United Nations
Educational, Scientific and
Cultural Organization

IHP/IC-XXI/CR
Paris, 20 June 2014
English only

International Hydrological Programme

21st session of the Intergovernmental Council
(Paris, 18 – 20 June 2014)

REPORTS OF UNESCO CATEGORY 2 WATER-RELATED CENTRES (2012-2014)

SUMMARY

The following reports of the UNESCO category 2 water-related centres cover the activities for the intersessional period between the 20th and the 21st sessions of the Intergovernmental Council of the IHP (June 2012 - May 2014).

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 Biennial Reports by UNESCO's Water-related Centres on activities related to the IHP in the period (June 2012- May 2014)

1. Basic information on the centre

Name of the Centre		ASIA PACIFIC CENTRE FOR ECOHYDROLOGY (APCE)
Name of Director		Prof. Dr. Hery Harjono
Name and title of contact person (for cooperation)		1. Prof. Dr. Hery Harjono 2. Dr. Ignasius D.A. Sutapa
E-mail		1. hery.harjono@gmail.com / hery.harjono@apce-unesco.or.id 2. ignasdas@yahoo.co.id / ignas.sutapa@apce-unesco.or.id
Address		CSC-BG, Jl. Raya Bogor Km 46, Cibinong – BOGOR – West Java - INDONESIA
Website		www.apce-unesco.or.id
Location of centre		city/town _CIBINONG - BOGOR_ country _INDONESIA_____
Geographic orientation *		☐ global X☐ regional
Region(s) (for regional centres)		Asia Pacific
Year of establishment		2009
Year of renewal assessment		2016
Signature date of most recent Agreement		Agreement APCE-UNESCO Jakarta 01 December 2012 (Ref : JAK/QUO/12/HYD-021)
Themes Of activities during reporting period	Focal Areas ♦	X☐ groundwater X☐ urban water management X☐ rural water management X☐ arid / semi-arid zones ☐ humid tropics ☐ cryosphere (snow, ice, glaciers) X☐ water related disasters (drought/floods) ☐ Erosion/sedimentation, and landslides X☐ ecohydrology/ecosystems ☐ water law and policy X☐ social/cultural/gender dimension of water ☐ transboundary river basins/ aquifers ☐ mathematical modelling X☐ hydroinformatics X☐ remote sensing/GIS X☐ IWRM X☐ Watershed processes/management x☐ global and change and impact assessment ☐ mathematical modelling X☐ water education X☐ water quality ☐ nano-technology X☐ waste water management/re-use X☐ water/energy/food nexus ☐ water systems and infrastructure ☐ other: (please specify) _____
	Scope of Activities ♦	X☐ vocational training ☐ postgraduate education ☐ continuing education X☐ public outreach

* check on appropriate box
♦ check all that apply

		X☐ research X☐ institutional capacity-building X☐ advising/ consulting ☐ software development X☐ data-sets/data-bases development ☐ other: (please specify) _____
Support bodies [1]		INDONESIAN INSTITUTE OF SCIENCES (LIPI)
Hosting organization [2]		INDONESIAN INSTITUTE OF SCIENCES (LIPI)
Sources of financial support [3]		INDONESIAN GOVERNMENT
Existing networks and cooperation [4]		UNESCO JAKARTA, ICHARM, ILEC, HTC, KYOTO UNIVERSITY, TSUKUBA UNIVERSITY, ANU, UNIVERSITY OF CANBERRA, UNIVERSITY OF WESTERN SYDNEY, K-WATER, YEUNGNAM UNIVERSITY KOREA, USM (MALAYSIA), UTM (MALAYSIA), NSM (THAILAND), UNIVERSITY OF QUENSLAND, MAB UNESCO, UNIVERSITY OF ADELAIDE, MONGOLIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY, UNIVERSITY OF INCHEON KOREA, IGES JAPAN, ERCE POLAND, ICQHS IRAN, KOREAN WATER FORUM, IRTCES CHINA, UNIVERSITY OF MALAYA, TEXAS STATE UNIVERSITY, UNISZA MALAYSIA, LAGUNA LAKE DEVELOPMENT AUTHORITY PHILIPPINES, CIRAD, IRD, GRIDMAP KENYA, NHSA NIGERIA, TSWRI EGYPT, RCWH SUDAN, ICIWARM, UNITED ARAB EMIRATES UNIVERSITY, IGRAC, WMO, RAMSAR, OSS, HIDROEX, OKAYAMA UNIVERSITY, NATIONAL HYDRAULIC RESEARCH CENTER PHILIPPINES, CHUNGNAM NATIONAL UNIVERSITY KOREA, CSEAS KYOTO JAPAN, GADJAH MADA UNIVERSITY YOGYAKARTA INDONESIA,UNIVERSITY OF TIMOR KEFAMENANU INDONEISA, INSTITUT PERTANIAN BOGOR INDONESIA
Governance		X☐ director and governing board ☐ 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 1__year(s) X☐ 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) : _12_____ number of staff who are water experts: __8_____ number of visiting scientists and postgraduate students: _____
Annual turnover budget in USD		250,000.00 USD

[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

2. Activities undertaken in the framework of IHP in the period June 2012 – May 2014

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII/VIII (Appendix-1 and 2) 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-VII and/or IHP-VIII activities
Please include research/applied projects outputs such as publications that directly contributed to the IHP-VII/VIII and WWAP objectives

In collaboration with RC for Limnology – Indonesian Institute of Sciences :

- Development of Saguling Reservoir Demo-site
- Biovillage development in Giam Siak Kecil – Bukit Batu Biosphere Reserve in collaborate with MAB – Unesco : Promoting Alternative Technology To Provide Clean Water In Peat land Area
- Development of Peat Water Treatment Technology To Provide Clean Water In Peat land Area in colaboration with Katingan Prefecture – in Central Kalimantan and Kuburaya Distric – West Kalimantan

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

- APCE organized IFAS (Integrated Flood Analysis System) Training Course in collaboration with ICHARM and Unesco Jakarta,January 2013 in Jakarta
- APCE organized workshop on water resouces management in Islamic Boarding School Ciamis, February 2013 in Ciamis
- APCE organized workshop on Lakes Management in collaboration with ILEC Japan, July 2013 in Jakarta for preparing WLC 2016 in Indonesia
- Workplan for each division in APCE organization
- Discussion and perparation for WLC 2016
- Discussion on book publication with topic Ecohydrology.
- Discussion and preparation for ICE (International Conference for Ecohydrology) on November 2014 at Yogyakarta
- Dr. Ignasius D.A. Sutaoa gives lecture in IHP Training Course in Kyoto University in December 2013

3. Collaboration and linkages

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

- APCE participate in IFIT Project in collaboration with UNESCO Jakarta Office and Indonesian National Committee for Unesco
- APCE organized IFAS Training course in collaboration with ICHARM and UNESCO Jakarta
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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)

- Annual meetings of the Regional Steering Committee for IHP in the Asia Pacific region are held in rotational base locations. APCE has always participated in these yearly meetings
- Dr. Iskandar Zulkarnain, Dr. Tri Widiyanto, Dr. Ignasius D.A. Sutapa Attend to 20th Session of IC of IHP in UNESCO Paris 4 – 7 June 2012
- Dr. Ignasius D.A. Sutapa attends to the International Workshop "The Asia Pacific Water Museum : Concept and Development" NWM, Pathum Thani 24 – 25 June 2012
- Dr. Gadis Sri Haryani attends to the International Seminar on Ecohydrology and Global Water Issues, University Algarve, Faro, Protugal, 4 – 5 September 2012

- Attending on General Conference UNESCO 3, Natural Science Commision, Paris – November 12-15, 2013
  Delegation:
  Prof. Dr. Iskandar Zulkarnain (Deputi Bidang IPK-LIPI)
  Prof. Dr. Hery Harjono (Directur APCE)
  Dr.Ir. Fatimah Zulfa Padma (Deputi Bidang Jasil)
  Dr. Siti Nuramaliati Prijono (Deputi Bidang IPH)
- Dr. Ignasius D.A. Sutapa attended on Strategic and High Level Meeting on Water Security and Cooperation, di Nairobi, Kenya – September 11 -13, 2013,
- Prof. Harjono attended the Strategic Meeting of Asia-Pacific IHP HELP and Ecohydrology in Jakarta (2-3 December 2013)
- Attending the 21th IHP Regional Steering Committee Meeting (RSC-Meeting) in Gyengju – South Korea, October 1 – 4, 2013
  Delegation :
  - Prof. Dr. Iskandar Zulkarnain
  - Prof. Dr. Hery Harjono
  - Dr. Ignasius D.A. Sutapa, MSc
- Consultative meeting with ILEC delegation, Japan, March 2013, Attending *International Symposium on Integrated Lake Basin Management (ILBM) which coordinator by* ILEC, Kyoto – Japan. In addition, also to discuss for preparing WLC (World Lake Conference) 2016 in Indonesia
  Delegation : Dr. Ignasius D.A. Sutapa, MSc
- Coordination in order to propose the *Governing Boards* APCE
  Governing Boards of APCE :
  Prof. Dr. Soon Tak Lee : South Korea
  Prof. Dr. Takara : Japan
  Prof. Dr. Quentin Grafton : Australia
  Personal from Indonesia :
  Prof. Dr. Iskandar Zulkarnain, Chairman of IHP Indonesia
  Prof. Dr. Hidayat Pawitan, IPB
- 21st IHP Nagoya Training Course in Asia and Pacific Region on Introduction to River Basin Environment Assessment under Climate Change. @8 November – 9 December 2013, Kyoto University, Japan.
- Attending at International Workshop on Freshwater Biodiversity Conservation in Asia (November 26 – 27, 2012 – Kyushu University, Japan). Sponsorship from AP-BON (Asia Pacific – Biodiversity Observation Network). Presenting paper : ***Biodiversity of various tropical lakes at the main islands in Indonesia.***
- Attending at the 37th Southeast Asia Seminar on "***Human-Nature Interactions in Southeast Asia: Trans-disciplinary Approaches***" (October 29 – 31, 2013 – Penang, Malaysia). Coorganized by CSEAS (Japan) and Universiti Sains Malaysia (Malaysia)***.***
- Keynote speaker at the 8th International Symposium on "The Recent Technologies for Flood Disasters Mitigation Measures" (November 6, 2013, Daejeon – South Korea). Coorganized by IWRRI (International Water Resources Research Institute) Chungnam National University and ARCROM (Advanced Research Centre for River Operation and Management)
- Keynote speaker at the 2nd International Symposium on "Advanced Technology for River Management" (November 7 - 9, 2013, Seoul – South Korea). Coorganized by ARCROM (Advanced Research Centre for River Operation and Management) and Seoul National University, Korea.
- Attending "**The First International Workshop on Climate and Societal Change in Coastal Areas in Indonesia And South East Asia**", February 19 - 22, 2014 at Sahid Hotel – Jakarta.
- Attending at the **Integrated Lake Basin Management Expert Group Meeting and Workshop** with the theme "Heartware Cases in Asia: Learning from the Philippines Experience", March 3 – 5, 2014 at San Pablo City, Laguna, Philippines.

- Attending at Transboundary Water Assesment Program (TWAP) – Lake Group Consultative Meeting with South Asia and Southeast Asia - Large Marine Ecosystems (LME) Group, March 6 – 7, 2014 at Manila, Philippines.

