine Countries, Russia with Siberia, North Japan, Northern USA with Alaska, Canada and furthermore Chile,

with the goal of sustainable long-term water balance and pollution prevention in the urban environment and the receiving waters. The main focus of the project will be on water balance in the catchment and control of flooding events. The steps outlined below will accomplish this.

- 1) Potential urban stormwater management solutions will be identified and applicability in cold climates will be evaluated.
- 2) At two different site locations, one or two demonstration units will be built for the solutions identified in part 1.
- 3) The demonstration units will be tested and monitored over two winter seasons.
- 4) Model of the identified and tested solutions will be developed based on data collected from the demonstration units.

The developed model in part 4 will be combined with ongoing modeling development of the Risvollan Urban Snow model within the Department of Hydraulic and Environmental Engineering at the Norwegian University of Science and Technology (NTNU).

This research will be conducted under the supervision of Associate Professor Thorolfsson at the Norwegian University of Science and Technology. The research will focus on three main research sites: 1) Sandsli in Bergen Municipality on the west coast of Norway, 2) Risvollan in Trondheim Municipality, and possibly 3) Begby/Bråten in Fredrikstad Municipality in southeast Norway. Sandsli, the first site has been in operation for more than 20 years and long-term monitoring data exist for the site. Site 3, Begby/Bråten, which is a new site, and Risvollan, site 2, will both need basic monitoring instrumentation installed and data acquisition software. The three counties, Trondheim, Fredrikstad, and Bergen, have all agreed to contribute resources towards practical tasks such as maintenance of the sites. This has been previously agreed to between Thorolfsson and the Municipalities.

The three chosen sites are located in different climatic regions of Norway and are in different stages of development, from well established in Bergen to a new site in Fredrikstad. This adds value to the research by spanning the climatic zones and studying sites in different stages of their life cycle. The costal zone in the west, where Bergen is located, has a costal climate with many low intensity precipitation events. Bergen is located in the northwest European climate zone, with relatively mild winters and cool summers and most of the precipitation events occur in the fall season. In this climatic zone, the weather often changes dramatically over a very short period of time, resulting in sudden flash floods and greatly affects the urban drainage system (Maksimovic, 2000). Fredrikstad, in southeast Norway, has fewer annual precipitation events but precipitation intensities are higher, resulting in higher peak volumes of runoff but not necessarily more total volume. This part of Norway is located in the central European climate zone, with cold winters and warm summers. Most of the precipitation occurs during the summer months of the year. Risvollan in Trondheim is in a climatic transition zone between inland and costal climate and also located in the transition zone between the northwest and central European climate zones. The transition zone location of Trondheim creates frequent rain on snow events during the winter months that has resulted in several severe flooding events over the past decade, including 2 events with a 50-year return period. This illustrates the need for sustainable solutions to the cold weather runoff events.

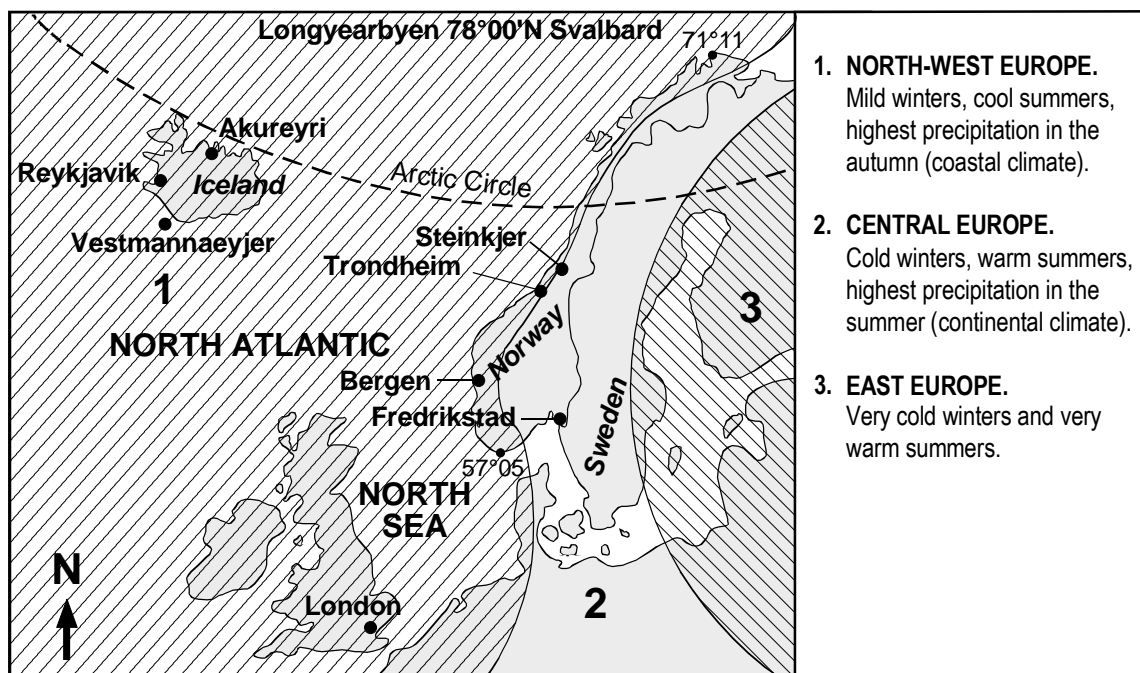


Figure a rough delineation of climatic zones in Northern Europe (Thorolfsson, 2000a)

Collaborations with other institutions, where similar cold climate research are being conducted will be emphasized. Luleå University of Technology is one example where similar research is being conducted. International collaboration is important in order to achieve the best possible results and success of the project.

The results of this project will include recommended sustainable and long-term solutions for urban stormwater management in cold climates. It will focus on solutions that can function satisfactory during the winter months with interchanging snow and rain events. The results will be based on monitoring data from the demonstration units and modeling results from the model development. The project will result in an improved model for cold climate urban stormwater management and establish additional data collection for future research. With the inclusion of both monitoring and modeling data, the results can be used as an aid in future planning and evaluation of different scenarios for urban planners and engineers.

Sveinn T. Thorolfsson

Curriculum Vitae: Sveinn Torfi Thorolfsson

Name: Sveinn Torfi Thorolfsson
Birth date: 5th September 1945
Nationality: Icelandic
Marital Status: Married, Sigridur E. Gunnarsdottir. One daughter, Gudbjörg, birth 4.8.1967.
Private Address: Nordre Hallsetvei 44, N-7034 Trondheim, Norway.
Working Address: Department of Hydraulic and Environmental Engineering,
Norwegian University of Science and Technology (NTNU), N-7034
Trondheim, Norway.
Position: Associate professor
Award 2002: NIFs "Stipend for pedagogisk nybrottsarbeid ved NTNU.
(NIF = The Association of Norwegian Chartered Engineers)
Scholarship for Pedagogic Pioneering Activities at NTNU.

EDUCATION – SCIENTIFIC WORKS ABROAD:

1965-1968 The University of Iceland. Several courses within Natural Science.
Fulfilment of: The 1st part of the M.Sc. study for Civil Engineering.
1971 Master of Science in Civil Engineering (MSc.), Norwegian Institute of
Technology, (NTH), Trondheim. (Municipal Engineering/Sewerage Systems).
1976 NTNf – Scholarship. One-year Research Scholar at: Norwegian Institute of Water
Research (NIVA-scholar), Oslo.
1979 Teaching Qualifications for Civil Engineers (Pedagogic seminar, PUFS). NTH.
1978 - 81 Several courses at NTH on: Urban Planning, Hydraulics, Water Resources
Management, Psychology, Economics, Water Technology in Cold Regions etc.
1988-1989 Visiting Researcher on Urban Drainage. (The academic year). The Department of
Hydraulics, Chalmers University of Technology, (CTH), Gothenburg, Sweden.
1996-1997 Visiting Scholar/Professor. Department of Civil Engineering, University of
Washington, Seattle. USA. (Centre for Urban Water Resources Management).
1991-2001 Several short term visits at the University of Iceland, Reykjavik

The first Icelander to specialise within Sanitary Engineering (VFI-Award 90).

Specialty. 1) Urban Drainage in Cold Climate (UDCC), 2) "The Steinkjer-system; An Alternative Trunk System" (A pressured system), 3) The Sandsli-system; A low-cost solution to urban wastewater drainage to be used in the coastal part of Norway/Regions around the North Atlantic. 4) Collection of urban hydrological data through the whole year in cold climate; Sandsli-Bergen and Risvollan-Trondheim, experimental catchments

EMPLOYMENT:

- 1971-1975 Cev. eng. A. R. Reinertsen, Consulting Engineer, Trondheim Norway. Division of Urban Planning and Water Supply and Sewerage, Trondheim. From 1975 the leader of the subdivision for Sewerage
- 1976 Norwegian Institute of Water Research (NIVA), Oslo. NTNF-scholarship
- 1977 - 1978 Part-time (80%) lecturer in Sanitary Engineering. Norwegian Institute of Technology NTH, Institute of Hydraulics and Sanitary Engineering. Trondheim. Part-time (20%) a consultant at Cev. eng. A. R. Reinertsen, Trondheim.
- 1978 - 1982 Assistant professor in Sanitary Engineering. Planning and Technology within Water Supply and Sewerage.
- 1982-to date Associate professor in Sanitary Engineering and Urban Water Systems, Norwegian Institute of Technology, Trondheim. A principal adviser and consultant on several projects on Water Supply and Sewerage in Norway, Iceland, Nepal, China (Xi'an).
- 1985 1.1.1985 – 1.4.1985. Professorship at Faculty of Civil and Environmental Engineering in Sanitary and Environmental Engineering. University of Iceland. Reykjavik, Iceland.
- 1988 / 1989 Visiting Researcher at Chalmers University of Technology, Department of Hydraulics, Gothenburg, Sweden. A Special Advisor and a Consultant for the Street Director of the City of Reykjavik, Iceland. Sewerage Pumping Stations, Overflows, Interceptors, Rain Gauging. Computer Simulations etc.
- 1985-to date Visiting Senior lecturer at The University of Iceland. Department of Continuing Education/Faculty of Engineering.
- 1997-to date Visiting lecturer at UNIS Svalbard. Water Supply and Wastewater Engineering under Arctic Conditions.
- 1996 - 1997 One year Sabbatical: Visiting Scholar at University of Washington, Department of Civil Engineering. Seattle, USA.

EDUCATIONAL EXPERIENCES AND RESPONSIBILITIES UP TO DATE:

1. NTH: No. 34545 Sanitary Engineering, Advanced Course. 1977 – 2000. ®
2. NTH: No. 34571 Storm Water Management, PhD - Course. 1987 – 1999 ®
3. NTH: No. 34525 Sanitary Engineering, Basic Course. (Partly) 1978 - 1993
4. NTH: No. 34512 General Hydrology, Basic Course. (Partly)
5. NTH: No. 34505 General Hydraulics, Basic Course. (Partly)
6. NTH: No. 14007 Basic Planning for Civil Engineers. (Partly)
7. NTH: No. 92507 An introduction to Organisation, Work Science and Environmental Protection (supervising groups in water related environmental topics)
8. NTH/NTNU No. 14006 Basic planning for civil engineers. (The water related part) 1991/98.
9. NTH: No. 45549 Water Building Projects. Supervisor for 49 Project - students
10. NTH: MSc – thesis 124 Diploma-students: 1977 - dd

Within NTNU's study plan from autumn 1997 to date:

The problem the based learning (BM1/BM2/BM3/BM5- The PBL-string).

11. SIF 8002: BM1 - Information technology, IT-Intro (The water related part) 1997
12. SIA 4003: BM2 – Surveying and Planning for Civil Engineers. (Kart og plan) 1998
13. SIA 4003: BM3 – Physical Environmental Planning (The water related part). 1999-2000
14. SIA 4004: BM3 – Physical Planning and the Environment. (The water related part) 2001
15. SIA 4005: BM1 – Physical Planning and the Environment. (The water related part) 2001
16. SIB 3030: BM5 - Projecting Buildings and Infrastructure. (The water related part) 1999 - dd.
17. SIB 5020: Water Resources Engineering. Introduction. 2000- dd ®
18. SIB 5030: Urban Water Systems (Partly) 2000-dd
19. SIB 50AA Stormwater Technology – Specialization New 2001 ®
20. SIB 5092 Projects (3.75 vt)
21. Supervisor on MSc- Thesis in 10th Semester.
22. DIB5094 Urban Stormwater Management New 2000 ®
23. NTH/NTNU: More than 40 courses on Continuing Education on: Water Supply and Wastewater Engineering, Urban Stormwater Management, Urban Water Resources Planning. Cold Climate Utilities.
24. From 1997, The University Studies in Svalbard (UNIS); Course, AT202/AT203 Arctic Water Resources. Part; Water Supply and Wastewater Engineering under Arctic Conditions.

Main courses No. 1 – 3 and 14,16 and 19 where I have the whole responsibilities/lectures/advisers etc.
®. Otherwise part-time.

Guest lectures:

- 1984: Technical Solutions to the Clean-Up Requirements on Points Discharges to Water Recipients in Iceland. Department of Civil Engineering. University of Iceland.
- 1993: 1) Urban runoff in Norway. 2) Examples on the Steinkjer – System and 3) Norwegian hard rock tunnelling within water supply and wastewater – Some examples. Department of Civil Engineering. University of Tokyo. Japan.
- 1993: Urban Runoff in Norway Compared with Japan: Department of Risk Management Engineering. University of Kyoto. Japan.
1996. Urban Runoff in Areas around the Northern Atlantic. Practical Solutions and Research Needs. Department of Civil and Environmental Engineering. University of Iceland. 2nd April 1996. 16:00 –18:00
1997. Urban runoff in Norway. Department of Civil Engineering. University of Washington. Seattle. USA.

Additional Educational Activities.

1. NIF-courses (1980 – date). Planning and lecturing more than twenty courses on by half of Norwegian Chartering Engineers, (NIF-courses).

2. Planning and lecturing courses at University of Iceland. Department of Continuing Education: 8 courses on, Water Supply, Urban Drainage, Urban Water Planning, and Stormwater Management 1991- 1996.
3. Several lectures given on courses/arrangements arranged by several Nordic, European, USA or Japanese Associations, Governmental Agencies and Educational Institutions.
4. Several seminars given in Bergen on behalf of PUB (The Project Group on Urban Runoff in Bergen).

Supervisor: 1993 12 M.Sc.- students,
1994; 11 M.Sc.- students, co-supervisor 1 PhD.- student.
1995; 9 M.Sc.- students,
1996; 1 M.Sc. - student
1999: 2 M.Sc. – students, 1 PhD-student
2000: 2 M.Sc. – students, 1 PhD-student (Present, Bernt V., Matheussen)

Supervisor for 124 MSc.-students in the period 1977 – date.

Opponent for Doctor Engineer Lars Risholt in spring 2000

Censor:

- 1) Norwegian University of Agriculture (NLH). Department of Agricultural Engineering.
On several MSc-thesis.

Expert (Sakkyndig) on:

- (2001) An Assessment of applicants for an Associate Professorship in Hydrology at Department of Hydraulic and Environmental Engineering, NTNU.
- 1994 An assessment of applicants for an Associate Professorship in Municipality Technology Courses at the University Centre in Rogaland County, Norway. 1994.

REVIEWER ON ABSTRACTS/PAPERS:

I have been reviewing abstracts/papers to national and international conferences for more than 10 years. The latest reviewing:

- 1) On International Conference on Urban Drainage (9ICUD), Portland, Oregon, USA. 8-13 Sept. 2002 on:
 - Deahl: Treatment, Storage and Control of Stormwater in Urbanized Developments
 - Takasou: The CSO Control by the Fine CSO Screen
 - Tomita: Development of High-Speed Combined Sewerage Stormwater Treatment System
 - Nix: Analysis of the Long-Term Performance of Storage/Release Systems Using Linked Watershed-Water Body Modeling
- 2) Nordic Hydrological Conference. (NHC-2002). Røros, 4- 8 August 2002:

MEMBER OF PROFESSIONAL ASSOCIATIONS:

- 1) Norwegian Association of Chartered Engineers (NIF) since 1974.
- 2) Icelandic Association of Chartered Engineers (VIF) since 1968.
- 3) Norwegian Water Association. (Vannforeningen).
- 4) Swedish Water Association. (Vatten föreningen).
- 5) IWA – International Water Association
- 6) Water Engineering Foundation (WEF)

RESEARCH AND PROFESSIONAL INTERESTS:

1. Urban Stormwater Management in Cold Climate.
2. Cold Climate Environmental Engineering
3. Urban Runoff in Norway/North Atlantic during the autumn and Winter Season.
4. Urban Hydrological and Field Data Acquisition. (Experimental catchment; Risvollan-Trondheim, Sandsli-Bergen and Fredrikstad, Norway)
5. Planning, Design and Optimization of Sewer Systems, including construction and operation costs (The Steinkjer System, now world-wide).
6. Use of EDB-based Models for planning, dimensioning and decision making within Sanitary/Stormwater Engineering.

PRINCIPAL ADVISER

1981 - dd: SINTEF – Division on Structural and Environmental Engineering. Group for Water Treatment and Water Transport Former NHL = Norwegian Hydro technical Laboratory).

Several projects within sanitary engineering, urban storm water and meltwater runoff, urban hydrological data, urban cold climate hydrology, urban water systems etc. A member of an UNESCO-IHP project advisory team on: Urban Drainage in Cold Climate. A co-author of a monograph.

1977 - dd: Reinertsen Engineering ANS, Trondheim (former Siv.ing. A. R.Reinertsen, Consulting Engineer, Trondheim. Several projects in Norway, Iceland and worldwide.

1985 - 1996: On several projects for the Street Director(s) in the City of Reykjavik, Iceland.

1984- 1993: A special adviser for the former Street Director in Reykjavik Ingi U. Magnusson

1996 – 2000: Preparation and implementation of a sewer Master plan for Akureyri, Iceland

1989 – 1994: Preparation and implementation of a sewer Master plan for Akureyri, Iceland.

1996 – 1998: Preparation of a Sewer Master plan for Akureyri, Iceland

1989 - dd: The Government of Iceland. Department of Environment.

PUBLICATIONS:

RECENT TEXTBOOKS:

- 2000 Urban Stormwater Management (Overvannshåndtering) 378 pages. (in Norwegian).
Dept. of Environmental and Hydraulics Engineering. NTNU.
- 1992 Sanitary Engineering, Part 1 Water Supply and Part 2, Urban Drainage (VA-Teknikk del 1 og del 2). Tapir Publishers Ltd, Trondheim.
- 1991/92 Textbooks in Advance Sanitary Engineering, 6 volumes (revised 1994 and 2000).
- 1995 Water – A Problem and a Resource. Textbook in Urban Planning (revised in 1996).

EDUCATIONL MATERIALS:

- 1 *Water - A Resource and a Problem*. Department of Hydraulic and Environmental Engineering. NTNU (in Norwegian). Written for courses: BM2, BM3 and BM1. Revised annually.
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Thorolfsson, S. T. (1995): *Nedbørens betydning for totalutslipp - Grunnlag. Kursdagene, NTH-95: TOTALUTSLIPP FRA AVLØPSANLEGG - Samvirke mellom nett og renseanlegg*. Norges Tekniske Høgskole, Trondheim 9-11 januar 1995.

- Thorolfsson, S. T. (1993): *Drift basert på risikoledninger*. Kursdagene, NTH'93: Forvaltning, Drift og vedlikehold av vann- og avløpsnett. Norges Tekniske Høgskole (NTH), 4 - 6 januar 1993. Trondheim.
- Thorolfsson, S. T. (1993): *Fremtidsvyer for transportsystemer*. Kursdagene, NTH'93: Forvaltning, Drift og vedlikehold av vann- og avløpsnett. Norges Tekniske Høgskole (NTH), Trondheim 4 - 6 januar 1993.
- Thorolfsson, S. T. (1991): *Nedbør og avrenning*. NIF-kurs: Overvannsteknikk og teknologi – et effektivitetseringspotensiale i megaklassen. Pers hotel 4-6. februar 1991. Gol
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- Thorolfsson, S. T. (1986): *Manglende kapasitet*. Kurs 7075. NTH'86: Bedre drift og vedlikehold av VA-nettet. Norges Tekniske Høgskole. Kursdagene, (NTH), 6-8. januar 1986. Trondheim.
- Thorolfsson, S. T. (1982): *Dimensjonering av avløpssystemer og kulverter*. NIF-kurs: Overvannsteknologi. Lillehammer hotel. 8-9. februar 1982. Lillehammer.
- Thorolfsson, S. T. (1982): *Nedbørsmengder*. Kurs NIF-kurs: Overvannsteknologi. Lillehammer hotel. 8-9. februar 1982. Lillehammer.
- Thorolfsson, S. T. (1980): *VA-SYSTEMER. Håndtering av overvann, Tekniske løsninger. Alternative ledningssystemer*. NTH-dagene VA-ledninger. Prosjektering, Utførelse og Kontroll. Norges Tekniske Høgskole. Kursdagene, (NTH), 7-9. januar 1980. Trondheim.
- Thorolfsson, S. T. (1979): *Arealdisponering og avløpssystemer. VA-ingeniørens rolle ved arealdisponeringen*. NIF-kurs: Valg av avløpssystem. Lillehammer hotel. 21-23 mai 1979. Lillehammer.

VITENSKAPELIGE REISER:

2001. 1st World Water and Environmental Resources Congress. May 29-24 May. 2001. Florida, USA
- 2001: NOVATECH2001. Innovative technologies in urban storm drainage. June 25 - 27. 2001. Lyon, France
2001. 1) IWA 2nd World Water Congress. Berlin Germany 15-19 October 2001.
2) NOVATECH 2001. Lyon. France, 25-27. June 2001
3) ACSE – EWRI – 1st World Water & Environmental Resources Congress 2001. Orlando, Florida, USA. 20-24 May 2001.
- 2002: Planned: Ninth International Conference on Urban Drainage. 5-13. September 2002 Portland Oregon, USA
- 1999: Eight International Conference on Urban Storm Drainage. Sydney. Australia. Hilton Hotel. 30. August – 3. September 1999.
- 1999: Conference on: Computer Support for Collaborative Learning. Designing New Medium for A New Millennium: Collaborative Technology for Learning, Education, and Training. December 12-15, 1999. Palo Alto, California. USA.

- 1998: Water Quality International 1998. 19th Biennial Conference on the International Association on Water Quality. June 21-26. Vancouver. Canada.
- 1998: NOVATECH1998. Innovative technologies in urban storm drainage. 4-6 May. 1998. Lyon, France
- 1996: Seventh Conference on Urban Storm Drainage. University of Hannover. Hannover. Germany. 9-13 September 1996.
- 1995: International UNESCO – IHP Symposium. Integrated Water Management in Urban Areas – Searching for new, realistic approaches with respect to developing world. Star Hotel. Lund. Sweden. 26-30 September. 1995.
- 1993: International Sixth Conference on Urban Storm Drainage. Niagara Falls. Ontario. Canada. Sheraton Falls view Hotel. 12-17 September 1993
- 1992: The second Japan-tour. A stay at University of Tokyo and tour to the Cities of Yokohama, Toyma, Osaka and the University of Kyoto. A special lecturers to students, invited specialists and engineers within hydrology and engineering. 19 October – 3rd November 1992
- 1991: A Conference on Urban Drainage and New Technologies (UDT'91) 17.-21. June. 1991. Dubrovnik, Yugoslavia.
- 1990: The first large Japan-tour. Fifth International Conference on Urban Storm Drainage. (5ICUSD). July 23-27, 1990. May Theater Suita, Osaka. Japan. Post conference tour to Tama Town and Tokyo City.
- 1990: International Conference on Urban Hydrology in Cold Climate. March 19-21 March 1990. Narvik, Norway.
1989. HYDROCOMP'89. An International Conference on Interactions of Computational Methods and Measurements in Hydraulics and Hydrology. June 12 –20, 1989. Dubrovnik, Yugoslavia
- 1987: Fourth International Conference on Urban Storm Drainage (4ICUSD). 31st August – 4. September 1987. Lausanne, Switzerland.
- 1984: Third International Conference on Urban Storm Drainage (3ICUSD). Chalmers Tekniska Högskolan. (CTH) Göteborg. Sweden. 4-8 June 1984.

ADMINISTRATIVE EXPERIENCES AND PROFESSIONAL AND SCIENTIFIC COMMITTEES:

- 1 The administrative leader (Head) (Instituttstyrer) of the Department of Hydraulic & Environmental Engineering, Faculty of Civil and Environmental Engineering, NTNU, 1st January 1992 – 31st December 1994 (3 years).
3. A member of the board of the Department of Hydraulic & Environmental Engineering, Faculty of Civil Engineering, NTNU/NTH. 1982 – 1988, 1990 – 1996 and 1998 – dd.
4. Member of the advisory board at: Faculty of Civil and Environmental Engineering at NTH 1st January 1992 – 31st December 1994.
5. A member of the Management Committee (MC) of COST Action C15 on: Technical Infrastructure and Vegetation-Improving relations and Preventing Conflicts by an Interdisciplinary Approach. A continuation from COST C3. (COST = European Co-Operation in the Field of Scientific and Technical Research). 2002 – to date.

6. A member of the of COST Action C3 Working group E on: Vegetation and Urban Civil Engineering. 1998 – 2000. To be followed by COST Action C15.
7. A member of the Steering Committee of the BPL- String Project at Faculty of Civil and Environmental Engineering, NTNU. 1997 – 1999.
8. A member of the International Editorial Board on UNESCO-IHP Publication. Vol. II. Urban Drainage in Cold Climate. 1999-2000.
9. Chairman of the organisation- programme- and editorial committee for VAR-FORSKNINGS DAGENE'98.
9. Leader of "The Urban hydrological Project Group in Bergen (PUB)" since 1981 to date (One of the founders).
6. Leader of "The Risvollan Urban hydrological Project Trondheim" Started in 1985. I initiated the whole project. A basis for my research and educational activities and practical engineering in the Trondheim region in Mid-Norway.
7. A member of Norwegian Committee of Hydrology (NHC) 1988 – 1992. A reserve member 1982-1988.
8. A member of the Library board at Faculty of Civil and Environmental Engineering, NTNU. 1997 – dd.
9. A member of the NTH – Japan, Committee 1992- 1994.
10. A member of the Committee on: A university cooperation between NTH – the Baltic Technical Universities (Kaunas – Riga – Tallinn) 1992 - 1994.
11. Chairman and secretary of: "Brukerforeningen for EDB-programmer i VAR-teknikken". 1982 – 1988. (1986-88 a special advisor).
12. Member of SOCOMA working group under the IAHR/IWA Joint Committee on Urban Drainage. (SOCOMA = Source Control for Stormwater Management)

Proposal 12: *“Mathematical Models for Urban Drainage under Different Climatic Conditions: Case Studies and Applications.”*

Book Title:

“Mathematical Models for Urban Drainage under Different Climatic Conditions: Case Studies and Applications.”

Relevance of the Proposal to UNESCO programmes.

The material of the book which is the subject of this Proposal falls within Theme 3 identified for the International Hydrological Programme IHP-VI: “Land Habitat Hydrology”. This Theme deals with regional focal areas following different climatic conditions (arid, humid, temperate, cold) and different land use (urban, rural, natural environment). In addition, the Proposal follows on naturally from Theme 7 of IHP-V: Integrated Urban Water Management.

Target readership: Engineers, planners and administrators responsible for planning and implementing urban drainage systems adapted to climatic conditions.

Summary of contents.

The early sections of the book present the mathematical basis that is essential for the proper description of water flow over surfaces and within closed and open channels, together with descriptions of methods for modelling sediment transport and deposition in urban environments, and other variables that give measures of water quality. Later sections describe how models are used to plan urban developments in the presence of uncertainty regarding precipitation input and extent of impermeable areas, and how models can be interfaced so as to allow rapid and easy interaction with planners who may not have knowledge of the mathematical basis of models that they must use. An important part of the book present case studies and applications that describe how mathematical models of urban drainage have been applied by practitioners, what success was achieved, and what lessons were learned for the future.

Participating authorship.

Contributions will be included from authors at the following institutions of specialisation in urban drainage problems.

Brazil: Instituto de Pesquisas Hidráulicas, Porto Alegre, RS.

Iran: Regional Centre for Urban Water Management, Tehran.

Malaysia: Regional Centre for Humid Tropics Hydrology and Water Resources, Kuala Lumpur.

Norway: Regional Centre for IRTCUD (International Research and Training Centre on Urban Drainage), Oslo.

Latin America and the Caribbean: CATHALAC: Water Centre for the Humid Tropics of Latin America and the Caribbean.

Egypt: Regional Centre for Water Studies in Arid and Semi-arid Zones.

The book will therefore draw upon a very wide range of experience with authorship from all major climate regions in which urban drainage presents problems of planning, design and construction. It is noted that by the year 2005, one third of the world's population of 7.1 billion people will live in the equatorial region, the majority of them in cities. It will therefore be essential to provide adequate drainage if destructive epidemics are to be avoided. Problems of human health from water-borne diseases are also likely to be aggravated if there is climate changes.

Outline of the book.

Part 1: Mathematical models of surface runoff, infiltration, and flow in open and closed channels. Specification of equations of flow, and numerical methods for their solution.

Part 2: Characteristics of models of water quantity at present used in urban conditions.

Part 3: Characteristics of models of water quality and sediment transport used in urban conditions.

Part 4: Making decisions about drainage design and operation under urban conditions, in the presence of uncertainty.

Part 5: Decision Support Systems for planners and administrators.

Part 6: Regional case studies:

Humid tropic regions..

Sub-tropical regions.

Arid and semi-arid regions.

Cold regions.

COST: The cost of the book is to pay the authors and editors. We are not planning the cost of publication since it will be published by UNESCO and/or book company.

The total cost planned is US \$ 25.000

Curriculum Vitae: CARLOS EDUARDO MORELLI TUCCI

1. AREAS

- Hydrology and Hydraulics
- Simulation of water resources systems
- Urban water management

2. DEGREES

- Civil engineer from Federal University of Rio Grande do Sul (1971);
- MSc in Civil Engineering /Water Resources Federal University of Rio Grande do Sul, (1975);
- Doctor of Philosophy, PhD, Civil Engineering Department, Colorado State University, USA, 1978.

3. ACADEMICS ACTIVITIES

- full professor of Hydromechanics and Hydrology Department of the Institute of Hydraulic (IPH) Research of Federal University of Rio Grande do Sul (UFRGS);
- adviser of many Master theses and PhD dissertations in the Water Resource and Sanitary Engineering graduate program of IPH/UFRGS
- former head of the Water Resource and Sanitary Engineering graduate program of IPH/UFRGS.

4. RESEARCH ACTIVITIES

- researcher funded by CNPq (National Research Council of Brazil) and consulting for research from other State and Federal Agencies in Brazil and South America;
- Manager of Water Resource Research Fund of Brazil support by Science and Technology Ministry;
- Resource person of South America Technical Advisory Committee of Global Water Partnership
- Main editor of the Brazilian Water Resource Journal;
- Coordinator of research activities in Urban Water Management and other Hydrology projects in IPH/UFRGS

5. OTHER ADMINISTRATIVE ACTIVITIES

- former president of ABRH, Brazilian Water Resources Association (1993-1995);
- Head of Hydrology sector of IPH/UFRGS.
- Vice-President of IAHS International Association of Hydrological Science

6. CONSULTING ACTIVITIES

- Developed many projects on water resources within Brazil and more widely throughout South America;
- Consultant for companies and government organizations such as: ANA – National Water Agency; Itaipu Bi-national; ANEEL – National Electric Energy Agency; and many others.

7. HONORS

- Medal of Civil Defense of Rio Grande do Sul State in 1985
- Best book on Science and Technology of 1994 in the Book Editor Society of Rio Grande do Sul for Hydrology Science and Application.