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

- Nomination of Governing Board members in progress :
    - Prof. Dr. Soon Tak Lee from IHP Korea
    - Prof. Dr. Kaoru Takara from IHP Japan
    - Prof. Dr. Quentin Grafton from IHP Australia
- Initiation of Collaboration between APCE and ICHARM(Japan), HTC (Malaysia), ERCE

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

- ERCE, HTC, ICHARM, IHP japan,

3.3.3 exchange of staff, most notably professionals and students

- promoting Master and PhD students in collaboration with ERCE, UQ Australia, ICCE (Portugal)

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 project for IFIT with Unesco jakarta

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

- Unesco Jakarta

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

- Indonesian National Committee for Unesco, Indonesia IHP, Japan IHP, Korean IHP, Australian IHP, Malaysian IHP,

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

- In collaboration with Ministry of Public Works and INC-UNESCO for World Water Day and Earth Day Events

4.2 Policy documents and advice

5. Update on Centre Operations

5.1 Membership of the Board of Governors between designated period

- Governing Board Members :
    - Prof. Dr. Iskandar Zulkarnain (Indonesia)
    - Prof. Dr. Soontak Lee (Korea)
    - Prof. Dr. Kaoru Takara (Japan)
    - Prof. Dr. Quentin Grafton (Australia)
    - Representative of DG UNESCO
    - Prof. Dr. Hidayat Pawitan (Indonesia/Observer)
- Executive Board Members :
    - Executive Director : Prof. Dr. Hery Harjono

- Executive Secretary : Dr. Ignasius D.A. Sutapa
  Yovita Lambang Isti
- Director for Research Program: Prof. Dr. Hidayat Pawitan
  Prof. Dr. Gadis Sri Haryani
- Director for Information System : Prof.Dr. Robert Delinom
  Dr. Luki Subehi
- Director for Public Awareness : Dr. Munasri
  Dr. Deny Hidayati
- Director for Traning and Workshop : Drs. M. Fakhrudin
  Dr. Apip

- We finished to build APCE Secretariate building. The APCE secretariate is now in fuction for the activities after the APCE building opening ceremony by the Chaimen of LIPI in March 25 2014.
-

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)

- Provide alternative technology (IPAG) in order to increase clean water services in peatland areas
- Remote sensing technology for lake water quality monitoring tools
- Sustainable water resources management concept for Islamic Boarding Schools

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

- Capacity building for local people in operating IPAG installation to produce clean water from peat water in Katingan and Bengkalis
- Capacity building for local people to manage water resources in Islamic Boarding Schools in Ciamis

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

- Adoption of IPAG technology by local government for increasing water services in peatland areas in Katingan Central Kalimantan Province and Bengkalis Riau Province.

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

7.1 Operational Plan (attach if available)

ASIA PACIFIC CENTRE FOR ECOHYDROLOGY (APCE) –
UNESCO CATEGORY II CENTRE

- **VISION**
  - To be an Internationally Reputed Asia Pacific Center in Urban and Rural Ecohydrology by 2021
- **MISSION**
  - Develop understanding and practices of ecohydrology through research, training and knowledge exchanges, information systems and public awareness.
- **VALUES**
  - Wisdom
  - Integrity
  - Harmony

STRATEGIC GOALS :

1. To promote local resources base ecohydrological research
2. To strengthen local capacity to adopt ecohydrological concept and approach

3. To provide easy access to local resources based ecohydrological information and knowledge
4. To enhance public awareness of local resources based ecohydrological practices

7.2 Strategic Plan linked with IHP-VIII (Appendix 2)
(attach strategic plan if available)

8. Strategic Alignment with IHP-VIII

8.1 Focal areas within IHP-VIII the centre plans to contribute to and specific actions the centre will undertake to align its activities with the strategic plan for IHP-VIII (Please see Appendix-2)

9. Annexes

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

- UNESCO Free Flow : "Managing water : from local wisdom to modern sciences." 2013
- Ignasius Sutapa, IPAG60 : Alternative technology to provide clean water in peatland area." October 2013, Daegu, Korea.
- Reliana Lumban Toruan, 2012, Zooplankton emerging from fresh and saline wetlands, Journal of Ecohydrology and hydrobiology, Vol.12 no 1. 2012
- **Subehi L** (2014) Hydrological regime of several rivers in Indonesia. Proceeding of the 8th International Symposium on "The Recent Technologies for Flood Disasters Mitigation Measures", November 6, 2013, Daejeon – South Korea).
- **Subehi L** & Setiawan F (2014) Limnological studies on river forested watersheds. Proceeding of the 2nd International Symposium on "Advanced Technology for River Management", November 7 - 9, 2013, Seoul – South Korea.
- **Subehi L** (2013) Characteristics of fluctuation in water temperatures as an indicator for sustainable water management at River Cianten, West Java. Proceeding of International Conference of Indonesian Inland Waters III (ISBN 978-602-8380-07-2), Palembang – Indonesia, November 2012, pp 209.
- **Subehi L,** Triyanto, Wibowo H, Ridwansyah I (2013) Analysis of hydrological dynamic of lake Limboto that related to fisheries production. Proceeding of International Conference of Indonesian Inland Waters III (ISBN 978-602-8380-07-2), Palembang – Indonesia November 2012, pp 37
- **Subehi L**, Setiawan F, Hidayat (2012) Analysis of water temperature changes as an indicator for sustainable water management on the river forested watershed. Water Supply Management System and Social Capital Vol. 3, Chapter 30 : 385 – 389.
- Wibowo H, Setiawan F, **Subehi L** (2012) Study of clean water services investment at Jabodetabek based on physical characteristics. Water Supply Management System and Social Capital Vol. 3, Chapter 14 : 215 - 222
-

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

- IFAS Training Course in collaboration with ICHARM and Unesco Jakarta
- Ecohydrology training and workshop in collaboration with Unesco Jakarta
-

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

Contribution of APCE in 7th Phase of IHP (2008-2013)

Theme 1. **Adapting to impacts of global changes on river basins and aquifer systems**

1. Climate change impacts on hydrological cycle and consequence impact on water resources
    - Impacts of landuse and climate change on hydrologic regime on a watershed
    - Studies on water resources carrying capacity (WRCC)

Theme 3. **Ecohydrology for sustainibility**

1. Improving ecosystem quality and services by combining structural solutions with ecological biotech. : in collaboration with Research Center for Limnology-Indonesian Institute of Sciences (LIPI) conduct research on Ecohydrology application in Lake Limboto, Gorontalo Province

Theme 5. **Water education for sustainable development**

1. Tertiery water education and professional development
    - Training of IFAS and Basic hydrological training for the water resources managers of the river area, in collaboration with ICHARM, Unesco Jakarta, Ministry of Public Works
    - Commemorating the world water day (with Ministry of Public Works), Exhibition, National seminar (opened by the Minister of Public Works), discussions with awardees good water management (Mayor of Surabaya)., 22 Ministries participated
    - International Seminar on delta region held by the Coordinating Ministry for People's Welfare at the JCC, (The event attended by researchers from about 12 countries, opened by the Minister.

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

Appendix-2

Overview of the Core Programme Themes of the Eighth Phase of the IHP (2014-2021)
WATER SECURITY: ADDRESSING LOCAL, REGIONAL, AND GLOBAL CHALLENGES

APCE will actively contibute to IHP phase VIII (specifically related to Themes 5 and 6) by involving in several project activities as below :

List of Projects and Timeline

1. **Project Title: Ecohydrology for water security in urban and rural areas**
   Description: poverty, ecohydrology concept, water security, urban and rural areas
   Timeline: 3 years
   Contribution to IHP VIII: Theme V Focal Area V.3

2. **Project Title: Strengthening water management capacity for local communities**
   Description: low capacity, local communities, water management, capacity building
   Timeline: 3 years
   Contribution to IHP VIII: Theme VI Focal Area VI.5

3. **Project Title: Sustainable water management for developing resilience cities**
   Description: water management, resilience cities, sustainable management
   Timeline: 3 years
   Contribution to IHP VIII: Theme IV Focal Area IV.4

4. **Project Title: Development of appropriate technologies for water security in marginal areas**
   Description: water security, marginal area (peatland, coastal and smmal islands, flooding area, water polluted areas), appropriate technology
   Timeline: 3 years
   Contribution to IHP VIII: Theme V Focal Area V.3

5. **Project Title:** Water education for children, youth, and local people by promoting awareness of water issues through informal water education
   Description: water education, informal education, public awareness, local poeple and wisdom
   Timeline: 3 years
   Contribution to IHP VIII: Theme VI Focal Area VI.3 and VI.4

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

Focal area 1.1 - Risk management as adaptation to global changes
Focal area 1.2 - Understanding coupled human and natural processes
Focal area 1.3 - Benefiting from global and local Earth observation systems
Focal area 1.4 - Addressing uncertainty and improving its communication
Focal area 1.5 - Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

Focal area 2.1 - Enhancing sustainable groundwater resources management
Focal area 2.2 - Addressing strategies for management of aquifers recharge
Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
Focal area 2.4 - Promoting groundwater quality protection
Focal area 2.5 - Promoting management of transboundary aquifers

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources
Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends
Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution
Focal area 3.4 - Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity
Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution

THEME 4: WATER AND HUMAN SETTLEMENTS OF THE FUTURE

Focal area 4.1 - Game changing approaches and technologies
Focal area 4.2 - System wide changes for integrated management approaches
Focal area 4.3 - Institution and leadership for beneficiation and integration
Focal area 4.4 - Opportunities in emerging cities in developing countries
Focal area 4.5 - Integrated development in rural human settlement

THEME 5: ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

Focal area 5.1 - Hydrological dimension of a catchment– identification of potential threats and opportunities for a sustainable development
Focal area 5.2 - Shaping of the catchment ecological structure for ecosystem potential enhancement ─ biological productivity and biodiversity
Focal area 5.3 - Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services
Focal area 5.4 - Urban Ecohydrology – storm water purification and retention in the city landscape, potential for improvement of health and quality of life
Focal area 5.5 - Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector
Focal area 6.2 - Addressing vocational education and training of water technicians
Focal area 6.3 - Water education for children and youth
Focal area 6.4 - Promoting awareness of water issues through informal water education
Focal area 6.5 - Education for transboundary water cooperation

Appendix-3. Photos of Construction of APCE Buiding

Figure 1.: strart of APCE building construction

Figure 2.: Chairman of LIPI in starting of APCE building construction

Figure 3. APCE Secretariate

Figure 4. APCE Secretariate

Figure 5. Meeting activities in APCE building

Figure 6. Inauguration of APCE Secretariate Building

Format for Biennial Reports by UNESCO's Water-related Centres on activities related to the IHP in the period (June 2012- May 2014)

1. Basic information on the centre

Name of the Centre		Water Center for Arid and Semi-Arid Zones of Latin America and the Caribbean (CAZALAC)
Name of Director		Gabriel Mancilla
Name and title of contact person (for cooperation)		Gabriel Mancilla, Executive Director.
E-mail		gmancilla@cazalac.org
Address		Benavente 980, La Serena, Chile
Website		www.cazalac.org
Location of centre		city/town La Serena___ country __Chile__
Geographic orientation *		☐ global ☒ regional
Region(s) (for regional centres)		Latin America and Caribbean
Year of establishment		2006
Year of renewal assessment		2016
Signature date of most recent Agreement		October 9th, 2010
Themes Of activities during reporting period	Focal Areas ♦	☒ groundwater ☐ urban water management ☐ rural water management ☒ arid / semi-arid zones ☐ humid tropics ☐ cryosphere (snow, ice, glaciers) ☒ water related disasters (drought/floods) ☒ Erosion/sedimentation, and landslides ☒ ecohydrology/ecosystems ☒ water law and policy ☒ social/cultural/gender dimension of water ☐ transboundary river basins/ aquifers ☒ mathematical modelling ☐ hydroinformatics ☐ remote sensing/GIS ☒ IWRM ☒ Watershed processes/management ☒ global and change and impact assessment ☐ mathematical modelling ☒ water education ☐ water quality ☐ nano-technology ☐ waste water management/re-use ☒ water/energy/food nexus ☒ water systems and infrastructure ☐ other: (please specify) _____
	Scope of Activities ♦	☒ vocational training ☐ postgraduate education ☐ continuing education ☒ public outreach ☒ research ☒ institutional capacity-building ☐ advising/ consulting ☐ software development ☒ data-sets/data-bases development ☐ other: (please specify) _____

* check on appropriate box
♦ check all that apply

Support bodies [1]	Chilean General Water Directorate (General Water Board)
Hosting organization [2]	University of La Serena, Chile
Sources of financial support [3]	Extrabudgetary fund UNESCO/Flanders; JRC-EU; Research funds of Chilean Government; Research funds from Coquimbo region local government.
Existing networks and cooperation [4]	UNCCD;FAO; European Union.
Governance	☒ director and governing board ☐ other: (please specify) _____ Link to election of board members to the IHP Intergovernmental Council (IGC) and hosting country IHP National Committee _____Chile_____ Frequency of meetings: once every 1__year(s) ☐ Existence of UNESCO presence at meetings
Institutional affiliation of director	Executive Director in CAZALAC (full-time); Assistant Professor at University of Chile (on seconded Commission)
Number of staff and types of staff	total number of staff (full-time, or equivalent) : ___4_____ number of staff who are water experts: _____3____ number of visiting scientists and postgraduate students: _____1____
Annual turnover budget in USD	360,000

2. Activities undertaken in the framework of IHP in the period June 2012 – May 2014

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII/VIII (Appendix-1 and 2) and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.

• CAZALAC was invited to deliver course in National workshop for capacity building in the management of extreme hydro-climatic events, Ministry of Science, Technology and Environment, Havana, Cuba. May 28 to June 1, 2012.

• CAZALAC was invited to dictate ongoing research in Engineering and Technology Center, Autonomous University of Baja California, Tijuana, Mexico. 10th to 18th June 2012.

• CAZALAC engineer Jorge Núñez participated as instructor in the Training Institute for Adaptive Water Management in Vulnerable River Basins under Climate Change. Inter-American Institute for Global Change Research (IAI), Center of Excellence for Water Security in the Americas (AQUASEC) and Water Centre for Arid and Semi-Arid Zones in Latin America and the Caribbean (CAZALAC). La Serena, Chile, 8-17 October, 2012. The workshop included 35 graduate students, including workers and specialists, most from more than 12 countries in Latin America and the United States.

• CAZALAC engineer Jorge Núñez participated as instructor in the Pan American Studies Institute (PASI) on Adaptive Management of Water and Power in the Dry Areas of the

[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

Americas. This training was held in La Serena, Chile, between 24 June and 3 July 2013. The event was organized by the Inter-American Institute for Global Change Research (IAI), Center of Excellence for Water Security in the Americas (AQUASEC) for Arid and Semi-arid zones of Latin America and the Caribbean (CAZALAC), University of Arizona, Pontificia Universidad Católica de Chile, UNESCO-IHP and the Stockholm Environment Institute Center. The workshop included 30 students from various countries of Latin America, the U.S. and Europe, mixing under-graduate and graduate students.

• CAZALAC personnel participated as instructors in the RALCEA-ATOS - CAZALAC workshop in Santiago, Chile, from 11 to 13 March 2013. The objective of the workshop was to present, analyze, discuss and evaluate the results and respective national maps that were developed by the attendees, who were all part of the EUROCLIMA-WATER project. In the workshop, the participants were trained on the Regional Frequency Analysis methods of precipitation, by using L-moments. After that, they designed their maps.

- CAZALAC engineer Jorge Núñez was the main instructor of the "Development of National Drought Atlas for Caribbean countries workshop", organized through MWAR - LAC and RALCEA projects, coordinated by UNESCO and CAZALAC (4 to 8 of November 2013, in Kingston, Jamaica). Training consider professionals from respective national institutions of the Caribbean countries, for the development of local maps in drought frequency.

2.2 Research activities that directly contributed to the IHP-VII and/or IHP-VIII activities

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

• **Project "Development of an innovative drive system seawater using wave energy to osmosis desalination plants** ". Funded by the Innova-Chile CORFO (Chilean Economic Development Agency). This is a project conducted by the Catholic University of Valparaiso, Chile, in which CAZALAC is an associate. The project assumes that the use of wave energy should provide sufficient energy to drive the operation of reverse osmosis plants, reducing production cost of desalinated water and increasing the competitiveness of this type of desalination technology. This is linked to a project under development by the researchers referred to the creation of innovative converter wave energy to electrical energy. Therefore, the project addresses the water-energy issue. There are still no publications regarding this project.

• **Project "A Forest and Environmental Development Plan for Rio Hurtado**". Funded by funds of the Regional Government of Coquimbo, Chile. The project was conducted by the University of Talca (Chile), in association with CAZALAC and the National Forestry Corporation (CONAF). The objective of the project was to develop a Forest and Environmental Development Plan for Rio Hurtado, which include participation of stakeholders through integrated methodologies for obtaining information from people living in the territory, as well as from the natural environment, thereby achieving a spatial planning tool. In addition, the plan would generate economic activity and develop concrete actions to combat desertification phenomenon. The project was conducted from june 2012 to june 2013.

Output. Book:"Plan de Desarrollo Forestal y Ambiental del Río Hurtado, PLADEFORA" (A Forest and Environmental Development Plan for Rio Hurtado, PLADEFORA). Edited by the University of Talca and the Regional Government of Coquimbo Region (Chile). ISBN: 978-956-7669-36-3. 81 pages.

• **Project "Implementation of a Meteorological Monitoring Network as a tool to support decision making in the field of agriculture and aquaculture of the Coquimbo Region**". Funded by the Regional Government of Coquimbo Region (Chile). Project conducted by the Center for Applied Studies in Dry Areas (CEAZA), in which CAZALAC was an associate for the years 2012 and 2013. CAZALAC provided online climate data and seasonal forecasts.

Outputs: Monthly reports for climate and climate indicators that are relevant for agriculture decision- making.

• **Project "Options for energy solutions for Rural Water Systems (APR) of the Coquimbo Region**". Funded by the Regional Government of Coquimbo Region (Chile), and conducted by CAZALAC, in collaboration with Ecoingenieros Ltd. The project was carried out between October 2012 and October 2013, however there is still a review pending. The objective of the project was to determine the economic, legal and technical feasibility for supplying either wind or photovoltaic energy power to the APR of Coquimbo Region. It also defined the conditions of the sites where it is possible to install such kind of power plants. The main beneficiaries of the project are the rural Drinking Water Committees, which make up a total of 179 APR systems, serving more than 150,000 people from rural population of the Region of Coquimbo.

Outputs: Four technical reports already delivered. A manuscript to be submitted to a peer-referred journal will be prepared in the second semester of 2014.

• **Project "Sea water desalination through Inverse Osmosis and Photovoltaic Energy for the provision of drinking water in Isla Damas, Coquimbo Region**". Funded by the Regional Government of Coquimbo Region (Chile), and the Belgian company VMW (Vlaamse Maatschappij voor Watervoorziening). The project was conducted by CAZALAC and the collaboration of the National Forestry Corporation of Chile (CONAF), between November 2011 and October 2013. This project was the first project in Chile that applied reverse osmosis for drinking water supply in rural areas, which included solar energy as main energy source. The objective was sizing, design, install and evaluate a desalination plant with reverse osmosis system which will use photovoltaic power to ensure energy sustainability of the system, beyond the protection of the environment.

Outputs: i) Reports provided to Regional Government of Coquimbo Region.
ii) Technical Report UNESCO PHI – LAC Nº33. "Desalación de agua de mar mediante sistema Osmosis Inversa y Energía Fotovoltaica para provisión de agua potable en Isla Damas, Región de Coquimbo". UNESCO 2013.
iii) Articles highlighting the project in four newspapers (regional and national).
iv) TV report on the project, in Chilean National Television (TVN).
v) In the second semester of 2014, a new TV report will be performed for a scientific program of the Catholic University channel (UC-TV).

• **Project "Development of a model for sustainable water management in Huasco Valley, through environmental flow assessment, economic valuation and social hydrological services**". Project funded by the Regional Government of the Atacama Region. It started in April 2011 and finished at the end of June 2012. The project was conducted by CAZALAC, an associated parties were the International Union for Conservation of Nature (IUCN), the Water Stakeholders Association of the Rio Huasco and the General Water Directorate of the Atacama region in Chile. The objective of the initiative was to design a comprehensive hydrologic model for the Huasco river basin, considering environmental flows as a basis. Therefore, a decision-making tool for water management was achieved, contributing to the sustainability of water resources and the economic and social activities that depend on it.

Outputs:i) Technical Report. M. Pouilly and G. Aguilera (2012). Evaluación inicial de

caudales ecológicos/ ambientales en la Cuenca del río Huasco-Chile, mediante la simulación del hábitat físico del pejerrey Basilichthys microlepidotus y el camarón de río Cryphiops caementarius (Initial evaluation of environmental flows in the Huasco river basin, by simulating the physical hábitat of the silverside Basilichthys microlepidotus and the river shrimp Cryphiops caementarius. UICN, Quito, Ecuador. 57 pages.

ii) Wagnitz, P. 2012. Cost Benefit analysis regarding environmental flow implementation in the semiarid Huasco watershed, northern Chile. Thesis to obtain the degree of Master of Science (M.Sc.), Cologne University of Applied Sciences. Germany.

iii) Modelación de Recursos Hídricos de la Cuenca del Río Huasco: Tutorial Modelo WEAP-Huasco (Modeling water resources of the Huasco river basin: tutorial of the WEAP-Huasco model).

iv) Article: Wagnitz, P., Núñez, J., and Ribbe, L., 2014. Cost of environmental flow during water scarcity in the arid Huasco River basin, northern Chile. Hydrological Sciences Journal, 59 (3–4), 1–13.

- **Project "Strengthening the Agro-climatic Observatory"**. Project funded by the Government of Chile and headed by the Agriculture Secretariat (Ministry of Agriculture). CAZALAC participates as an associate, together with UNESCO, CEAZA, some universities and the General Water Directorate of Chile (DGA). The objective for strengthening the Agro-climatic Observatory in Chile is using hardware components, as well as providing technical assistance in the collection and computational implementation of compiled national data. The project started in October 2013.

  Output: An initial platform of data management is available at the web site http://www.climatedatalibrary.cl/UNEA/maproom/

- **Project EUROCLIMA-RALCEA. Contract ATOS-CAZALAC**. Funded by the European Commission. CAZALAC participates as an associate of the group headed by Dr. Cesar Carmona-Moreno of the JRC (Joint Research Center). The contract period of performance extended from late 2012 until 05/15/2014, and seeks concrete actions for implementing the theme "Variability of Water Balance Components in Latin America" by using the methodology that CAZALAC has widespread in the region, called Regional Frequency Analysis with L-moments.

  Outputs: i) Technical reports
  ii) A set of thematic maps for many countries of Latin-America
  iii) Trained professionals of many countries of LAC.

- **Project MWAR-LAC (Management of Water Resources in Arid and Semi- Arid Zones in Latin America and the Caribbean).) Phase III: Adoption of the draft framework MWAR -LAC.** Funded by UNESCO – Government of Flanders. CAZALAC participates as an associate. The project aims to strengthen the management capacity of water resources in arid and semi-arid areas in Latin America through networking and facilitate international and regional cooperation. This is achieved through the development of pilot projects and participation in regional projects with relevant partners in Latin America. Three main thematic priorities are performed: a) improve water governance as the basis for achieving integrated resource management; b) the use of modern techniques and methodologies to assess and improve the efficiency of water use ; c) hydro -climatic risk management including decision making. The overall objective of the proposed project is to improve the quality of life and alleviate poverty of local communities in arid and semiarid regions of Latin America and the Caribbean (LAC) , by reducing the vulnerability of water resource systems to global changes based on sound science. The project started in 2012 and will finish in 2014.

Outputs: i) An initial platform of data management is available at the web site http://www.climatedatalibrary.cl/UNEA/maproom/ (and that is also part of the project "Strengthening the Agro-climatic Observatory" of the Chilean Ministry of Agriculture).

ii) Drought observatories, data library, drought atlas, and many other products (see http://www.cazalac.org/mwar_lac/index.php?id=36&L=0 for more information about MWAR-LAC products).

• **Project "Cooperation in the field of water resources management between the Regional Government of Coquimbo Chile and the Mexican Institute of Water Technology (IMTA)".** Project funded by the Joint Cooperation Fund Chile – Mexico. The initiative is conducted by the association of the Regional Government of Coquimbo, the Mexican Institute of Water Technology (IMTA), CAZALAC and the Center for Advanced Studies in Arid Zones (CEAZA). The project started in August 2012 and it will finish by July 2014. The objective of the project was to establish cooperation and exchange of experiences and knowledge on water issues between all the parties.

Outputs: i) Water management professionals from public institutions were trained in Chile and Mexico in technology delegations to each country.
ii) Open seminars were performed to raise awareness about the proper use and conservation of water to civil society, and dissemination of both Mexican and Chilean experiences in water resources technology.
iii) Open seminars were performed to analyze water policy in Chile and contrast with the Mexico water policy. In addition, actions related to water culture were enhanced.