8.PUBLICATIONS

Publications totals	
Type	Amount
Books	10
Books chapters	30
International Journals	15
National Journals	55
Symposium and Seminars	85
Institutions publications	32
Master and PhD	2
Total	229

Proposal 13: *Identification of sensitive zones in Central and Eastern part of the Danube catchment*

Project title:	<i>Identification of sensitive zones in Central and Eastern part of the Danube catchment</i>
Title (number) of the Urban Water Management component within IHP VI Programme*: (Focal Area 3.5) (*see the attachment)	Focal area 3.5, Project No2
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	The project is compatible with the UNESCO and UNEP action programs, as well as Central and Eastern Europe countries National programs for accession to the EU
Project proposer	University of Architecture, Civil Engineering and Geodesy, Sofia, Bulgaria
Partners in the project (consortium – network – form at least two different countries)	<ul style="list-style-type: none"> • University of Architecture, Civil Engineering and Geodesy, Bulgaria (BG) • University of Belgrade, Federation of Serbia and Montenegro (FSM) • Urban Institute of Republic of Srpska, Bosnia and Herzegovina (RS – BH) • Regional Environmental Centre, Hungary (H) • Technical University of Civil Eng., Bucharest, Romania (RO)
Supporting partners (cash and in kind)	-
Objective:	To define and map sensitive areas of some important river basins at the Danube catchment in participating Central and Eastern European countries in order to prepare their national legislations for harmonization with the EC ones (Directive 91/271/EEC, Water Framework Directive 2000).
Brief description*: *(Attach a separate Case for support – up to 3 pages)	See the Attachment
Implementation strategy:	Introduction of the Project outputs into relevant National legislation, related to water environment protection, drinking water abstraction and wastewater treatment.
Implementation mechanism	According to the relevant Nationally adopted procedures, possibly including: <ul style="list-style-type: none"> • Public discussions • Discussions at the relevant Ministries

	<ul style="list-style-type: none"> • Discussions with the relevant NGOs • Implementation into the relevant National Water Management Strategy Plan • Implementation into the relevant water-related legislation
Expected results	<ul style="list-style-type: none"> • Identification and mapping of sensitive zones; • Classification of these zones by their sensitivity to pollution in relation to their functions; • Definition of municipal wastewaters effluent standards; • International cooperation and transfer of knowledge; • Contribution to solution of environmental problems related to the river water eutrophication in the Danube catchment. • Preparation for harmonization of national legislations with the EC ones.
Deliverables and availability	<ul style="list-style-type: none"> • Regular and final reports • Maps, identifying the sensitive areas; • Draft pollution prevention and monitoring programs for effective management of eutrophication related pollution
Target beneficiary groups	<ul style="list-style-type: none"> • Regional River Basin Directorates • Ministry of Environment and Water in participating countries
Geographical location of the beneficiaries	Bulgaria, Bosnia and Herzegovina, Hungary, Romania and Federation of Serbia and Montenegro
Project duration	24 months
Proposed project coordinator (attach a brief CV)	Prof. D.Sc. Eng. Roumen Arsov
Proposed project budget: a. Equipment b. Travel and subsistence c. Personal costs d. Dissemination Other (specify)	<p>1 500 000 EURO</p> <p>600 000 EURO (including software)</p> <p>200 000 EURO</p> <p>600 000 EURO</p> <p>50 000 EURO</p> <p>50 000 EURO (overheads, post and communication expenses, office consumables etc.)</p>
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)	-

Case for Support

IDENTIFICATION OF SENSITIVE ZONES IN CENTRAL AND EASTERN PART OF THE DANUBE CATCHMENT

Project Objectives

Construction of wastewater treatment plants in Central and Eastern Europe countries as a part of their environmental programmes for the EU accession should be in a compliance with the relevant EU Directives requirements and with the Directive 91/271/EEC in particular. The objectives of the project are to identify sensitive areas and classify zones according to their sensitivity, define subsequent effluent standards and prepare draft pollution prevention and monitoring programmes for effectively managing eutrophication-related pollution in the river basins under investigation, in accordance with the provisions laid down in EU Directive 91/271/EEC (Urban Wastewater Treatment Directive).

The **specific objectives** aimed at reaching the above overall objective are:

- To **define and map sensitive areas** within the Central and Eastern part of the Danube river basin in accordance with Annex II of EU Directive 91/271/EEC.
- To **classify these areas by their sensitivity to pollution** related to their function (drinking water, recreation, natural value, irrigation, bathing, fishing, etc).
- To **define realistic environmental quality objectives** with regard to pollutants that require specific treatment taking into account the sensitivity of the specific area.

A series of important benefits will result from the successful realisation of those objectives:

- Sensitive receptors will be identified in the study areas, in compliance with the requirements Directive 91/271/EEC.
- Draft programmes for water quality improvement will be prepared, in compliance with the requirements of Directive 91/271/EEC.
- Co-operation between the Danube countries will be promoted.
- Contribution to the Black Sea environmental problems solution will be established.
- The requirements of the Water Framework Directive will be complied with.
- Contribution to the improvement of the local and general European state of the environment.

Legislative Background

European Directive 91/271/EEC – Urban Wastewater Treatment Directive (amended with Directive 98/15/EC):

The Directive concerns the collection, treatment and discharge of urban wastewater as well as wastewater from certain industrial sectors.

The designation of sensitive and less sensitive zones is required by the Directive, since, depending on the sensitivity of the receptor, treatment of a different level is necessary prior to discharge. According to the Directive, discharges into sensitive areas require advanced treatment, whereas for those into some less sensitive zones conventional treatment is considered to be sufficient.

Specifically, the designation of certain zones in the EU countries as sensitive is followed by the requirements that:

- Collection systems should have been provided at the latest by 31 December 1998 for agglomerations of more than 10,000 p.e. (population equivalent) (Article 3 (1));
- Discharge into sensitive areas be subject to more stringent treatment than that described in Article 4, by 31 December 1998 at the latest for all discharges from agglomerations of more than 10,000 p.e.;

Under the terms of Article 5(5), more stringent standards than those required by Article 4 are also to be applied to discharges situated in the relevant catchment of sensitive zones and which contribute to the pollution of those areas. Article 4(1) of the Directive specifies secondary treatment as the norm for receiving waters which have neither been identified as a sensitive area nor as a less sensitive area.

Urban wastewater discharges from agglomerations of between 10,000 to 150,000 p.e. into coastal waters and those from agglomerations of between 2,000 and 10,000 p.e. into estuaries, in areas designated as less sensitive, are subject to treatment less stringent than the one prescribed in Article 4. According to the Directive such discharges should receive at least primary treatment, while comprehensive studies should indicate that they will not adversely affect the quality of the environment.

Sensitive and less sensitive areas are identified in accordance with certain criteria laid down in Annex II. The identification process in the EU should have been completed by 31 December 1993 and reviewed at intervals of no more than four years.

The criteria set by the Directive for the identification of sensitive areas are as follows:

- a) Natural freshwater lakes, other freshwater bodies, estuaries and coastal waters which are found to be eutrophic or which in the near future may become eutrophic if protective action is not taken. The following elements might be taken into account when considering which nutrient should be reduced by further treatment:
 - (i) lakes and streams reaching lakes/reservoirs/closed bays which are found to have a poor water exchange, whereby accumulation may take place. In these areas, the removal of phosphorous should be included unless it can be demonstrated that the removal will have no effect on the level of eutrophication. Where discharges from large agglomerations are made, the removal of nitrogen may also be considered;
 - (ii) estuaries, bays and other coastal waters which are found to have a poor water exchange, or which receive large quantities of nutrients. Discharges from small agglomerations are usually of minor importance in those areas, but for large agglomerations the removal of phosphorous and/or nitrogen should be included unless it can be demonstrated that the removal will have no effect on the level of eutrophication;
- b) surface freshwaters intended for the abstraction of drinking water which could contain more than the concentration of nitrate laid down under the relevant provisions of Council Directive 75/440/EEC concerning the quality required of surface water intended for the abstraction of drinking water in the Member States, if action is not taken;
- c) areas where further treatment than the prescribed in Article 4 of this Directive is necessary to fulfil the Council Directives.

For the purpose of this Directive eutrophication is defined as “the enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorous, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of the organisms present in the water and to the quality of the water concerned”.

PROJECT ACTIVITIES

The following activities will be carried out:

- Review of the existing reports with data on main river, tributaries, lake, reservoirs and intakes, to be provided by the Project Beneficiaries;
- Identification of additional data sources, mainly through liaison with the Partner Institutions;
- Data analysis and set up of databases;
- Identification of sensitive areas by river basin and their mapping;
- Classification of the zones according to their sensitivity;
- Definition of environmental effluent standards specific to the respective zones and sensitive areas;
- Preparation of draft programmes for pollution prevention;
- Preparation of draft programmes for monitoring;
- Preparation of draft programmes for improvement of water quality.

To fulfil the project objectives interdisciplinary teams should be assembled. Experts on

Hydrology, Water quality modelling, Wastewater treatment, Environmental management, Hydrogeology, GIS and Hydrobiology will be involved.

Curriculum Vitae: Roumen Vladimirov Arsov

Name: Roumen Vladimirov Arsov

Degrees: Professor, D.Sc., M.Sc. in Civil Engineering on Water Supply and Sewerage

Date of Birth: 21 June 1946

Place of Birth: Sofia, Bulgaria

Nationality: Bulgarian

Office Address: 1 Chr.Smirnensky blvd., 1046 Sofia,

Faculty of Hydrotechnics, University of Architecture, Civil Engineering and Geodesy; Tel./ fax: +359 2 656 648; +359 2 668 995;

E-mail: r_arsov_fhe@uacg.acad.bg

Present Occupation

- Dean of the Faculty of Hydrotechnics at the University of Architecture, Civil Engineering and Geodesy, since February 2000.

Fields of Professional Expertise:

- Wastewater Treatment Technologies (biological nutrients removal, wastewater sludge dewatering and biological stabilisation, wastewater treatment plants - biological processes dynamic behaviour modelling);
- Environment Protection Technologies;
- Information Technologies in Urban Drainage (urban storm drainage network modelling, surface runoff and combined sewer overflow quality modelling and impact on the receiving waters, GIS in urban water quantity and quality assessment);
- Teaching in Environmentally Oriented Subjects (sewer networks and facilities; wastewater treatment, pumps and pumping systems);
- Management in Higher Education, Science and Research (graduate education management, curricula development, administrative and scientific councils participation).

Recent Participation at International Projects and Scientific Events

- “Mesta River Ecological Management Plan”, (1995); Participating organisations: LDK - Consultants, Engineers and Planners, Athens, Greece, University of Architecture, Civil Engineering and Geodesy, Sofia, Bulgaria; Acting as a local consultant in Bulgaria;
- TEMPUS JEP “Environmental Biotechnology” (1996 - 1998); Participating countries: Belgium, Bulgaria, Germany, Italy and France; Acting as a local co-ordinator for UACEG, Bulgaria;
- PHARE (1998), Feasibility Study Preview of Water Pollution in the Crossborderly River Basins and Identification of High Priority Environmental Projects in South Bulgaria, Ministry of Environment and Water, Carl Bro International - Phare Environment Consortium;
- First (1995), Second (1998) and Third (2001) International Black Sea Conference on “Environmental Protection Technologies for Coastal Areas”, Varna, Bulgaria; Acting as the editor of the Conferences Proceedings;
- Fourth International Conference on “Developments in Urban Drainage Modelling”, 21 – 24 September 1998, London, UK; Acting as a member of the Programme Committee;

- International Conference on “Environmental Engineering and Management”, 30 September – 2 October 1998, Barcelona, Spain; Acting as a member of the International Scientific Advisory Committee;
- NATO Advanced Research Workshop (ARW): “Transboundary Water Resources Management in the Balkans”, Thessaloniki, Greece, 11 - 15 October 1999; Acting as an invited speaker;
- NATO Advanced Research Workshop (ARW): “Coping with Floods: Lessons Learned from Recent Experience”, Ostrava, Czech Republic, 16 – 21 May 1999: Acting as a lecturer;
- INTERREG II Programme – Joint Greek/Bulgarian Project “Training of Engineers and Transfer of Know-How in Environmental Protection of Nestos (Mesta) River Basin in Both Greece and Bulgaria”; Acting as an organiser, researcher and lecturer.

Membership at National and International Organisations and Councils:

- Scientific Council on “Water Constructions” at the Higher Accreditation Commission at the Council of Ministry, Bulgaria;
- Bulgarian National Association on Water Quality (BNAWQ), Sofia;
- International Water Association (IWA), London;
- Water Environment Federation (WEF), USA;

Languages:

- Bulgarian - mother tongue;
- English;
- Russian.

Sofia, April 2002

Roumen Arsov

Proposal 14: Urban Water protection education in the South Eastern Europe

Project title:	<i>Urban Water protection education in the South Eastern Europe</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	<i>9. Urban water education and technology transfer</i>
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, B, ..other (specify))	<i>UNESCO, UNEP</i> <i>(the project may also be suggested to Stability Pact)</i>
Project proposer	<i>IRTCUD, Belgrade</i> <i>Urban Integration Foundation, Albania</i>
Partners in the project (consortium – network – form at least two different countries)	1. NGOs from the region, Albania, FYROM, FYR, Croatia, Bosna and Hercegovina 2. Local Governments (respective responsible bodies of territory development and control; Tourism development; etc.),
Supporting partners (cash and in kind)	A. Open to international institutions (as UNESCO, UNEP and others) that have experience and work in the field of technology transferring B. 1. Local governments, communities and stakeholders 2. Local media may be involved as an education and public awareness tool.
Objective:	Raise the regional awareness on the importance of water protection and adapt new policies in the field, basing on the best international experiences
Brief description*: *(Attach a separate Case for support - up to 3 pages)	The SEE countries are all opening their markets toward the region and to the rest of the world. The development of market economies, of industries and urban development are linked with the use of natural resources. This development will necessarily need to be sustainable, and one of the basic natural resources where it is based is water. <ul style="list-style-type: none"> • While our development are still spontaneous and still far from the careful policies that they need to adapt; • While the control and sustainable use over the natural resources is still very scarce

	<ul style="list-style-type: none"> • While the unsustainable and uncontrolled use of natural resources influence not only the individual countries but also the regions and the whole world • While there are many achievements of the field and nothing to be introduced or discovered: <p>The only effort is to transfer the knowledge, to assist the region to adapt sustainable policies in the sector of Water Management.</p> <p>Very usually the techniques are very simple and they are linked mostly with planning and less with operation issues and bodies in the field. So, all what is needed is the:</p> <ul style="list-style-type: none"> (i) The raising of awareness of population as a whole; relevant communities; and especially specialists for a sustainable use of water (ii) The identification, dissemination and implementation of best practices adaptable to specific regional conditions (iii) Training of specialists of different levels and issues of water management (iv) Preparation and dissemination of specialized literatures that will guide specialists <p>Specialized institutions that have experience in the field, which may be suggested and selected from donors, may support all those actions.</p>
Implementation strategy:	<ol style="list-style-type: none"> 1. Development of series of training and awareness tools 2. Organization of regional training programs
Implementation mechanism	<ul style="list-style-type: none"> • <u><i>Analyses (as an introduction and part of justification of need for raising the regional awareness)</i></u> Detailed analyses of the causes of water crises (shortage) 1. Global; 2. Regional; 3. Local and the contribution of the SEE region in existing and future situations. • <u><i>In collaboration with supporting donors and international institutions we will need to identify the best practices for sustainable use and best management of water resources in future development of tourism in the region.</i></u> Analyses of cases; and identification of best practices. • <u><i>Public awareness raising by media and other</i></u> • <u><i>Trainings of:</i></u> <ul style="list-style-type: none"> ➤ Decision makers

	<ul style="list-style-type: none"> ➤ Specialists (water, planners, maintenance staff) • <u><i>A Regional Conference of decision makers</i></u> in the field of water management will be necessary to adapt some measures in regional level • <u><i>Frequent training courses for planners and urban water & environment professionals</i></u> • <u><i>Set up of a permanent training network in the SEE region and share of expertise</i></u> will help and will ensure the continuity of the work of all the actors in the region.
Expected results	<ol style="list-style-type: none"> 1. Better understanding of water management best techniques 2. Knowledge and technology exchange with more advanced countries 3. Capacity developed for UW operation management
Deliverables and availability	<ol style="list-style-type: none"> 1. Reports 2. Lecture materials for training courses 3. Awareness materials 4. Regional Conference
Target beneficiary groups	<ol style="list-style-type: none"> 1. Decision makers 2. Professional community 3. General population of respective countries 4. The SEE Countries
Geographical location of the beneficiaries	<p style="text-align: center;">Albania, FYROM, FYR , Croatia Bosna-Hercegovina</p>
Project duration	3 years
Proposed project coordinator (attach a brief CV)	<p>IRTCUD, Belgrade</p> <p>Urban Integration Foundation, Albania</p>
Proposed project budget:	The total cost is estimated of about 539.000 euro
e. Equipments	a. 54.000 euro
f. Travel and subsistence	b. 65.000 euro
g. Personal costs	c. 180.000 euro
h. Dissemination	d. 42.000 euro
i. Regional conference	e. 30.000 euro

<p>j. Trainings</p> <p>k. Regional training network</p> <p>l. Project administration, coordination and reporting</p> <p>Other (specify)</p>	<p>f. 48.000 euro</p> <p>g. 52.000 euro</p> <p>h. 68.000 euro</p>
<p>Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)</p>	<p>10 % in kind contributions from the beneficiary countries and their administrative structures</p>

Case for Support

RAISING OF PUBLIC AWARENESS AND EDUCATION ON WATER PROTECTION AND CONSERVATION IN SEE COUNTRIES

PROJECT ACRONIM	RPAEWPC SEEC
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PREPARED BY: URBAN INTEGRATION FOUNDATION, ALBANIA

WHILE THE SCIENTIST'S COMMUNITY IN THE RESTS OF THE WORLD WORK FOR THE HIGH STANDARDS STUDIES IN THE FIELD OF URBAN WATER, TRANSITION COUNTRIES, FACED WITH RELATIVELY HIGH ECONOMIC, URBAN AND CONSTRUCTION DEVELOPMENT RHYTHMS, FIRST HAVE NO POSSIBILITY TO UNDERTAKE OR PARTICIPATE IN THOSE LEVELS OF STUDIES, SECONDLY, HAVE NO PRACTICAL WAYS TO REACH THE ACHIEVEMENTS OF THE INTERNATIONAL COMMUNITY AND AFTER, ADOPT THEM IN THEIR SPECIFIC CASES.

BY THE OTHER HAND, THE INFLUENCE OF THE LOCAL PHENOMENA, ESPECIALLY WATER POLLUTION AND OVEREXPLOITATION, INFLUENCE IN THE WHOLE REGION AND IN GLOBAL ENVIRONMENT, AND DO NOT ALLOW MISTAKES AND MISMANAGEMENTS OF THE WATER RESOURCES.

In order to provide information and education for a wide range of players of urban water it is needed to analyze, select and use the existing world literature and studies, trainings and awareness raising tools, make them present to different regional stakeholders and also develop on their bases practical instruments useful for the region.

In this situation the SEE countries will be included in a network of technology transfer and education of the different levels of management and awareness raising of the population in order to: (i) analyze the situation of water reserves in the region and its relation with local and global situation as well as the influences; (ii) raise of awareness of water managers, planers and specialists, decision makers and public on the situation. Also regional modules of training will be developed and regional training session will be held for different levels of interests (specialists, managers, decision makers). As a very effective tool media will be used for rising awareness on water conservation and protection.

Curriculum Vitae: Elvana ÇANI

1. Personal

Family name	ÇANI
First name	Elvana
Date of birth	30.04. 1966
Nationality	Albanian
Civil status	Married
Residence	Rr. Abdyl Frasherri, Vila 5, Tirana, Albania

2. Education:

Institution	University of Tirana, Civil Engineering Faculty
Date: <i>from (month/year)</i>	September /1984
<i>To (month/year)</i>	July/1989
Diploma obtained:	Degree on Urban Planning

3. Language skills: (Mark 1 to 5 for competence)

Language	Reading	Speaking	Writing
English	4	4	4
Italian	4	3	3
French	3	2	2

4. Professional experience

Professional experience	Period	
	• 1989-1992	Urban Planer in Institute of Architecture , Sector of City Planning.
	• 1992-1995	Urban Planer in National Planning Institute , Sector of City Planning, Management of neighborhood development and redevelopment projects.
	• 1995-1996	Urban Planer in National Planning Institute , Sector of Tourism Development, investments in new sites.
	• 1995-1997	Lecturer at University of Tirana , Civil Engineering Faculty, Urban Planning Department. Planning of new cities.
	• 1996-1997	Technical Director of Alfa Shpk , Private Developer, supervision of civil works of 4

		contracts
	<ul style="list-style-type: none"> • 1997 	Specialist in Urban Planning Department, Ministry of Public Works and Transport
	<ul style="list-style-type: none"> • 1997-1999 	Director of Project Coordinating Unit, Urban Land Management Program, MPWT . World Bank funded project based on community organization and participation on planning, designing and partial funding.
	<ul style="list-style-type: none"> • 1999 	Consultant at UNICEF, Tirana Office.
	<ul style="list-style-type: none"> • 1999 present 	Executive Director Urban Integration Foundation
Professional Memberships		
	<ul style="list-style-type: none"> • 1992 present • 1995 • 1995 present • 1998 present • 2001 present • 2000 present 	<ul style="list-style-type: none"> • Albanian Association of Architects • Member of URISA, participation in annual Conference URISA '95 • Association of Environment Protection • Member of Coordinating Group of Land Registration Program, UASID, EU-PHARE. Representative of MPWT. • Member of Municipality Council of Tirana • Member of Council of Territory Adjustment of Tirana Municipality.
Participation		
	<ul style="list-style-type: none"> • 2000 • 2001 • 2001 • 2002 • 2002 	<ul style="list-style-type: none"> • <i>Participation in Urban Transport Conference, Bremen Germany.</i> • OECD Forum Sustainable Development on the New Economy • World Bank Regional Meeting on Community Empower & Public Participation • International Workshop on reactivation of IRTCUD and Pre-Donors Conference on Urban Water Management •
Additional qualifications		
	<ul style="list-style-type: none"> • 1990 	<ul style="list-style-type: none"> • English post-graduation test at University of Tirana (certification) • Trainings in GIS, 2 months in Tirana, on job

	<ul style="list-style-type: none"> • 1994 -1996 • 1996 • 1996 • 1997 • 1997 • 1998 • 1998 • 1999 • 1999 • 2002 • 2002 	<p>training and 2 weeks Split, Croatia.</p> <ul style="list-style-type: none"> • Training in AutoCAD (certification), Tirana. • English test of Academic level, USAID, Tirana. • Course on Environment Impact Assessment, UNEP, MAP, Tirana. • Organization and functioning of the state structures, organization of Ministry of Transport, collaboration with international funding agencies, involvement of private agencies. Athena, Greece • Course on Preparing Projects for International Funding, PHARE, Netherlands Economic Institute. • Training Seminar of World Bank Procurement Procedures • Preparation of training plans for state structures • A one-week Training Development Workshop on Environmental Impact Assessment, organized under METAP Program, Tirana. Certificate. • Experience with International Institutions on implementation of projects. Familiar with standard documents and procedures and procurement guidelines of WB, EBRD, FIDIC etc. • Training seminar on Aarhus Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters • Training on EIA and SEA organized by Regional Environmental Centre Hungary within the Project ReREP of Stability pact
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Science contributions:

- Planning of new living areas in the main cities of Albania: Tirana, Vlorë, Korça 1991 – 1993
- General Development Plan of Drini Bay, tourism, housing, transports and Port 1993-1995.
- Strategy of tourism for Albanian Coast, 1994.
- Control over construction permissions issued in Saranda Vlorë and Tepelena 1994, State Control.
- Coastal Zone Management Program for Albania, UNEP, MAP, PAP/RAC 1993 - 1994.

- Albania Coastal Zone Management Plan, World Bank, UNEP, METAP1994 - 1996.
- Implications of Climatic Changes for the Albanian Coast, UNEP, Mediterranean Action Plan, member of Albanian task team 1996.
- Conservation and wise use of the wetlands in the Mediterranean basin.
- Project on raising the public awareness on air pollution hazards in Tirana
- *Land management and Urban Development—presentation in International Conference of urban and industrial zones, 1999.*
- *“Urban Development and the role of Community”, analyses and suggestions for improvements of the legal framework, 1999.*
- *Population migration, the education network in Albania and its future, 1999*
- *“The high power electricity network and its health damages especially at children” study, 2000.*
- *“Alternative environmentalists solutions in the development of new millennium cities” paper in the Global Conference on Urban Future, Berlin 2000.*
- *“Population movement and urban future in Albania” world Conference for Social Development, Switzerland 2000.*
- “Organized Community – a good partner in governance”. The project analyzed the situation of urban and social infrastructure on the area of Selita, part of Tirana suburbs, organized the Selita Association, the association of householders in the quality of representative organization, 2000.
- “Assessment of tourist carrying capacities of Lalzi Bay, Albania” financed by the Ministry of Environment, 2001 (work team leader).
- 2001 The project “The encouragement of community initiatives” focused in Ksamil with the aim of organization of community for a participation in decision-making and raising their awareness about reciprocal responsibilities between community and local government.
- 2002 Project Director of Set up of Community Information Center in Selita, Tirana
- Member of the Albanian team on “Albanian EIA Overview” September 2002.
- Local expert on training on Strategic Environmental Assessment on ICZM October – November 2002

Proposal 16: *Generic water, drainage and sanitation systems for urban areas in developing countries*

Project title:	<i>Generic water, drainage and sanitation systems for urban areas in developing countries</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	2, 5
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	UNESCO, WHO, UNDP,
Project proposer	W. Schilling (NTNU, Norway)
Partners in the project (consortium – network – form at least two different countries)	suggested: TETT group of the IAHR/IWA Joint Committee on urban drainage, other IWA specialist groups dealing with developing countries
Supporting partners (cash and in kind)	
Objective:	Elaborate a catalogue of generic urban water, drainage and sanitation systems for various, but typical local and climatic conditions in developing countries
Brief description*: *(Attach a separate Case for support - up to 3 pages)	<p>The background for the proposal is the observation that the direct transfer of concepts, techniques and technologies from developed countries (e.g. centralized large water supply and sewer systems) to developing countries where climatic, urban and social conditions are rather different is not appropriate.</p> <p>The objective of this project consists to elaborate and to disseminate a catalogue of generic urban water, drainage and sanitation systems that could be implemented by effectively accounting for local specific (including socio-economic) conditions.</p> <p>The catalogue will consist of a set of case descriptions, if necessary anonymous. Each case includes water supply, drainage and sanitation.</p> <p>This project could contribute to the extension of the documents on “Urban drainage in specific climates”</p>
Implementation strategy:	<p>Find a sponsor for a pre-project.</p> <p>Design a skeleton for the case descriptions (incl. climatic, technical, socio-economic, financial conditions, analysis, lessons learned and conclusions: optimum approach).</p> <p>Test the approach by compiling two anonymous case descriptions (one successful system, one failure).</p>

	<p>Review the test. If successful: Embark on larger project.</p>
Implementation mechanism	<p>Create a dedicated team with colleagues from developing countries and industrial countries as a project supervisory committee.</p> <p>The overall project is led by one colleague from an industrial country and one from a developing country.</p> <p>Publish a "call for cases" via Internet, email, IWA etc. to create an Internet conference on adapted water, drainage and sanitation systems for developing countries.</p> <p>Select the best descriptions and allow authors to refine their descriptions.</p> <p>The teams are led by the colleagues from the developing countries.</p> <p>Each refined case description is sponsored by a certain sum, payable upon delivery and acceptance of the project leader.</p>
Expected results	<p>Catalogue of generic urban water, drainage and sanitation systems, case studies, conditions of implementation, advantages and drawbacks, compared costs and sustainability</p>
Deliverables and availability	<p>Book and/or CD ROM.</p> <p>Might be used as course material for continuing education courses.</p>
Target beneficiary groups	<p>municipalities, urban water systems operators, city planners, local consultants, universities (courses).</p>
Geographical location of the beneficiaries	<p>developing countries worldwide</p>
Project duration	<p>2-3 years</p>
Proposed project coordinator (attach a brief CV)	<p>Wolfgang Schilling, Dragan Savic</p>
Proposed project budget:	<p>estimated:</p>
Equipment	<p>2000 \$ for organisation of internet conference</p>
Travel and subsistence	<p>5000 \$ for post conference meeting of supervisory committee to select the best cases</p>
Personal costs	<p>1 man-month per refined case-description</p>
Dissemination	<p>10% for project admin</p>
Other (specify)	<p>100\$ per case for communication (email)</p> <p>5000\$ per course after project is finished</p>
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)	

Case for Support

GENERIC WATER, DRAINAGE AND SANITATION SYSTEMS FOR URBAN AREAS IN DEVELOPING COUNTRIES

Prepared by:

Prof. Wolfgang Schilling NTNU, Norway wolfgang.schilling@bygg.ntnu.no

Prof. Dragan Savic University of Exeter d.savic@exeter.ac.uk
United Kingdom

Introduction

Of the cities that have a population of more than 10 million people, more than 80% are in developing countries. In most of these megacities, more than half of the population can be categorised as urban poor with little or no access to services. Currently both the management and end-use of water are inefficient and wasteful and expensive supply side solutions continue to dominate the agenda (WWF, 2000). The background for the proposal is the observation that *the direct transfer of concepts, techniques and technologies from developed countries (e.g. centralised large water supply and sewer systems) to developing countries where climatic, urban and social conditions are rather different is not appropriate.*

In many countries, water shortages stem from inefficient use, degradation of the available water by pollution and the unsustainable use of underground water in aquifers. For example, 40 to 60 per cent of water used by utilities is lost to leakage, theft and poor accounting (UN, 1998). There also has been an overemphasis on monitoring of piped water with insufficient attention to alternative communal sources of water which are widely used by people unable to connect to, or pay for, piped water supplies. Planners have not appreciated that in poor households water quality is often worse both at the source and within the home. Lack of information about how the poor use and pay for water has led to technological, economic and institutional mistakes.

Project Objectives

The main aim of this project is to elaborate and to disseminate a catalogue of generic urban water, drainage and sanitation systems that could be implemented by effectively accounting for local specific (including socio-economic) conditions.

The catalogue will consist of a set of case descriptions, if necessary anonymous. Each case includes water supply, drainage and sanitation. This project could contribute to the extension of the documents on "Urban drainage in specific climates"

Specific Objectives:

To design a skeleton for the case descriptions (incl. climatic, technical, socio-economic, financial conditions, analysis, lessons learned and conclusions: optimum approach)

To test the approach by compiling two anonymous case descriptions (one successful system, one failure).

To review the tests and recommend changes, improvements and identify larger projects to be included.

To embark on a larger project.

Deliverables

Deliverables of the project include:

- Catalogue of generic urban water, drainage and sanitation systems
- Case studies, conditions of implementation, advantages and drawbacks, compared costs and sustainability
- Book and/or CD ROM delivery.
- Course material for continuing education courses

Management and Resources

Management of the project will be the ultimate responsibility of Professors Shilling and Savic. The project steering committee will consist of all colleagues from developing, developed and countries in transition. The committee will meet every six months although the advice and assistance of individual members will be sought where necessary between these meetings. The committee will publish a "call for cases" via Internet, email, IWA etc. to create an Internet conference on adapted water, drainage and sanitation systems for developing countries. The next step in the process will be the selection of the best descriptions and authors will be allowed to refine their descriptions. It is envisaged that the teams will be led by the colleagues from the developing countries. Each refined case description will be sponsored by a certain sum, payable upon delivery and acceptance of the project leader.

Support is requested for a three-year programme to develop the catalogue.

a. Financial resources required

	Total \$US
Staff	50,000
Travel and subsistence	15,000
Dissemination	50,000
Equipment	10,000
Sub-total	\$125,000
Indirect Costs	12,500
Total	\$137,500

References

United Nations (UN, 1998): Towards efficient water use in urban areas in Asia and the Pacific, UN, New York, 1998.