- **Project "Regional Strategy for Water Resources 2014-2030".** Project funded by the Regional Government of Coquimbo Region through the Regional Corporation for Productive Development. The project started in April 2014 and it will finish in December 2014. The study focus in each watershed of Coquimbo region. There, CAZALAC will collect all local water stakeholders' opinions and then elaborate a common strategy to improve planning, use and governance of water in a short (2014-2018) and long term period (2018-2030). Of course, a baseline of available data will be provided. The strategy for each watershed will contrast the stakeholders opinion, technical and financial issues to result in defining the more appropriate actions for water use in the future.

  Outputs: Not yet.

- **Other projects waiting for financial support.** There are two proposals that were presented by CAZALAC and are waiting for a decision about financial support. These are:
  i) **"**Generación y desarrollo de una propuesta tecnológica de captura de aguas lluvias para el incremento de las disponibilidades de agua con fines productivos en zonas de secano de la Región de Coquimbo" (Developing a technological proposal for rainwater catchment and store to increase water availability for productive uses in dry areas of the Coquimbo region). Applying to the funding "Public Goods for Competitiveness" of the Chilean Economic Development Agency (CORFO).

ii) "Cooperación en el ámbito de la gestión de la recarga de acuíferos (Managed Aquifer Recharge - MAR) entre la Dirección General de Aguas (Chile), CAZALAC (ALC) y el Instituto Mexicano de Tecnología del Agua (IMTA-México)" (Cooperation on Managed Aquifer Recharge between the Chilean Water Directorate, CAZALAC and the Mexican Institute for Water Technology). Applying to the Joint Cooperation Fund Chile – Mexico.

- **Proposals that were not funded.** Between June 2012 and May 2014, three proposals were not funded:

i) Proposal “A system for climate risk management and water availability for the Coquimbo region”, applied to 2012 Funds from the Regional Government of Coquimbo.

ii) Proposal “A system for climate risk management and water availability for the La Ligua and Petorca rivers basins in Valparaiso region, Chile”. Applied to 2012 Funds from the Regional Government of Valparaiso region, Chile.

iii) Proposal “Supporting water resources provision for agriculture and livestock, by designing and constructing catchment and store of rainwater (SCALL) and the water distribution by non-conventional renewable energy sources, in Río Hurtado, Coquimbo region, Chile. Applied for Funds of the Regional Government of Coquimbo.

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

- CAZALAC participated in the coordination and teaching of the Training Institute for Adaptive Water Management in Vulnerable River Basins under Climate Change. Organized by the Inter-American Institute for Global Change Research (IAI), Center of Excellence for Water Security in the Americas (AQUASEC) and Water Centre for Arid and Semi-Arid Zones in Latin America and the Caribbean (CAZALAC), in La Serena, Chile, 8-17 October, 2012. The workshop included 35 graduate students, including workers and specialists, from more than 12 countries in Latin America and the United States. The workshop was funded by the MWAR-LAC project and the IAI.

- CAZALAC participated by teaching in the Pan American Studies Institute (PASI) on Adaptive Management of Water and Power in the Dry Areas of the Americas. This training was held in La Serena, Chile, between 24 June and 3 July 2013. The event was organized by the Inter-American Institute for Global Change Research (IAI), Center of Excellence for Water Security in the Americas (AQUASEC) for Arid and Semi-arid zones of Latin America and the Caribbean (CAZALAC), University of Arizona, Pontificia Universidad Católica de Chile (Catholic University of Chile), UNESCO-IHP and the Stockholm Environment Institute Center. The workshop included 30 students from various countries of Latin America, the U.S. and Europe, mixing under-graduate and graduate students. The workshop was funded by the MWAR-LAC project and the IAI, the latter through the National Science Foundation (NSF) of the United States of America.

- CAZALAC engineers taught in the RALCEA-ATOS - CAZALAC workshop in Santiago, Chile, from 11 to 13 March 2013. The objective of the workshop was to present, analyze, discuss and evaluate the results and respective national maps that were developed by the attendees, who were all part of the EUROCLIMA-WATER project. In the workshop, the participants were trained on the Regional Frequency Analysis methods of precipitation, by using L-moments. After that, they designed their maps.

- CAZALAC participated in organizing and teaching in the "Development of National Drought Atlas for Caribbean countries workshop", organized through MWAR -LAC and RALCEA projects, coordinated by UNESCO and CAZALAC (4 to 8 of November 2013, in Kingston, Jamaica). Training consider professionals from respective national institutions of the Caribbean countries, for the development of local maps in drought frequency. The instruction dealt with the implementation of the Regional Frequency Analysis Using L-moments. Specifically, the objectives were: a) to train professionals in the use of Regional frequency analysis using L-moments for hydrological applications and analysis of vulnerability to drought; b) training in the various options of open source software (R and REFRAN-CV); c) increase the number of specialists in the region who are trained in the methodology; d) generate maps of drought frequency in the participating countries of the Caribbean.

• Quenting Satge, was a student of ISTOM, École Supérieure d'Agro Développement International, France. He developed his professional practice in CAZALAC. The goal of their practice was the development of a simulation model and planning of water resources, in WEAP environment to Choapa river basin. Practice Period: 15/04/2012 to 30/09/2012.

3. Collaboration and linkages

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

• Collaboration agreement framework between CAZALAC – CEAZA.
There is currently a broad collaboration agreement with CEAZA in order to facilitate mutual form, skills in human resources, equipment, information and infrastructure of both centers for the development of Research, Development and Innovation in matters of common interest.

• Collaboration agreement with the European Commission (EUROCLIMA – RALCEA).
There is a tacit agreement between CAZALAC and the EUROCLIMA-RALCEA project group. CAZALAC has coordinated EUROCLIMA activities in Latin America and the Caribbean, and it will continue doing that in the future.

• Collaboration agreement with FAO (Food and Agriculture Organization), related to the participation of CAZALAC in specific actions that are linked to data management and climate prediction tools.

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)

• Workshop for linking the PROMEP RRHIFLUCO network with the UNESCO International Hydrological Programme. 19-22 of November 2012, in Queretaro, Mexico. Former CAZALAC CEO, Mr. Guido Soto Alvarez, attended the workshop. The main objective of the conference was to strengthen the bonds of "Red PROMEP for characterizing hydro, river and coastal risk" with the various national and international actors (UNESCO IHP LAC) in hydrology of extreme floods, civil protection and hydro-meteorological general phenomena.

• CIH UNESCO-FRIEND meeting. CAZALAC Engineer, Mr. Manuel Soto-Benavides attended the meeting, which related to analysis and implementation of the PHI-LAC database (FRIEND Program). The meeting was held in Ciudad del Este, Paraguay from 6 to 10 May 2013. The meeting was hosted by experts from the Center for Hydro - CIH, and UNESCO-FRIEND. The event aimed to review the status of development of the Integrated Database (SIBD) and establish an implementation plan.

• UNESCO Joint Strategic and High -level Meeting on Water Security and Cooperation. Nairobi, Kenya 11 to September 13, 2013. Meeting at which was discussed in depth the scope of Phase VIII of the International Hydrological Programme. CAZALAC Executive Director, Dr. Gabriel Mancilla, attended to the meeting. IHP- VIII priority is water security (quantity and quality), from a holistic view that integrates people, ecosystems, water, culture and economy. Detailed of the objectives and challenges of the new phase were described at the meeting, noting that they will be implemented by the usual UNESCO programs and effective participation of National Committees of the IHP.

- Tenth National Committees and IHP Focal Point Meeting of Latin America and the Caribbean, Jiutepec, Morelos state, Mexico; December 2nd – 4th, 2013. Dr. Gabriel Mancilla, Executive Director of CAZALAC attended the meeting. There, the activities of each of the National Committees, Centers, Programmes and Chairs were detailed an analyzed.

- Coordination Meeting of MWAR-LAC project. Montevideo, Uruguay, 3-5 February 2014. Meeting that was organized by MWAR-LAC and the IHP of LAC. Advances of the project were described, as well as the proper activities of each of the institutions attending the meeting. Dr. Gabriel Mancilla, Executive Director of CAZALAC attended the meeting.

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

- Exchange of information with the ICIWarm, of the US Army Corps of Engineers. CAZALAC and ICIWARM are continuously exchanging information related to databases (climate data mainly), and participating in workshops. In addition, as Global Coordination of G-WADI program, ICIWARM has designated CAZALAC as its coordinator in LAC.

- CAZALAC is in charge for seeking local candidates for applying to graduate studies sponsored by the International Centre for Water Hazard and Risk Management (ICHARM) of Japan. However, this is a verbal agreement with Mr. Kuniyoshi Takeuchi.

3.3.3 exchange of staff, most notably professionals and students

- CAZALAC and ICiWARM have started some exchange of professionals. In particular, engineer Jorge Núñez has been involved in some activities that are supported by ICIWARM. CAZALAC expects to increase this collaboration, but it is necessary to formalize this relation.

- CAZALAC, through engineer Mr. Manuel Soto, participated in activities developed by the Center of Hydro Informatics (CIH) in Paraguay. In the future, there is an interest for increase this collaboration, but first it is necessary to formalize this relation.

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

- CAZALAC and ICiWARM have performed some joint activities, such as exchange of professionals, workshops, data sharing and knowledge exchange. This collaboration needs to be formalized anyway.

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

- Relationship with UNESCO Santiago (Chile). CAZALAC has a fluid relationship with the UNESCO headquarters in Santiago. Particularly, there has been continuous activity through the MWAR-LAC project, that is headed by Dr. Koen Verbist.

- Relationship with UNESCO Montevideo (Uruguay). The LAC regional headquarters for hydrology issues is located in Montevideo, in particular the regional hydrologist, Mrs. Zelmira May. CAZALAC is regularly asking questions and getting support from Montevideo.

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

- Relationship with the local IHP National Committee is pretty fluid. Once a month a meeting takes place, where all the IHP National Committee members describe their ideas, goals and needs. In addition, joint work is performed. CAZALAC is an active member of the IHP National Committee.

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

- CAZALAC participates in IHP UNESCO Programmes. Particularly, CAZALAC has made contributions in FRIEND and G-WADI Programs, and plans to do it in the Ecohydrology Program. In the FRIEND Program, CAZALAC participated in the CIH -FRIEND UNESCO meeting in May 2013 on Paraguay (Ciudad del Este). The event aimed to review the status of development of the Integrated Database (SIBD) and establish an implementation plan. For G-WADI, CAZALAC has made some contribution to the Program web-site and newsletter. CAZALAC plans to deliver a drought related book for LAC during 2014. In the ECOHYDROLOGY Program, CAZAAC will start contributing during 2014.

4. Communication

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

- M. Pouilly and G. Aguilera (2012). Evaluación inicial de caudales ecológicos/ ambientales en la Cuenca del río Huasco-Chile, mediante la simulación del hábitat físico del pejerrey Basilichthys microlepidotus y el camarón de río Cryphiops caementarius (Initial evaluation of environmental flows in the Huasco river basin, by simulating the physical hábitat of the silverside Basilichthys microlepidotus and the river shrimp Cryphiops caementarius. UICN, Quito, Ecuador. 57 pages.

- Wagnitz, P. 2012. Cost Benefit analysis regarding environmental flow implementation in the semiarid Huasco watershed, northern Chile. Thesis to obtain the degree of Master of Science (M.Sc.), Cologne University of Applied Sciences. Germany.

- Modelación de Recursos Hídricos de la Cuenca del Río Huasco: Tutorial Modelo WEAP-Huasco (Modeling water resources of the Huasco river basin: tutorial of the WEAP-Huasco model).

- Wagnitz, P., Núñez, J., and Ribbe, L., 2014. Cost of environmental flow during water scarcity in the arid Huasco River basin, northern Chile. Hydrological Sciences Journal, 59 (3–4), 1–13.

- Technical Report UNESCO PHI – LAC Nº33. "Desalación de agua de mar mediante sistema Osmosis Inversa y Energía Fotovoltaica para provisión de agua potable en Isla Damas, Región de Coquimbo". UNESCO 2013.

- Núñez, J.., Rivera, D., Oyarzún, R. and Arumí, J.L. 2013. Influence of Pacific Ocean multidecadal variability in the distributional properties of hydrological variables in North-Central Chile. Journal of Hydrology. 501 (25): 227–240.

- Oyarzún, J.; Carvajal, M.; Maturana, H.; **Núñez, J**.; Kretschmer, N.; Amezaga, J.; Rötting, T.; Strauch, G.; Thyne, G. and Oyarzún, R. 2013. Hydrochemical and isotopic patterns in a calc-alkaline Cu- and Au-rich arid Andean basin: The Elqui River watershed, North Central Chile. Applied Geochemistry. (33):50-63.

- CAZALAC newsletter, edited in Spanish and English every two months. Digital newsletter.

- MWAR LAC web-site. Managed by CAZALAC in its configuration and creation.

- CAZALAC web-site. Managed, created and updated by CAZALAC.

4.2 Policy documents and advice

5. Update on Centre Operations

5.1 Membership of the Board of Governors between designated period

CAZALAC´s Governing Board is still integrated just by representatives of Chilean institutions (International Governing Board is being arranged with the parties). The President of the Governing Board is the Governor of the Coquimbo region (where La Serena city is located). There were four different Governors in the June 2010- May 2012 period, Mr. Sergio Gahona (until November 2012); Mr. Mario Burlé (November 2012-August 2013); Mr. Juan Fuenzalida (August 2013-March 2014); and Ms. Hanne Utreras (March 2014 to present). The vice-President of CAZALAC Governing Board is the Director of the Water General Directorate of Chile, and Mr. Francisco Echeverría was in charge of that duty until March 2014, being then replaced by the actual Director, Mr. Carlos Estevez. The directors were the representative from the University of La Serena, Mrs. María Aguirre; the representative from the Catholic University of Valparaíso, Mr. Manuel Cerda; the representative from the University of Chile, Mrs. Ximena Vargas; the representative from the University of Talca, Mr. Roberto Pizarro; and lastly, the representative from the University of Concepción, Mr. José Vargas.

5.2 Key decisions made (attach minutes of meetings)

- During the June 2012- May 2014 period, CAZALAC Governing Board achieved some important decisions, which are included in the minutes of the meetings. Even though the related minutes of the Governing Board meetings are attached, these are exclusively written in Spanish and there is not an official translation to English.

- In meeting of November 13th, 2012, the Governing Board decided to start all the arrangements to achieve the new international Governing Board of CAZALAC.

- In meeting of January 18th, 2013, CAZALAC´s Executive Director at that time, Mr. Guido Soto communicates the Governing Board about his retirement during that year (2013), so the Governing Board agrees to recruit candidates for CAZALAC´s Executive Director Position.

- In an Extraordinary meeting of CAZALAC´s Governing Board (January 18th, 2013 as well), the directors agreed in modifying one of the Articles of Association. In particular, it will be established now that once the actual CAZALAC (which has a national status) moves to an international status (and thus, with a different tributary identification number), all the goods belonging to the Centre will go to the new international Centre.

- In an Extraordinary meeting of CAZALAC´s Governing Board (June 7th, 2013), the Governing Board designates Mr. Gabriel Mancilla as the new Executive Director of CAZALAC.

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)

Between June 2012 and May 2014, CAZALAC contributed in different ways to water and water-related science:

- Publishing Scientific and Technical documents (books and manuscripts) that can be consulted everywhere by people (most of them online).

- Working on database and decision-support computer platforms that can be accessed easily from the Internet.

- Media impact: Some of the CAZALAC's projects have been highlighted by the media, such as TV and newspapers. Particularly, the project "Sea water desalination through Inverse Osmosis and Photovoltaic Energy for the provision of drinking water in Isla Damas, Coquimbo Region" had a great impact in the media, enhancing the scientific and technological joint to provide solutions in water security for remote sites without freshwater resources.

- CAZALAC's work in climate database and useful mapping is often recognized. Many requests for joining CAZALAC to national and international projects are received every year.

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

- Through the European Commission's EUROCLIMA and RALCEA Projects, and also the UNESCO - M-WAR LAC project, CAZALAC spread the Regional Frequency Analysis with L-moments, as a standard analysis tool for the execution of the Variability and frequency properties of the Water Balance component in Latin America project.

- Distribution of technical documents that are related to PHI topics, which is the result of some projects developed by CAZALAC.

- CAZALAC has organized many seminars and workshops, which have been related to the projects achieved during 2012 and 2013. Professionals that have been trained in these workshops usually apply their new knowledge in their respective countries. These actions demonstrate that the role of CAZALAC as a training institution receives a very good recognition.

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

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

7.1 Operational Plan (attach if available)

7.2 Strategic Plan linked with IHP-VIII (Appendix 2)
(Attach strategic plan if available)

At the end of 2013, CAZALAC finished writing its Strategic Plan, which focuses in water security, as the same of the IHP. Therefore, the Centre has an important tool for future plans. The strategic plan is attached; however, it is only available in Spanish.

8. Strategic Alignment with IHP-VIII

8.1 Focal areas within IHP-VIII the centre plans to contribute to and specific actions the centre will undertake to align its activities with the strategic plan for IHP-VIII (Please see Appendix-2)

a. **Theme 1. Water-related disasters and hydrological cycle**.

Focal area 1.1 - Risk management as adaptation to global changes. Specific actions: CAZALAC will continue contributing to EUROCLIMA and RALCEA projects with JRC (Joint Research Center); in addition, CAZALAC will continue being an associate in the M-WAR LAC project.

Focal area 1.3 - Benefiting from global and local Earth observation systems. Specific actions: CAZALAC will continue working on Chilean National Observatory. It will possibly be participating in creating the Honduras` National Observatory.

b. **Theme 2. Groundwater in a changing environment**. **Focal area 2.1 - Enhancing sustainable groundwater resources management.** Specific actions: CAZALAC joins IMTA (Mexican Institute in Water Technology) to study aquifers artificial water recharge.

Focal area 2.2 - Addressing strategies for management of aquifers recharge. Specific actions: CAZALAC joins IMTA (Mexican Institute in Water Technology) to study aquifers artificial water recharge.

c. **Theme 3. Addressing water scarcity and quality**.

For all Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources; Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends; and Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution. Specific actions**:** CAZALAC was called by the Government of the Coquimbo region (north of Chile) to perform the “Regional Strategy for Water Resources 2014-2030”. This study will be focused in each watershed of Coquimbo region and it will consider the opinion of all local water stakeholders, in such a way to find a common strategy to improve planning, use and governance of water in a short (2014-2018) and long term period (2018-2030).

Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution. Specific actions: i) CAZALAC has just finished the project "Sea water desalination through Inverse Osmosis and Photovoltaic Energy for the provision of drinking water in Isla Damas, Coquimbo Region”. Through that project, a solution for obtaining drinking water was provided for an area (Isla Damas. "Damas Island”) without any freshwater sources. The desalination system was

supplied by solar energy; ii) CAZALAC is now finishing the project "Options for energy solution for Rural Drinking Water Systems in the Region of Coquimbo". The project is supported by the local government of the Coquimbo region, and provides an analysis to decide which non-conventional energy source (wind or photovoltaic) is more convenient for each of the Rural Drinking Water Systems. Nowadays, energy is more than 50% of the cost that rural people must pay for drinking water supply, so a solution to make that cost cheaper is strongly necessary.

d. Theme 4. Water and human settlements for the future

Focal area 4.3 - Institution and leadership for beneficiation and integration. Specific actions: The "Regional Strategy for Water Resources 2014-2030" study, that is being developed by CAZALAC for Coquimbo region, will try to find a common strategy to improve planning, use and governance of water in a short (2014-2018) and long term period (2018-2030). For planning, CAZALAC must involve all stakeholders of each watershed, coordinating local institutions to integrate their objectives in such a way of sharing benefits and tasks.

e. Theme 5. Ecohydrology. Engineering harmony for a sustainable world. Specific actions: CAZALAC was asked for participating in the Ecohydrology Program of LAC region, starting 2014. There is still not clarity about which focal areas the Centre will be contributing to.

f. Theme 6. Water Education, key for water security.

Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector. Specific actions: CAZALAC will continue performing and collaborating in workshops for training students from LAC region in modeling tools and techniques such as the L-moments. The Centre is performing new agreements with M-WAR LAC project and EUROCLIMA projects in order to do that.

9. Annexes

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

- M. Pouilly and G. Aguilera (2012). Evaluación inicial de caudales ecológicos/ ambientales en la Cuenca del río Huasco-Chile, mediante la simulación del hábitat físico del pejerrey Basilichthys microlepidotus y el camarón de río Cryphiops caementarius (Initial evaluation of environmental flows in the Huasco river basin, by simulating the physical hábitat of the silverside Basilichthys microlepidotus and the river shrimp Cryphiops caementarius. UICN, Quito, Ecuador. 57 pages.

- Wagnitz, P. 2012. Cost Benefit analysis regarding environmental flow implementation in the semiarid Huasco watershed, northern Chile. Thesis to obtain the degree of Master of Science (M.Sc.), Cologne University of Applied Sciences. Germany.

- Modelación de Recursos Hídricos de la Cuenca del Río Huasco: Tutorial Modelo WEAP-Huasco (Modeling water resources of the Huasco river basin: tutorial of the WEAP-Huasco model).

- Wagnitz, P., Núñez, J., and Ribbe, L., 2014. Cost of environmental flow during water scarcity in the arid Huasco River basin, northern Chile. Hydrological Sciences Journal, 59 (3–4), 1–13.

- Technical Report UNESCO PHI – LAC Nº33. “Desalación de agua de mar mediante sistema Osmosis Inversa y Energía Fotovoltaica para provisión de agua potable en Isla Damas, Región de Coquimbo”. UNESCO 2013.

- Núñez, J.., Rivera, D., Oyarzún, R. and Arumí, J.L. 2013. Influence of Pacific Ocean multidecadal variability in the distributional properties of hydrological variables in North-Central Chile. Journal of Hydrology. 501 (25): 227–240.

- Oyarzún, J.; Carvajal, M.; Maturana, H.; Núñez, J.; Kretschmer, N.; Amezaga, J.; Rötting, T.; Strauch, G.; Thyne, G. and Oyarzún, R. 2013. Hydrochemical and isotopic patterns in a calc-alkaline Cu- and Au-rich arid Andean basin: The Elqui River watershed, North Central Chile. Applied Geochemistry. (33):50-63.

- CAZALAC newsletter, edited in Spanish and English every two months. Digital newsletter.

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

- Eng. Jorge Nuñez, from CAZALAC, is invited to be a trainer of a Course in the Center for Engineering and Technology of the Universidad Autónoma de Baja California, Tijuana, México, from June 10th thru 18th, 2012.

- Eng. Jorge Nuñez, from CAZALAC, is invited to teach in the National Workshop for strenghtening capabilities for managing extrems hydroclimatic events, by the Ministry of Science, Technology and environment of Cuba. La Habana, Cuba, May 28th to june 1st, 2012.

- CAZALAC participated in the coordination and teaching of the Training Institute for Adaptive Water Management in Vulnerable River Basins under Climate Change. Organized by the Inter-American Institute for Global Change Research (IAI), Center of Excellence for Water Security in the Americas (AQUASEC) and Water Centre for Arid and Semi-Arid Zones in Latin America and the Caribbean (CAZALAC), in La Serena, Chile, 8-17 October, 2012. The workshop included 35 graduate students, including workers and specialists, from more than 12 countries in Latin America and the United States. The workshop was funded by the MWAR-LAC project and the IAI.

- CAZALAC participated by teaching in the Pan American Studies Institute (PASI) on Adaptive Management of Water and Power in the Dry Areas of the Americas. This training was held in La Serena, Chile, between 24 June and 3 July 2013. The event was organized by the Inter-American Institute for Global Change Research (IAI), Center of Excellence for Water Security in the Americas (AQUASEC) for Arid and Semi-arid zones of Latin America and the Caribbean (CAZALAC), University of Arizona, Pontificia Universidad Católica de Chile (Catholic University of Chile), UNESCO-IHP and the Stockholm Environment Institute Center. The workshop included 30 students from various countries of Latin America, the U.S. and Europe, mixing under-graduate and graduate students. The workshop was funded by the MWAR-LAC project and the IAI, the latter through the National Science Foundation (NSF) of the United States of America.