World Water Forum, WWF (2000): *From Vision to Action: Session Report on Water and Megacities*, 19 March 2000, <http://www.worldwaterforum.net/Dossiers/docs/megacities.pdf>.

Curriculum Vitae: **Wolfgang Schilling**

Prof. Dr.-Ing. habil. Wolfgang Schilling

Professor of Urban Water Systems

Department of Hydraulic and Environmental Engineering

The Norwegian University of Science and Technology, N - 7491 Trondheim, Norway

phone: +47 - 735 94754, fax: +47 - 735 91298

Email: wolfgang.schilling@bygg.ntnu.no

Internet: <http://www.ntnu.no/~wos/>

- 23 Feb 1954 **born** in Hannover/Germany, **married** since 1980, **three children** (born 1980, 82, 84), German citizenship
- 1960 Starting primary school in Hamburg, followed by Gymnasium.
- Nov 1972 **Baccalaurate** ("Abitur").
- Oct 1973 Beginning of civil engineering studies at **Technische Universität Hannover, Germany**.
- Jun 1979 **Diplom** at Technische Universität Hannover.
- Aug 1979 **Graduate studies** in Water Resources Systems, Optimization Techniques, Probability and Stochastic Processes at **Massachusetts Institute of Technology**, Cambridge, Mass., USA; **Research assistant** with Prof. R. L. Bras.
- Apr 1980 **Research associate** with Prof. F. Sieker at Institut für Wasserwirtschaft, Universität Hannover.
- Mar 1983 **Doctoral degree** (Dr.-Ing., equivalent to Ph.D.) at Universität Hannover
- Apr 1984 **Visiting Scientist**, Department of Civil Engineering, **Colorado State University**, Fort Collins, Colorado, USA.
- Jan 1985 **Visiting Professor**, Department of Civil Engineering, **University of Ottawa**, Ottawa, Ontario, Canada, lecture series on "Urban Water Resources Systems".
- Oct 1985 **Research associate** with Prof. F. Sieker at Institut für Wasserwirtschaft, Universität Hannover (continuation).
- Jan 1987 **Habilitation** on the subject of "Operationelle Stadtentwässerung". **Privatdozent** (lecturer) for "Operationelle Wasserwirtschaft" (Operational Water Resources Management) at Universität Hannover.
- Apr 1987 **Temporary professorship**, one year substitution of Prof. F. Sieker (due to his sabbatical) at Institut für Wasserwirtschaft, Universität Hannover.
- Nov 1988 **Senior research associate** position at Eidgenössischen Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz (EAWAG), Dübendorf bei Zürich. Tasks: **Development of an urban hydrology group, university lecturing, research, consulting**.
- Apr 1990 **Lecturer** in "Siedlungswasserwirtschaft" (Sanitary Engineering) at **ETH Zürich** (Swiss Federal Institute of Technology).
- Sep 1991 Invitation to negotiate **Professorship** in Sanitary Engineering ("Siedlungswasserwirtschaft") at **ETH Zürich** / Switzerland.

- Jul 1993 Acceptance of call for **Professorship** at **NTH Trondheim** / Norway.
- Oct 1993 **Professorship for Urban Water Systems** at NTH Trondheim / Norway (to date)
- Jun 1994 **Scientific Adviser**, SINTEF - Applied Chemistry, Dept. of Water and Wasterwater (to date).
- Jan 1996 **Vice-Dean** (“Prodekanus”) at Faculty for Civil and Environmental Engineering, NTNU (former NTH, until 12/1998).
- Aug 1996 **Chairman**, IAHR/IAWQ Joint Committee on Urban Drainage (until 9/1999)
- Jun 1997 **Member of the board**, Ingeniør Chr. F. Grønners Stiftelse (Engineer Chr. F. Grønners Foundation, to date)
- Jan 1999 **Head**, Department of Hydraulic and Environmental Engineering, NTNU (to date)
- 2001/02 Sabbatical at INSA de Lyon, France
- Oct 2001 Co-opt member of IAHR Council
- Feb 2002 Elected member of IWA Strategic Council

Lyon, 12 April 2002

Curriculum Vitae: Dragan Savic

Education:

- PhD, 1987-1990, University of Manitoba, Winnipeg, Canada (Civil Engineering)
- M.Sc, 1984-1987 (part-time) University of Belgrade, Belgrade, Yugoslavia (Civil Engineering)
- Dipl. –Ing, 1978-1983, University of Belgrade, Belgrade, Yugoslavia (Civil Engineering)

Membership of Professional Association:

- Chartered Engineer (CEng), UK
- Member of the Chartered Institution of Water and Environmental Management
- Member of the British Hydrological Society
- Member of the International Water Resources Association
- Member of the International Association of Hydrological Sciences
- Member of the International Association of Hydraulic Research
- Member of the International Water Association

Employment History:

- January 2001 to present: Professor of Hydroinformatics, University of Exeter.
- January 1994-December 2000: Research Fellow/Lecturer/Senior Lecturer, University of Exeter.
- April 1991-December 1993: Lecturer, University of Novi Sad, Yugoslavia
- April 1991-December 1993: Project Manager, Energoprojekt Consulting Group, Belgrade, Yugoslavia.
- October 1990-March 1991: Hydraulic/Hydrologic Engineer, KGS Group, Winnipeg, Canada.
- September 1987-Sept 1990: Research/Teaching Associate, University of Manitoba, Winnipeg, Canada.
- November 1983-August 1987: Junior/Senior Engineer, Energoprojekt Consulting Group, Belgrade, Yugoslavia

Publications:

Co-author of 1 book, 1 book chapter, over 100 papers in refereed journals and conference proceedings, and co-editor of 2 conference proceedings.

Research Funding Received:

Recipient of over £1M in research funding since 1994.

Journal Editorial Board Membership:

- Associated Editor, Journal of Water Resources Planning and Management, American Society of Civil Engineering (ASCE), 2000-present.
- Water International (quarterly peer-reviewed journal of the International Water Resources Association), 1999-present.
- Journal of Hydroinformatics (the official journal of the International Association for Hydraulic Research – IAHR, and International Water Association – IWA), 1999-present.
- Acta Hydrotechnica 2001-present.

Research Grant Review:

- Reviewer, Engineering and Physical Sciences Research Council, UK
- Reviewer, Australian Research Council
- Reviewer, National University of Singapore
- Reviewer: US Civilian Research and Development Foundation
- Reviewer: Australian CRC for Water Quality and Treatment

External Examining:

- Examiner, PhD by research, Imperial College, UK.
- Examiner, PhD by research, Lancaster University, UK.
- Examiner, PhD by research, The University of Central Queensland, Rockhampton, Australia (3 candidates)
- Examiner, PhD by research, The University of Adelaide, Adelaide, Australia (3 candidates).
- Examiner, PhD by research, The University of New South Wales, Australia (1 candidate).

Proposal 17: *E-IUWS: Extended International Course on Integrated Urban Water Systems*

Project title:	<i>E-IUWS : Extended International Course on Integrated Urban Water Systems</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	9 (Urban water education, training and technology transfer)
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, other (specify))	UNESCO IHP VI, UNESCO Virtual University on TTSD (Technology Transfer for Sustainable Development), TETT
Project proposers	W. Schilling, J.-L. Bertrand-Krajewski, B. Chocat
Partners in the project (consortium – network – form at least two different countries)	Existing partners of the IUWS Course (16 partners from universities in 7 European countries) + UNESCO Virtual University in Lyon (France) + new partners especially from developing countries (see attached Project justification) + REC (Regional Environmental Center for central and eastern Europe, Hungary)
Supporting partners (cash and in kind)	UNESCO + others
Objective:	Develop a course (book + CD-ROM + e-learning) dealing with integrated urban water systems, with lecture notes, basic models, exercises and case studies for both frontal and self-education and training, covering various urban water contexts (climate, urbanisation, sewerage, ...)
Brief description*: *(Attach a separate Case for support -up to 3 pages)	The integrated approach applied to urban water systems is strongly required, but experience shows that courses for students and continuous education for professionals are not accounting for this integration. Courses remain separated in traditional independent disciplines like sewer systems, drinking water networks, wastewater treatment, water production, water resources, etc. Integration is not considered as an issue and, thus, the drawbacks of isolated discussion of water supply, urban sanitation, wastewater handling and water resources issues prevent the student to overlook the complete urban water cycle and its interdependencies. Interactions with city planning are also an important question. Moreover, it is necessary to move from traditional static (i.e. maximum load) design approaches and concepts to dynamic modelling of the time varying

	<p>phenomena and of their interactions at various time scales.</p> <p>The aim of the E-IUWS project consists to provide basic material (lecture notes, modelling tools and exercises). It will be used to analyse real case studies where a dynamic integrated approach is necessary to understand the behaviour of the urban water system and the interactions within the urban water and pollutant cycles, and to propose adequate and sustainable solutions.</p> <p>An initial version of the course, named IUWS, mainly devoted to European and other developed country contexts, is under preparation : a first release should be available by the end of 2002, for which publishers have already been identified.</p> <p>The proposed project, named E-IUWS, will extend the IUWS course to different urban water contexts, especially geared towards developing countries with their specific conditions (climatic, hydrographic, socio-economic, administrative, and urban conditions, ...), and to implement it as both part of the UNESCO IHP VI and part of the UNESCO Virtual University on TTSD which has been launched in Lyon (France) on June 2001.</p> <p>The E-IUWS course should also be made available on the world-wide web for e-learning.</p>
Implementation strategy:	International working groups + steering and co-ordination committee
Implementation mechanism	co-ordinated work by email + regional meetings and/or visits to ensure appropriate co-ordination, providing of a general editing frame, as already developed for the IUWS project
Expected results	Course material available as a book + CD-ROM + e-learning + specific courses like summer courses or workshops
Deliverables and availability	see above
Target beneficiary groups	students (postgraduates, PhD students) and professionals (continuous education)
Geographical location of the beneficiaries	world-wide
Project duration	3 years
Proposed project coordinator (attach a brief CV)	Jean-Luc Bertrand-Krajewski
Proposed project budget:	(in Euro)
a. Equipment	0
b. Travel and subsistence	100 000

c. Personal costs	648 000
d. Dissemination	50 000
e. Other (specify)	
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)	

Case for Support

EXTENDED INTERNATIONAL COURSE ON INTEGRATED URBAN WATER SYSTEMS

The E-IUWS (Extended Integrated Urban Water Systems) Course project is based on pre-existing initiatives and networks of active European researchers. It will benefit from synergy opportunities, which will ensure the achievement of the objectives.

The pre-existing initiatives and networks are:

- the European IUWS Course project, where two of the project proposers (WS and JLBK) are actively involved,
- the UNESCO Virtual University in Lyon, where two of the project proposers are involved (BC and JLBK),
- the UNESCO IHP VI programme, where one of the project proposers (JLBK) is involved.

Initial IUWS Course project

The integrated approach applied to urban water systems is strongly required, but experience shows that courses for students and continuous education for professionals are not really accounting for this integration. Courses remain separated in traditional independent disciplines like sewer systems, drinking water networks, wastewater treatment, water production, water resources, etc. Integration is not considered as an issue. However, there is only one water cycle, and its comprehensive and complete understanding is mandatory to cope with urban water management problems. Interactions with city planning are also an important question. Moreover, it is necessary to move from traditional static design approaches and concepts to dynamic modelling of the phenomena and of their interactions at various time scales.

This is the reason why 16 partners from 13 universities in 9 European countries have decided to join their efforts to produce an international course on integrated urban water systems, named IUWS, which aims to include all relevant engineering aspects of UWS with particular focus on interactions between its various elements. The co-ordinator of the project is Wolfgang Schilling, from NTNU in Trondheim, Norway. Jean-Luc Bertrand-Krajewski, from INSA de Lyon, France, is one of the active members of the IUWS Course project. The main learning goal consists to get acquainted with and apply concepts of integrated urban water systems analysis to real world problems. These include i) definition of problems, ii) recognition of key variables, iii) quantitative description of the important aspects of dynamic processes with models, and iv) expression of modelling results and conclusions in engineering terms.

The teaching material contains lecture notes, sets of teaching overheads (as files), drill exercises with solutions and cases studies where integration aspects are the main objectives. The IUWS Course project has been launched in 1999, and a first release, mainly devoted to European and other developed country contexts, will be published as a book with an accompanying CD-ROM at the end of 2002 or at the beginning of 2003. Publishers have already been identified.

UNESCO Virtual University

In June 2001, Mr El Tayeb, Director of UNESCO, launched in the city of Lyon, France the UNESCO Virtual University, with a chair devoted to TTSD (Technology Transfer for Sustainable Development). The INSA of Lyon, and especially the laboratory for Urban Hydrology (INSA UH), has been identified as a significant contributor to provide support and teaching material for the TTSD chair, especially in the field of urban water systems management. As head of INSA UH, Prof. Bernard Chocat will co-ordinate this action.

UNESCO IHP VI Programme

In the frame of the UNESCO IHP VI programme, the point no 9 in the Focal Area 3.5 concerns "Urban water education, training and technology transfer".

The E-IUWS Course project

The proposed E-IUWS Course project will contribute to all three above initiatives and benefits from the involved pre-existing contacts and networks.

The main goals of the E-IUWS Course project are :

- extend the initial IUWS Course project to different urban water contexts, especially of developing countries with their specific conditions (climatic, hydrographic, socio-economic, administrative, and urban conditions, ...),
- be a significant and world-wide valuable contribution to the TTSC Chair of the UNESCO Virtual University of Lyon, by providing material available for e-learning,
- contribute to the UNESCO IHP VI Programme.

The E-IUWS Course project will provide basic material (lecture notes, models and exercises), which is then used to analyse real case studies where a dynamic integrated approach is necessary to understand the behaviour of the system and the interactions within the urban water and pollutants cycles, and to propose adequate and sustainable solutions.

New partners and contributors have been pre-identified in various countries (Australia, Brazil, Lebanon, Iran, Malaysia, India, Ethiopia, Uganda, Ghana, South Africa), and additional contributors will be identified to cover other regions of the world. These new contributors will have two main tasks :

- complete the existing teaching material (lecture notes, overheads...) with specific approaches relevant for contexts (arid, tropical or equatorial climates, rapidly growing cities, specific urban water systems infrastructure, temporary watercourses, water scarcity, etc.) which are different from the contexts concerned by the IUWS Course project. This will ensure that various world-wide conditions will be accounted for.

- provide case studies where integration and interaction at catchment scale should be particularly emphasised, and where dynamic effects are significant (with this aspect there is a strong link to proposal no 16 co-ordinated by Wolfgang Schilling).

Likewise the initial IUWS Course project, the work will be co-ordinated by email exchanges and websites resources. General meetings and/or visits to ensure appropriate co-ordination will be organised. A general editing frame will be provided to all contributors. A steering committee will be in charge of the general management of the project. The project manager will be Jean-Luc Bertrand-Krajewski.

In order to make the teaching material available as e-learning resource for the TTSD Chair, Mrs Eva Csobod, from the REC (Regional Environmental Center for Central and Eastern Europe) in Budapest, Hungary, who is well experienced in e-learning, will co-ordinate the electronic adaptation of the “paper” teaching material.

Mutual recognition of diploma by universities remains a very complex question, and will not be part of the project. Nevertheless, the possibility will be further investigated, at least to have some universities to accept the E-IUWS Course as one of the modules in their curriculum.

Workshops and/or summer schools will be organised in years 2 and 3 of the project to make full-scale tests and use of the teaching material. This is also part of the dissemination.

Curriculum Vitae: Jean-Luc BERTRAND-KRAJEWSKI

Born in 1964 in France. Civil Engineer since 1986, Doctor in Environmental Engineering since 1992. Research Engineer in the research centres of the Lyonnaise des Eaux water company in Paris and Bordeaux, France from 1992 to 1997. Academic associate professor at INSA de Lyon (National Institute for Applied Sciences), France since 1997, in the laboratory of Urban Hydrology.

Main teaching activities at INSA de Lyon :

- numerical analysis
- operational research and decision making methods
- urban hydrology and urban drainage (at postgraduate and PhD levels)

Other teaching activities :

- urban hydrology and urban drainage, at ENTPE (Engineering Highschool of the French Minister for Public Works and Equipment) in Lyon, France
- waste water treatment, at the Faculty of Civil Engineering of the Lebanese University, in Beirut, Lebanon
- active member of the IUWS course.

Main fields of research activities :

- metrology and modelling of flow and pollutant production and transfer in sewer systems
- modelling of solid transport in sewer system
- metrology and management of sewer sediments
- dynamics of waste water treatment plants during storm events
- infiltration and exfiltration in sewer systems (co-ordinator of the European project APUSS).

Other research activities :

- Member of national and international working groups, especially the IWA-IAHR Joint Committee on Urban Drainage « Sewer sediment and processes working group » (vice-chairman and secretary), the IAHR-EGW working group for European courses at PhD level (member of the steering group from 1998 to 2001), the COST Actions 682 and 624 on integrated modelling of urban water systems.
- Publication of more than 40 scientific and technical papers.
- Author or co-editor of three books.
- Member of many organisation and scientific committees of international conferences.

Proposal 18: *Benchmarking of Urban Water Management Systems in transitional countries with special regard to data structures and institutional strengthening*

Project title	<i>Benchmarking of Urban Water Management Systems in transitional countries with special regard to data structures and institutional strengthening</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	primary: 6 (socio-economic interactions), 1 (macro project), 3 (data, processes) also: 4 (integrated UWM), 7 (UW in developing and transition countries), and 8 (education, training, technology transfer)
Compliance with programmed frameworks (UNECSCO, UNEP, UNIDO, EU, WB, ...other specify)	UNESCO, EU (WFD),
Project proposer	Dr. Primož Banovec, Prof. Dr. Franci Steinman, Prof. dr. Boris Kompare,
Partners in the project (consortium - network - form at least two different countries)	Slovenia - University of Ljubljana, UK - University of Exeter, TU Graz – Austria, University of Bradford Partners from transitional countries with a need of improved management of existing UWM infrastructure and restoration requirements with regard to data management and institutional strengthening
Supporting partners (cash and kind)	Immediate beneficiaries - End users (households) and partner local communities, - public companies, - regulatory agencies, - financing institutions.
Objective	<ul style="list-style-type: none"> • Development of tool for benchmarking of urban water management systems (public water supply, sewerage, waste water treatment plants, drinking water treatment plants, etc.) with special regard of analysis of interactions between the internal environment of the urban water management services and external environment that should enable a efficient and transparent work of those. • Improved knowledge on urban water management standards and data requirements • Improved management of the existing urban water management infrastructure • Improved transparency of the procedures and roles of stakeholders in the institutional framework of the urban water

	<p>management infrastructure</p> <ul style="list-style-type: none"> • Support for planning of new/rehabilitation of existing UWM infrastructure • Legal/institutional strengthening, especially in developing/transition countries
<p>Brief description*</p> <p>*(attach a separate Case for support -up to 3 pages)</p>	<p>See attachment</p>
<p>Implementation strategy</p>	<ul style="list-style-type: none"> • analysis of possible set of indicators for the benchmarking (use of the resources and related outcomes) • development of the methodology • analysis of the management practice of the selected UWM systems • analysis of the results and necessary revise of the methodology
<p>Implementation mechanism</p>	<ul style="list-style-type: none"> • Collaborative research and appropriate educational/communication means.
<p>Expected results</p>	<ul style="list-style-type: none"> • developed methodology for benchmarking of the internal and external environment for the performance of the UWM services. • revised accounting standards for UWM infrastructure and related issues • improved knowledge on mechanism of full cost recovery and value of water • improved transparency of project development and follow-up procedures • institutional analysis from the point of view of water services related assets, financial flows, and standards • data requirements analysis with standardization of data types, classification analysis, data hierarchy • project quality management/assurance guidelines with best management practice guidelines • methodology for the partner approach between the service provider and community (also in case of provision of services in the form of the concession act; private-public partnership)
<p>Deliverables and availability</p>	<ul style="list-style-type: none"> • benchmarking methodology for UWM infrastructure - manual • analysis of the country-by-country practice in this field with the defined bottlenecks and proposed mitigatory measures. • UWM data structure - manual • guidelines for the regulatory agencies
<p>Target beneficiary groups</p>	<p>Urban municipalities, public companies, regulatory bodies, financing institutions, end-users, professionals and students in this field</p>

Geographical location of the beneficiaries	<p>macro project – analysis of the external environment that enable efficient services will be of general importance</p> <p>regional project – the project results will be applied to the specific target group of transitional countries</p>
Project duration	<p>analysis and preparation of the methodology - 1 year</p> <p>implementation and follow up reporting 2 years</p> <p>analysis and preparation of the final methodology, dissemination of the results 1 year</p> <p>total: 4 years</p>
Proposed coordinator (attach a brief CV)	Dr. Primož Banovec
<p>Proposed project budget</p> <p>a. Equipment</p> <p>b. Travel and subsistence</p> <p>c. Personal costs</p> <p>d. Dissemination</p> <p>Other (specify)</p>	340.000 €
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)	National governments, regional and local entities, regulatory agencies

Case for Support

BENCHMARKING OF URBAN WATER MANAGEMENT SYSTEMS IN TRANSITIONAL COUNTRIES WITH SPECIAL REGARD TO DATA STRUCTURES AND INSTITUTIONAL STRENGTHENING

Reference literature:

Literature on benchmarking of the internal environment for the provision of UWM services:

- Benchmarking in der Siedlungswasserwirtschaft – Österreichisches Forschungsprojekt, Erfassung und vergleich von technischen und wirtschaftlicher Kennzahlen in der Siedlungswasserwirtschaft (Abwasserableitung und -reinigung) - endbericht, Wien Dezember 2001, contract No. 21UFG/1993
- IWA, Francisco Cubillo, (2002), Performance indicator for wastewater services (working version 3, March 2002);
- IWA, Alegre H., et al, (2000), Performance indicators for water supply services;

Key literature on urban water management in target countries

- Berbeka et.al, (2000), Water pricing in selected Accession Countries to the European Union, current policies and trends, Part I – Comparative Analysis, Part II – Country description, A report produced for the European Commission – Environment, Contract Number B4-3040/99/130877/MAR/B2
- DVWK (2000), Water resources management in the Czech Republic, Hungary, Lithuania, Slovenia, (DVWK Bulletin, 21). Bonn: Deutscher Verband für Wasserwirtschaft und Kulturbau e.V
- Correia, N. (ed.), (1998), Water Resource Management in Europe: Institutions, Issues & Dilemmas, Balkema Publishers

Introduction

Countries in transition have in the last decade faced a dramatic change that is identifiable in different aspects. The most obvious change of switch from planned economy (supply side economy) to the free market economy (demand side economy) is only the most obvious one. This change has been somehow less obvious in the sector of public services, where a general conclusion could be that the UWM infrastructure is in poor condition, with large need for investments (i.e. ISPA funds from the EU for financing of infrastructure, especially waste water treatment plants). The focus has been therefore given to the infrastructure itself and the less extent to the environment that would enable effective management of the entire life-cycle of it. The proposed project is covering especially those aspects and by this contributing to the elimination of the important bottleneck.

Project description

The main issue to be tackled by the project addresses the specific situation in the field of urban water management in transitional countries and developing countries. Basic UWM infrastructure in those countries is operating under unsuitable standards because of the lack of the maintenance, migration pressures, inadequate technological solutions and other factors that affect this field. Technical improvement of those services (also restoration) and related improved maintenance efforts are related

to specific managerial problems as the provision of UEM services normally presents a natural monopoly and some supplementary mechanisms has to be put in place that replace the absence of market mechanisms.

One of the few tools provided for this purpose, that has proved to be efficient in analyzing and comparing complex systems is benchmarking. Benchmarking linked to the system analysis approach is based on selection of a set of indicators that give sufficient information about the system behavior and thus enables analysis of comparable systems. This is also a scope of already developed benchmarking tools (IWA 2000, IWA 2002, etc.). The main obstacle in the real implementation of those tools in transitional countries as well as developing countries is:

- The benchmarking tools are developed for the analysis of services in a specific environment (specific countries) and can not be used in the countries that have different institutional, legal and economic situation, that define the external environment of the service provider.
- The benchmarking tools are focused mainly to the service provider and to much smaller extent to the environment in which he is supposed to perform his services.

External environment affects to the large extent to the level of services with water pricing methodologies, supervision and control practices, legislation enforcement, litigation procedures and specific decision making practices at different levels. The status of those will be analyzed by the project. This is also defining the expected results that will in general help to close the management (decision making) cycles with a clear role of both – service provider and external environment that enables performance of services.

The analysis of the external environment will be closely linked to the analysis of the data needed for the improvement of the current status. The data will include technical (physical, measurable) attributes, as well as attributes that describe economical, legal and institutional aspects in this field. For this purpose a basic data structure, and data sets will be defined that are needed (in some kind of standardized manner that enable comparison and analysis) for the successful provision of services.

Inventive aspects

In the view of integrative or comprehensive management of complex system, as urban water management system is, the proposed project importantly adds to the real exhaustiveness of the analytical space with multiple objectives and usually large set of decision variables. Analysis of the broader environment in which define the decision making space and improved standardization of data sets on that will importantly add to the current knowledge on the system.

The project results will therefore help to the goal that feasible and efficient technical solutions will also lead to a successful life of the infrastructural systems.

Curriculum Vitae: Primož Banovec

1. Family name: Banovec

2. First names: Primož

3. Date of birth: May 21, 1970

4. Nationality: Slovene

5. Civil status: married, one child

6. Education:

Institution	University of Ljubljana, Faculty of Civil Engineering and Geodesy
Date	May 25, 1995
Degree:	dipl. ing. in Civ. Eng.

Institution	CUOA (Consorzio universitario per gli studi di organizzazione aziendale), Vicenza, Italy
Date	April 1996 – November 1996
Certificate	Corso Master Promoters/Proposal – Project Manager

Institution	University of Ljubljana, Faculty of Civil Engineering and Geodesy
Date	June 11, 2001
Degree:	Ph.D. – Doctor of Science

7. Language skills: (with 5 being the highest level of competence)

Language	Reading	Speaking	Writing
English	5	5	5
Italian	5	5	4
German	4	4	3
Serbian/Croatian	5	5	4

8. Member of professional bodies:

International association for irrigation and drainage, International association for hydraulic research, Društvo vodarjev Slovenije, DVWK, IAHR

9. Other skills:

Computer literacy: Office software programmes, Project management software, CAD software, hydraulic modelling software, internet software

10. Present position:

Researcher at the Faculty of civil eng. and geodesy,

11. Years within the firm:

9 years, 7 of them regularly employed

12. Key qualifications:

- water resources economics
- hydraulic, hydraulic structures
- project management
- water management
- water resources planning
- institutional/organisational aspects of water management
- water legislation issues
- certified engineer, state exam (April 7, 1997, No. 63/97)

14. Selected professional Experience Record:

Employment record:

Date	1995 – 2001
Location	Ljubljana
Organisation	Universtiy of Ljubljana
Position	Researcher, assistant, Ph.D. student
Description	<ul style="list-style-type: none">• Research tasks, project work• Work on different projects related to water resources management (see bibliography)

Date	September 1997 – 2000
Location	Ljubljana, Slovenia

Organisation	Ministry of agriculture forestry and food
Position	Project manager assistant
Description	<ul style="list-style-type: none"> • Slovenia irrigation project 3600 ha of feasibility studies, 2000 ha of detail design, 2 dam prefeasibility studies, marketing, organisational, sociological studies... • coordination and supervision of work for the client, project correspondence

Active employment status:

Date	2001 -
Location	Ljubljana
Organisation	Universtiy of Ljubljana, Faculty of Civil Eng. and Geodesy
Position	Researcher, assoc. Prof.
Description	<ul style="list-style-type: none"> • work on research projects, • consultancy.

Date	May 1998 – present
Location	Ljubljana, Slovenia
Organisation	Ministry of environement and physical planning
Position	Assigned expert for water management
Description	<ul style="list-style-type: none"> • Bilateral water management commission for Soča river basin, assigned expert advisor by the Government of Slovenia, preparation of the framework for the tender documentation for the Soča river basin management plan

Date	January 2002
Location	Trieste, Italy
Organisation	University of Trieste, dept. of Civil Engineering
Position	researcher
Description	<ul style="list-style-type: none"> • One year research project (post Ph.D.) on water management on international river basins

15. Other:

Specialised training courses:

- 17.10.-3.12.1993 in 7.2.-18.3.1994 Universität der Bundeswehr München, Institut für Konstruktiver Wasserbau, practical and theoretical work on the experimental hydraulic,
- Mathematical groundwater models in Bavaria (Matematische Grundwassermodelle in Bayern), Symposium, Technische Universität Munchen, Germany, 15. 3 1994,

- Insurance in case of floods in Germany – Risks and potential costs (Ueberschwemmungsversicherungen in Deutschland - Risiko und Schadenpotentiale) 24.2.1994, Seminar, Universität der Bundeswehr München,
- Protection of waters in chemical industry – measures for reduction of emissions (Wasserreinigung in der chemischen Industrie - Massnahmen zur Verminderung von Emissionen) 28.4.1994, Seminar, Universität der Bundeswehr München,
- 31.7.-4.8. 1995 Universität der Bundeswehr München, Hydraulic of outlets from secondary sedimentation reservoirs, consultation
- 8.8.-26.8. 1995, University of Copenhagen, Danish Freshwater Biology Institute, research on adequacy of different calculation methods for determination of hydraulic conductivity of vegetated streams
- Measures for the environmental friendly stabilisation of streams (Massnahmen zur naturnahen Gewässerstabilisierung) 20.9. - 22.9.1995, DVWK seminar, Universität der Bundeswehr München,
- Seminar on data acquisition and analysis, 16.12.1994, Technical faculty Maribor, Slovenia
- Seminar on the protection of banks and stabilisation of channels in modern hydraulics, Seminar: "Uferschutz und Gerinne-stabilisierung im modernen Gewässerausbau", Vienna, Austria, November 1994
- 34. Congress International Commission on Drainage and Irrigation, Rome, 11.-15.8.1995, Representative of Slovenia in Young Professional Forum - International Commission on Irrigation and Drainage.
- 1.4. 1996 - 11.11.1996 Corso Master di Promoters/Proposal-Project Management (Master course on the Project Management in Construction) Organised by: ICE/CUOA Vicenza, Italy
- 24.5.-31.5.1998 Professional visit at different institutions dealing with water management, regional development and irrigation (CACG, BRL, Cemagref, Canal de Provence, International office for water, different ministries...)
- Analysis of environmental data with machine learning tools, Jozef Stefan Institute, Ljubljana, 7-10 September 1998
- EPYS meeting, Madrid, October 2001
- Cooperation with University of Exeter 1999 – 2001 (Prof. dr. Dragan Savic) – Advanced analysis of water supply systems.
- EPYS (European Young Scientist) meeting, 17-20 oktober 2000, Madrid
- Drought Mitigation and prevention of land desertification, ICID conference, Bled, Slovenia, April, 21-24, 2002

Ljubljana, 10.7.2002

Primož Banovec

Proposal 20: *The Use of Water Systems for Sustainable Tourism Development*

Project title:	<i>The Use of Water Systems for Sustainable Tourism Development</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	The project is compatible with the activities number 7 of the Urban Water Initiative of the IHP -VI (2002-2007) and UNESCO MAB Programme.
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	UNESCO, UNEP, EU
Project proposers	<ul style="list-style-type: none"> • CUW-Banja Luka, Bosnia and Herzegovina, • Urban Integration, Tirana, Albania
Partners in the project (consortium – network – from at least two different countries)	<ul style="list-style-type: none"> • Institute of Architecture, Civil Engineering and Geodesy, Sofia, Bulgaria • IRTCUD/CUW SEE Network, • The Institute for Urbanism RS, Bosnia and Herzegovina • Urban Integration, Tirana, Albania • EXPEDITIO, Montenegro, FR Yugoslavia
Supporting partners (cash and in kind)	Local communities and stakeholders
Objective:	Enhanced understanding of the possibilities for sustainable tourism development based on rehabilitation of devastated water systems, use of aquatic habitats and promotion of environmentally friendly activities in management of endangered water resources.
Brief description*: *(Attach a separate Case for support - up to 3 pages)	<p>In many urban and rural areas with significant tourism potential, deteriorated water resources pose a major limiting factor.</p> <p>Improved knowledge and methodological base for the integration of aquatic habitats into urban water development is one of the component of IHP-VI and sustainable tourism, sport and recreation can be easily identified as one of the key economic factor for the development and prospect of these environmentally sensitive areas.</p> <p>Environmentally progressive zones such as seas, lakes, rivers, wetlands, waterfalls, etc have a high natural potential and should be used as a leading power for further socio-economic development.</p> <p>Environmentally friendly techniques for integrated water use proved to be beneficial so promotion and concrete</p>

	<p>application of these measures is immediately needed; especially in social and environmentally important areas.</p> <p>Project tends to develop the strategy for sustainable tourism development based on environmentally sound management of water resources under various climate, geographic, socio-economy and other circumstances through the couple of subprojects or pilot cases. Pilot cases will include different aquatic habitats and will serve as a fine example for the application of sustainable management practices. In addition they will be incorporated into one unique network for the information and experience share.</p>
Implementation strategy:	<p>Transboundary research, methodology development that includes rehabilitation of the existing underdeveloped or devastated areas and upgrade of those which have reached the “capacity saturation” under the existing, unsustainable concept, education and awareness rising, creation of multidisciplinary working groups various implementation activities.</p>
Implementation mechanism	<ul style="list-style-type: none"> • Development of multi-purpose decision support system for sustainable tourism development based on water interactions and wise use of eco resources, • Integration workshops for the promotion of the methodology results, • Implementation of the strategy through the local institutions.
Expected results	<p>Guidelines for sustainable tourism development based on use and management of water resources in sensitive areas, promotion of the sustainability principles and environmentally friendly activities, participation of the local communities.</p>
Deliverables and availability	<ul style="list-style-type: none"> • Guidelines for sustainable tourism, sport and recreational activities development and promotion based on the best available techniques for the aquatic habitats management, • Availability of documentation through the web, • Action plans for selected case studies representing typical conditions: wetlands, archeological site, small scale historical coastal cities, eco-tourist resorts, art centres in the nature.
Target beneficiary groups	<ul style="list-style-type: none"> • Professionals dealing with regional and local planning of tourism development • Communities living near valuable tourist potential but suffering from devastated water resources • Decision makers and the whole society
Geographical location of the beneficiaries	<p>Case sites with high potential for sustainable tourism promotion (wetland Bardaca, mountain-land Zelenkovac, coastal resorts in Albania, Montenegro and Croatia)</p>

Project duration	2.5 years
Proposed project coordinator (attach a brief CV)	Dr Duško Đurić
Proposed project budget: a. Equipment b. Travel and subsistence c. Personal costs d. Case study monographs development e. Dissemination (workshops, summer schools, etc.)	Total budget is 480 000 € a. 48 000 € b. 72 000 € c. 216 000 € d. 72 000 € e. 72 000 €
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)	

Case for Support

THE USE OF WATER SYSTEMS FOR SUSTAINABLE TOURISM DEVELOPMENT

Problem description

Many coastal cities along the Mediterranean sea (including the Region of Boka Kotorska bay) feature a big number of valuable cultural heritage sites, some of which are placed on UNESCO World Heritage List. Most of the heritage is seriously endangered by many negative factors, of which alarming is the problem of impact of waste water and storm water and polluted or brackish ground water. Considering the fact that some of these areas have very high level of participation, they are under threat of irrecoverable damage.