- CAZALAC engineers taught in the RALCEA-ATOS - CAZALAC workshop in Santiago, Chile, from 11 to 13 March 2013. The objective of the workshop was to present, analyze, discuss and evaluate the results and respective national maps that were developed by the attendees, who were all part of the EUROCLIMA-WATER project. In the workshop, the participants were trained on the Regional Frequency Analysis methods of precipitation, by using L-moments. After that, they designed their maps.

- CAZALAC participated in organizing and teaching in the "Development of National Drought Atlas for Caribbean countries workshop", organized through MWAR -LAC and RALCEA projects, coordinated by UNESCO and CAZALAC (4 to 8 of November 2013, in

Kingston, Jamaica). Training consider professionals from respective national institutions of the Caribbean countries, for the development of local maps in drought frequency. The instruction dealt with the implementation of the Regional Frequency Analysis Using L-moments. Specifically, the objectives were: a) to train professionals in the use of Regional frequency analysis using L-moments for hydrological applications and analysis of vulnerability to drought; b) training in the various options of open source software (R and REFRAN-CV); c) increase the number of specialists in the region who are trained in the methodology; d) generate maps of drought frequency in the participating countries of the Caribbean.

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

Appendix-2

Overview of the Core Programme Themes of the Eighth Phase of the IHP (2014-2021)
WATER SECURITY: ADDRESSING LOCAL, REGIONAL, AND GLOBAL CHALLENGES

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

- Focal area 1.1 - Risk management as adaptation to global changes
- Focal area 1.2 - Understanding coupled human and natural processes
- Focal area 1.3 - Benefiting from global and local Earth observation systems
- Focal area 1.4 - Addressing uncertainty and improving its communication
- Focal area 1.5 - Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

- Focal area 2.1 - Enhancing sustainable groundwater resources management
- Focal area 2.2 - Addressing strategies for management of aquifers recharge
- Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
- Focal area 2.4 - Promoting groundwater quality protection
- Focal area 2.5 - Promoting management of transboundary aquifers

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

- Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources
- Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends
- Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution
- Focal area 3.4 - Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity
- Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution

THEME 4: WATER AND HUMAN SETTLEMENTS OF THE FUTURE

- Focal area 4.1 - Game changing approaches and technologies
- Focal area 4.2 - System wide changes for integrated management approaches
- Focal area 4.3 - Institution and leadership for beneficiation and integration
- Focal area 4.4 - Opportunities in emerging cities in developing countries
- Focal area 4.5 - Integrated development in rural human settlement

THEME 5: ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

- Focal area 5.1 - Hydrological dimension of a catchment– identification of potential threats and opportunities for a sustainable development
- Focal area 5.2 - Shaping of the catchment ecological structure for ecosystem potential enhancement ─ biological productivity and biodiversity
- Focal area 5.3 - Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services
- Focal area 5.4 - Urban Ecohydrology – storm water purification and retention in the city landscape, potential for improvement of health and quality of life
- Focal area 5.5 - Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

- Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector
- Focal area 6.2 - Addressing vocational education and training of water technicians
- Focal area 6.3 - Water education for children and youth
- Focal area 6.4 - Promoting awareness of water issues through informal water education
- Focal area 6.5 - Education for transboundary water cooperation

Format for Biennial Reports by UNESCO's Water-related Centres on activities related to the IHP in the period (June 2012- May 2014)

1. Basic information on the centre

Name of the Centre		Centre for Sustainable Management of Water Resources in the Caribbean Island States. (CEHICA)
Name of Director		Juan Ramón Chalas
Name and title of contact person (for cooperation)		Juan Ramon Chalas. Director
E-mail		jrchalas@gmail.com ; cehica@indrhi.gob.do
Address		Ave, Enrique Jiménez Noya esq. Juan De Dios Ventura Simó, Centro de los Réroes, Sto. Dgo. , Rep Dom.
Website		indrhi.gob.do
Location of centre		city/town Sto. Dgo_____ country Dominican Republic._____
Geographic orientation *		☐ global x☐ regional
Region(s) (for regional centres)		Caribbean
Year of establishment		2010
Year of renewal assessment		2016
Signature date of most recent Agreement		March 2010
Themes Of activities during reporting period	Focal Areas ♦	x☐ groundwater ☐ urban water management x☐ rural water management x☐ arid / semi-arid zones ☐ humid tropics ☐ cryosphere (snow, ice, glaciers) x☐ water related disasters (drought/floods) x☐ Erosion/sedimentation, and landslides ☐ ecohydrology/ecosystems ☐ water law and policy x☐ social/cultural/gender dimension of water x☐ transboundary river basins/ aquifers ☐ mathematical modelling ☐ hydroinformatics ☐ remote sensing/GIS x☐ IWRM ☐ Watershed processes/management x☐ global and change and impact assessment ☐ mathematical modelling x☐ water education x☐ water quality ☐ nano-technology ☐ waste water management/re-use ☐ water/energy/food nexus ☐ water systems and infrastructure ☐ other: (please specify) _
	Scope of Activities ♦	☐ vocational training ☐ postgraduate education x☐ continuing education ☐ public outreach x☐ research ☐ institutional capacity-building

* check on appropriate box
♦ check all that apply

	☐ advising/ consulting ☐ software development ☐ data-sets/data-bases development ☐ other: (please specify) _____
Support bodies [1]	National Institute of Water Resources in the Dominican Republic. (INDRHI)
Hosting organization [2]	
Sources of financial support [3]	Government of the Dominican Republic (public funds)
Existing networks and cooperation [4]	
Governance	x☐ director and governing board ☐ other: (please specify) _____ Link to election of board members to the IHP Intergovernmental Council (IGC) and hosting country IHP National Committee Olgo Fernández. Director of INDRHI. direccion@indrhi.gob.do_____ Frequency of meetings: once every _year(s) x☐ 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) : 13_____ number of staff who are water experts: 6_____ number of visiting scientists and postgraduate students: _____
Annual turnover budget in USD	

2. Activities undertaken in the framework of IHP in the period June 2012 – May 2014

a.- Attendance to the Event Fair Day Memorial Water to Water. October 2013. Governmental and private institutions in the water sector expressed their instrumentals and initiatives and projects underway for the management and conservation of water, both in quality and quantity.

b.- Involvement in the project "Water Resources Management in Arid and Semi Arid Regions of Latin America and the Caribbean (MWAR - LAC), which aims to develop risk maps from droughts in the Caribbean, using frequency analysis L – moments.

c.- Involvement Workshop IFI FRIEND on Hydrological Maximum in Panama from 28 to 30 April, 2014

Studies and research

a.- Simulation of the Effects of Climate Change on Water Resources and Adaptation Strategies in the basin of the Yaque del Norte River. concluded in January 2014.

b. Modeling hydrological regimes and processes erosion / sedimentation and simulation scenarios for watershed restoration. Concluded in January 2014.

c -. Financial, physical and environmental sustainability of irrigation service rate in the Dominican Republic. Concluded in March 2014

[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

d -. Sustainability Assessment Process of decentralization of Irrigation Service in the Dominican Republic. Concluded in June 2014.

e.- Assessment of the quality of surface and ground water in the main river basins (5) of the country. Permanent.

f -. Redesign monitoring system for water quality in the basin of the river Yaque del Sur, in the Dominican Republic. concluded

Formulated research projects

a -. Simulation of the Effects of Climate Change on Water Resources through Regionalization Technique to Lower Rank Statistics "Statistical Downscaling" Basin of Rio Yaque del Sur.

b -. Simulation of salt intrusion, evolution and development in the tourist area of San Pedro de Macoris and La Romana

c -. Analysis of extreme rainfall generated by tropical cyclones and hydrological and hydraulic modeling in Dominican watersheds.

Educational activities

Coordination to carry out a regional course - workshop on "Rainwater Harvesting in the Dominican Republic.

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII/VIII (Appendix-1 and 2) 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-VII and/or IHP-VIII activities
Please include research/applied projects outputs such as publications that directly contributed to the IHP-VII/VIII and WWAP objectives

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

3. Collaboration and linkages

a.- Involvement in the creation in April 2013, the UNESCO Chair "Water, Gender and Governance

.b - CEHICA coordinated the participation of an expert from the Department of Hydrology at the International Workshop "Developing National Drought Atlas for the Caribbean" which was held in Kingston, Jamaica, November 2013 Under the. project "Water Resources Management in Arid and Semi Arid Regions of Latin America and the Caribbean (MWAR - LAC), which aims to develop risk maps of drought Caribbean countries, applying frequency analysis L – moments

c.- Under the coordination of International Center for Integrated Water Resources Management (ICIWaRM), category 2 center associated with the IHP UNESCO, was organized and conducted a course on hydrological modeling in June 2013, in which about 25 technical of INDRHI received training on HMS management software for hydrological analysis

d.- Attendance to the Strategic High Level Meeting on Water Security and Cooperation (Strategic and High Level Meeting on Water Security and Cooperation), which was held in Nairobi, Kenya, West Africa, from 11 to 13 September 2013

e -. With the International Institute for Sustainable Development (IISD) and coordinated by the CEHICA and INDRHI a draft climate risk management was implemented in the basin of the Rio Yaque del Sur, in which various participative techniques were employed with hydrological models analysis and effects of climate change on agriculture

f-. Attendance and coordination regional course-workshop on hydrologic simulation of reservoirs, from 12 to 16 May 2014. Instructors were provided by ICIWaRM, UNESCO category 2 center

3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies
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)
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
  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
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
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 between designated period
5.2 Key decisions made (attach minutes of meetings)

6. Evidence of the Centre's Impacts

The CEHICA using national funds provided by the INDRHI has made several regional activities for capacity building, strengthening partnerships between members of the Centre, identifying research needs for the region, disseminate works of IHP-LAC, among other

6.1 Science Impacts (Major contributions to the science, technology, education, and regional and/or international cooperation in the field of water)
6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)
6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)

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

Future Activities
Activities planned for 2014-2015.

The activities programmed presented below for this period are preliminary, pending the approval of the board of CEHICA. These actions are grouped into three areas:

a.- Generation of scientific and technological knowledge of research projects to be transferred to the Caribbean

b.- Initiatives of direct impact for the region

c.- Tasks for institutional strengthening of CEHICA

Generation of scientific and technological research projects to be transferred to the Caribbean knowledge.

Total investment: U.S. $ 683,923.00
External Resources : U.S. $ 638,923.00
Internal resources : U.S. $ 45,000.00

a.1 - . Simulation of the Effects of Climate Change on Water Resources and Adaptation Strategies in the basin of Rio Yaque del Norte. (U.S. $ 71,375.00) .

a.2 - . Modeling hydrological regimes and processes of erosion / sedimentation and simulation scenarios for watershed restoration . (U.S. $ 185,700.00) .

a.3 - . Financial , physical and environmental sustainability of irrigation service rate in the Dominican Republic . (U.S. $ 15,476.00) .

a.4 - . Sustainability Assessment Process Decentralization of Irrigation Service in the Dominican Republic . (U.S. $ 22,619.00) .

a.5 - . evaluation of the quality of surface and ground water in the main river basins (5) of the country. (U.S. $ 35,000.00) .

a.6 - . Simulation of the Effects of Climate Change on Water Resources through Regionalization Technique to Lower Rank Statistics "Statistical Downscaling " Basin in Rio Yaque del Sur. (U.S. $ 141,986.00)

a.7 - . Simulation of salt intrusion , evolution and development in the tourist area of San Pedro de Macoris and La Romana. (U.S. $ 137,469.00) .

a.8 - . analysis of extreme rainfall generated by tropical cyclones and hydrological and hydraulic modeling Dominican watersheds. (U.S. $ 64,298.00)

a.9.- Characterization of hydro properties of agricultural soils irrigated the Dominican Republic . (U.S. $ 10,000.00

Initiatives for direct impact for the region

Total investment: U.S. $ 101,200.00
External Resources: U.S. $ 60,000.00
Internal resources: U.S. $ 41,200.00

b.1 -. study "Assessment and structuring tariff regime in the different uses of water in the Caribbean region." U.S. $ 15,000.00.

b.2 -. Developing National Drought Atlas for the Caribbean region.

b.3 -. competitive fund (FONDOCEHICA) for presentation of research projects. U.S. $ 60,000.00.

b.4. - Two Courses - regional workshops "Hydrological Simulation" in coordination with ICIWaRM

Tasks for institutional strengthening of CEHICA.

c.1 -. Meeting of the Administration Board.

c.2 -. Creation / establishment of the Scientific Council.

c.3 -. Elaboration strategic plan of CEHICA. U.S. $ 20,000

7.1 Operational Plan (attach if available)
7.2 Strategic Plan linked with IHP-VIII (Appendix 2) (attach strategic plan if available)

8. Strategic Alignment with IHP-VIII

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

Focal area 1.1 - Risk management as adaptation to global changes

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

Focal area 2.1 - Enhancing sustainable groundwater resources management

Focal area 2.5 - Promoting management of transboundary aquifers

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector

Focal area 6.2 - Addressing vocational education and training of water technicians

Focal area 6.3 - Water education for children and youth

Focal area 6.4 - Promoting awareness of water issues through informal water education

8.1 Focal areas within IHP-VIII the centre plans to contribute to and specific actions the centre will undertake to align its activities with the strategic plan for IHP-VIII (Please see Appendix-2)

9. Annexes

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

9.2 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

Appendix-2

Overview of the Core Programme Themes of the Eighth Phase of the IHP (2014-2021)
WATER SECURITY: ADDRESSING LOCAL, REGIONAL, AND GLOBAL CHALLENGES

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

- Focal area 1.1 - Risk management as adaptation to global changes
- Focal area 1.2 - Understanding coupled human and natural processes
- Focal area 1.3 - Benefiting from global and local Earth observation systems
- Focal area 1.4 - Addressing uncertainty and improving its communication
- Focal area 1.5 - Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

- Focal area 2.1 - Enhancing sustainable groundwater resources management
- Focal area 2.2 - Addressing strategies for management of aquifers recharge
- Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
- Focal area 2.4 - Promoting groundwater quality protection
- Focal area 2.5 - Promoting management of transboundary aquifers

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

- Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources
- Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends
- Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution
- Focal area 3.4 - Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity
- Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution

THEME 4: WATER AND HUMAN SETTLEMENTS OF THE FUTURE

- Focal area 4.1 - Game changing approaches and technologies
- Focal area 4.2 - System wide changes for integrated management approaches
- Focal area 4.3 - Institution and leadership for beneficiation and integration
- Focal area 4.4 - Opportunities in emerging cities in developing countries
- Focal area 4.5 - Integrated development in rural human settlement

THEME 5: ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

- Focal area 5.1 - Hydrological dimension of a catchment– identification of potential threats and opportunities for a sustainable development
- Focal area 5.2 - Shaping of the catchment ecological structure for ecosystem potential enhancement ─ biological productivity and biodiversity
- Focal area 5.3 - Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services
- Focal area 5.4 - Urban Ecohydrology – storm water purification and retention in the city landscape, potential for improvement of health and quality of life
- Focal area 5.5 - Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

- Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector
- Focal area 6.2 - Addressing vocational education and training of water technicians
- Focal area 6.3 - Water education for children and youth
- Focal area 6.4 - Promoting awareness of water issues through informal water education
- Focal area 6.5 - Education for transboundary water cooperation

Format for Biennial Reports by UNESCO's Water-related Centres on activities related to the IHP in the period (June 2012- May 2014)

1. Basic information on the centre

Name of the Centre		Hidroex - Centro Internacional de Educação, Capacitação e Pesquisa Aplicada em Águas (International Centre for Water Education, Training & Applied Research)
Name of Director		Octávio Elísio Alves de Brito
Name and title of contact person (for cooperation)		Octávio Elísio Alves de Brito
E-mail		octavio.elisio@hidroex.mg.gov.br
Address		Avenida Professor Mário Palmério, 1000 – Bairro Universitário- CEP: 38.200-000 - Frutal / MG / Brasil
Website		http://www.hidroex.mg.gov.br/
Location of centre		city/town Frutal/Minas Gerais country Brazil
Geographic orientation *		X global ☐ regional
Region(s) (for regional centres)		
Year of establishment		2009
Year of renewal assessment		
Signature date of most recent Agreement		
Themes Of activities during reporting period	Focal Areas ♦	X groundwater X urban water management X rural water management ☐ arid / semi-arid zones ☐ humid tropics ☐ cryosphere (snow, ice, glaciers) X water related disasters (drought/floods) X Erosion/sedimentation, and landslides X ecohydrology/ecosystems X water law and policy X social/cultural/gender dimension of water X transboundary river basins/ aquifers ☐ mathematical modelling ☐ hydroinformatics X remote sensing/GIS X IWRM X Watershed processes/management ☐ global and change and impact assessment ☐ mathematical modelling X water education X water quality ☐ nano-technology ☐ waste water management/re-use ☐ water/energy/food nexus ☐ water systems and infrastructure ☐ other: (please specify) _____
	Scope of Activities ♦	X vocational training

* check on appropriate box
♦ check all that apply

		X postgraduate education X continuing education ☐ public outreach X research X institutional capacity-building ☐ advising/ consulting ☐ software development ☐ data-sets/data-bases development X other: (please specify) community education
Support bodies [1]		Federal Government of Brazil – Ministry of Science, Technology and Innovation (MCTI), Ministry of Education (MEC); National Council for Scientific and Technological Development (CNPq) Minas Gerais State Government – State Secretariat for Science, Technology and Higher Education (SECTES); Minas Gerais Research Support Foundation (FAPEMIG)
Hosting organization [2]		
Sources of financial support [3]		Annual budget of the State of Minas Gerais, transfer of federal resources Federal and State Funding Agencies (Fapemig, CNPq, Fapesp, CTHidro) Other Funding Sources: Energy Company of Minas Gerais State – CEMIG
Existing networks and cooperation [4]		Institute for Water Education (UNESCO-IHE) Delft, The Netherlands; UNESCO's Regional Offices: Brazil, LAC and CPLP; Cousteau Foundation, Chesapeake, Virginia, USA; The Community of Portuguese Speaking Countries (CPLP); Helmholtz Centre for Environmental Research (UFZ), Germany; Regional Centre on Urban Water Management (UNESCO-RCUWM), Iran; International Centre for Water Hazard and Risk Management (ICHARM), Japan; National Council for Scientific and Technological Development (CNPq); Ministry of Higher Education, Science, Technology and Innovation of the Republic Of Cape Verde; National Institute for Water (INA), Argentina; The Water Condominium: Hidroex; Minas Gerais Federal University; Ouro Preto Federal University; the State University of Minas Gerais; Uberlândia Federal University; Triângulo Mineiro Federal University; Lavras Federal University; Alfenas Federal University, Viçosa Federal University; Itajubá Federal University; the Pontifical Catholic University of

[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

	Minas Gerais; São João Del Rey Federal University; Vales do Jequitinhonha e Mucuri Federal University; Minas Gerais Technological Center Foundation; Minas Gerais State Secretariat for Science, Technology and Higher Education; National Water Agency (ANA), Brazilian Agricultural Research Corporation and International Hydroinformatics Centre, Itaipu
Governance	X director and governing board X other: Advisory Scientific Council Link to election of board members to the IHP Intergovernmental Council (IGC) and hosting country IHP National Committee 6 members (3 Nominated and 3 Alternate) Frequency of meetings: once every 1 year(s) X Existence of UNESCO presence at meetings
Institutional affiliation of director	Minas Gerais State Government – State Secretariat for Science, Technology and Higher Education (SECTES)
Number of staff and types of staff	total number of staff (full-time, or equivalent): 63 number of staff who are water experts: 5 number of visiting scientists and postgraduate students: 26 visiting scientists; 55 students (24 postgraduate and 31 undergraduate - trainees)
Annual turnover budget in USD	Amounts financed by State of Minas Gerais Budget by year: 2012 - US$ 4,242,821.00 2013 - US$ 2,586,251.00

2. Activities undertaken in the framework of IHP in the period June 2012 – May 2014

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII/VIII (Appendix-1 and 2) and WWAP *Please include here those activities which led to accreditation of degrees, or those held in formal school settings.*

2.1.1 The experience of Hidroex to develop and offer formal education is being undertaken with UNESCO-IHE or with other academic institutions such as the Federal University of Ouro Preto (UFOP) and the Federal University of Lavras (UFLA). The agreement with UFOP, which will be initiated in mid-2014, will offer a joint MSc degree in socio-economic sustainable development. The public call with the rules for the selection of candidates of the Master is available from the 5th of May 2014. (Attached)

2.1.2 Additionally each year an increasing number and thematic orientations of short courses are being offered and the amount of research being undertaken is also growing incrementally, and many of these short course in partnership with IHE-DELFT mentioned in item 2.3 come later as academic credit at this institution. Additionally, the UEMG initiated in 2014 a new MSc program in environmental sciences in cooperation with Hidroex at the City of Waters.

2.2 Research activities that directly contributed to the IHP-VII and/or IHP-VIII activities

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

2.2.1 Water for Life – a model of Integrated Management of Water Resources. (IHP VII, THEME 1: 1.2 THEME 2: Focal Areas 2.1 to 2.5; THEME 3: Focal area 3.1, 3.2; THEME 4: Focal areas 4.3, 4.4; THEME 5: Focal areas 5.3, 5.4 – IHP VIII, THEME 1, Focal area 1.1, 1.2, 1.5; THEME 3: Focal areas 3.1, 3.2, 3.3, 3.4, THEME 4: Focal areas 4.1, 4.2, 4.5; THEME 5: Focal areas 5.1, 5.2, 5.4; THEME 6)

2.2.2 Recovery and long-term conservation of soils and water resources. (IHP VII, THEME 2: Focal areas 2.4, 2.5; THEME 3: Focal area 3.2; THEME 4: Focal area 4.4 – IHP VIII, THEME 3: Focal areas 3.1,3.2; THEME 4: Focal areas 4.5; THEME 5: Focal areas 5.1)

2.2.3 Forest recovery in Permanent Preservation Areas, Legal Reserves and ecological corridors. (IHP VII,THEME 4: Focal area 4.4 – IHP VIII, THEME 3: Focal areas 3.1)

2.2.4 Undertaking of an agro-ecological zoning planning process. (IHP VII THEME 2: Focal Area 2.5; THEME 4: Focal area 4.4 – IHP VIII, THEME 3: Focal areas 3.1,3.3)

2.2.5 Development of a forest inventory of the watershed. (IHP VII, THEME 3: Focal area 3.1, THEME 4: Focal area 4.4 – IHP VIII, THEME 3: Focal areas 3.1; THEME 5: Focal area 5.2)

2.2.6 Quantification and description of forest fragments and establishment of a genetic conservation system. (IHP VII, THEME 3: Focal area 3.1, THEME 4: Focal area 4.4 – IHP VIII, THEME 3: Focal areas 3.1; THEME 5: Focal area 5.2)

2.2.7 Characterization of river environments and inventory of aquatic biodiversity. (IHP VII, THEME 3: Focal area 3.1, THEME 4: Focal area 4.3, 4.4 – IHP VIII, THEME 1: Focal area 1.2; 1.5; THEME 3: Focal areas 3.1, 3.4; THEME 5: Focal area 5.1, 5.2)

2.2.8 Identification of alternatives to incentives and payment for environmental services. (IHP VII THEME 2: Focal Area 2.1, 2.2, 2..3, 2.4; THEME 4: Focal area 4.4 – IHP VIII, THEME 3: Focal areas 3.1, 3.3, 3.4; THEME 4: Focal area 4.5)

2.2.9 Sustainable urban water management. (IHP VII THEME 2: Focal Area 2.1; THEME 4: Focal area 4.3 – IHP VIII,THEME 1: Focal area 1.2; 1.5; THEME 3: Focal areas 3.1, 3.2, 3.3; THEME 4: Focal area 4.1; THEME 5: Focal area 5.1, 5.4).

2.2.10 Mapping of waterborne diseases. (IHP VII THEME 2: Focal Area 2.1; THEME 3: Focal areas 3.2 – IHP VIII, THEME 1, Focal area 1.1, 1.5; THEME 3: Focal areas 3.1, 3.3, 3.5; THEME 5: Focal area 5.1, 5.4).