These areas are very attractive and still not explored enough as a target of tourist destinations. That's why the interaction between problems mentioned above and development of tourism is necessary. The project tackles systematic analyses of the methods of sites rehabilitation for the sake of sustainable tourism development by solving water problems. Similar studies can be found in many cities including the old historical sites along the Mediterranean coast.

Aims of the project

Get together civic society (NGO) and experts from the field of urban waters and develop the methodology for common planning of cultural property reconstruction threatened by rain, underground, superficial, polluted and other waters.

Identifying tourism as a basic resource of the two pilot project areas of Boka Kotorska bay and Skadarsko lake and creating conditions for sustainable tourism development.

Informing and involving public, civic society and NGO sector in problems of cultural heritage protection by solving problems of negative influence of water.

Fostering development of collaboration between two regions (Montenegro and Northern Albania).

Distribution of tasks

Experts from IRTCUD will analyze impact of surface and underground waters, using contemporary models and methodology for analyzing the impact of naturally and antropogenally polluted waters (rain, superficial and ground water bodies) on objects of cultural heritage and buildings on one hand and also analysis efficiency treatments will be suggested.

NGO will be responsible for organizing of all activities, setting up working schedules, coordination of participants, informing public, local community and authorities about project, its aims, importance, progress and results.

Activities

1.PART – PROJECT INCEPTION

In the first part, contacts established with relevant authorities and local communities and project concepts will be introduced.

2.PART – DATA GATHERING ANALYSIS

Collaboration and interaction work on recognition, definition and location of particular problems will be realized by participants. Development of analytical and problem solving tools. Exchange of data structure, analytical tools and expertise.

Experiences from the professional teams between collaborating organizations from Montenegro and Albania will be exchanged.

Technical solution will be proposed, but for the success of the project both social and economical aspects have to be tackled.

Local organizations and communities will be informed about problems, both - by discussing the issue with professionals from IRTCUD organization, and by practical help and assistance in project working on specific tasks.

Program will be organized to suit wider involved population in solving present problems.

During those 18 months experts from both countries and participants of program will have opportunity to exchange experience and observations by direct contacts with stakeholders. Experience from work in mixed groups, where people from different places and different cultures works together is to be exercised in a series of workshops in the form of summer schools.

Two summer schools are planed (one in Montenegro and one in Albania) during this project phase. Tutors of the SUMMER SCHOOL courses are experts from IRTCUD, who will lecture participants about topic problems solving procedure, and also show different case examples and studies that were recently experienced in other countries. The workshops will provide direct contact between participants in situ, and give them the opportunity to exchange deeper knowledge, which could be applied in their local communities in the future.

Representatives of local community will be invited to participate.

3. PART – PRESENTATION AND DISSEMINATION OF RESULTS

In this last part all gathered material, projects, observations, notes, technical solution, proposed conclusions, photos etc. will be classified and elaborated to be easily accessible to all interested parties.

The project dissemination will be organized in such a way that the key decision makers can make unbiased assessment and prioritisation and preparation for tendering and general public can be made fully aware on the extent of problems and sustainable solutions.

Budget

Expected budget for "COURSES ON ANALYZING AN INTERACTION BETWEEN CULTURAL HERITAGE REHABILITATION AND URBAN WATERS FOR SUSTAINABLE TOURISM" run by two local NGO's is as follows:

Two (2) Workshops – summer schools	
Participants	<ul style="list-style-type: none">- multidisciplinary team of experts and young professionals from 2 participating countries- participants from EU countries- participants from other Mediterranean countries
Number of participants	17 participants+ 5 lecturers (tutors)

Duration	15 days each of the 2 years	
Venue	<ol style="list-style-type: none"> 1. Kotor, Perast - Montenegro 2. Skada (Squeter) - Albania 	
Costs covered	<ul style="list-style-type: none"> - travel & subsistence for lecturers and participants - equipment - lecturers and organizers fees - preparation and running costs - trips & technical tours - elaboration of presentation material 	
Total for 2 workshops	OPTIMAL	MINIMAL
	78 500 €	72 000 €

Curriculum Vitae: Duric Dusko

- 1. FAMILY NAME: DURIC**
- 2. FIRST NAMES: DUSKO**
- 3. DATE OF BIRTH:** 17th March 1949.
- 4. NATIONALITY:** Bosnia & Herzegovina
- 5. CIVIL STATUS:** Married
- 6. EDUCATION:**

6.1	Institution	Civil Engineering Faculty Sarajevo, Bosnia and Herzegovina
	Date	1972 - 1977
	Degree(s) or Diploma(s) obtained	Bachelor of Civil Engineering Department for Hydraulic Engineering
6.2	Institution	International Institute for Hydraulic and Environmental Engineering, Delft, The Netherlands.
	Date	1982
	Degree(s) or Diploma(s) obtained	Dipl. HE Delft, Post graduate Diploma
6.3	Institution	Civil Engineering Faculty, University Zagreb, Croatia
	Date	1987.
	Degree(s) or Diploma(s) obtained	Master degree
6.4	Institution	Mississippi Consortium for International Development, Jackson - Mississippi, USA
	Date	1998.
	Degree(s) or Diploma(s) obtained	Certificate of Completion “ Water Systems Management for Bosnia and Herzegovina, Republic of Srpska Managers”
6.5	Institution	Seattle – Washington in cooperation with the Mississippi Consortium of International Development sponsored by USAID – American Cultural Exchange, Seattle, Washington, USA
	Date	1998
	Degree(s) or Diploma(s) obtained	Certificate of Completion of a four week program in water system management arranged by International Training and Development Institute
6.6	Institution	Faculty of Civil Engineering of Belgrade
	Date	1999
	Degree(s) or Diploma(s) obtained	Ph.D. in Hydraulic Engineering

7. LANGUAGES SKILLS:

N.	Language	Reading	Speaking	Writing
7.1.	Serbian, Bosnian, Croatian	5	5	5
7.2.	English	4	4	4
7.3.	Germany	3	3	3

8. MEMBERSHIP OF PROFESSIONAL BODIES:

- Food and Agriculture Organization of the United Nations
- Yugoslav Hydrological and Hydraulic Society
- Yugoslav Drainage and Irrigation Society
- Expert of EU in the area of water protection and water management

9. OTHER SKILLS:

Expert in a field of open channel hydraulics, ground water hydraulics, Interactions of ground water and urban water, uncertainty of input data for water – supply systems and for ground water analyses, water protection, project management and design.

10. PRESENT POSITION:

- 10.1. Faculty of Architecture and Civil Engineering, University of Banja Luka, Associated Professor in Water Supply and Water Treatment, and Hydraulics Structures
- 10.2. The Institute for Urbanism of Republic of Srpska, Banja Luka, Advisor

11. EMPLOYMENT HISTORY:

- 11.1. 1968 – 1972: Institute of Geodesy, Srajevo, Surveyor
- 11.2. 1977 -1978: Unioninvest, Srajevo, Project director for water supply and water treatment systems
- 11.3. 1978 - 1992: The Institute for Water Management, Sarajevo, Designer
- 11.4. 1992 - 1996: Ministry of Agriculture, Forestry and Water Management, Director of department for water management
- 11.5. 1996 - 2000: The Institute for Water Management of Republic Srpska, Coordinator of World Bank sponsored project for the reconstruction of infrastructural systems in Republic Srpska
- 11.6. 2000 – present: Faculty of Architecture and Civil Engineering, University of Banja Luka, Associated Professor in Water Supply and Water Treatment, and Hydraulics Structures

- 11.7. 2000 – present: The Institute for Urbanism of Republic of Srpska, Banja Luka, Advisor
- 11.8. 2002 – present: Institute of Architecture, Civil Engineering and Geodesy of Faculty of Architecture and Civil Engineering of Banja Luka

12. KEY QUALIFICATIONS:

- Overall experience in working out designs of hydraulic structures, studying of theoretical and practical problems in connection with river basins, flood protection, water and soil protection, water supply, earth and rock fill dams with multiple purpose, protection of water sources, economic analyses of projects, coordination with financiers, contracting, project management, advisory service etc.

13. PROFESSIONAL EXPERIENCE:

Date	1979
Location	Sarajevo, B&H
Company	The Institute for Water Management, Sarajevo,
Position	Designer
Description	International project /Yugoslavia-Albania/ Regulation of river Bojana and Skadar lake - project

Date	1994
Location	Bijeljina, B&H
Company	Ministry of Agriculture, Forestry and Water Management, Director of department for water management
Position	Project director
Description	Analysis of water supply systems in Republic of Srpska

Date	1994
Location	Banjaluka, B&H
Company	Ministry of Agriculture, Forestry and Water Management, Director of department for water management
Position	Project director
Description	Feasibility study for irrigation of agricultural areas in Republic of Srpska

Date	1994
Location	Banjaluka, B&H
Company	The Institute for Urbanism of Republic of Srpska

Position	Member of the Working Team
Description	Spatial plan of Republic of Srpska for period of 1996 to 2001

Date	1998
Location	Banjaluka, B&H
Company	Ministry of Agriculture, Forestry and Water Management, Director of department for water management
Position	Project director
Description	Revitalisation and development of systems for flood protection in Republic of Srpska

Date	September 1998 – November 2002
Location	Banjaluka, B&H
Company	The Institute for Urbanism of Republic of Srpska
Position	Member of the Working Team
Description	Project founded by EU LIFE TCY98/BHZ/165 “Sustainable Rehabilitation of Urban Environmental Systems”

Date	2000
Location	Sarajevo, B&H
Company	The Institute for Urbanism of Republic of Srpska
Position	Member of the Organising group
Description	Priority internal navigation in Balkan region and their connection with European corridors, Collection of works from regional investing forum 2000 – Infrastructure for South-East Europe, International Symposium, Sarajevo

Date	2000
Location	Banjaluka, B&H
Company	The Ministry For Urbanism, Residential and Communal Activities, Civil Engineering and Environment
Position	Member of the Design group
Description	Impact of drought on water resources, Collection of the work from round table - UNFCCC, United Nations Framework Convention on Climate Change

Date	2001
Location	Banjaluka, B&H
Company	Faculty of Architecture and Civil Engineering, University of Banja Luka

Position	Author
Description	Drinking Water Supply - book

Date	2001
Location	Brussels, Belgium
Company	Faculty of Architecture and Civil Engineering, University of Banja L
Position	Member of the Working Team
Description	Member of exper team of EU for the evaluation of projects in the area of water protection and management of water resources

Date	2002
Location	Banjaluka, B&H
Company	Faculty of Architecture and Civil Engineering, University of Banja Luka
Position	Co-author
Description	Dusko Duric, Cedo Maksimovic, Marko Ivetic and Ivan Andjelkovic: Sustainability of Urban Environmental Systems - Code of Practice

Date	January 2002 – present
Location	Banjaluka, B&H
Company	The Institute for Urbanism of Republic of Srpska
Position	Chief of the Working Team
Description	Project founded by EU LIFE 00/TCY00/BiH/000041 “Local Institutional Capacity Development in Evironmental Sensitive Areas” - LICENSE

Date	January 2002 – present
Location	Banjaluka, B&H
Company	The Institute for Urbanism of Republic of Srpska
Position	Member of the Working Team
Description	Project founded by EU LIFE 00/TCY00/BiH/000042 “Institutional Framework for Regional Environmental Development” – INFRA-RED

Proposal 21: *Sustainable water use in newly developed areas*

Project title:	<i>Sustainable water use in newly developed areas</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	The project is a follow-up action of the IHP V programme Theme 7 and is compatible with IHP VI programme Theme 3 (Focal Area 3.5)
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	UNESCO-ROSTE UNEP-IETC
Project proposers	IRTCUD/CUW Belgrade
Partners in the project (consortium – network – from at least two different countries):	A network of SEE countries
Supporting partners (cash and in kind):	IRTCUD - Belgrade, Central and local Governments
Objective:	Development of the local expertise for implementation of sustainability principles in small scale developments. The methodology involves demand managed water supply systems, decentralized waste water collection and treatment (such as constructed wetlands, etc.), Sustainable Urban Drainage Systems (SUDS), waste recycling and local suburban and rural amenities. The methodology will be applicable in residential, tourist and other small scale (new) developments.
Brief description*: *(Attach a separate Case for support - up to 3 pages)	This project is linked to the project No. 9 (Strengthening of Co-operation in South East European Countries for Capacity Building in Urban Water Management) and will be focused on newly developed areas where possibility of exercising new approaches for sustainable urban water management will be tested. (See attached project supporting document.) The SEE countries are faced with decentralized urban, touristic, industrial and civil services developments. The new developments usually solve water supply and waste and storm water collection problems using conventional approaches without consideration of capability and sustainability of designed solution in a long term period. As a consequence, the new developments deteriorate the existing urban environment, water supply and waste water and drainage networks, discharge waste water without any treatment directly into the rivers and seas and therefore induce great treat to the future

	<p>environmental management.</p> <p>It is evident that the new concepts which will change the existing design, construction, maintenance and management paradigm are needed. The emphasis will be placed on environmentally sound techniques.</p> <p>In order to assist the professional community of water and planners specialists and end-users and in comprehending and mastering new technologies, a series of trainings, best practices, models and methods need to be developed, tested and implemented on pilot scale.</p> <p>As the access to sources of updated information axes is extremely limited among end-users and developers, thus the information and methodologies need to be transferred to this end in catchable and understandable ways.</p>
Implementation strategy:	<ul style="list-style-type: none"> • Development of the methodologies appropriate to SEE countries, • Creation of "Codes of Practice", • Trial applications and selected case studies, • Organization of end-users training, • Collection of feed-back information.
Implementation mechanism:	<ul style="list-style-type: none"> • Use of the SEE IRTCUD/CUW network for developing and implementation of new methodologies in selected case studies. • Preparation of guidelines and running of training modules. • Checking of the methodologies in the pilot cases. • Regional consultation and update of information and best practices.
Expected results:	Acceptance of principles of sustainable development in planning, design and development in the region, specially in the newly developed settlements.
Deliverables and availability:	Innovative methodologies, Codes of practice, trained personnel, pilot cases, reports and action plans.
Target beneficiary groups:	Professional community, Planners and developers, End-users, NGOs
Geographical location of the beneficiaries:	SEE countries - according to their interest
Project duration:	3 years
Proposed project coordinator: (attach a brief CV)	SEE IRTCUD / CUW network, Urban Integration Foundation
Proposed project budget: a. Equipment	The total cost is estimated of about 450.000 Euro a. 10%

b. Travel and subsistence c. Personal costs d. Training and dissemination e. Unforeseen cost	b. 15% c. 50% d. 20% e. 5%
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind):	10% in-kind contribution from the beneficiaries and their administrative structures

Case for Support

SUSTAINABLE WATER USE IN NEWLY DEVELOPED AREAS

Prepared by:

Prof. Cedo Maksimovic Coordinator of the IRTCUD/CUW
Network

c.maksimovic@ic.ac.uk

Introduction

The past decades are characterised by significant changes in planning, design and management of urban water resources in both developed and developing countries. It gradually being accepted that lack of quality drinking water and absence of profound wastewater and stormwater management is a limiting factor for sustainable urban development. Traditional techniques are being applied also in the design of new areas thus preventing them from achieving higher level of sustainability. Concerns about environmental impacts of human activities and limited available fresh water induce need for development of alternative solution for managing of urban water in integrated manner. This includes incorporation of new technologies and professional practices in every day urban water management, education of professionals and consumers and changing of existing institutional practices.

Water management in urban areas is governed by an old, traditional technical paradigm developed at the beginning of the 20th century in Europe and North America. Current practices in urban water management have the following nature:

Water supply - sources for water supply are usually nearby surface or underground water which is either treated or untreated before supplying to the customers. Water that satisfy quality criteria for drinking purposes is usually used for water supply as well as for other purposes - in industry, for irrigation, washing, toilet flushing, etc., even though water does not need to be of potable standards for many of these applications. Water losses in the water supply network are very often high due to the bad design and construction and poor maintenance of the network. If demands for water supply are increased solution applied is to draw water from the distant sources and from tapping the aquifers without tackling the problems of the existing leakage and management problem in the system. There is no consistent policy in leakage management.

Wastewater – wastewater originating from domestic wastewater, surface runoff, industrial wastewater and water from part of surface runoff and street cleaning are usually disposed in the combined wastewater systems. That wastewater is most often treated in the central or regional wastewater treatment facilities. In developing countries treatment of wastewater is not common practice, waste water is disposed off without any treatment in the near by water course. Some treatment is practiced only in sporadic cases. Practice of disposing untreated wastewater directly to rivers, lakes and seas represents a big treat to the environment as well as to sustainable urban water management. Wastewater treatment generally produces large quantities of sludge that has to be processed, treated and properly disposed.

Stormwater – Traditionally solution for stormwater drainage is transferring large quantities of water downstream as quickly as possible using piped sewers. This approach is successful in eliminating local flooding problems but increased volumes and peak flows has caused downstream flooding problems, pollution and erosion of the natural receivers.

Urban amenities – Water features, although practiced in earlier periods are often not dealt with in new developments in developing countries.

Urban streams usually serve as ultimate recipient of treated wastewater and untreated surface runoff despite the existence of innovative approaches (C. Maksimovic, J.A.T. Guibert, 2000).

The new developments usually solve water supply and waste and storm water collection problems using conventional approaches without consideration of capability and sustainability of designed solution in a long-term period. As a consequence of this approach, the new developments place additional stress on the existing water supply and waste water and drainage networks, often discharging waste water without any treatment directly into the rivers, lakes and seas and therefore induce even greater treat to the environment.

It is evident that the new concepts that will change the design, construction, maintenance and management paradigm are needed. This concept has limited scope in the existing build-up areas but can be applied in the new development.

Groundwater interactions – Groundwater in urban areas interact with both wastewater and stormwater sewers. This is often not taken in account.

Project Objectives

This project aims at developing of new methodologies for sustainable urban water management in the newly developed settlements appropriate for new development in the transition and developing countries. In order to avoid the shortfalls of the current practices and to assist the professional community of water and planers specialists and end-users, a series of trainings, best practices, models and methods need to be developed.

The new paradigm in urban water management consists of the following:

Water supply – Water supply is dominant concern of urban water management. This concern can be tackled by the innovative concept generally dominated by DEMAND MANAGEMENT which includes water conservation and distribution loss management, optimal utilization of the available water supplies, water reuse and socio-economical interactions. Optimal utilization of available water sources includes measures to control abstractions, artificially recharge groundwater aquifers or encourage the conjunctive use of multiple water sources, which can be sustained. The joint use of two or more sources according to a carefully planned rule can lead to a cheaper supply than that gained by their independent use. Demand management together with distribution loss management through pressure regulation, metering and asset management is a promising way of reducing future water requirements within distribution systems.

The provision of secondary water supply (for toilet flushing, clothes washing) may help compensate the cost of treating and pumping more potable water and could increase the sustainability of the potable water supply in the future. This type of dual water supply system may not be feasible in older water supply systems but can be successfully applied in the newly developed systems. Significant progress can be made in reducing domestic water usage by technological devices, including water saving toilet flushers, shower heads, washing machines and dishwashers, and reuse of water in washing machines and dishwashers. Further reduction is feasible with water reuse for different processes (moving from the highest quality towards the lowest) and use of additional (sub-potable) water supplies. Rainwater and grey water can be used for sub-potable water supply, usually after some pre-treatment (filtration and disinfection). Black waters can be also reused in agriculture and landscape irrigation.

Industry operations offer many opportunities for water reuse and recycling. With appropriate planning and process analysis minimal treatment may be required for reuse (ultrafiltration, activated carbon filtration, reverse osmosis systems, etc.).

Agriculture – increase sustainability of fresh water supplies include the use of rainwater for washing and animal drinking, and treatment of wash water for reuse in irrigation and manure flushing.

Integrated water supply requires integration of water resources and development of interconnecting transport networks, water conservation measures based on public education and development of water saving techniques in all sectors, and utilization of alternative water resources. Such resources include

wastewater reuse, collection of surface runoff/rainwater for groundwater recharge and other purposes and desalination of brackish and salt waters.

Wastewater – Solution for improving the sustainability of wastewater management is separation of wastewaters at the source and their reuse. This separation upgrade the efficiency of the end-of pipe treatment processes and facilitates wastewater recycling and retention and extraction of nutrients from solids, with subsequent reuse in agriculture. When wastewaters are separated at the source, blackwater is treated as using aerobic bioreactors, while greywater can be treated in such simple systems as wetlands or sand filters and reused.

Sustainability in wastewater management can be achieved by reuse of the water and nutrients in the wastewater for agriculture or aquaculture. To achieve this industrial wastes must be separated, treated (and reused) and not discharged with domestic wastewater. Domestic water is separately collected, treated and reused. Reuse of wastewater can be done in many different ways – reuse of cooling water, reuse of wastewater in agriculture and irrigation, enhancement of wetlands habitat, groundwater recharge, aquaculture and fisheries, and sub-potable water supply (Ref. IETC (2001)).

In the case of decentralized and small settlements innovative solutions of decentralized treatment are becoming feasible and are considered sustainable. In the SEE they are not used because of the lack of awareness and appropriate local expertise.

Stormwater – The new approach in stormwater drainage is management of stormwater on a catchment-scale basis including incorporation of the concepts of “source control”. In the source control (or SUDS) schemes, stormwater is not immediately discharged but is stored, treated, reused or discharged locally, close to its point of generation. In this way the volume of runoff is significantly decreased and quality increased.

Special emphasize will be given to education and training of end-users and developers as the information axes is extremely limited in the low level (end-users and developers). The information needs to be addressed to this end in catchable and understandable ways.

The project is a follow-up action of the IHP V programme Theme 7 and is compatible with IHP VI programme Theme 3 (Focal Area 3.5).

Project Actions, Means and Benefits

Development of the local expertise for implementation of sustainability principles in small-scale new developments. The methodology involves demand managed water supply systems, decentralized waste water collection and treatment, SUDS, waste recycling and local suburban and rural amenities. The methodology will be applicable in residential, tourist and other small-scale developments.

The project actions will include:

- Use of the SEE IRTCUD/CUW network for developing and implementation of new methodology applicable for use in the new developments,
- Research into development of the technologies appropriate for the local conditions,
- Preparation of guidelines and training modules,
- Checking of the methodologies in the pilot cases,
- Organization of end-users training,
- Regional consultation and update of information and best practices.

Expected Project Results

Expected project results are:

- Developed and tested local solutions for the innovative-sustainable urban water small scale systems;
- More comprehensive planning, design and development in the region, specially in the newly developed small scale settlements;
- Pilot cases which will be source for collecting of feed-back information;
- Training material developed on the innovative methodologies on urban water management;
- Codes of practice for various water and environment subsystems;
- Trained personnel, including end-users, to be able to use the new methodology.

Target beneficiary groups

- Professional community (planners, designers, consultants, governmental service, environmental agencies) in urban water and complementary environmental areas
- Consumers

Management and Resources

Project will be managed and coordinated by Professor Cedo Maksimovic.

Budget

Total budget of the project in 450 000 Euro broken down as follows:

	Amount (Euro)
Equipment	45 000
Travel and subsistence	67 500
Personal costs	225 000
Training and dissemination	90 000
Unforeseen cost	22 500
Total	450 000

References

- Frontiers in Urban Water Management: Deadlock or Hope, Edited by C. Maksimovic and J.A. Tejada-Guibert, Published by IWA Publishers, 2001
- UNEP-IETC: Sustainable Wastewater and Stormwater Management, Published by IWA Publishers, 2001

Curriculum Vitae: Čedo Maksimović

Personal data

Date of birth: 28th February 1947

Place of birth: Glamočani, Srbač, Bosnia and Herzegovina, Yugoslavia

Parents: Father Teodor, Mother Zorka

Marital status: Married: wife Kovinka, economist

Children: 2 daughters: Ivana and Biljana

Citizenship: Yugoslavia

Home address: 44 Hanover Steps, London W2 2YG, UK

Address at work: Imperial College of Science and Technology, Department of
Civil and Environmental Engineering, London SW7 2BU, UK

Telephone: + 44 207 594 6036

Fax +44 207 225 2716

email: c.maksimovic@ic.ac.uk web site ewre-www.cv.ic.ac.uk

Education and degrees

Elementary school: (8 years): 1954 - 1962 in Srbač, Yugoslavia

Secondary school: Technical college - (4 years): 1962 - 1966 in Belgrade

University: Faculty of Civil Engineering: Department of Hydraulic Engineering Belgrade
(5 years programme: 1966 - 1971)

Postgraduate course: MSc course (2 years) and MSc thesis: Effect of Turbulence on Local Scour -
University of Belgrade, (1976)

DSc (PhD) thesis: Preparatory phase in UK (Hydraulics Research Station - Wallingford, DAMPT
Cambridge, Department of Civil Engineering University of Newcastle upon Tyne,

Thesis: Effect of Polymer Solutions on Development and Characteristics of a Boundary Layer and on
Drag Reduction, presented at the University of Belgrade 1981

Teaching and research positions held between 1971 and 2000

Subjects: Fluid Mechanics, Hydrometry - Measurements in Water Engineering and Urban Drainage
at the Faculty of Civil Engineering - Belgrade

1971-1973 Research Associate (hydraulic laboratory, scale models, hydraulic structures etc.)

1973-1981 Teaching and research assistant (Fluid Mechanics, Fundamentals of Water
Engineering, Computer Programming)

1981-1988 Associate Professor (Fluid Mechanics, Hydrometry, Urban Drainage)

1988 - 1996 Professor (Fluid Mechanics, Hydrometry, Measurements in Water Engineering,
Urban Drainage,)

1996 - present Visiting Professor, Imperial College, London (lecturing at UG and MSc courses, supervising MSc and PhD students and coordination of contracted research)

Managing positions:

1981-1983 Deputy Director of the Institute of Hydraulic Engineering (41 employees)

1983-1987 Manager of the Institute of Hydraulic Engineering (43 employees)

1987-1991 Vice-Dean of the Faculty of Civil Engineering (220 employees)

1987-1989 Coordinator of IRTCUD - UNESCO sponsored International Research and Training Centre on Urban Drainage (establishment of the Centre, business development, initiation of projects, international networking, coordination of research)

from 1989 Director of IRTCUD/IRTCUW network (research, training and technology transfer, coordination of research projects, development of training tools, organization of international scientific meeting, training courses, publishing)

Current positions:

- Visiting Professor (Professorial Research Fellow) - EWRE - Environmental and Water Resources Engineering Section, Department of Civil Engineering, Imperial College of Science, Technology and Medicine, London, UK ewre-www.cv.ic.ac.uk
- In charge of IRTCUD System - UNESCO sponsored International Research and Training Centres on Urban Drainage in Belgrade with Regional sub-centres: for Tropical Climates - Sao Paulo, Brazil, for Cold Climates - NTNU/SINTEF Trondheim, Norway and for Arid Climates - under formation in the Middle East with CUW-UK Technology Transfer Unit in London UK. Co-operation with WMO, UNEP, UNDP,
- Editor in Chief of URBAN WATER The International Journal Published quarterly by Elsevier Science – Oxford UK (www.urbanwater.net)
- Chairman of the NGO “6E&6I” (6Es are: Expertise spreading in Environment, Energy, Economy and Education through Evolutionary approach in 6Is: Innovations, Informatics, Interactions, Institutions, Instrumentation aiming at International standards) fostering creative multidisciplinary

Languages: - in addition to mother tongue (Serbian or Serbo-Croat)

(S - Speaking, W - Writing, R - Reading and Understanding, L - Lecturing)

English (S, W, R, L), French (S, R, - fair), German (S, R, -fair), Russian (S, R,)

- fair understanding of other Latin originated languages: Italian, Spanish, Portuguese, Romanian,

and fair understanding and speaking of the other slavonic languages: Bulgarian, Czech, Macedonian, Polish, Slovak, Slovenian, Ukrainian.

Membership in International Scientific Committees and Working Group:

WMO (World Meteorological Organization) - WMO Rapporteur on Operational Hydrology in Urban Areas (1993- 1996),

IAHR/IAWQ Joint Committee on Urban Drainage - International Working Group on Data Models (chairman of the IWGDM 1984 -2000), and Chairman of the Mediterranean Group for Urban Hydrology,

Editor and Member of Editorial Board of International Journals:

URBAN WATER -Co-Editor-in-Chief, Elsevier (initiated and launched)

WATER RESOURCES MANAGEMENT, Kluwer Academic Publishers, (Editorial Board Member)

Prizes Awards and Recognition

Three awards of the “Jaroslav Cerni” fond for the best achievements in the undergraduate and MSc course at the Faculty of Civil Department of Hydraulic Engineering, Belgrade Yugoslavia

IAHR <http://www.iahr.nl> Lecturer of the year 2001 award:

Major fields of research and professional activities

Applied fluid mechanics, hydraulics, hydrology, hydrometry, water resources and environmental engineering :

- urban water infrastructure systems, water supply systems, demand management, surface runoff - urban drainage and its interaction with ground waters and infrastructure systems, source control, integrated urban water systems' operational management of environmentally sensitive systems
- GIS and remote sensing applied in urban water infrastructure systems,
- metrology (reliability and accuracy of measurements in hydrodynamics) in open channels, urban and natural catchments, pressurized systems, network analysis, diagnosis of water balance and leakage in networks,
- turbulence, transport processes, diffusion and dispersion, pressure fluctuations, drag reduction, fluid-structure interaction,
- flow measuring instrumentation
- development of multimedia training tools and running training programmes,
- international projects (concepts, initiation, management, training and technology transfer)

International lecturing and training

Applied hydrodynamics in water supply and urban drainage, merging measurements with advanced modelling of urban water systems, GIS in urban waters, applied metrology in water resources systems, informatic support, sensitivity analysis of model parameters, new technologies in demand management of water supply systems.

Lecturing and training done in the following countries: Austria, Belgium, Brazil, Bulgaria, Canada, Czechoslovakia, Egypt, Estonia, Finland, France, Germany, Greece, Holland, Hungary, India, Iran, Italy, Japan, Norway, Malaysia, Malta, Palestine, Poland, Taiwan, Turkey, Spain, Sweden, Switzerland, UK, and USA, Yugoslavia (all republics ex-YU).

Internationally accepted software products

Several software products conceptualized and supervised are present in the international academic community:

- UDM - International data bank on rainfall-runoff modelling,
- UDM-Italiana - Italian National Data Bank on Rainfall and Runoff,
- EBEMUS - educational software for training in sensitivity analysis of rainfall-runoff modelling,

Research projects in UK (after 1996)

1. CIRA (UK) - RP555 Construction Industry Research and Information Association project:
2. SUSTAINABLE URBAN RUNOFF MANAGEMENT
3. EPSRC (UK) - Engineering and Physical Sciences Research Council project (Fellowship): Modelling the Management of Street Surface Contaminants in Urban Runoff (till January 1998)
4. EPSRC (UK) The major WITE project: Monitoring, Modelling & Leakage Management in Water Distribution Networks, (started October 1998)
5. EPSRC (UK) Inverse Transient Analysis in Pipe Networks for Leakage Detection Quantification and Roughness Calibration (Started July 1999)
6. UNEP - IETC - Osaka- Environmentally Sound Waste Water and Storm Water (CUW-UK project)
7. EU LIFE project: Sustainable rehabilitation of urban environmental systems (exercised through ICON and UZRS - Institute for Urban Planning, Banja Luka, Republic Srpska 1998-2001)
8. EU LIFE project: Local Institutional Capacity Development in Environmentally Sensitive Areas (LICENCE) (to be exercised through ICON and UZRS - Institute for Urban Planning, Banja Luka, Republic Srpska for 2002-2005)

Selected international research projects (accomplished earlier) - coordination or participation

1. COMETT 2 (EC) Project 4991-Cb: Advanced Computer Techniques for Urban Storm Drainage
2. UNESCO/IHP IV M.3.3.b. Project: Urban Runoff and Drainage in Different Climate: Tropical, Arid or Semi-arid and Cold
3. UNESCO/IHP IV M.3.3.a. Project: Integrated Water Management in Urban Areas
4. WMO project: Operational Hydrology in Urban Conditions
5. Bilateral Project: Surface Runoff Water Quality (with University of Lund, Sweden)
6. TEMPUS Project (EU) - coordinator, 2424-91: Upgrade of Engineering Curricula in Advanced Information Systems for Environmental Improvement in Hydraulic Engineering
7. TEMPUS Project (EU) 266-90 (coordination of one theme): Environmentally Sound River Basin Development
8. CALWARE (EU - Techware) Project: Computer Aided Learning in Water Resources (participation in the sub-project: Urban Drainage)
9. Master Drainage Plan for Upper Tiete River – Sao Paulo, Brazil
10. Real Time Control in Storm Drainage systems with large underground storage- Strategic technological development, Toshiba, Japan (1999-2000)

Books authored and co-authored:

A. Books authored and co-authored, published by international publishers

1. C. Maksimovic and B. Jaksic (2001) (Editors and authors): Sustainability of Water and Environmental Systems Rehabilitation, Proceedings of the LIFE International Conference, Banja Luka 22-24 September
2. C. Maksimovic, J. A. Tejada-Guibert, (editors and authors) Frontiers in Urban Water Management -Deadlock or hope, Book published by International Water Association 2001
3. J. A. Tejada-Guibert and C. Maksimovic (editors) Frontiers in Urban Water Management - Deadlock or hope, Proceedings of the Workshops held at the UNESCO Symposium, Marseille June 2001, Published by UNECO/IHP, Technical documents in Hydrology No.45
4. L. Bentsson, J. Milina, V.Lobanov, C. Maksimovic, J. Marsalek, M. Viklander, (2001) Urban Drainage in Cold Climate, (Edited by S. Sveinung, J. Milina, S. T. Thorolfsson), Vol. 1 of the UNESCO Series: Urban Drainage in Specific Climates, Editor-in-Chief : C. Maksimovic
5. B. P. F. Braga, Jr. A. Canholi, N. Campana, M. N. Desa, P. S. Dias, R. Frendlich, J. Gofdenfum, J. Kalman, C. Maksimovic, M. F. A. Porto, M. R. La Porto, C. E. M. Tucci, A. L. L. de Silvoira, A. Villanuova (2001), Urban Drainage in Humid Tropics (Edited by C. E. M. Tucci) Vol. 2. 1 of the UNESCO Series: Urban Drainage in Specific Climates, Editor-in-Chief : C. Maksimovic
6. A. Al-Abdulali N. Carmi T. Hanna C. Maksimovic M. Nouh, A. Al-Quarch A. Al-Shamsy J. Simons (2001) Urban Drainage in Arid and Semi Arid Climates, (Edited by M. Nouh), Vol. 3 of the UNESCO Series: Urban Drainage in Specific Climates, Editor-in-Chief : C. Maksimovic (In press)
7. Hydroinformatics in Planning, Design, Operation and Rehabilitation of Sewer Systems (1998) (editor and co-author) ASI Series, Edited by J. Marsalek, C. Maksimovic, E. Zeman and R. Price, Published by Kluwer,
8. M. Vignolles, E. Woloszyn, J. Niemczynowicz, C. Maksimovic, J. Marsalek: Rain and Floods in Our Cities (author and chief editor) - World Meteorological Organization, Geneva, Switzerland, 1996
9. F. Calomino, C. Maksimovic, B. Molino: Urban Drainage (editor and author),, Experimental Catchments in Italy Printed by Editoriale Bios, Italy 1995.
10. C. Maksimovic, M. Radojkovic: Fundamentals and Application of Urban Storm Drainage (IRTCUD series of lecture notes for the international training courses, Printed by the Int. Centre for Water Resources -Perugia Italy) 1992
11. A. Ichikawa and C. Maksimovic (authors and editors) Urban Runoff and Its Reduction (editor and author) - in Japanese-.Published by Kashima Publishers, Tokyo, 1988
12. C. Maksimovic and M. Radojkovic: Urban Drainage Catchments. Published by Pergamon Press, Oxford, 1986

B. Books authored and co-authored, published in Yugoslavia

1. C. Maksimovic: Merenja u hidrotehnici (Measurements in Water Engineering) (1993), Publ. by Faculty of Civil Engineering, Belgrade,
2. C. Maksimovic, A. Spoljaric, S. Djordjevic, D. Prodanovic, A. Tomanovic (1993): Zbirka zadataka iz Mehanike fluida - Solved Problems in Fluid Mechanics, Publ. by Faculty of Civil Engineering, Beograd
3. G. Hajdin, C. Maksimovic, M. Ivetic, A. Spoljaric (1990): Solved Problems for Student Practicals in Fluid Mechanics}, Publ. by Naucna knjiga, Beograd,

4. D. Obradovic, M. Radojkovic, C. Maksimovic: *Primena racunara u komunalnoj hidrotehnici - (Computer Aided Design of Water Supply and Sewer Systems)*, (1989) Publ. by Gradjevinska knjiga, Belgrade,
5. C. Maksimovic: *Hydrodynamic Measurements and Data Processing (IRTCUD lecture notes for the international training courses on water engineering)*

Books edited and co-edited:

1. *Frontiers in Urban Water Management - Deadlock or Hope (2001)*, Proceedings of the UNESCO Symposium, (Edited by C. Maksimovic and J. A. Tejada-Guibert) Marseille, France, 18-21 June,
2. *Developments in Urban Drainage Modelling*, (1999), Special Issue of the *Water Science and Technology*, Vol. 39, Number 9 ISSN 0273-, Editors D. Butler and C. Maksimovic
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Papers in Scientific and Professional Meetings:

Belgrade Workshop, 14-16 March, 2002

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Proposal 22: *Integrated models for urban water scenario planning*

Project title:	<i>Integrated models for urban water scenario planning</i>
Title (number) of the Urban Water Management component within IHP VI Program*: (Focal Area 3.5) (*see the attachment)	Integrated urban water system interactions (Number 4)
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	
Project proposer	Prof. Dragan Savic (University of Exeter, UK)
Partners in the project (consortium – network – form at least two different countries)	Prof. Godfrey Walters (University of Exeter, UK), Prof. Bruce Beck (University of Georgia, USA), Prof. David Butler (Imperial College, UK), Prof. Claudia Pahl-Wostl (University of Osnabrück, Germany) and Dr Manfred Schütze (Institut fuer Automation und Kommunikation, Germany).
Supporting partners (cash and in kind)	Research Councils in partner countries, private water companies from developed countries and governments
Objective:	To provide integrated modelling tools which will include consideration of technical, social and environmental issues, to support complex decisions for effective integrated urban water management and, by improving the understanding of the problem, to empower the users (public, authorities, service providers) and help capacity building
Brief description*: *(Attach a separate Case for support - up to 3 pages)	See attached project description.
Implementation strategy:	Research and educational activities
Implementation mechanism	Collaborative research and appropriate educational/communication means
Expected results	Decision support tools for integrated urban water management
Deliverables and availability	See attached project description
Target beneficiary groups	Engineering and management institutions in charge of water systems in developing and developed countries
Geographical location of the beneficiaries	Developing and developed countries including countries in transition.

Project duration	3 years
Proposed project coordinator (attach a brief CV)	Prof. Dragan Savic
Proposed project budget: f. Equipment g. Travel and subsistence h. Personal costs i. Dissemination Other (specify)	The request for funding is for \$1,544,981 (details given in the accompanying case for support). The minimum required funds for the proposal to proceed will be of the order of \$250,000 (with reduced objectives).
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)	Matching funding from industry and research councils

Case for Support

INTEGRATED MODELS FOR URBAN WATER SCENARIO PLANNING

Prepared by	Prof. Dragan Savic	University of Exeter, UK (d.savic@ex.ac.uk)
	Prof. Bruce Beck	University of Georgia, USA (beck@smokey.forestry.uga.edu)
	Prof. David Butler	Imperial College, UK (d.butler@ic.ac.uk)
	Prof. Claudia Pahl-Wostl	University of Osnabrück, Germany (pahl@usf.uni-osnabrueck.de)
	Dr Manfred Schütze	Institut fuer Automation und Kommunikation, Germany (mas@ifak.fhg.de)

Introduction

Since the Earth summit in Rio de Janeiro in 1992 it has become obvious that there can be no global sustainable development without sustainable settlement (UNEP, 1992). However, today the issue of urban environmental sustainability is becoming critical because urbanisation and its associated environmental impacts are occurring at an unprecedented rate. In 1900 just fourteen percent of the world's population lived in cities, but by the year 2000 that number was estimated to reach over fifty per cent (Okun, 1991). Urbanisation brings increased demand for energy, raw materials and results in pollution and production of waste. It also brings an enormous pressure on water as natural resource, thus stressing the necessity of a well-organised *Integrated Urban Water Management (IUWM)* programme. It is not surprising then that governments around the world are urged to take action on the formulation and implementation of policies for the integrated management of water resources in large cities and towns, to control pollution from sewage and effluents; and to protect groundwater from over-utilisation and pollution (UN, 1996).

Although the river catchment has been acknowledged to be the appropriate unit of analysis to address the challenges facing water management, modelling at the urban scale can provide essential information for policy makers in their decisions on allocation of resources. Therefore, IUWM has to be researched as a vital component of the integrated water management at a catchment scale. *Integrated urban water management means that in the planning and operation of urban water management, consideration should be given to the interaction and collective impact of all water-related urban processes.* The impacts are particularly important for human health, environmental protection, quality of receiving waters, water demand, affordability, equity, recreation, and stakeholder satisfaction.

Integrated urban water management covers a range of domains from technological to social. It requires involvement by stakeholders such as those responsible for water supply and sanitation services, storm water and solid waste management, regulating authorities, consumers (domestic and industrial) and the general public. Effective IUWM implies having the right information about possible impacts of water-related urban processes on time and easily accessible; it also means being aware of the social environment that ultimately could determine whether IUWM policy would either succeed or fail. The 'social environment' in this case includes both government administrations and

'the public'. *To address IUWM in a coherent and comprehensive manner the integration of the social issues with the technical, engineering and hydrological issues is necessary.*

This project aims to develop conceptual modelling tools for integrated water management in urban areas including water supply and distribution, wastewater, stormwater, and groundwater. The tools will be developed to support decision making processes (by exploring the decision process, futures, patterns of technological/infrastructure adoption, etc.) for both developing and developed countries, i.e. countries with no or minimal sanitation and sewerage provision as well as those with pollution problems due to overloaded sewerage systems. *It is hoped that the tools will promote - within the general public - a broader awareness of the issues and a deepening sense of responsibility for doing something about them.*

Project Objectives

Overall Objective: This project aims to provide integrated modelling tools, which are based on systems analysis and will include consideration of technical, social and environmental issues, to support complex decisions for effective integrated urban water management and, by improving the understanding of the problem, to empower the users (public, authorities, service providers) and help capacity building.

Specific Objectives

- 1) To develop the conceptual model of the entire urban water cycle (that will provide information and the capacity to use it to make policy and predict responses).
- 2) To develop the tools that will perform the detailed analysis of the uncertainty in the modelling results and the risk in the model-based water management decisions.
- 3) To integrate the conceptual model (see 1 above) with ideas of agent based modelling to provide integration of technical and socio-economic considerations.
- 4) To develop educational tools, especially in a participatory sense, following on from (3).

Programme of Work

There are individual models for individual elements of the urban water cycle, e.g. water supply and distribution, wastewater, stormwater, and groundwater. Although there are models which integrate several of those elements (FWR, 1998; Schütze et al., 1999; Gill, et al., 2001), truly integrated urban water management models to evaluate the overall effectiveness of alternative management scenarios do not exist. These models need to be integrated with each other at different scales and need to consider not only technical, but also social and environmental issues (Pahl-Wostl, 2002; Tillman et al., 2001).

A thirty-six month programme is proposed in order to develop the modelling and educational tools. The work packages divide up as follows:

(1) Development of Conceptual Model

The project will start by combining the clean water (Savic et al, 2000) and wastewater (Schütze et al, 2002) sides of the urban water cycle, with a balanced level of system description in each of the sectors (abstraction, water treatment, water supply, households, sewer network, wastewater treatment, groundwater, surface water).

In order to develop integrated management tools that include the human, natural and technical dimension, a systems approach will be used (Beck, 1997). A true systems approach recognises the individual components as well as the linkages and interactions between them, and that a disturbance at one point in the system will be translated to other parts of the system. Sometimes the effect on another part of the system may be indirect, and may diminish due to natural resilience and disturbance. Sometimes the effect will be direct, significant and may intensify as it propagates through the system.

The main problems with integrated modelling are (after Geldof, 1997):

- (a) *Complexity* (the number of components within integrated water management is large and the interactions between the components are extensive and complicated).
- (b) *Subjectivity* (the information obtained about the system is not always free of values, i.e. it is often biased, and it is necessary to weigh things up against each other).
- (c) *Uncertainty* (it is impossible to collect and process all the information about the complex system).

(2) Analysis of Complexity, Risk and Uncertainty

The major research challenge here is to model complexity and uncertainty (input, model and output), i.e. to combine uncertainty in model predictions (and the quantification of this uncertainty) with uncertainty of technological and socio-economic models (including subjectivity). The proposers will utilise their experience in dealing with model uncertainty (Beck, 1987, Kapelan et al., 2001) starting from expressions for parameter and prediction uncertainties based on first-order approximations using Taylor series expansion. These will be verified using the Monte-Carlo simulations (MCS) technique, which is more accurate for the case of strongly non-linear systems. In addition to MCS, accurate, non-linear parameter or model prediction uncertainties can be calculated using some optimisation based approach. However, both MCS and optimisation approach are computationally far more expensive than the first-order approximation approach (Kapelan et al., 2001).

The aforementioned uncertainty analysis techniques will be extended by considering the conceptual model as a tool that will provide the mechanism for propagating a set of uncertain input factors – namely, process parameters, initial conditions, and forcing functions – into the future. Various sampling-based methods for identifying and ranking the importance of these factors in influencing the speculated future behaviours will be analysed, e.g. Regionalised Sensitivity Analysis, Tree Structured Density Estimation, Uniform Coverage with Probabilistic Rejection algorithms, etc. (Osiedle and Beck, 2002).

(3) Integration of Conceptual Model with Socio-Economic Considerations

External influences (e.g. socio-economic models describing regulation, public opinion, social exclusion, institutional barriers, etc.) have not yet been effectively addressed in modelling overall performance and trends in technological change.

Agent based models are a very promising approach to including the human dimension into integrated models in a more realistic fashion. Agents, in this context, are autonomous software systems that are intended to describe the behaviour of observed social entities (e.g. individuals, organisations, government agencies). An enormous advantage of agent based modelling is the ability to assess the plausibility of the behaviour of agents, the ways in which the agents interact and the consequences of that behaviour and interaction. Human beings may also change the rules under which they operate, they have subjective valuation schemes and mental models on which they base their decisions. Hence, the design of socio-technical systems poses new challenges to planners and engineers (Johnson, 2001; Pahl-Wostl 2002) and the combination of agent based modelling and stakeholder participation is a new conceptual and methodological approach to meet these challenges.

(4) Development of Educational Tools

The proposers will produce didactic material, including innovative educational multimedia software and telematic applications, and run training programmes for selected target groups in various economical and geographical conditions. These activities will facilitate capacity building by using the tools and material developed in the project.

Management and Resources

Management of the project will be the ultimate responsibility of Professor Savic. The project steering committee will consist of all five leading collaborators. The committee will meet every six months although the advice and assistance of individual members will be sought where necessary between these meetings.

Support is requested for a three-year programme of research to develop conceptual modelling tools. This multi-discipline, multi-centre project, which necessarily involves active research collaboration and with an ambitious dissemination programme, requires a significant management input. A post-doctoral research associate at Exeter University will fulfil this requirement on a day-to-day basis.

The complexity of the work requires full time post-doctoral input in all five institutions. Funds are therefore requested for 36 months of PDRA time to complete the theoretically and computationally intensive work. Past experience has shown that truly collaborative projects of this type require substantial travel and subsistence funding in order that staff at the collaborating institutes can spend the necessary time working together. Significant travel and subsistence budgets are therefore requested.

a. Financial resources required

	Total \$US
Staff	908,487
Travel and subsistence	117,000
Equipment	65,250
Sub-total	\$1,090,737
Indirect Costs	454,244
Total	\$1,544,981

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DOB: 22 April 1960

Education:

- PhD, 1987-1990, University of Manitoba, Winnipeg, Canada (Civil Engineering)
- M.Sc, 1984-1987 (part-time) University of Belgrade, Belgrade, Yugoslavia (Civil Engineering)
- Dipl. –Ing, 1978-1983, University of Belgrade, Belgrade, Yugoslavia (Civil Engineering)

Membership of Professional Association:

- Chartered Engineer (CEng), UK
- Member of the Chartered Institution of Water and Environmental Management (CIWEM)
- Member of the British Hydrological Society (BHS)
- Member of the International Water Resources Association (IWRA)
- Member of the International Association of Hydrological Sciences (IAHS)
- Member of the International Association of Hydraulic Research (IAHR)
- Member of the International Water Association (IWA)
- Member of the American Geophysical Union (AGU)

Employment History:

- January 2001 to present: Professor of Hydroinformatics, University of Exeter, UK.
- January 1994-December 2000: Research Fellow/Lecturer/Senior Lecturer, University of Exeter, UK.
- April 1991-December 1993: Lecturer, University of Novi Sad, Yugoslavia
- April 1991-December 1993: Project Manager, Energoprojekt Consulting Group, Belgrade, Yugoslavia.

- October 1990-March 1991: Hydraulic/Hydrologic Engineer, KGS Group, Winnipeg, Canada.
- September 1987-Sept 1990: Research/Teaching Associate, University of Manitoba, Winnipeg, Canada.
- November 1983-August 1987: Junior/Senior Engineer, Energoprojekt Consulting Group, Belgrade, Yugoslavia

Publications:

Co-author of 1 book, 1 book chapter, over 150 papers in refereed journals and conference proceedings, and co-editor of 2 conference proceedings.

Research Funding Received:

Recipient of over £1M in research funding since 1994.

Journal Editorial Board Membership:

- Associated Editor, Journal of Water Resources Planning and Management, American Society of Civil Engineering (ASCE), 2000-present.
- Water International (quarterly peer-reviewed journal of the IWRA), 1999-present.
- Journal of Hydroinformatics (the official journal of the IAHR and IWA), 1999-present.
- Acta Hydrotechnica 2001-present.

Research Grant Review:

- Reviewer, Engineering and Physical Sciences Research Council, UK
- Reviewer, Australian Research Council
- Reviewer, National University of Singapore
- Reviewer: US Civilian Research and Development Foundation
- Reviewer: Australian CRC for Water Quality and Treatment

External Examining:

- Examiner, PhD by research, Imperial College, UK.
- Examiner, PhD by research, Lancaster University, UK.
- Examiner, PhD by research, The University of Central Queensland, Rockhampton, Australia (3 candidates)
- Examiner, PhD by research, The University of Adelaide, Adelaide, Australia (3 candidates).
- Examiner, PhD by research, The University of New South Wales, Australia (1 candidate).

Proposal 23: Integrated Water Quality Modelling in Distribution Systems

Project title:	Integrated Water Quality Modelling in Distribution Systems
Title (number) of the Urban Water Management component within IHP VI Programme*: (Focal Area 3.5) (*see the attachment)	Focal area 3.5, Theme 4
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	The project is compatible with the UNESCO and UNEP action programs (as HELP), as well as with directives and regulations established by European Union and United States Environmental Protection Agency
Project proposer	Imperial College and Sheffield University, UK CUW Network
Partners in the project (consortium – network – from at least two different countries)	<ul style="list-style-type: none"> • Urban Water Research Group in the Environmental and Water Resources Engineering Section, Department of Civil and Environmental Engineering at Imperial College (London,UK) • Penine Water Group at Sheffield and Bradford University • IRTCUD/CUW Network, focal points Sofia and Belgrade • Cranfield University (bio-film aspect)
Supporting partners (cash and in kind)	In kind support expected from the United Kingdom Water Industry companies
Objective:	Improving of understanding, modelling and management of water quality in water distribution systems by development and testing of new generation Water Quality Modelling Tools (WQMT). The model will be generic in nature, capable of handling any particular type of water and a particular distribution network to be able to predict accurately the water quality degradation along the system by tackling biological and chemical processes. Based on that, model will be able to provide guidance for improvement of both water treatment at the source and management of the system itself in order to prevent unfavourable ageing and degradation of water quality of the system.
Brief description*: *(Attach a separate Case for support – up to 3 pages)	See the Attachment

Implementation strategy:	Research tool, 2D turbulence transport based water quality model (2D-WQMT) in a single pipeline, will be developed. The model will be experimentally calibrated and validated. The knowledge from the 2D turbulence model will be extended to 1D water quality models which can be used in real water supply networks.
Implementation mechanism	<p>Development of the WQMT is split into five major phases:</p> <ul style="list-style-type: none"> • Development of 2D integrated water quality model • Laboratory testing programme for module development • Development and evaluation of modules • Improvement of 1D models using results obtained from 2D models • Final analysis of collected data and software validation • Production of final report and analysis of trends and future research needs
Expected results	<ul style="list-style-type: none"> • Developing of simplified 1D water quality modules which will be compatible with existing software packages (EPANET or others) and will allow water utilities to use it in the actual management of their systems. The models will incorporate complex processes (physical, chemical and biological) and their mutual interactions considering special management module with the effects of operational management on water quality (frequency of flushing, scrubbing, precipitation, biofilm growth and detachment from the walls, pipe corrosion, dissolution of lead and copper, free chlorine decay, chlorine residuals formation and sedimentation).
Deliverables and availability	<ul style="list-style-type: none"> • Annual progress reports, where the main results will be presented, will be issued • Publication of papers in academic and professional international journals • Attendance and presentation of papers at international and national conferences • Final report and educational version (public domain)
Target beneficiary groups	<ul style="list-style-type: none"> • Municipal organizations responsible for water supply, treatment management • Water companies • Consumers
Geographical location of the beneficiaries	Developing and developed countries including countries in transition.

Project duration	30 months (2.5 years)
Proposed project coordinator (attach a brief CV)	Prof. Adrian Saul and Prof. Cedo Maksimovic
Proposed project budget: j. Equipment and laboratory rig k. Travel and subsistence l. Personal costs m. Dissemination Other (specify)	Proposed project budget: 850 000 Euro a) 170 000 Euro b) 127 500 Euro c) 467 500 Euro d) 85 000 Euro
Possible contribution to the project by beneficiary or from other sources (both cash and in-kind)	It is expected that interested water companies will contribute up to 10 – 15 % (in kind costs).

Case for Support

INTEGRATED WATER QUALITY MODELLING IN DISTRIBUTION SYSTEMS

(A joint proposal of Imperial College (IC) and Bradford and Sheffield University (SU))

IC: Prof. Cedo T. Maksimovic ; SU: Prof. Adrian J. Saul

Prepared by:

Prof. Cedo Maksimovic Coordinator of the IRTCUD/CUW Network c.maksimovic@ic.ac.uk

Introduction

The distribution of drinking water has become a technological challenge from both quantitative and qualitative aspects. Consumers have to be supplied without interruption with an adequate flow and with water complying with all the qualitative parameters of the drinking water standards. Distribution system is a big bio-chemical reactor, subject to continuous variations in hydrodynamic status, which affects the chemical and biological processes, transport of the deposited material, biofilm development and decay. The characteristics of the process are not yet well known. The increased public awareness for the quality of water, as well as the generation of increasingly strict water standards raised interest on qualitative aspects and concerns on its acute and cumulative effect on public health. There is no reliable model in the world that meets the needs. This project aims at development of a breakthrough model of the new generation.

Water quality problems and causes. The whole Water Distribution System (WDS) operates as a “dynamic gigantic reactor” in which numerous chemical, physical and biological processes occur. Despite the fact that when leaving modern water treatment facility water quality meets all standards and criteria, water quality can deteriorate dramatically. Many complex and interrelated factors influence water quality decay in WDS (Besner et al., 2001) some of which are difficult to correlate and it often happens that tap water is a reason for serious public health concern. Problems that utility customers notice immediately are taste, odour and discoloration. These can be caused by chlorination, microbial intrusion during low pressure periods and growth, or by pipes corrosion. Of primary concern is excessive microbial biofilms growth on pipe walls which interact with both pipe material and core of the water flow. The microbial outbreaks are a risk to public health. Many outbreaks have occurred. In 1989, in Cabool (USA), some bacteria caused 243 cases of diarrhoea and 6 deaths. In 2000, in Walkerton (Canada), an outbreak of *Esherichia coli* killed up to 11 people (<http://canadanews.about.com/cs/walkerton>).

Since the early 1900's, drinking water has been disinfected by adding chlorine (or chloramines) before supplying the distribution system, in order to maintain a certain level of residual chlorine in water minimising microbial contamination in the network.

The main factors responsible for water quality deterioration in WDS are: (i) supply sources going on- and off-line creating inevitable pressure surges; (ii) contamination via cross-connections or from leaky pipe joints; (iii) corrosion of iron pipes and dissolution of lead and copper; (iv) loss of disinfectant residual; (v) reactions of disinfectants with organic and inorganic compounds, including pipe material resulting in taste and odour problems and in the formation of DBPs; (vi) bacterial regrowth; and (vii) increased turbidity caused by particulate resuspension and pipe corrosion.

Developments in water quality modelling. To help water utilities to meet water quality challenges, numerous water qualities models have been developed. These can be categorised in three main

groups: (I) “first-order” models, which describe water quality using simple first-order kinetic mass-balance equations; and (II) “fundamental-process” models that describe the reactions using sets of inter-dependent mass-balances and (III) operational management processes which aim at assisting the water utilities in reducing the number and consequences of discoloration occurrences.

The most commonly used “first-order” model for water quality is EPANET (Rosman et al. 1994). This is a hydraulic model with first-order kinetics incorporated. It is based on the extended period simulation approach. There are other commercially available “first-order” models, such as WaterCAD, H₂ONET, Synergiee and PICCOLO. These models reasonably estimate the disinfectants decay due to biological and chemical reactions (LeChevallier et al. 1990, Powell et al. 2000, Rossman et al. 1994). However they cannot simulate other complex chemical and biological processes that affect interactions in the system and determine water quality on the tap.

The developments proposed in this project will be based on “fundamental-process” models which describe bacterial metabolism (biofilm processes) and disinfectant decay by using sets of interdependent, multi-species, mass-balance equations based on the fundamental reactions and their interaction with each other.

The so called Operational management processes to which the Sheffield university has given its contribution, will also be incorporated.

Motivation and missing issues. Drinking water distribution network ecosystems are complex and poorly understood due to their system to system variations and their high sensitivity to physico-chemical conditions in the network. Thus, each WDS has its “identity” in develops unique microbial growth patterns. Disinfection effectiveness is highly dependent on the disinfectant type, organism location and systems characteristics. Hence, it is of major importance to find a balance between the control of health risks from compounds formed during water disinfection and the risks from microbial intrusion, which will be addressed in the project.

The concept associated with this new generation of multi-integrated water quality models is to simultaneously account for all the processes related to water quality deterioration in a synergistic and realistic perspective. These processes include biofilm growth and detachment from the walls, pipe corrosion, dissolution of lead and copper, free chlorine decay, chlorine residuals formation and sedimentation. Development of this real breakthrough type of model require strong interaction of several specialists: hydrodynamics, water chemistry, microbiology-biofilm modelling. It also requires a series of target oriented (module development) experiments to be carried out in order to calibrate and verify the module’s parameters. This synergetic water quality approach will definitively contribute to the sustainable development of future generations of water supply systems.

Project Objectives

The main objective of this research to improve understanding and management of water quality in water distribution systems. This will be achieved by development and testing of a new generation Integrated Water Quality Model (IWQM). This model will link the realistic the main physical, chemical and biological processes occurring in the system their interaction between each other under gradually varying and transient flow conditions. The model will be generic in nature, capable of handling any particular type of water and a particular distribution network to be able to predict accurately the water quality degradation along the system. Based on that, model will be able to improvements of both water treatment at the source and management of the system itself in order to prevent unfavourable ageing and degradation of both water quality and of the system.

Specific objectives are the following:

1. To better understand and describe the main chemical and microbiological processes occurring in the drinking water distribution system after conventional treatment and their contribution to water quality degradation.

2. To extend the knowledge from 2D-turbulence models (2D-IWQM) to 1D water quality models to be able to use them in real networks.

Programme of Work, Dissemination and Exploitation

Programme of work:

The work divides into six major phases:

- (I) Development of 2D integrated water quality model
- (II) Laboratory Testing Programme (Hydrodynamics, chemistry, biofilm) and development of modules
- (III) Model Evaluation
- (IV) Improvement of 1D models
- (V) Final Analysis of Collected Data and Software Validation
- (VI) Production of Final Report and Analysis of Trends and Future Research Needs.

Dissemination and Exploitation:

Dissemination of the work will include the issue of annual progress reports where the main results will be presented, and the publication of papers in academic and professional international journals. The attendance and presentation of papers at international and national conferences will be another important component to the dissemination of the results of this research work. Exploitation of any commercially viable results from this work will be handled through subsidiary companies set up by the universities involved.

Expected Project Result

Expected project result is:

- Developing of simplified 1D water quality modules which will be compatible with existing software packages (EPANET or others) and will allow water utilities to use it in the actual management of their systems. The models will incorporate complex processes (physical, chemical and biological) and their mutual interactions considering special operation management module with the effects of operational management on water quality (frequency of flushing, scrubbing, precipitation, biofilm growth and detachment from the walls, pipe corrosion, dissolution of lead and copper, free chlorine decay, chlorine residuals formation and sedimentation.

Target beneficiary groups

- Municipal organizations responsible for water supply, treatment management
- Water companies
- Consumers

Management and Resources

This joint project will be carried out by the Urban Water Research Group in the Environmental and Water Resources Engineering Section (EWRE), Department of Civil and Environmental Engineering, at Imperial College (IC), and in the Penine Water group at Sheffield and Bradford University (SU). The other partners in the project are IRTCUD/CUW Network, focal points Sofia and Belgrade.

The project will be managed and coordinated by Professors Čedo Maksimović and Adrian Saul.

Budget

Total budget of the project in 850 000 Euro broken down as follows:

	Amount (Euro)
Equipment and laboratory rig	170 000
Travel and subsistence	127 500
Personal costs	175 000
Training and dissemination	467 500
Unforeseen cost	85 000
Total	850 000

Curriculum Vitae: Čedo Maksimović

Personal data

Date of birth: 28th February 1947

Place of birth: Glamočani, Srbač, Bosnia and Herzegovina, Yugoslavia

Parents: Father Teodor, Mother Zorka

Marital status: Married: wife Kovinka, economist

Children: 2 daughters: Ivana and Biljana

Citizenship: Yugoslavia

Home address: 44 Hanover Steps, London W2 2YG, UK

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email: c.maksimovic@ic.ac.uk web site ewre-www.cv.ic.ac.uk

Education and degrees

Elementary school: (8 years): 1954 - 1962 in Srbač, Yugoslavia

Secondary school: Technical college - (4 years): 1962 - 1966 in Belgrade

University: Faculty of Civil Engineering: Department of Hydraulic Engineering Belgrade
(5 years programme: 1966 - 1971)

Postgraduate course: MSc course (2 years) and MSc thesis: Effect of Turbulence on Local Scour -
University of Belgrade, (1976)

DSc (PhD) thesis: Preparatory phase in UK (Hydraulics Research Station - Wallingford, DAMPT
Cambridge, Department of Civil Engineering University of Newcastle upon Tyne,

Thesis: Effect of Polymer Solutions on Development and Characteristics of a Boundary Layer and on
Drag Reduction, presented at the University of Belgrade 1981

Teaching and research positions held between 1971 and 2000

Subjects: Fluid Mechanics, Hydrometry - Measurements in Water Engineering and Urban Drainage
at the Faculty of Civil Engineering - Belgrade

1971-1973 Research Associate (hydraulic laboratory, scale models, hydraulic structures etc.)

1973-1981 Teaching and research assistant (Fluid Mechanics, Fundamentals of Water
Engineering, Computer Programming)

1981-1988 Associate Professor (Fluid Mechanics, Hydrometry, Urban Drainage)

1988 - 1996 Professor (Fluid Mechanics, Hydrometry, Measurements in Water Engineering,
Urban Drainage,)

1996 - present Visiting Professor, Imperial College, London (lecturing at UG and MSc courses, supervising MSc and PhD students and coordination of contracted research)

Managing positions:

1981-1983 Deputy Director of the Institute of Hydraulic Engineering (41 employees)

1983-1987 Manager of the Institute of Hydraulic Engineering (43 employees)

1987-1991 Vice-Dean of the Faculty of Civil Engineering (220 employees)

1987-1989 Coordinator of IRTCUD - UNESCO sponsored International Research and Training Centre on Urban Drainage (establishment of the Centre, business development, initiation of projects, international networking, coordination of research)

from 1989 Director of IRTCUD/IRTCUW network (research, training and technology transfer, coordination of research projects, development of training tools, organization of international scientific meeting, training courses, publishing)

Current positions:

- Visiting Professor (Professorial Research Fellow) - EWRE - Environmental and Water Resources Engineering Section, Department of Civil Engineering, Imperial College of Science, Technology and Medicine, London, UK ewre-www.cv.ic.ac.uk
- In charge of IRTCUD System - UNESCO sponsored International Research and Training Centres on Urban Drainage in Belgrade with Regional sub-centres: for Tropical Climates - Sao Paulo, Brazil, for Cold Climates - NTNU/SINTEF Trondheim, Norway and for Arid Climates - under formation in the Middle East with CUW-UK Technology Transfer Unit in London UK. Co-operation with WMO, UNEP, UNDP,
- Editor in Chief of URBAN WATER The International Journal Published quarterly by Elsevier Science – Oxford UK (www.urbanwater.net)
- Chairman of the NGO “6E&6I” (6Es are: Expertise spreading in Environment, Energy, Economy and Education through Evolutionary approach in 6Is: Innovations, Informatics, Interactions, Institutions, Instrumentation aiming at International standards) fostering creative multidisciplinary

Languages: - in addition to mother tongue (Serbian or Serbo-Croat)

(S - Speaking, W - Writing, R - Reading and Understanding, L - Lecturing)

English (S, W, R, L), French (S, R, - fair), German (S, R, -fair), Russian (S, R,)

- fair understanding of other Latin originated languages: Italian, Spanish, Portuguese, Romanian,

and fair understanding and speaking of the other slavonic languages: Bulgarian, Czech, Macedonian, Polish, Slovak, Slovenian, Ukrainian.

Membership in International Scientific Committees and Working Group:

WMO (World Meteorological Organization) - WMO Rapporteur on Operational Hydrology in Urban Areas (1993- 1996),

IAHR/IAWQ Joint Committee on Urban Drainage - International Working Group on Data Models (chairman of the IWGDM 1984 -2000), and Chairman of the Mediterranean Group for Urban Hydrology,

Editor and Member of Editorial Board of International Journals:

URBAN WATER -Co-Editor-in-Chief, Elsevier (initiated and launched)

WATER RESOURCES MANAGEMENT, Kluwer Academic Publishers, (Editorial Board Member)

Prizes Awards and Recognition

Three awards of the “Jaroslav Cerni” fond for the best achievements in the undergraduate and MSc course at the Faculty of Civil Department of Hydraulic Engineering, Belgrade Yugoslavia

IAHR <http://www.iahr.nl> Lecturer of the year 2001 award:

Major fields of research and professional activities

Applied fluid mechanics, hydraulics, hydrology, hydrometry, water resources and environmental engineering :

- urban water infrastructure systems, water supply systems, demand management, surface runoff - urban drainage and its interaction with ground waters and infrastructure systems, source control, integrated urban water systems' operational management of environmentally sensitive systems
- GIS and remote sensing applied in urban water infrastructure systems,
- metrology (reliability and accuracy of measurements in hydrodynamics) in open channels, urban and natural catchments, pressurized systems, network analysis, diagnosis of water balance and leakage in networks,
- turbulence, transport processes, diffusion and dispersion, pressure fluctuations, drag reduction, fluid-structure interaction,
- flow measuring instrumentation
- development of multimedia training tools and running training programmes,
- international projects (concepts, initiation, management, training and technology transfer)

International lecturing and training

Applied hydrodynamics in water supply and urban drainage, merging measurements with advanced modelling of urban water systems, GIS in urban waters, applied metrology in water resources systems, informatic support, sensitivity analysis of model parameters, new technologies in demand management of water supply systems.

Lecturing and training done in the following countries: Austria, Belgium, Brazil, Bulgaria, Canada, Czechoslovakia, Egypt, Estonia, Finland, France, Germany, Greece, Holland, Hungary, India, Iran, Italy, Japan, Norway, Malaysia, Malta, Palestine, Poland, Taiwan, Turkey, Spain, Sweden, Switzerland, UK, and USA, Yugoslavia (all republics ex-YU).

Internationally accepted software products

Several software products conceptualized and supervised are present in the international academic community:

- UDM - International data bank on rainfall-runoff modelling,
- UDM-Italiana - Italian National Data Bank on Rainfall and Runoff,
- EBEMUS - educational software for training in sensitivity analysis of rainfall-runoff modelling,

Research projects in UK (after 1996)

9. CIRA (UK) - RP555 Construction Industry Research and Information Association project:
10. SUSTAINABLE URBAN RUNOFF MANAGEMENT
11. EPSRC (UK) - Engineering and Physical Sciences Research Council project (Fellowship): Modelling the Management of Street Surface Contaminants in Urban Runoff (till January 1998)
12. EPSRC (UK) The major WITE project: Monitoring, Modelling & Leakage Management in Water Distribution Networks, (started October 1998)
13. EPSRC (UK) Inverse Transient Analysis in Pipe Networks for Leakage Detection Quantification and Roughness Calibration (Started July 1999)
14. UNEP - IETC - Osaka- Environmentally Sound Waste Water and Storm Water (CUW-UK project)
15. EU LIFE project: Sustainable rehabilitation of urban environmental systems (exercised through ICON and UZRS - Institute for Urban Planning, Banja Luka, Republic Srpska 1998-2001)
16. EU LIFE project: Local Institutional Capacity Development in Environmentally Sensitive Areas (LICENCE) (to be exercised through ICON and UZRS - Institute for Urban Planning, Banja Luka, Republic Srpska for 2002-2005)

Selected international research projects (accomplished earlier) - coordination or participation

11. COMETT 2 (EC) Project 4991-Cb: Advanced Computer Techniques for Urban Storm Drainage
12. UNESCO/IHP IV M.3.3.b. Project: Urban Runoff and Drainage in Different Climate: Tropical, Arid or Semi-arid and Cold
13. UNESCO/IHP IV M.3.3.a. Project: Integrated Water Management in Urban Areas
14. WMO project: Operational Hydrology in Urban Conditions
15. Bilateral Project: Surface Runoff Water Quality (with University of Lund, Sweden)
16. TEMPUS Project (EU) - coordinator, 2424-91: Upgrade of Engineering Curricula in Advanced Information Systems for Environmental Improvement in Hydraulic Engineering
17. TEMPUS Project (EU) 266-90 (coordination of one theme): Environmentally Sound River Basin Development
18. CALWARE (EU - Techware) Project: Computer Aided Learning in Water Resources (participation in the sub-project: Urban Drainage)
19. Master Drainage Plan for Upper Tiete River – Sao Paulo, Brazil
20. Real Time Control in Storm Drainage systems with large underground storage- Strategic technological development, Toshiba, Japan (1999-2000)

Books authored and co-authored:

A. Books authored and co-authored, published by international publishers

13. C. Maksimovic and B. Jaksic (2001) (Editors and authors): Sustainability of Water and Environmental Systems Rehabilitation, Proceedings of the LIFE International Conference, Banja Luka 22-24 September
14. C. Maksimovic, J. A. Tejada-Guibert, (editors and authors) Frontiers in Urban Water Management -Deadlock or hope, Book published by International Water Association 2001
15. J. A. Tejada-Guibert and C. Maksimovic (editors) Frontiers in Urban Water Management - Deadlock or hope, Proceedings of the Workshops held at the UNESCO Symposium, Marseille June 2001, Published by UNECO/IHP, Technical documents in Hydrology No.45
16. L. Bentsson, J. Milina, V.Lobanov, C. Maksimovic, J. Marsalek, M. Viklander, (2001) Urban Drainage in Cold Climate, (Edited by S. Sveinung, J. Milina, S. T. Thorolfsson), Vol. 1 of the UNESCO Series: Urban Drainage in Specific Climates, Editor-in-Chief : C. Maksimovic
17. B. P. F. Braga, Jr. A. Canholi, N. Campana, M. N. Desa, P. S. Dias, R. Frendlich, J. Gofdenfum, J. Kalman, C. Maksimovic, M. F. A. Porto, M. R. La Porto, C. E. M. Tucci, A. L. L. de Silvoira, A. Villanuova (2001), Urban Drainage in Humid Tropics (Edited by C. E. M. Tucci) Vol. 2. 1 of the UNESCO Series: Urban Drainage in Specific Climates, Editor-in-Chief : C. Maksimovic
18. A. Al-Abdulali N. Carmi T. Hanna C. Maksimovic M. Nouh, A. Al-Quarch A. Al-Shamsy J. Simons (2001) Urban Drainage in Arid and Semi Arid Climates, (Edited by M. Nouh), Vol. 3 of the UNESCO Series: Urban Drainage in Specific Climates, Editor-in-Chief : C. Maksimovic (In press)
19. Hydroinformatics in Planning, Design, Operation and Rehabilitation of Sewer Systems (1998) (editor and co-author) ASI Series, Edited by J. Marsalek, C. Maksimovic, E. Zeman and R. Price, Published by Kluwer,
20. M. Vignolles, E. Woloszyn, J. Niemczynowicz, C. Maksimovic, J. Marsalek: Rain and Floods in Our Cities (author and chief editor) - World Meteorological Organization, Geneva, Switzerland, 1996
21. F. Calomino, C. Maksimovic, B. Molino: Urban Drainage (editor and author), Experimental Catchments in Italy Printed by Editoriale Bios, Italy 1995.
22. C. Maksimovic, M. Radojkovic: Fundamentals and Application of Urban Storm Drainage (IRTCUD series of lecture notes for the international training courses, Printed by the Int. Centre for Water Resources -Perugia Italy) 1992
23. A. Ichikawa and C. Maksimovic (authors and editors) Urban Runoff and Its Reduction (editor and author) - in Japanese-.Published by Kashima Publishers, Tokyo, 1988
24. C. Maksimovic and M. Radojkovic: Urban Drainage Catchments. Published by Pergamon Press, Oxford, 1986

B. Books authored and co-authored, published in Yugoslavia

6. C. Maksimovic: Merenja u hidrotehnici (Measurements in Water Engineering) (1993), Publ. by Faculty of Civil Engineering, Belgrade,
7. C. Maksimovic, A. Spoljaric, S. Djordjevic, D. Prodanovic, A. Tomanovic (1993): Zbirka zadataka iz Mehanike fluida - Solved Problems in Fluid Mechanics, Publ. by Faculty of Civil Engineering, Beograd
8. G. Hajdin, C. Maksimovic, M. Ivetic, A. Spoljaric (1990): Solved Problems for Student Practicals in Fluid Mechanics}, Publ. by Naučna knjiga, Beograd,

9. D. Obradovic, M. Radojkovic, C. Maksimovic: *Primena racunara u komunalnoj hidrotehnici - (Computer Aided Design of Water Supply and Sewer Systems)*, (1989) Publ. by Gradjevinska knjiga, Belgrade,
10. C. Maksimovic: *Hydrodynamic Measurements and Data Processing (IRTCUD lecture notes for the international training courses on water engineering)*

Books edited and co-edited:

14. *Frontiers in Urban Water Management - Deadlock or Hope (2001)*, Proceedings of the UNESCO Symposium, (Edited by C. Maksimovic and J. A. Tejada-Guibert) Marseille, France, 18-21 June,
15. *Developments in Urban Drainage Modelling*, (1999), Special Issue of the *Water Science and Technology*, Vol. 39, Number 9 ISSN 0273-, Editors D. Butler and C. Maksimovic
16. *Developments in Urban Drainage Modelling*, 2 Volumes (1998) Proc. of UDM'98 Conference, London, September, Edited by D. Butler and Maksimovic
17. *Water Supply Systems - New Technologies*, (editor), ASI Series, Edited by C. Maksimovic, F. Calomino, J. Snoxell, Published by Springer, 1996
18. *Remote Sensing and GIS in Urban Waters*, (1995) Proc. of the Sec. Int. UDT Conference, Moscow, Russia, Edited by C. Maksimovic, J. Elgy, V. V. Dragalov
19. *HYDRINFORMATICS '94 (1994)* Proc. of the First International Conference on Hydroinformatics, Delft, Holland (2 Volumes), Edited by A. Verwey, A. W. Minns, V. Babovic and C. Maksimovic, Published by Balkema, Rotterdam,
20. *Interaction of Computational Methods and Measurements in Hydraulics and Hydrology (1992)* editor. Proceedings of the Int. Conf. HYDROCOMP '92, Budapest, Hungary, Edited by J. Gayer, O. Starosolszky and C. Maksimovic, Published by Water Resources Research Centre (VITUKI)},
21. *New Technologies in Urban Drainage (1991)* Proceedings of Int. Conf. UDT'91, Dubrovnik, Yugoslavia, 1991, Edited by C. Maksimovic Published by Elsevier Applied Science, London,
22. *Computational Modelling and Experimental Methods in Hydraulics (1989)* Proceedings of Int. Conf. HYDROCOMP '89, Dubrovnik, Yugoslavia, 1989 Edited by C. Maksimovic and M. Radojkovic, Published by Elsevier Applied Science, London,
23. *HYDROSOFT '86 (1986)* Proceedings of the Second International Conference on Hydraulic Engineering Software, Southampton, U.K. Edited by M. Radojkovic, C. Maksimovic, and C.A. Brebbia, Published by Springer-Verlag, Berlin Heidelberg and CML Publications, Southampton,
24. *Urban Drainage Modelling (1986)* Proceedings of the International Symposium on Comparison of Urban Drainage Models with Real Catchment Data UDM '86, Dubrovnik, Yugoslavia Edited by C. Maksimovic and M. Radojkovic, Published by Pergamon Press, Oxford,
25. *HYDROSOFT '84 (1984)* Proceedings of the International Conference on Hydraulic Engineering Software, Portoroz, Yugoslavia Edited by C.A. Brebbia, C.. Maksimovic and M. Radojkovic, Published by Elsevier Applied Science, Amsterdam
26. *EUROMECH 130 Symposium on Turbulent and Diffusion and Dispersion in Open Channels*, (editor) Preprints of the proceedings - Belgrade, 1980 Edited by K. Hanjalic, S. Bruk, C. Maksimovic

2. Papers in journals and chapters in books:

38. C. Maksimovic: Reducing Drag for Dam Construction. *Water Power and Dam Construction*, Vol. 30, pp. 53-58, London, 1978
39. Maksimovic, M. Radojkovic: Computer Aided Design of Storm Sewer Systems (in Serbian: Projektovanje sistema kisne kanalizacije racunarima). Chapter in the *Civil Engineering Calendar*
40. Published by the Association of Civil Engineers and Technicians, Belgrade, 1988
41. C. Maksimovic, M. Radojkovic: Computer Aided Modelling of Urban Storm Drainage Systems. *Journal of Sanitary Engineers and Technicians of Poland*, 1986
42. D. Prodanovic, A. Spoljaric, M. Ivetic, C. Maksimovic: Dynamic Characteristics of a Pressure Measuring System. Chapter in the book: *Measuring techniques in Hydraulic Research*. Edited by
43. Wessels. Publ. by AA. Balkema, Rotterdam, 1986
44. C. Maksimovic, S.T. Thorolfsson: Effect of Regional Climate Conditions on Rainfall-Runoff Process in Urban Catchments: The Case of Snowy Surfaces. *IAHS Publications No. 191*, 1990
45. C. Maksimovic, L. Buzek, J. Petrovic: Corrections of Rainfall Data Obtained by Tipping Bucket Raingauge, *Atmospheric Research*, Vol. 27(1-3), 1991
46. M. Simic, C. Maksimovic: A Novel of Tipping Bucket Raingauge with Variable Centre of Gravity Position. *Journal of Environmental Hydrology*, Vol I. No. 3. 1993
47. M. Simic, C. Maksimovic: Effect of Siphon Control on Dynamic Characteristics of a Tipping Bucket Rain Gauge, *Hydrological Sciences Journal*, Vol. 38, 6 December 1993
48. C. Maksimovic, L. Fuchs, D. Prodanovic, J. Elgy: Full Scale Application of Standard GIS Packages with Urban Storm Drainage Simulation Software". in *German Journal: Kurier Abwasserung*;, 1995
49. J. Elgy, C. Maksimovic, D. Prodanovic, Using Geographical Information Systems for Urban Hydrology, *IAHS Publ. no 211*, 1993
50. C. Maksimovic: Measurements of Turbulence and Diffusion (in Serbian: Merenje turbulencije i difuzije). *Transactions of the Academy of Sciences of BiH, Sarajevo*, 1979
51. M. Milojevic, C. Maksimovic: Measurements of Waste Water Quantity (in Serbian: Merenje kolicina otpadnih voda). Chapter in the *The Civil Engineering Calendar*, Belgrade, 1986
52. C. Maksimovic (co-author): Problem Assessment in Present Urban Water Management. *International Workshop, UNESCO/IHP M-3-3a Project: The Use, Planning and Treatment of Water and wastewater in Urban Areas*. Chapter in the publication: *Ecosystem Approach to Water Resources Management in Urban and Surrounding Areas*, Essen, 1992
53. C. Maksimovic (co-author): Education and Training. *International Workshop, UNESCO/IHP M-3-3a Project: The Use, Planning and Treatment of Water and Wastewater in Urban Areas*. Chapter in the publication: *Ecosystem Approach to Water Resources Management in Urban and Surrounding Areas*, Essen, 1992
54. C. Maksimovic: Measurements of Rainfall and Runoff in Experimental Storm Drainage Catchments. Chapter in the book: *Urban Drainage, Experimental Catchments in Italy*, 1995
55. C. Maksimovic, M. Ivetic: Calibration and Verification of Urban Drainage Models by UDM Data Base. *Monografias 10: Inundaciones y Redes de Drenaje Urbano*. Edited by J. Dolz, M. Gomez, J.P.
56. Martin. Publ. by Universitat Politecnica de Catalunya, Barcelona, 1992
57. C. Maksimovic: Review on the Special Aspects of the Application of Real Catchments Data. *5th ICUSD, Post-conference Publ. (in Japanese)*, Osaka, 1990

58. C. Maksimovic, M. Radojkovic: Decrease of Peak Flows in Urban Drainage Practice. Chapter in "Urban Runoff and Its Reduction" (in Japanese). Edited by A. Ichikawa and C. Maksimovic. Published by
59. Kashima Publishers, Tokyo, 1988
60. M. Radojkovic, C. Maksimovic: Recent Tendency in the Development of the Modelling of Urban Storm Drainage. Chapter in: "Urban Runoff and Its Reduction" (in Japanese). Edited by A. Ichikawa and C. Maksimovic. Published by Kashima Publishers, Tokyo, 1988
61. V. Vukmirovic, C. Maksimovic, J. Petrovic: Measurements and Analysis of Rainfall in Urban Drainage. Publication: New Technologies Applied to Design and Renovation of Sewer Systems. Edited by Cabrera Publ. by Universidad Politecnica de Valencia, 1993
62. C. Maksimovic Measurement of Runoff Quantity, Chapter in the book: Rain and Floods on Our Cities, WMO, Geneva, Switzerland, 1996
63. C. Maksimovic: Measurements Methods for Diagnosis and Rehabilitation of Existing Systems, in Water Supply Systems - New Technologies, 1996, Elsevier,
64. Application of GIS in Analysis and Design of Water Supply Systems, in Water Supply Systems - New Technologies, 1996, Elsevier
65. International Framework for Training of Specialists for Water Supply Systems, The Status and Problems to be Solved, in Water Supply Systems - New Technologies, 1996, Elsevier
66. A. Tomanovic, C. Maksimovic: Improved Modelling of Suspended Solids Discharge from Asphalt Surfaces During Storm Event, Water Science and Technology, Vol. 33, No 4-5, pp 363-369, 1996
67. A. Deletic, C. Maksimovic and M. Ivetic, Modelling of Storm Wash-off of Suspended Solids from Impervious Surfaces, J. of Hydraulic Research, (IAHR) 35(1), pp 99-119, 1997
68. A. Deletic, C. Maksimovic, Evaluation of Water Quality Factors in Storm Runoff from Paved Areas, Journal of Environmental Engineering ASCE, Vol. 124, No. 9. September 1998, paper. 10815
69. C. Maksimovic: Differences in Urban Flood Mitigation between the Developed and Developing Countries, Stockholm Water Front, No 2. May 1999
70. C. Maksimovic, D. Butler, N. Graham, Emerging Technologies in the Water Industry, In Water Industry Systems: Modelling and optimization applications, (edited by D. Savic and G. Walters), October 1999. Published by Research Studies Press
71. C. Macropoulos, D. Butler, C. Maksimovic: GIS supported evaluation of source control applicability in urban areas, Water Science and Technology, Vol 39, Number 9 ISSN 0273-, p. 209-216
72. S. Djordjevic, D. Prodanovic, C. Maksimovic: An Approach to simulation of dual drainage, Water Science and Technology, Vol 39, Number 9 ISSN 0273-, p. 95-104
73. D. Butler, C. Maksimovic (1999) Urban Water Management – Challenges for the next Millennium. Progress in Environmental Sciences, Vol 1. No. 3.
74. Jankovic-Nisic, B., C. Maksimovic, D. Butler, N. J. D. Graham, (2001), Use of Flow Meters for Managing Water Supply Networks, Accepted for the Journal of Water Resources, Planning and Management, ASCE

Papers in Scientific and Professional Meetings:

Belgrade Workshop, 14-16 March, 2002

Over 185 papers published

AUGUST 2002

Curriculum Vitae: Adrian John SAUL

Name : **Adrian John SAUL**

Date of Birth : **30 December 1950**

Marital Status : **Married : Two children**

Home Address : **Hardy House Farm, Little Hucklow,
Buxton, Derbyshire, SK17 8RT**

Work Address : **Department of Civil Engineering,
University of Sheffield, P O Box 600, Mappin Street,
Sheffield, South Yorkshire, S1 3JD**

QUALIFICATIONS

1972	BEng.Hons. Class 1	University of Liverpool
1977	PhD	Heriot Watt University

POSTS HELD

1975 - 1978	Lecturer	Bolton Institute of Technology
1979 - 1989	Lecturer	University of Manchester
1989 - 1990	Sabbatical Leave	University of Technology, Sydney
1990 - Present	Professor	University of Sheffield

INSTITUTION AND RESEARCH ORGANISATION MEMBERSHIP

Member International Association Water Quality
Member International Association for Hydraulic Research
Member of IWA/IAHR Sewer Processes Committee
Member OF UK Water Industry Wastewater Planners User Group (WAPUG) Committee

RESEARCH INTERESTS

Design of Urban Drainage Systems for optimum pollution retention and control.

Combined sewer overflow and storage tank performance studies : hydraulic scale model studies, fieldwork and numerical modelling

Real time control of hydrodynamic sewer systems and ancillary structures.

The sewer as a biochemical reactor: septicity in detention tanks, in-sewer processes, in-sewer treatment and the impact on treatment works performance.

Cohesive-like sewer sediment transport and first flush pollution effects.

Software development to describe the above processes for use by practising engineers.

Water quality changes in potable water distribution systems.

Leakage prediction and control measures.

Whole life costs associated with water distribution system management

RESEARCH SUPERVISION AND CONTRACTS

Currently supervising 10 researchers (four part-time) with existing research contracts of total value in excess of 1M. These contracts are funded by the Engineering and Physical Science Research Council (UK Government), the UK Water Industry and the Environment Agency.

PUBLICATIONS

Over 150 publications have been made from the results of the research. These include two books, three edited conference proceedings and 37 Journal publications.

Proposal 24: *Urban Drainage and Stormwater Management in Developing Countries - Development and Dissemination of Training Material*

Project title:	<i>Urban Drainage and Stormwater Management in Developing Countries - Development and Dissemination of Training Material</i>
Title (number) of the Urban Water Management component within IHP VI Program:	UNESCO IHP-IV (2002-2007) Theme 5 focussing on Water Education and Training (5.1 - Teaching Techniques and material development)
Compliance with programme frameworks (UNESCO, UNEP, UNIDO, EU, WB, ..other (specify))	UNESCO DFID
Project proposer	<i>Dr. Jonathan Parkinson</i> <i>GHK International, London, UK</i>
Partners in the project (consortium – network – form at least two different countries)	IAHR / IWA Joint Committee on Urban Drainage - Technology Exchange, Transfer and Training (TETT) Working Group <i>Centre for Ecology and Hydrology - Wallingford</i> <ul style="list-style-type: none"> • Department of Civil Engineering, Indian Institute of Technology, Bombay, India • Centre of Excellence in Water Resources Engineering CEWRE, University of Engineering & Technology, Lahore, Pakistan • Institute of Flood Control and Drainage Research (IFCDR), Bangladesh University of Engineering and Technology (BUET), Dhaka , Bangladesh
Supporting partners (cash and in kind)	Members of the TETT group are expected to contribute towards the production of the course training material and development of the technical guide.
Objective:	The objective is to disseminate contemporary knowledge and exchange practical experiences of problems and solutions in urban hydrology and drainage in South Asia. This exchange is intended to improve understanding and ability of local stakeholders to solve drainage and hydrology problems in the specific regional context of South Asia.

Brief description*:	The short courses deal with urban stormwater management problems and suggests methods for urban drainage problem analysis and solutions. It is designed for professionals dealing with urban drainage problems in developing countries. The courses are practically oriented, intensive, and equal weight is given to lectures and case work in small groups. The courses will be supplemented by the distribution of a technical guide,
Implementation strategy:	Structured training and focus group workshops. Each workshop would be 3 days, including a field visit for participants.
Implementation mechanism	The proposed activities would be carried at the academic institutions named above
Expected results	Enhanced capacity of trainees to plan and design for effective and sustainable urban drainage system.
Deliverables and availability	Dissemination of technical guide to stormwater management and urban drainage system design
Target beneficiary groups	Urban planners and municipal managers Government engineers and technicians from non-governmental organisations.
Geographical location of the beneficiaries	South Asia (Bangladesh, India, Pakistan)
Project duration	1 year
Proposed project coordinator	Dr. Jonathan Parkinson GHK International 526 Fulham Road, London SW6 5NR, UK
Proposed project budget:	£ 47,000
Equipment	£ 4,000
Travel and subsistence	£ 16, 000
Personal costs	£ 18,000
Dissemination	£ 6, 000
Other (specify) - contingency	£ 3,000
Possible contribution to the project by beneficiary or form other sources (both cash and in-kind)	Department for International Development (DFID) £20,000 Ian Curtis, Senior Water Resources Engineer, Infrastructure & Urban Development Department, Department for International Development, 1 Palace Street, London SW1E 5HE IWA Foundation

Case for Support

URBAN DRAINAGE AND STORMWATER MANAGEMENT IN DEVELOPING COUNTRIES - DEVELOPMENT AND DISSEMINATION OF TRAINING MATERIAL

Background

Increasing urbanization has led to a decrease in the impervious area. Flash floods can be a major threat to life and property in most urban areas. Flooding has increased both in volume and frequency and inadequate drainage has been identified as one of the main reasons for the outbreak of water borne diseases during monsoons.

The control of storm runoff is vital to creating healthy and liveable urban environments, yet the absence or in-operation of effective drainage causes havoc in many developing world cities. Runoff, contaminated by street rubbish and mixed with sewage, invades urban life causing flood damages, disruption, and major public health risks. However, providing strategic drainage systems can be costly and challenging, particularly when design methods are based mainly on conditions, criteria and procedures from the developed world, and when local rainfall and runoff data are rarely available to check the applicability of the methods in new situations.

Previous projects funded by DFID (Centre for Ecology and Hydrology and the London School of Hygiene and Tropical Medicine) and a more recent project to evaluate the scope for sustainable urban drainage system in developing countries (WEDC) show that conventional design methods may not be appropriate and contemporary methodologies for drainage have been developed.

Technology Exchange, Transfer and Training working Group (TETT)

The objectives of TETT are

- 1) To exchange knowledge and experience of problems and solutions in urban hydrology and drainage between developed, developing and transitional countries.
- 2) This exchange is intended to improve our understanding and ability to solve drainage and hydrology problems in the specific contexts of developing and transitional countries.
- 3) To co-ordinate educational and training activities (courses, publications) tailored to the requirements of the Third World and of the countries in transition.

TETT has previously organised training courses at the Department of Technology, Makerere University, Kampala which was financially sponsored by UNESCO-IHP, NUFU/Norway and DFID/UK.

CEH

A previous DFID funded project has collaborated with local institutes to monitor rainfall-runoff response in chosen urban drainage systems in Lahore (Pakistan), Kanpur (India) and Dhaka (Bangladesh). These

data show that models and parameters currently in use can seriously overestimate design flows, in some cases by a factor of four. New guidelines on urban runoff modelling have been developed and now need to be publicised to software developers and drainage engineers in the UK and overseas.

Details of Project proposal

Stage 1 Identification of training needs

This will involve liaison and discussion with the regional collaborators on the training needs, the scope of the training workshops, and the form and presentation of the information in the technical guide.

Stage 2 Development and publication of technical guide.

The work will primarily be undertaken in the UK using a combination of TETT training material in conjunction with the CEH design guide. The publication will be produced in South Asia to reduce costs.

Stage 3 Training workshops in the Lahore, Mumbai, and Dhaka (Bangladesh).

These would be presented by visiting lecturers in conjunction with the local collaborating research institutes and drainage authorities, and delegates would include local drainage authority representatives, local consulting engineers and interested scientists from local institutes. The lead scientist from each of the collaborating institutes would attend all three workshops in order to present the specific issues on their drainage situation and field data programmes. Costs include travel and subsistence, preparation and presentation time for the speakers, a per diem and overnight allowance for local delegates, and the use of local meeting room facilities. All local arrangements will be handled by the collaborating institutes.

Stage 4 Consultation with regional partners

This will involve follow up with regional partners about the merits of the training and consultation to discuss development drainage area plans including the development of a computer model incorporating revisions to urban runoff models. Proposals for further funding for these activities will be discussed at this stage.

Curriculum Vitae: Jonathan Parkinson BSc. MSc. PhD.

- PROFESSIONAL STATUS** : Civil and Environmental Engineer
- DATE OF BIRTH** : 24 October 1967
- NATIONALITY** : British
- EDUCATION** : 1999 PhD. Sustainable Management of Urban Wastewater, Imperial College of Science, Technology and Medicine, London
1993 MSc. Environmental Engineering, University of Newcastle upon Tyne
1990 B.Eng. (Hons.) Civil and Environmental Engineering, University of Newcastle upon Tyne
- LANGUAGES** : English (fluent), French (conversational), Portuguese (basic)
- PROFESSIONAL SOCIETIES** : Secretary IWA/IAHR Technology Exchange, Transfer and Training Urban Drainage specialist group

Graduate member of the Chartered Institution of Water and Environmental Management (CIWEM)
- COUNTRIES OF WORK EXPERIENCE** : Bangladesh, India, Lao PDR, Nepal, Pakistan, Thailand, United Kingdom.

KEY QUALIFICATIONS

Jonathan Parkinson is a civil and environmental engineer, specialising in the provision of infrastructure and services and urban waste management in low-income communities. His academic training combined with consultant engineering experience provides him with the knowledge and understanding for the design and analysis of engineered sanitation, low-cost sewerage, and stormwater drainage systems. He has worked in South and South Asia and understands the roles of government and non-governmental agencies in project implementation and the need to develop appropriate institutional frameworks to ensure operational sustainability.

As part of Faisalabad Area Upgrading Project, he worked with WASA engineers to develop

appropriate standards and specifications for the design and construction of tertiary sewers for use in low-income areas of Pakistan. He has recently assisted in the production of a '*Guide to Strategic Planning for Urban Sanitation*' which includes material to assist in planning and decision-making for improved urban sanitation and wastewater management.

Jonathan is an experienced researcher and has been responsible for preparing a number of research proposals. He is currently managing a 3 year DFID funded research project entitled *Capacity-building for effective decentralised wastewater management* which involves close collaboration with project partners and information sharing with organisations working in the sector. He has extensive experience of information management, networking and has been involved with internet conferences and discussion groups.

Before joining GHK, Jonathan completed a PhD. at Imperial College in which he developed a computer model for the simulation and design of sewerage and stormwater drainage infrastructure in order to compare alternative wastewater management strategies in terms of their sustainability. Previously, he worked in India on a DFID-funded study entitled *Performance Based Evaluation of Drainage Systems in a Low Income Community in India*. As part of an interdisciplinary research team, which undertook an evaluation of the performance of stormwater drainage systems during the monsoon season, he studied problems of flooding and transmission of water-related diseases exacerbated by poor maintenance.

EMPLOYMENT RECORD

2001 – present	GHK International
1999 – 2001	GHK Research and Training
1995 - 1998	Imperial College of Science, Technology and Medicine, London
1994 - 1995	London School of Hygiene and Tropical Medicine
1992 - 1993	University of Newcastle upon Tyne
1991 - 1992	Balfour Maunsell, Norwich, United Kingdom

PROFESSIONAL EXPERIENCE

August 2001 - Capacity-building for effective decentralised wastewater management

DFID Engineering Knowledge and Research Programme R8056

The primary purpose of the research is to ensure that information on viable options for decentralised wastewater management is widely available in a form that is accessible to local stakeholders. The project aims to identify appropriate forms of wastewater treatment technology and associated management requirements, develop training material to promote effective wastewater management and develop policy recommendations to support appropriate institutional management frameworks.

February 2001 Faisalabad Area Upgrading Project - Pakistan (DFID)

-

Development of a set of appropriate design standards, technical specifications, and

recommended procedures for construction, operation and maintenance of tertiary-level sewerage systems. These design guidelines are targeted towards government institutions and line agencies for official design of procedures in the Punjab. Other beneficiaries are non-governmental organisations who are currently promoting community sewerage through their low-cost sanitation programmes.

**September
2000 - January
2001**

Vientiane Urban Infrastructure and Services, Lao PDR (ADB PPTA 3333)

Working in conjunction with the local consultants, GHKI prepared the project design for a proposed ADB loan for Vientiane Urban Infrastructure and Services Project (VUISP) to be implemented by the Vientiane Urban Development and Administration Authority (VUDAA) with financial and technical assistance from the Asian Development Bank (ADB). Jonathan Parkinson was responsible for the design of sanitation, drainage and wastewater management component of the project. The strategy was developed based upon an analysis of the existing situation and lessons learnt from previous initiatives, and was designed to provide a flexible response in accordance with local physical conditions, affordability, and expressed demands.

**August -
September
2000**

Windows-based software and manual for 'Simplified Sewerage' design (DFID)

Member of team led by Leeds University, UK. Responsible for reviewing material on the practical aspects of sewerage design and the ways in which a computer-based design package, based on the Brazilian condominium sewerage approach, can be integrated into an overall planning and design process.

**April - August
2000**

Civil Society Participation in Tertiary Level Water Supply and Sanitation Infrastructure and Services in South Asia (GHK Research and Training)

Fieldwork in Bangladesh, Nepal, India involved working with government and non-government agencies working towards the provision of water and sanitation to low-income urban communities. The study focussed on the role of civil society, community-based and non-governmental organisations in the planning, implementation, management and operation of these services. Specific emphasis was placed on the design and financing of water supply, low-cost sanitation and drainage systems.

May 2000

Nepal Urban Sector Strategy (ADB)

Working with staff from HMGN, the primary task was to obtain, present and analyse data and statistics relating to urban services and infrastructure coverage, access to services, and development indicators in Nepal. Demographical data, socio-economic development indicators, land use and housing, and natural resources and the environment were also covered. Responsibility for organising workshops to discuss impact of ADB projects on poverty alleviation in the urban sector. Other responsibilities included visiting donor and international lending organisations in order to obtain details of current and planned programs influencing development.

1999 - 2000

Practical Development of Concepts of Strategic Sanitation (DFID)

DFID funded research study undertook to develop a working methodology for planning, implementation, and operation of urban sanitation based fundamentally on a recognition of the importance of a demand-based approach and full cost recovery. As part of this study Jonathan visited a number of NGOs in Pakistan who are working with community based groups to help them gain access to sanitation. A number of case studies focussed on low-cost sewerage and the institutional arrangements between

community organisations and government line agencies.

1995-1998 Ph.D. in Sustainable Management of Urban Wastewaters, Imperial College of Science, Technology and Medicine

A methodology to evaluate the impact of future developments within the urban wastewater system in terms of sustainability was developed. A systems based approach of quantitative analysis using computer modelling was used to simulate components of the urban wastewater cycle was used to model changes in domestic wastewater characteristics resulting from water conservation and re-use, as well as alternative stormwater and sanitation strategies. These were quantified in terms of their effect on the effective operation of existing drainage infrastructure, treatment processes, and resultant pollutant loads in receiving waters.

1994-1995 Research Assistant - Stormwater drainage in low-income communities in India, The London School of Hygiene and Tropical Medicine

In July 1994, Jonathan joined a multi-disciplinary ODA funded research team to assess the provision for stormwater drainage in low-income communities in developing countries. Responsibility for data collection in Indore required working with a team in Indian engineers to collect data prior to computer analysis in order to study the performance of drainage systems during the monsoon season. The study evaluated aspects of sewerage engineering design and maintenance procedures, and involved work alongside social scientists to assess health implications of flooded sanitation systems, and considered perceptions of the risks posed by flooding.

1992-1993 MSc. Environmental Engineering, University of Newcastle Upon Tyne, UK

The course focused on design and analysis of engineered water supply, distribution, wastewater collection and treatment systems as well as solid waste and air pollution management. Other components of the course included mathematical modelling of environmental systems, water quality analysis as well as quality procedures, legislation and environmental impact assessment.

The dissertation evaluated the practice of stormwater disposal into bathing waters and an appraisal of recreational water quality control procedures. Jonathan specialised in appropriate sanitation and water supply technology used in developing countries for the reduction of the transmission of disease. As part of his dissertation, he investigated the die-off of enteric pathogens from sewage discharges into receiving waters.

1991-1992 Graduate Civil Engineer - Hydrology and hydraulics Section, Maunsell & Partners / Balfour Maunsell, Norwich, UK

Work experience with an international engineering consultancy firm involved work on a varied set of projects requiring hydraulic analysis and engineering design. Predominantly, the work focused on the formulation of drainage area plans and feasibility studies for stormwater drainage systems. Extensive use of sewer simulation and analysis software (HYDROWORKS) required computer modelling skills. Comparison of various design options involved cost estimation and environmental impact assessment.

PUBLICATIONS

- a. Urban drainage in developing countries – challenges and opportunities
Jonathan Parkinson
Waterlines, May 2002 (awaiting publication)
 - b. Sanitation and Wastewater Management in Peri-Urban Areas: Opportunities and Constraints in Developing Countries
Jonathan Parkinson and Kevin Tayler
International Conference ‘Rural-Urban Encounters: Managing the Environment of the Peri-Urban Interface’, Development Planning Unit, University College London, November 2001
 - c. **People and puddles – is drainage important?**
Reed, B., Parkinson, J., and Nalubega, M.
27th WEDC Conference, Lusaka, Zambia, 20-24 August 2001
 - d. **Modelling Strategies for Sustainable Domestic Wastewater Management**
First National Conference on Sustainable Drainage
Coventry University, 18-19 June 2001
 - e. **Linking Strategy and Practice in Urban Sanitation Provision**
Kevin Tayler and Jonathan Parkinson
WaterLines Vol. 19 No. 1 July 2000
 - f. **Strategic Planning for Urban Sanitation**
Kevin Tayler and Jonathan Parkinson.
Water21, Magazine of the International Water Association, February 2000
 - g. **Assessing the sustainability of urban wastewater systems**
Jonathan Parkinson and David Butler. Proceedings of the 6th IRNES Conference *Technology, the Environment and Us*, Imperial College, September 1997.
 - h. **Towards Sustainable Urban Drainage**
David Butler and Jonathan Parkinson,
Special Edition of the IAWQ Journal *Water, Science and Technology*, Vol. 35 No. 9, 1997.
 - i. **Drainage without drains? Performance studies in India and their implications**
Kolsky P.J., Parkinson J.N., Butler D/ and Sihorwala T.A.
 - j. **“Third World surface water drainage: The effect of solids on performance”**,
Peter Kolsky, Jonathan Parkinson and David Butler. Published in *Low-Cost Sewerage*, edited by Duncan Mara, John Wiley and Sons, Chichester 1996.
 - k. **An appraisal of recreational water quality control procedures**, Jonathan Parkinson, Foundation for Water Research, Research Report FR/WW 001, November 1996
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Format for Reports by UNESCO's Water-related Centres on activities related to the IHP in the period June 2008 – May 2010

1. Basic information on the centre

Name of the Centre		Training Sector for Water Resources and Irrigation
Name of Director		Prof. Maha Mohsen Tawfik
Name and title of contact person (for cooperation)		Prof. Mohamed Bakr Abdel Ghani
E-mail		info@rctws.com
Address		P.O. Box 58 the 6 th of October City
Website		www.rctws.com (Under Maintenance)
Location of centre		city/town <u>Cairo</u> country <u>Egypt</u>
Geographic orientation *		<input type="checkbox"/> global <input checked="" type="checkbox"/> regional
Year of establishment		
Themes	Focal Areas ♦	<input checked="" type="checkbox"/> groundwater <input checked="" type="checkbox"/> urban water <input checked="" type="checkbox"/> arid / semi-arid zones <input type="checkbox"/> humid tropics <input type="checkbox"/> droughts and floods <input type="checkbox"/> sediment transport and management <input checked="" type="checkbox"/> water and environment <input type="checkbox"/> ecohydrology <input checked="" type="checkbox"/> water law and policy <input type="checkbox"/> transboundary river basins/ aquifers <input checked="" type="checkbox"/> IWRM <input checked="" type="checkbox"/> global and climate change <input type="checkbox"/> mathematical modelling <input checked="" type="checkbox"/> social and cultural dimensions of water <input checked="" type="checkbox"/> water education <input checked="" type="checkbox"/> other: (please specify) _____
	Scope of Activities ♦	<input checked="" type="checkbox"/> vocational training <input type="checkbox"/> postgraduate education <input type="checkbox"/> continuing education <input type="checkbox"/> research <input checked="" type="checkbox"/> institutional capacity-building <input checked="" type="checkbox"/> advising/ consulting <input type="checkbox"/> software development <input type="checkbox"/> other: (please specify) _____
Support bodies ¹		Ministry of Water Resources and Irrigation - Egypt UNESCO (Cairo Office)
Hosting organization ²		Ministry of Water Resources and Irrigation - Egypt
Sources of financial support ³		Governmental
Existing networks and cooperation ⁴		JICA AWARENET Cap-net GTZ
Governance		<input checked="" type="checkbox"/> director and governing board <input type="checkbox"/> other: (please specify) _____ Link to election of board members to the IHP Intergovernmental Council (IGC) and hosting

* check on appropriate box
♦ check all that apply

¹ please specify bodies that cover the operational costs of the centre, and other essential costs such as salaries and utility bills, and that provide institutional support to ensure centre's sustainability

² if different from support bodies

³ please specify sources of main budgetary and extrabudgetary funds to implement projects

⁴ please write international networks, consortiums or projects that the centre is part of, or any other close links that the centre has with international organizations or programmes, which are not already mentioned above

	country IHP National Committee _____ Frequency of meetings: Twice every 1 year(s) <input type="checkbox"/> Existence of UNESCO presence at meetings
Institutional affiliation of director	
Number of staff and types of staff	total number of staff (full-time, or equivalent) : 150_____ number of staff who are water experts: 10_____ number of visiting scientists and postgraduate students: 10 _____
Annual turnover budget in USD	1,080,830 (National) ? (Regional)

2. Activities undertaken in the framework of IHP in the period June 2008 – May 2010

- 2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII (Appendix-1) and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings. Research activities that directly contributed to the IHP-VII and activities by WWAP
Please include research/applied projects outputs such as publications that directly contributed to the IHP-VII and WWAP objectives: Not included in the center activities
- 2.2 Training activities that directly contributed to the IHP-VII and WWAP objectives: *Not included in the center activities*
- 2.3 Training activities that directly contributed to the IHP-VII and WWAP objectives

2008

- ✓ Train-the-Trainer Workshop Learning about adaptive management in the Nile basin – Learning for interdependence (NeWater + ATP): 19-21 / 2/ 2008 Training Program: "Environmental Management of Mega Irrigation Projects" (ATP-National Course): 11-22/5/2008
- ✓ Training Program: "IWRM: New Participatory Initiatives for Young Professionals" (ATP-National Course): 15-26/6/2008
- ✓ Training Program: "Project Feasibility Studies & Project Financing" (2 Courses) - (NBI/SVP/WRPMP): 6-17/7/2008 Training of Trainers workshop on: "Climate Change and its Impacts on Water Resources Management in the region" (RCTWS + RCUWM + UNESCO Cairo & Tehran Offices) - Syria, Damascus: 13-16/10/2008
- ✓ Training Program: "GIS and RS Uses for IWRM" (ATP-National Course): 19-30/10/2008
- ✓ Training Program: "ToT Training on WRM in Yemen" (JICA Yemen & Cairo - Ministry of Foreign Affairs, Egypt): 25/10-20/11/2008
- ✓ Training Program: "On Farm Water Management, Irrigation & Drainage" (JICA): 25/10 – 4/12/2008
- ✓ Training Program: "Projects Financial Management" (NBI/SVP/WRPMP): 26-30/10/2008

2009

- ✓ Training Program: "Operation & Maintenance of Pumping Stations and Irrigation Projects" (JICA Iraq): 4-22/1/2009
- ✓ Training Program: "CAD Applications in Design" (JICA Iraq): 4-29/1/2009
- ✓ Water & Land Capacity Development Workshop for Water and Environmental Journalists in the Arab Countries (UNW-DPC + UNCCD + AWC + IDRC): 22-24/1/2009
- ✓ Training Program: "Controlling Aquatic or Invasive Weeds" (JICA Iraq): 1-19/2/2009
- ✓ Training Program: "ARC GIS" (JICA Iraq): 1-26/2/2009
- ✓ Training Program: "Operation & Maintenance of Pumping Stations and Irrigation Projects" (JICA Iraq): 27/9-15/10/2009

- ✓ Training Program: "CAD Applications in Design" (JICA Iraq):27/9-22/10/2009
- ✓ Training Program: "On Farm Water Management, Irrigation & Drainage" (JICA):11/10-19/11/2009
- ✓ Training Program: "ToT Training on WRM in Yemen" (JICA Yemen & Cairo - Ministry of Foreign Affairs, Egypt): 11/10-5/11/2010
- ✓ Training Program: "Dam Safety" (JICA Iraq): 8/11-18/11/2009
- ✓ Training Program: "ERDAS" (JICA Iraq): 6/12-24/12/2009

3. Collaboration and linkages

- 3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies
- 1] Agreement with JICA office in Cairo to conduct regional training in On-farm water management at field level
 - 2] Project extended by MWRI and GTZ for capacity development of engineers in management.
- 3.2 Participation in meetings related to the IHP and UNESCO (e.g., the UNESCO General Conference, the UNESCO Executive Board, the IHP Intergovernmental Council and/or other meetings organized by IHP)
- ✓ Steering committee for: "Environment Sustainability: Groundwater Resources & Wetland Interaction Training Course" (UNESCO/IHP): 25-26/8/2008
- 3.3 Country to Country Visit to Egypt & TF Meeting (NBI/SVP/WRPMP): 14-18/12/2008 Collaboration and networking with other UNESCO category 1 or 2 institutes/ centres
- 3.3.1 cross-appointment of directors of the category 1 or 2 institutes or centres on the governing board
 - 3.3.2 exchange of information on activities such as training/educational materials, and funding opportunities
 - 3.3.3 exchange of staff, most notably professionals and students
 - 3.3.4 implementation of joint activities, such as workshops, conferences, training programmes, joint projects, field visits, software and data sharing, knowledge exchange and publications
- 3.4 Relationships with the UNESCO field and regional office whose jurisdiction covers the country of location

Few regional events have been conducted under the umbrella of UNESCO Cairo office.

- 3.5 Relationship with the UNESCO National Commission and the IHP National Committee in the country of location and with other organizations of other countries

Participating in national meetings and seminars

- 3.6 Relationship with other UNESCO-related networks, such as UNESCO Clubs, ASPnet, and UNESCO chairs: No relations

4. Communication

- 4.1 Communication and knowledge dissemination activities undertaken in the framework of IHP
- ✓ National Nile-Net Workshop (ATP-National): 26-28/6/2008

It is running through e-mails and websites

- 4.2 Policy documents and advice

It is running through e-mails and websites

5. Update on Centre Operations

- 5.1 Membership of the Board of Governors between designated period
- 5.2 Key decisions made (attach minutes of meetings)

6. Evidence of the Centre's Impacts

- 6.1 Science Impacts (Major contributions to the science, technology, education, and regional and/or international cooperation in the field of water)

Transferring technology to arid and semi-arid and African countries throughout courses, workshops in the field of IWRM

- 6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)

Improving and developing the skills and capacities of trainees in IWRM

- 6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)

Increasing awareness of Junior; senior staff and policy makers in IWRM

7. Future activities that will contribute directly to IHP and/or to WWAP

- 7.1 Operational Plan (2010-2011) (attach operational plan for 2008-09 if available)

- ✓ Training Program: "Operation & Maintenance of Pumping Stations and Irrigation Projects" (JICA Iraq): 17/10-4/11/2010
- ✓ Training Program: "CAD Applications in Design" (JICA Iraq): 10/10-4/11/2010
- ✓ Training Program: "ARC GIS" (JICA Iraq): 28/11-10/12/2010
- ✓ Training Program: "On Farm Water Management, Irrigation & Drainage" (JICA): 19/9-28/10/2010
- ✓ Training Program: "ToT Training on WRM in Yemen" (JICA Yemen & Cairo - Ministry of Foreign Affairs, Egypt): 19/9-14/10/2010
- ✓ Training Program: "ERDAS" (JICA Iraq): 17/10-4/11/2010

- 7.2 Strategic Plan linked with IHP-VII (attach strategic plan for 2010-13 if available)

Delivered In the previous Report

8. Annexes

- 8.1 List of publications released by the centre (there can be overlap with those listed in 2.3 above)
- 8.2 List of training courses conducted (there can be overlap with those listed in 2.1 above)

Appendix-1

Overview of the Core Programme Themes of the Seventh Phase of the IHP (2008-2013) WATER DEPENDENCIES: SYSTEMS UNDER STRESS AND SOCIETAL RESPONSES

Theme 1: ADAPTING TO THE IMPACTS OF GLOBAL CHANGES ON RIVER BASINS AND AQUIFER SYSTEMS

Focal area 1.1 - Global changes and feedback mechanisms of hydrological processes in stressed systems

Focal area 1.2 - Climate change impacts on the hydrological cycle and consequent impact on water resources

Focal area 1.3 - Hydro-hazards, hydrological extremes and water-related disasters

Focal area 1.4 - Managing groundwater systems' response to global changes

Focal area 1.5 - Global change and climate variability in arid and semi-arid regions

Theme 2: STRENGTHENING WATER GOVERNANCE FOR SUSTAINABILITY

Focal area 2.1 - Cultural, societal and scientific responses to the crises in water governance

Focal area 2.2 - Capacity development for improved governance; enhanced legislation for wise stewardship of water resources

Focal area 2.3 - Governance strategies that enhance affordability and assure financing

Focal area 2.4 - Managing water as a shared responsibility across geographical & social boundaries

Focal area 2.5 - Addressing the water-energy nexus in basin-wide water resources

Theme 3: ECOHYDROLOGY FOR SUSTAINABILITY

Focal area 3.1 - Ecological measures to protect and remediate catchments process

Focal area 3.2 - Improving ecosystem quality and services by combining structural solutions with ecological biotechnologies

Focal area 3.3 - Risk-based environmental management and accounting

Focal area 3.4 - Groundwater-dependent ecosystems identification, inventory and assessment

Theme 4: WATER AND LIFE SUPPORT SYSTEMS

Focal area 4.1 - Protecting water quality for sustainable livelihoods and poverty alleviation

Focal area 4.2 - Augmenting scarce water resources especially in SIDS

Focal area 4.3 - Achieving sustainable urban water management

Focal area 4.4 - Achieving sustainable rural water management

Theme 5: WATER EDUCATION FOR SUSTAINABLE DEVELOPMENT

Focal area 5.1: Tertiary water education and professional development

Focal area 5.2: Vocational education and training of water technicians

Focal area 5.3: Water education in schools

Focal area 5.4: Water education for communities, stakeholders and mass-media professionals

Format for Reports by UNESCO's Water-related Centres (category 1 and 2) on activities related to the IHP in the period June 2008 – May 2010

1. Basic information on the centre

Name of the Centre		Regional Centre on Urban Water Management - Tehran
Name of Director		Dr. Homayoun Motiee
Name and title of contact person (for cooperation)		Mr. Alireza Salamat
E-mail		info@rcuwm.org.ir
Address		No. 120; Khoramshahr St. Tehran, 1553713511; Iran
Website		www.rcuwm.org.ir
Location of centre		city/town Tehran country Iran
Geographic orientation *		<input type="checkbox"/> global <input checked="" type="checkbox"/> regional
Year of establishment		2002
Themes	Focal Areas ♦	<input checked="" type="checkbox"/> groundwater <input checked="" type="checkbox"/> urban water <input checked="" type="checkbox"/> arid / semi-arid zones <input type="checkbox"/> humid tropics <input checked="" type="checkbox"/> droughts and floods <input type="checkbox"/> sediment transport and management <input checked="" type="checkbox"/> water and environment <input type="checkbox"/> ecohydrology <input type="checkbox"/> water law and policy <input type="checkbox"/> transboundary river basins/ aquifers <input checked="" type="checkbox"/> IWRM <input checked="" type="checkbox"/> global and climate change <input type="checkbox"/> mathematical modelling <input checked="" type="checkbox"/> social and cultural dimensions of water <input checked="" type="checkbox"/> water education <input type="checkbox"/> other: (please specify) _____
	Scope of Activities ♦	<input type="checkbox"/> vocational training <input type="checkbox"/> postgraduate education <input type="checkbox"/> continuing education <input checked="" type="checkbox"/> research <input checked="" type="checkbox"/> institutional capacity-building <input checked="" type="checkbox"/> advising/ consulting <input checked="" type="checkbox"/> software development <input type="checkbox"/> other: (please specify) _____
Support bodies ¹		Government of I.R. Iran
Hosting organization ²		Ministry of Energy, I.R. Iran
Sources of financial support ³		Government of I.R. Iran, UNESCO and some Governing Board Members
Existing networks and cooperation ⁴		G-WADI, UNESCO-IHP, IAHR
Governance		<input checked="" type="checkbox"/> director and governing board <input type="checkbox"/> other: (please specify) _____ Link to election of board members to the IHP IGC and hosting country IHP National Committee _____ Frequency of meetings: once every year(s)

* check on appropriate box
 ♦ check all that apply

¹ please specify bodies that cover the operational costs of the centre, and other essential costs such as salaries and utility bills, and that provide institutional support to ensure centre's sustainability

² if different from support bodies

³ please specify sources of main budgetary and extrabudgetary funds to implement projects

⁴ please write international networks, consortiums or projects that the centre is part of, or any other close links that the centre has with international organizations or programmes, which are not already mentioned above

	<input checked="" type="checkbox"/> Existence of UNESCO presence at meetings
Institutional affiliation of director	Power and Water University of Technology, Assistant Professor
Number of staff and types of staff	total number of staff (full-time, or equivalent) : 3 number of staff who are water experts: 4 number of visiting scientists and postgraduate students: 2
Annual turnover budget in USD	~\$ 350,000

2. Activities undertaken in the framework of IHP in the period June 2008 – May 2010

- 2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VI and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.
- 2.2 Research activities that directly contributed to the IHP-VI and activities by WWAP
Please include research/applied projects outputs such as publications that directly contributed to the IHP-VI and WWAP objectives
- **Manual of the Training of Trainers Workshop on "Integrated Urban Water Management"**
- 2.3 Training activities that directly contributed to the IHP-VI and WWAP objectives
- **Training Workshop on "Integrated Flood Management", Tehran, Iran**
 - **Training Workshop on "Risk Assessment and Flash Flood Strategies", Kuala Lumpur, Malaysia**
 - **Training of Trainers Workshop on "Challenges of Sustainable Water Use in Arid and Semi-arid Regions", Tashkent, Uzbekistan**

3. Collaboration and linkages

- 3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies
- **The International Water Academy**
 - **The International Water Association**
 - **UNESCO-IHE**
 - **UNW-DPC**
 - **UN-HABITAT**
 - **CENTER FOR HYDROMETEROLOGY AND REMOTE SENSING**
- 3.2 Participation in meetings related to the IHP and UNESCO (e.g., the UNESCO General Conference, the UNESCO Executive Board, the IHP Intergovernmental Council and/or other meetings organized by IHP)
- **National IHP Committees' Meeting, Tehran, Iran, July 2009**
 - **19th session of IHP Intergovernmental Council, UNESCO HQ, Paris, July 2010**
- 3.3 Collaboration and networking with other UNESCO category 1 or 2 institutes/ centres
- 3.3.1 cross-appointment of directors of the category 1 or 2 institutes or centres on the governing board
- **UNW-DPC**
 - **UN-HABITAT**

- 3.3.2 exchange of information on activities such as training/educational materials, and funding opportunities
 - **UN-HABITAT**
 - **WMO**
 - **UNW-DPC**
 - **INTERNATIONAL CENTER FOR WATER HAZARD AND RISK MANAGEMENT (ICHARM)**
 - **Regional Humid Tropics Hydrology and Water Resources Centre for South-East Asia and the Pacific (HTC Kuala Lumpur)**
 - **UNESCO DUNDEE CENTRE FOR WATER LAWS...**
- 3.3.3 exchange of staff, most notably professionals and students
- 3.3.4 implementation of joint activities, such as workshops, conferences, training programmes, joint projects, field visits, software and data sharing, knowledge exchange and publications
 - **UNW-DPC**
 - **WMO**
 - **INTERNATIONAL CENTER FOR WATER HAZARD AND RISK MANAGEMENT (ICHARM)**
 - **Regional Humid Tropics Hydrology and Water Resources Centre for South-East Asia and the Pacific (HTC Kuala Lumpur)**
 - **UNESCO DUNDEE CENTRE FOR WATER LAWS...**
- 3.4 Relationships with the UNESCO field office whose jurisdiction covers the country of location
 - **UNESCO Tehran Cluster Office**
 - **UNESCO New Delhi Office**
 - **UNESCO Cairo Office**
 - **UNESCO Beijing Office**
- 3.5 Relationship with the UNESCO National Commission and the IHP National Committee in the country of location
 - **Iranian National Commission for UNESCO**
 - **Turkmenistan National Commission for UNESCO**
 - **Pakistan National Commission for UNESCO**
 - **Oman National Commission for UNESCO**
- 3.6 Relationship with other UNESCO-related networks, such as UNESCO Clubs, ASPnet, and UNESCO chairs
- 4. Communication**
 - 4.1 Communication and knowledge dissemination activities undertaken in the framework of IHP
 - 4.2 Policy documents and advice
- 5. Update on Centre Operations**
 - 5.1 Membership of the Board of Governors during designated period
3 new members of the Governing Board:
 - **Ministry of Electricity and Water Authority, Bahrain**
 - **Ministry of Water Resources, Iraq**
 - **Ministry of Water Resources and Development, Zimbabwe**
 - **United Nations Human Settlements Programme (UN-HABITAT)**
 - **Center for Hydrometeorology and Remote Sensing (CHRS)**
 - 5.2 Key decisions made (attach minutes of meetings)
Annex (I)
- 6. Assessment of the Centre's Impacts**
 - 6.1 Science Impacts (Major contributions to the science, technology, education, and regional and/or international cooperation in the field of water)

- Reconstruction of Hydro-meteorological Network of Afghanistan
- Establishment of Water Research Center in Kabul, Afghanistan
- Expert Group Meeting on "Municipal Wastewater Use for Irrigation", Sana'a, Yemen
- Participating in the 4th International Water Exhibition, Tehran, Iran
- International Conference on "Water Resources Management in the Islamic Countries", Tehran, Iran
- International Symposium on "New Directions in Urban Water Management", Paris, France
- Participating in the 5th World Water Forum, Istanbul, Turkey
- International Conference on "Capacity Development in Urban Water Management under Water Scarcity Conditions", Muscat, Oman

6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)

- Training of Trainers Workshop on "Application of Models and New Technologies in Groundwater Management in Arid and Semi-arid Regions", Karaj, Iran
- International Workshop on "Flash Floods in Urban Areas and Risk Management", Muscat, Oman
- International Workshop on "Groundwater for Emergency Situations", Tehran, Iran
- Training of Trainers Workshop on "Integrated Urban Water Management (IUWM)", Lahore, Pakistan
- International Workshop on "Water Demand Management in Urban Areas in Light of Tourism", Muscat, Oman
- International Workshop on "Capacity Development for Water Journalists", Tehran, Iran
- Training Workshop on "Integrated Flood Management", Tehran, Iran
- Training Workshop on "Risk Assessment and Flash Flood Strategies", Kuala Lumpur, Malaysia
- Training of Trainers Workshop on "Challenges of Sustainable Water Use in Arid and Semi-arid Regions", Tashkent, Uzbekistan
- Training Workshop on "Reservoir Dams Sedimentation Control", Karaj, Iran
- Regional Workshop on "Development of Hydropower Plants", Tehran, Khuzestan and Isfahan, Iran
- International Workshop on "Capacity Development for Farm Management Strategies to Improve Crop-Water Productivity using AquaCrop", Tehran, Iran

6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)

- International Law and Transboundary Freshwaters and Symposium and Workshop 2010, Global, national and regional strategies for promoting security and sustainability within a rapidly changing world – Water for All

7. Future activities that will contribute directly to IHP and/or to WWAP

7.1 Operational Plan (2010-2011) (attach operational plan for 2008-09 if available)

Annex (II) and Annex (III)

7.2 Strategic Plan linked with IHP-VII (attach strategic plan for 2010-13 if available)

Annex (IV)

8. Annexes

- 8.1 List of publications released by the centre (there can be overlap with those listed in 2.2 above)
- **4 Newsletters (January and June 2009, January and June 2010)**
 - **Manual of the Training of Trainers Workshop on "Integrated Urban Water Management"**
- 8.2 List of training courses conducted (there can be overlap with those listed in 2.3 above)
- **Training Workshop on "Integrated Flood Management", Tehran, Iran**
 - **Training Workshop on "Risk Assessment and Flash Flood Strategies", Kuala Lumpur, Malaysia**
 - **Training of Trainers Workshop on "Challenges of Sustainable Water Use in Arid and Semi-arid Regions", Tashkent, Uzbekistan**
 - **International Workshop on "Capacity Development for Farm Management Strategies to Improve Crop-Water Productivity using AquaCrop", Tehran, Iran**

Annex I

Agreed Minutes

Seventh Governing Board Meeting

Regional Centre on Urban Water Management- Tehran

(under the auspices of UNESCO)

Tehran-Iran, 05 May 2010 (09:00-13:00)

The Seventh Governing Board meeting was held in Tehran, 5 May 2010. The meeting was attended by the following honourable members:

Member States:

- **Iran**
H.E. Mr. Majid Namjoo, Chairman of the GB and Minister of Energy
Mr. Mohammadreza Attarzadeh, Deputy Minister of Energy for Water and Wastewater Affairs
Dr. Homayoun Motiee, Director of RCUWM-Tehran
- **Oman**
H.E. Mr. Abdullah bin Salim bin Amer Al Rawas, Minister of Regional Municipalities and Water Resources
- H.E. Ali bin Mohammed Al Abri, Undersecretary For Water Resources Affairs, Ministry of Regional Municipalities and Water Resources
- **Afghanistan**
H.E. Mr. Al-Haj Mohammad Ismael, Minister of Energy and Water
- **India**
H.E. Mr. Sanjay Singh, Indian Ambassador in Tehran
- **Kuwait**
Mr. Mashan Al Otaibi, Representative of Ministry of Electricity and Water
- **Tajikistan**
Mr. Makhmasaid Isoev, Representative of Ministry of Water Economy and Land Reclamation
- **Syria**
Mr. Kamal Al Shaykha, Representative of Ministry of Housing and Construction
- **Bangladesh**
H.E. Mr. Khandkar Abdus Sattar, Bangladesh Ambassador in Tehran
- **Lebanon**
H.E. Mr. Zein Al-Moussawi, Lebanon Ambassador in Tehran

- **Bahrain**
Mr. Adnan Mohamed Abdulrahman Fakhroo, Representative of Ministry of Electricity and Water Affairs
- **Iraq**
Mr. Salar Koshnow, Representative of Ministry of Water Resources
- **Zimbabwe**
Representative from Zimbabwean Embassy in Tehran

Organisations:

- **UNESCO**
Mr. Qunli Han, Representative
- **UNESCO-IHE**
Mr. Meine Pieter Van Dijk, Representative
- **UNW-DPC**
Mr. Reza Ardakanian, Director
- **UN-HABITAT**
Mr. Debashish Bhattacharjee, Representative
- **CHRS**

Special Guests

- **Iranian National Commission for UNESCO**
Mr. Mohammadreza Saeedabadi, General Secretary
- **Iraq**
Mr. Amer Khalil Ismael, Representative of Ministry of Municipalities and Public Works
- **Ministry of Energy, I.R. Iran**
Mr. Behzad, Deputy Minister of Energy in Power and Energy Affairs
Mr. Mahsouli, Vice Minister in International Affairs
Mr. Alireza Almasvandi, Managing Director, Iranian Water Resources Management Company
Mr. Ghasemi Afshar, Head of Ministerial Office
Mr. Aminian, Head of Security Office

The representatives of Egypt, Germany, Pakistan, and Yemen as well as The International Water Academy (TIWA), the Inter-Islamic Network on Water Resources Development and Management (INWRDAM), International Water Association (IWA) and Wageningen University apologised for not being able to participate in the meeting.

1- OPENING:

After reciting Holy Quran and I.R. Iran national anthem, the following speeches were delivered:

The Director of the Centre, Mr. Homayoun Motiee welcomed the participants to the 7th Governing Board Meeting of the Regional Centre on Urban Water

Management (RCUWM-Tehran). He hoped to observe effective decisions to be made during the board meeting which will lead towards promoting the Centre's performance.

Mr. Qunli Han as the Representative of UNESCO delivered UNESCO's remarks. The following issues were highlighted in his speech:

- a) Water resources challenges, conflicts and priorities in the MENA region.
- b) Future plans of the 7th phase of the International Hydrological Programme.
- c) UNESCO's preparedness in collaborating with RCUWM-Tehran in its activities and projects.
- d) New proposals and ideas required from the Category II Centres for promoting regional cooperation.
- e) The importance of the new initiative proposed by the Centre as the International Drought Initiative (IDI) was raised.
- f) Efficient transboundary water management, issues to be worked on.
- g) Contribution of the regional countries with the world water assessment program, due to water scarcity issues in the region.

The meeting was officially opened by H.E. Mr. Majid Namjoo, Minister of Energy, Islamic Republic of Iran and the Chairperson of RCUWM-Tehran Governing Board. He highlighted several issues in his speech some of which were as follows:

- A) A warm welcome to the new candidates of RCUWM GB Membership: Iraq, Bahrain, Zimbabwe and the United Nations Human Settlements Programme (UN-HABITAT) and the Center for Hydrometeorology and Remote Sensing (CHRS).
- B) Promoting regional and international cooperation among RCUWM member states and organizations.
- C) Special attention given to Climate Change and its impacts on water resources.
- D) Capacity building and training as an important component.
- E) High importance of structural and non-structural aspects for better management of water resources.
- F) Developing new technologies such as cloud seeding, rainwater harvesting, etc.
- H) Special attention given to promoting scientific collaboration to decrease the cost of sea water desalination.
- I) Developing capacities for recycling and reusing returned water, industrial and agricultural wastewater.
- J) Joint cooperation in the field of implementing technical training of human resources.

2- Adoption of the Agenda

The draft agenda was put on the floor and it was unanimously adopted as follows:

- *Opening*
- *Director's report on implemented activities between the 6th and 7th GBM, budget and work plan of 2010, new memberships*
- *Short film on RCUWM – Tehran activities*
- *Comments and Approvals on the Director's Report, members contribution towards the Centre's activities, status of inactive members, Country Reports*
- *New memberships in RCUWM Governing Board*
- *Date and Venue of the 8th Governing Board Meeting*
- *New memberships in the RCUWM Executive Committee*
- *Other Issues*
- *Closing (by the Chair)*

3- Director's Report

The Director of the Centre presented a brief report on the activities and achievements carried out in between the period of the 6th and 7th Governing Board (November 2008 – May 2010) as well as the budget allocated to the projects implemented by the Centre which included UNESCO's and other member states / organizations shares. The training events held in different countries such as Malaysia, Uzbekistan, Oman and Iran were described. He also addressed the participants on the work plan and budget of the Centre in 2010.

He also came up with new proposals for jointly being carried out by the Centre and its members during 2010 and the coming year. The proposals were as follows:

- Towards sustainable water management in line with SWITCH-in-Asia project (SWITCH is fully explained in page 26 and annex XI of the compendium).
- Impacts of Climate Change and drought on Water Resources Management (Urban and Rural)
- Water Demand Management in Mega Cities
- Application of RS and GIS in Water Resources Management
- Irrigation Water Management and its impacts on Urban Water
- The Centre's contribution in establishing the OIC Water Council

4- Video Film on RCUWM Performance

A short video film on the activities and achievements of the Centre since its establishment in 2002 was demonstrated which was highly received by the members of the board meeting. Worth noting that this film has been prepared in Farsi, English, Russian and Arabic during 2009 and a copy of it has been distributed among the participants.

5- Comments by GB Members and Approvals of the Meeting

All distinguished members of the GB presented their viewpoints on the Director's report, contribution toward the Centre's activities and their countries' and organisations' policies and strategies in water management issues.

The following remarks were made by the Centre's member states / organizations:

OMAN: H.E. Mr. Al Rawas thanked the Ministry of Energy, I.R. Iran and the Regional Centre on Urban Water Management- Tehran for hosting the 7th Governing Board Meeting. The following issues were presented by the Minister:

- a) RCUWM plays a vital role in the region.
- b) Oman is prepared to host two events as "Application of RS and GIS in Water Resources Management" and "Impacts of Drought on Water Resources" during late 2010 and 2011, respectively.
- c) Regional cooperation is required for facing water challenges.
- d) Water security should be one of the top priorities of the Centre's activities.
- e) The Centre should work harder so that information exchange among its member states and organisations is effectively carried out.
- f) Special focus on desalination techniques and information exchange on new technologies.

AFGHANISTAN: H.E. Mr. Ismael Khan after thanking the Centre for organizing this event, briefed the participants on Afghanistan's situation in concern with water resources and the total population having access to water, security, health, etc. He also pointed out the new water and environmental laws which he deemed very vital for his country.

No considerable project in the water section has been carried out, as stated by H.E. the Minister. Afghanistan has been mainly focusing in the field of Capacity Building and Training in the water sector. He also called for financial support towards the National IHP Committee of Afghanistan and required support from I.R. Iran for reconstruction projects in the field of water in his country.

SYRIA: The representative of Syria thanked the Ministry of Energy, I.R. Iran and RCUWM for hosting this event. He pointed out the nitrate problem in drinking water and called for support toward establishing wastewater treatment plants by I.R. Iran in Syria.

BAHRAIN: The representative of Bahrain expressed his sincere appreciations to the Ministry of Energy, I.R. Iran and RCUWM for hosting this event. The representative stated that Bahrain is ready to learn from Iran and co-organize joint events in this concern. Bahrain is a poor country in respect to water resources and it mainly depends on groundwater which is also very low. Another challenge is the real price of water which is not received from the subscribers.

INDIA: The representative from the Indian Embassy in Tehran delivered the apologies of Minister of Water Resources, for not being able to attend the meeting. He promised to deliver the outcomes of this meeting to the Minister, in due time. The representative also wished to observe promotion in the two countries relation in the field of water resources management.

LEBANON: The representative from Lebanon Embassy in Tehran addressed the severe problems of Lebanon in the water sector and the efforts carried out for finding solutions. He also called for developing water relations between the two countries.

BANGLADESH: The representative from the Embassy wished success for the Centre's activities and promised to deliver the results of this meeting to his government.

ZIMBABWE: The representative from the Embassy stated that due to climate change impacts on the country's water resources, the country is changing into deserts and global contribution is required in this concern.

KUWAIT: The representative delivered his thanks to the Centre for hosting the 7th Governing Board Meeting in Tehran. He also expressed Kuwait's preparedness in carrying out joint projects with the Centre. The representative of Kuwait also stated that close cooperation is required for solving water problems in the region and Kuwait is quite prepared to collaborate with Iran in this concern.

TAJIKISTAN: The representative stated that Tajikistan has plenty water and has good capacities for hydropower plants and it is ready to collaborate with the Centre on this issue. He also stated that the International Conference on the mid-term comprehensive review of the implementation of international decade for action "water for life" 2005 - 2015 will take place in Tajikistan, 8-10 June 2010 and invited all the participants to attend this event.

IRAQ: The representative from Iraq thanked the Ministry of Energy and the Centre for effectively holding the 7th Governing Board and stated that Iraq has confronted severe problems in potable water due to climate change impacts on water resources. The representative also stated that efforts have been carried out for equal dissemination of water in their country. The Ministry of Water Resources called for training events to be held for Iraqi experts and required support from I.R. Iran for reconstruction projects in the field of water in his country. Worth noting that the representatives of the Ministry of Water Resources and the Ministry of Municipalities and Public Works were present during the board meeting.

UNW-DPC: The representative thanked RCUWM and its wonderful team for holding the 7th Board Meeting. He also explained about the indirect relation of

Agricultural water to urban water issues, and the logic of having the Centre's activities extended to issues indirectly related to urban water.

He also stated that title of the World Water Day for the year 2011 would be "Water and Urbanisation" and it is a good opportunity for the Centre to effectively be involved in activities related to the world water day (22 March 2011).

As expressed an International Conference on Water Transboundary Management for Promoting Cooperation in Afghanistan will be held in Bonn in near future and all participants were invited to attend this event.

UNW-DPC also expressed its willingness to support joint activities with the Centre at regional level.

UNESCO-IHE: The representative of UNESCO-IHE delivered the rector's sincere thanks to the Ministry of Energy and RCUWM authorities for hosting the meeting. He stated that UNESCO-IHE is quite prepared to hold joint online and short-term courses for the GB member states.

He also pointed out that research projects are lacking from the Centre's activities. One of the important projects being carried out by UNESCO-IHE is integrated water management in the Asian cities with the aim of maximising the use of water by treating and reusing it and the Centre is invited to be involved.

As stated, separating gray and brown water and desalination are amongst other issues IHE is interested to jointly work with RCUWM. UNESCO-IHE is also prepared to jointly work on the SWITCH project with the Centre.

UN-HABITAT: The representative of UN-HABITAT stated that this Centre mainly works on Capacity Building and Training activities and it looks forward to jointly carrying out a project on water and sanitation under disaster situation with RCUWM.

IRANIAN NATCOM: The representative of Iranian Natcom, as an observer focused on capacity building and awareness activities as referred in RCUWM mandate and raised the importance of including water issues in the schools and universities curriculum.

As stated, training of trainers activities on different issues related to urban water management should be amongst the activities carried out by the Centre. He also mentioned that the new proposal prepared by RCUWM as the International Drought Initiative (IDI) is under investigation by UNESCO and it will be presented during the IHP Intergovernmental Council in Paris, July 2010.

H.E. Mr. Attarzadeh thanked all the participants for their participation. He stated that the importance of Climate Change and the need for better contacts between the countries as well as transferring water to neighbouring countries to mitigate negative impacts of drought on their water resources should be considered. He also provided brief information on the capabilities of the I.R. Iran in the field of Dam Construction and irrigation networks.

He also mentioned that a regional commission on climate change in Iran covering all regional countries should be established for research and information exchange on this specific issue. He also pointed out the importance of virtual meetings and video conferences for regular contacts between the Centre's members.

6- New Memberships in RCUWM Governing Board

The membership of Bahrain, Iraq, Zimbabwe and the two international organizations as UN-HABITAT and CHRS was approved by the GB Members. Worth noting that the representative of CHRS was not able to attend the meeting and this Center was presented by RCUWM director. The activities of CHRS were briefly described and as stated this Center has the ability to carry out meteorological anticipations for specific periods with the use of satellites. The Center is also a strong database in concern with climatic information. Both entities were welcomed to RCUWM Governing Board family.

7- Date and Venue of the 8th Governing Board Meeting

The director of the Centre invited the member states to host the 8th GB meeting. After having it proposed by the Director of UNW-DPC, Afghanistan representative accepted to host the 8th Governing Board Meeting of the Centre in Afghanistan during Spring 2011. The exact date and venue will be announced in near future.

8- New Memberships in RCUWM Executive Committee (EC)

As stated by the chair, the Executive Committee of the Centre is the acting body of the Governing Board. This Committee follows up the decisions made during the board meeting.

The chair called for further members in the Centre's EC in addition to Iran, Germany and Oman as well as UNW-DPC, UNESCO and TIWA. No feedbacks were received in this concern. The Centre will follow the procedure of receiving the countries' and organizations' interest in becoming a member of the Centre's Executive Committee.

9- Other issues

- RCUWM director asked for further motivation by all GB members.
- The chair of the meeting stated efforts are being carried out for changing the Centre into an international entity for extending its GB members and activities.
- A proposal on water prize was announced by H.E. Mr. Namjoo as the chair for the best work carried out in the field of work. A concept paper will be prepared by the Center to be disseminated to all GB members for their feedbacks. The next GB will then approve the proposal for being put into action.
- H.E. Mr. Attarzadeh, Deputy Minister of Energy for Water and Wastewater Affairs announced the preparedness of the Ministry of Energy, I.R. Iran to host 5-10 participants from the Governing Board

to visit Iran each year with the purpose of being familiarized with the capabilities of the I.R. Iran in the field of water. The Centre will follow up this issue.

- The chair also invited the countries to become a member of the International Centre on Qanats and Historic Hydraulic Structures which is another Category II Centre, under the auspices of UNESCO, based in Yazd.
- The chair also stated that the possibility of having the ECO Regional Centre on Water being established in Tehran with the support of RCUWM is under investigation. The progress report will be delivered to the GB members, after being finalized.
- As stated the first meeting of the Advisory Panel on OIC Water Vision will be held in Dubai, Emirates, 25-26 May 2010. The panel is being established as a follow up to the recommendations of the meeting of Ministers responsible for Water from OIC member states which was held in conjunction with the 5th World Water Forum, 20 March 2009 in Istanbul, Turkey. The main objective of this meeting is to work out the strategies of establishing an OIC Council on Water. RCUWM director will be participating in this meeting

10- Closing Remarks:

- The closing remarks were presented by the chair, by briefing the participants on the proposals presented by each of the GB attendees during the meeting.

All members attending the Seventh Governing Board Meeting expressed their appreciation for attending the board meeting and further expressed their gratitude for the hospitality shown during their stay in the Islamic Republic of Iran.

All members of the GB meeting visited the Water and Wastewater exhibition held in the Ministry.

ANNEX(II)

Regional Centre on Urban Water Management (RCUWM - Tehran) Operational Plan (2010 - 2011)

IHP VII Themes and Focal Areas

Theme 1:	
Focal area 1.1	
Focal area 1.2	
Focal area 1.3	
Focal area 1.4	
Focal area 1.5	
Theme 2:	
Focal area 2.1	
Focal area 2.2	1- Training of Trainers on Integrated Urban Water Management
Focal area 2.3	
Focal area 2.4	1. International Laws and Transboundary Freshwaters Symposium
Focal area 2.5	
Theme 3:	
Focal area 3.1	
Focal area 3.2	
Focal area 3.3	
Focal area 3.4	
Theme 4:	
Focal area 4.1	
Focal area 4.2	
Focal area 4.3	1. ToT on Integrated Urban Water Management 2. Training Course on Application of GIS and RS in Water Resources Management 3. Training Course on Application of GIS and RS Technuques in Water Resources Development
Focal area 4.4	
Theme 5	
Focal area 5.1	
Focal area 5.2	
Focal area 5.3	
Focal area 5.4	1. ToT on Integrated Urban Water Management 2. Training Course on Application of GIS and RS in Water Resources Management 3. Training Course on Application of GIS and RS Technuques in Water Resources Development

ANNEX(III)

Regional Centre on Urban Water Management (RCUWM - Tehran) Operational Plan (2008 - 2009)

IHP VII Themes and Focal Areas

Theme 1:	
Focal area 1.1	
Focal area 1.2	1- Impacts of Climate Change on Water Resources in MENA Region (emphasizing on Supplying drinking water)
Focal area 1.3	
Focal area 1.4	
Focal area 1.5	1- Impacts of Climate Change on Water Resources in MENA Region (emphasizing on Supplying drinking water)
Theme 2:	
Focal area 2.1	
Focal area 2.2	1- Impacts of Climate Change on Water Resources in MENA Region (emphasizing on Supplying drinking water) 2- Training of Trainers on Urban Water Management Issues 3- International Conference on Water Resources Management (Middle East, CIS and MENA Countries)
Focal area 2.3	
Focal area 2.4	1- Empowerment of Women's Role in Water Issues
Focal area 2.5	
Theme 3:	
Focal area 3.1	
Focal area 3.2	1- Health and Safety in Municipal Water Reuse for Irrigation
Focal area 3.3	
Focal area 3.4	
Theme 4:	
Focal area 4.1	1- Arsenic Removal Technology 2- Health and Safety in Municipal Water Reuse for Irrigation
Focal area 4.2	
Focal area 4.3	1- Arsenic Removal Technology 2- Impacts of Climate Change on Water Resources in MENA Region (emphasizing on Supplying drinking water) 3- Empowerment of Women's Role in Water Issues 4- Training of Trainers on Urban Water Management Issues 5- Health and Safety in Municipal Water Reuse for Irrigation 6- International Conference on Water Resources Management (Middle East, CIS and MENA Countries)
Focal area 4.4	1- Arsenic Removal Technology 2- International Conference on Water Resources Management (Middle East, CIS and MENA Countries)
Theme 5	
Focal area 5.1	
Focal area 5.2	
Focal area 5.3	
Focal area 5.4	1- Empowerment of Women's Role in Water Issues 2- Training of Trainers on Urban Water Management Issues 3- International Conference on Water Resources Management (Middle East, CIS and MENA Countries)

Annex IV



Regional Centre on Urban Water Management
(Under the auspices of UNESCO)

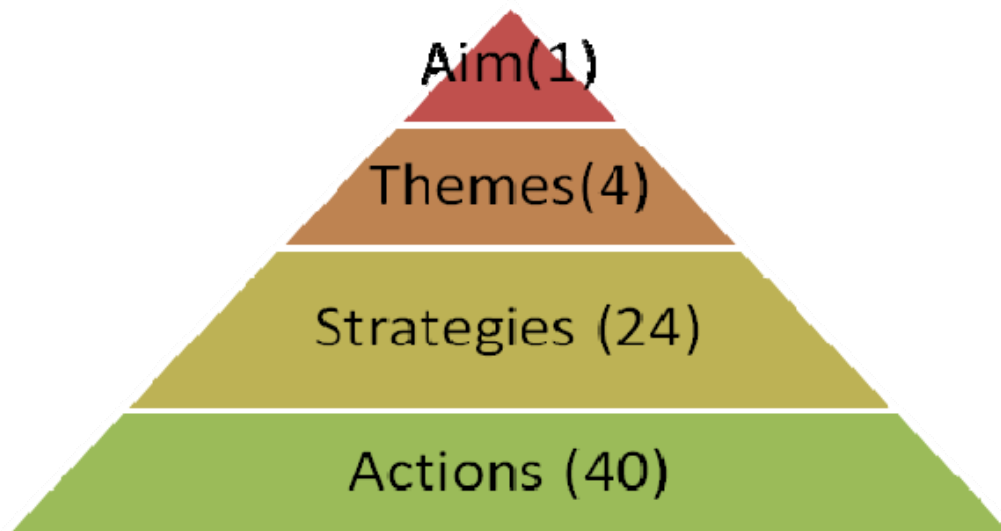


United Nations
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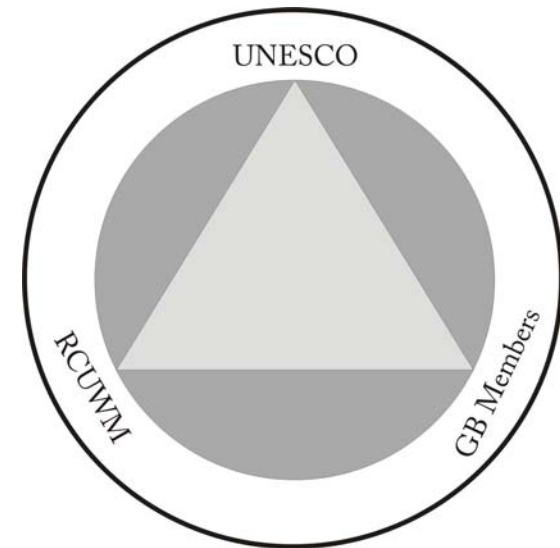
**An overview on the
Strategic Plan for the Second Five Year Period of
RCUWM-Tehran**

July 2008

Promoting the Centre's Activities



Actors



RCUWM –Tehran

Main Theme	Strategy	Actions
Financial Resources	1- Through regular budget	1-1- To follow up supplying the current annual budget of the Centre by considering an appropriate increase mechanism
		1-2-Providing extra budget for developing the Centre’s premises
	2- Through research projects with governmental and non-governmental entities at national level	2-1- Assessment of national needs for research projects
		2-2- Signing bilateral contracts with national entities for providing training and capacity building services
		2-3- Holding fund raising meetings at national levels
	3- Through government, regional and international entities	3-1- Establishing the project generation unit for setting priorities, project definition and following up financial mobilization through regional and international entities
		3-2- Signing bilateral MoU’s with non GB member governments for executing special projects
		3-3- Providing training and capacity building services at the regional level

GB Members

Main Theme	Strategy	Actions
Financial Resources	1- Setting membership fees	1-1- Decision making during the 6 th GBM
	2- Supplying totally or partially, the financial requirements of training/ capacity building projects	2-1- GB members commitments in the framework of long-term plans of the Centre and IHP-VII
		2-2- Signing bilateral MoU's with the Centre
	3- Encouraging the national entities of member countries for receiving the Centre's services	3-1- Introducing the Centre to the national entities and organizations with the aim of signing MoU's for bilateral cooperation

UNESCO

Main Theme	Strategy	Actions
Financial Resources	1- Allocating funds in the framework of IHP biannual budget	1-1- Considering the Centre's request while compiling the biannual plans
		1-2- Setting specific mechanisms for budget allocation in the General Conference of UNESCO for Category II Centres
	2- Using the extra budgetary of IHP for executing research and capacity building projects	2-1- Appointing a part-time expert for investigating and deriving important projects and negotiating with relevant entities
		2-2- Using the Centre's capacities in arranging relevant plans
	3- Encouraging regional and international entities and governments to involve the Centre in training and research plans	3-1- Introducing the Centre to the entities and governments that request, technical and scientific contribution from UNESCO
		3-2- Involving the Centre in executing important international events held by UNESCO

RCUWM – Tehran

Main Theme	Strategy	Actions
Research	1- Establishing a research Committee in the Centre	1-1- Holding meetings with research Centers and universities within the country for having the Centre involved in their research programs
		1-2- Organizing joint technical workshops
		1-3- Proposing student thesis relevant to IHP-VII
	2- Setting communicating strategies with the executive bodies in the country	2-1- Determining the problems and categorizing them at national level to suggest research projects

GB Members

Main Theme	Strategy	Actions
Research	1- Establishing brainstorming sessions	1-1- Introducing relevant universities and research centers to cooperate with the Centre
		1-2- Investigating and presenting the ideas about problems of Urban Water Management in the region
		1-3- Organizing online workshops for investigating needs for research

UNESCO

Main Theme	Strategy	Actions
Research	1- Facilitate and set up the mechanisms for having the Centre involved in different IHP activities	1-1- Introducing the Centre and its potentials and in order to involve the Centre in IHP-VII activities
		1-2- Exchanging the results of researches carried out in the framework of IHP

RCUWM – Tehran

Main Theme	Strategy	Actions
Participation of GB Members and other Category II Centers	1- To put into practice different items of the MoU's exchanged between the Centre and other entities	1-1- Establishing a Task Force for preparing action plans
	2- Monitoring the effectiveness of the Centre's activities in the region	2-1- Compiling appropriate indices for determining the effectiveness of achievements
		2-2- Establishing an interactive weblog to determine the results of the activities at the regional level
	3- Cooperating with other UNESCO Category II Centers	3-1- Organizing annual meetings with Category I and II Centers
		3-2- Defining joint and bilateral activities / projects with other Category II Centers
		3-3- Establishing the weblog of UNESCO Category II Centers
	4- Establishing relation with other knowledge institutes and relevant grassroot organizations in the region	4-1- Establishing direct relation/ via UNESCO
		4-2- Defining the fields of cooperation
		4-3- Multi field Capacity Building with knowledge institutes in the region

UNESCO

Main Theme	Strategy	Actions
Participation of GB Members and other Category II Centers	1- To play an active role in facilitating different items of the MoU's exchanged between the Centre and other entities	1-1- Supporting the action plans that have been proposed in bilateral MoU's
	2- Facilitating cooperation with other UNESCO Category II Centers	2-1- Organizing annual meetings with Category I and II Centers 2-2- Developing joint and bilateral activities / projects with other category II centers
	3- Facilitating relation with other knowledge institutes and relevant grassroots organizations in the region	3-1- Establishing direct relation/ via UNESCO

RCUWM – Tehran

Main Theme	Strategy	Actions
Capacity Building Development, organizing and transmitting knowledge and information	1- Using new technologies	1-1- Using the “hands on type activities” method
		1-2- Establishing high-speed internet and video conference
		1-3- Installing high-speed systems to access technical and scientific information databases
		1-4- Online internet accessibility during the Centre’s events
		1-5- Organizing online training courses
		1-6- Taking advantage of participatory techniques
	2- Qualitative assessment of the Centre’s activities	2-1- Preparing questionnaires and analyzing the responses for assessing the qualitative and quantitative issues of organized events
		2-2- Preparing an abstract report on the assessment procedure and its results for each event
		2-3- Using the results of the assessment reports for future events of the Centre

GB Members

Main Theme	Strategy	Actions
Capacity Building Development, organizing and transmitting knowledge and information	1- Using new technologies	1-1- Access to online internet in the Centre's events

UNESCO

Main Theme	Approaches	Measures
Capacity Building Development, organizing and transmitting knowledge and information	1- Using new technologies	1-1- Access to online internet in the Centre's events
		1-2- Introducing new training technologies