2.2.11 The Impact of Education on Water Management. (IHP VII THEME 2: Focal Area 2.1; THEME 5: Focal areas 5.1, 5.4 – IHP VIII, THEME 6: Focal areas 6.3, 6.4).

2.2.12 History and culture of water. (IHP VII THEME 2: Focal Area 2.1– IHP VIII,THEME 1: Focal area 1.2).

2.2.13 Recycling lives: from an environmental problem to a social solution. (IHP VII THEME 4: Focal area 4.3 – IHP VIII, THEME 3: Focal areas 3.5; THEME 4: Focal area 4.1)

2.2.14 Development of a Water Museum. (IHP VII THEME 5: Focal areas 5.1, 5.4 – IHP VIII, THEME 6: Focal areas 6.3, 6.4).

2.2.15 Sustainable Regulation of Aquaculture Activity in the Reservoir of São Simão, Paranaíba River – Minas Gerais/Goiás. (IHP VII THEME 3: Focal Area 3.2, 3.3; THEME 4: Focal area 4.1, 4.4;

– IHP VIII,THEME 1: Focal area 1.5; THEME 3: Focal Area 3.1; THEME 5: Focal areas 5.1, 5.2).

2.2.16 Sustainable Regulation the Reservoir of Marimbondo – Grande river, Minas Gerais/São Paulo. (IHP VII THEME 3: Focal Area 3.2, 3.3; THEME 4: Focal area 4.1, 4.4; – IHP VIII,THEME 1: Focal area 1.5; THEME 3: Focal Area 3.1; THEME 5: Focal areas 5.1, 5.2).

2.2.17 Invasive species in reservoirs. (IHP VII THEME 1: Focal Areas 1.3; THEME 3: Focal Area 3.1, 3.3; – IHP VIII,THEME 1: Focal areas 1.1, 1.2; THEME 5: Focal areas 5.1, 5.3).

2.2.18 Water Quality Control and Environmental Revitalization of Grande River. (IHP VII, THEME 3: Focal area 3.1, THEME 4: Focal area 4.4 – IHP VIII, THEME 1: Focal area 1.2; 1.5; THEME 3: Focal areas 3.1, 3.3; THEME 5: Focal area 5.1, 5.2).

2.2.19 Scientific-Technical Study of a stretch of San Francisco River for Environmental Revitalization. (IHP VII, THEME 3: Focal area 3.1, THEME 4: Focal area 4.4 – IHP VIII, THEME 1: Focal area 1.2; 1.5; THEME 3: Focal areas 3.1, 3.3).

2.2.20 The São Francisco Revitalization Program's research and control of water quality. (IHP VII, THEME 3: Focal area 3.3; THEME 5: Focal area 5.1, 5.2 – IHP VIII,THEME 6: Focal area 6.1 to 6.4).

2.2.21 Biodiversity of freshwater micro-crustaceans in rocky fields within Cerrado and Caatinga Biomes- Environmental. (IHP VII, THEME 3: Focal area 3.3; THEME 5: Focal area 5.3, 5.4 – IHP VIII, THEME 1: Focal area 1.5; THEME 6: Focal area 6.3, 6.4).

2.2.22 Consolidation of the Nucleus of Reference and Innovation on Irrigation and Water Resources (NURII) in Frutal, MG, with the National Water Agency (ANA) and The Brazilian Agricultural Research Corporation (EMBRAPA). (IHP VII, THEME 1: 1.2; THEME 4: Focal area 4.4 – IHP VIII, THEME 1: Focal area 1.2, 1.5; THEME 3: Focal area 3.1, 3.3, 3.3; THEME 4: Focal area 4.1).

2.2.23 CECAFE – Environmental Science Center "Forest School" – Water and Biodiversity. Develops 23 scientific activities. (IHP VII, THEME 3: Focal area 3.1, THEME 4: Focal area 4.4, THEME 5: Focal area 5.3., 5.4 – IHP VIII, THEME 5: Focal area 5.1, 5.2; THEME 6: Focal areas 6.3, 6.4, 6.5)

2.2.24 The São Francisco Revitalization Program's research and control of water quality – research/capacity building boat. (IHP VII, THEME 3: Focal area 3.3, THEME 5: Focal area 5.2, 5.3 - IHP VIII, THEME 1: Focal area 1.1, 1.5; THEME 5: Focal area 5.1, THEME 6: Focal area 6.2, 6.3)

2.2.25 Water quality control and revitalization of the Rio Grande River. (IHP VII THEME 2, Focal Area 2.4, 2.5, IHP THEME 3, Focal Area 3.1, 3.2, 3.3 - IHP VIII THEME 1: Focal area 1.1, 1.5, THEME 5: Focal area 5.1, 5.3)

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

2.3.1 Education for Water – A interdisciplinary perspective - capacity building of elementary school teachers.Duration: 16 hours. Where: Uberaba, Frutal, Buritizeiro and Pirapora (Brazil) (IHP VII, THEME 2, Focal area 2.1, THEME 5, Focal area 5.1, 5.2, 5.3, 5.4)

2.3.2 Integrated Watershed Management - Duration: 120 hours. Where: Frutal and Brasília (Brazil), Buenos Aires (Argentina)

and Montevidéu (Uruguai) (IHP VII THEME 2, Focal area 2.4 IHP THEME 5, Focal area 5.1, 5.2, 5.3, 5.4)

2.3.3 Integrated Flood Risk Management: concepts, approaches and challenges. Where:Del Cauca, Colômbia. (IHP VII THEME 1, Focal area 1.1, 1.2, 1.3, THEME 2, Focal area 2.4, THEME 5, Focal area 5.2)

2.3.4 Water Quality Training - Where: Praia City (Cape Verde), Belo Horizonte (Brazil), Maputo (Mozambique), Santa Fé (Argentina) (IHP VII THEME 2, Focal area 2.4, THEME 5, Focal area 5.1, 5.2, 5.3, 5.4)

2.3.5 Leadership Training for Management of Watershed Committees – Where: Centralina e Frutal (Brazil) (IHP VII THEME 2, Focal area 2.1, 2.2, 2.3, THEME 5, Focal area 5.1, 5.2, 5.4)

2.3.6 Climate and Management of Extreme Events – Where: Maputo (Mozambique) (IHP VII THEME 1, Focal area 1.1, 1.2, 1.3, THEME 2, Focal area 2.4, THEME 5, Focal area 5.2)

2.3.7 Workshop on Application of GIS, held at Hidroex in October 2012. (IHP VII, THEME 5: Focal area 5.2, IHP VIII, THEME 3: Focal area 3.5, THEME 6: Focal area 6.1, 6.2)

2.3.8 Course on Agroecology, for farmers, students and community in general, held at Hidroex, from September 2013 to May 2014. (IHP VII THEME 2: Focal Area 2.1, 2.5; THEME 3: Focal area 3.2; THEME 4: Focal area 4.4, THEME 5: Focal area 5.4 – IHP VIII, THEME 4: Focal area 4.5; THEME 6: Focal area 6.4).

2.3.9 Program: Sister-Schools Program (Cape Verde and Frutal, MG, December 2013) This program involved some 160 students from public schools in both Frutal and Cape Verde in better understanding environmental issues in both countries and included email exchanges, video conferencing and the travel of several students from Cape Verde to Frutal, MG. concluding in an environmental fair in Brazil.

2.3.10 Program: UNESCO- Hidroex Yara Lins Ecocidadania Center: June to December 2013. This program involved nearly 1000 young people from Frutal in an ongoing series of art and crafts workshops to promote the aspects of good citizenship as well as a better understanding of environmental issues and their relationship to quality of life issues.

3. Collaboration and linkages

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

3.1.1 Marseille - 6th World Water Forum (participation and presentation on the City of Waters)– 09-19 March, 2012

3.1.2 Rio +20 Conference (Rio de Janeiro, 2012) - Hidroex was part of the Official Delegation of the Minas Gerais State who attended The United Nations Conference on Sustainable Development (UNCSD) and participated in side events, like:

3.1.2.1 Forum on Science, Technology and Innovation for Sustainable Development, sponsored by The International Council for Science (ICSU),

3.1.2.2 Rio+20 World Meeting of Environmental Lawyers, promoted by The International Centre of Comparative Environmental Law (CIDCE), Program on Law and the Environment (PDMA), FGV DIREITO RIO and the Environmental Law Institute; and

3.1.2.3 2012 ICLEI World Congress (which took place in Belo Horizonte)

3.1.3 Lisbon- Meeting at the headquarters of the Community of Portuguese Speaking Countries – CPLP, 3 September, 2012

3.1.4 Marseille - 6th General Assembly of the World Water Council 17-18 November, 2012

3.1.5 Lisbon - meeting at the headquarters of CPLP – 20-21 November, 2012

3.1.6 Delft - 5th Delft Symposium on Water Sector Capacity Development: Developing Capacity From Rio To Reality. Who's Taking The Lead?, Delft, Netherlands, 29-31 May 2013.

3.1.7 Free Flow: Reaching Water Security through Cooperation - The Hidroex contributed with an article ("Hidroex International Centre an example of water cooperation") and cover photo of the book "Free Flow: Reaching Water Security through Cooperation". Conceived on the occasion of the International Year of Water Cooperation, coordinated by UNESCO on behalf of UN-Water, this joint publication by UNESCO and Tudor Rose was launched officially during the Budapest Water Summit in October 2013. The book had the participation of more than 100 authors from more than 50 international institutions, who shared their experiences in water management and cooperation at the international, regional, national and municipal level, showing how people are establishing cooperation and changing their interaction with water.

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)

3.2.1 Paris - 20 th Session of the IHP Intergovernmental Council and meeting of the UNESCO-IHP water centers – 02-11 June, 2012

3.2.2 Faro - participation in the International Seminar on Global Water Issues and Ecohydrology (ICCE)– 4-5 September, 2012

3.2.3 Paris - Meeting at UNESCO (IHP, and Brazilian representation) – 06-07 September, 2012

3.2.4 Paris - Meeting at UNESCO (IHP and Brazilian representation) 16 November, 2012

3.2.5 Paris - meetings at the headquarters of UNESCO (Launch of the International Year of Water Cooperation and IHP); 11-12 February, 2013

3.2.6 Washington, D.C. - U.S. National Committee for the IHP Annual Meeting, March, 2013

3.2.7 Nairobi - UNESCO Strategic and High-Level Meeting on Water Security and Cooperation *(Second panel on water security and cooperation in Africa; Moderator: working group -IHP-VIII IMPLEMENTATION PLAN (Theme 6: Water education, key for water security); Panel: Cooperation within the Unesco Water Family)* 11-13 September, 2013)

3.2.8 Paris-37th General Conference of UNESCO *(12/11 - side event: Water Education and Capacity Development; 13 November: High-level Panel Session on Climate change; impacts on water resources and adaptation policies in mountainous regions (in the context of the IYWC 2013); 13 November: Launch of the Women in African History: An E-learning Tool project; 13 November: Building Ocean Knowledge through partnerships for a Blue Society: UNESCO's*

IOC as a catalyst for partnership 13-14 November: International Water Cooperation), 10-15 November, 2013-

3.2.9 Washington, D.C. - U.S. National Committee for the IHP Meeting, November 2013

3.2.10 Jiupetec and Mexico City - X IHP-LAC National Committees and Focal Points Meeting and Closing Ceremony of International Year of Water Cooperation, 01-08 December, 2013

3.2.11 Paris- 50th session of the Bureau of the International Hydrological Programme (IHP)- 31 March - 1 April, 2014

3.2.12 Sao Tome and Principe - Workshop "Strengthening Water Education at the School level", 28-30 April, 2014

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

3.3.2.1 Memorandum of Understanding signed among, SECTES, Hidroex and the International Centre for Water Hazard and Risk Management (ICHARM). Objective: cooperation in education and research in water. Signed on June 2012.

3.3.2.2 Partnership with International Hydroinformatics Centre – Itaipu, Brazil on the elaboration of joint projects and activities such as the training on the use of radioweb.

3.3.3 exchange of staff, most notably professionals and students

3.3.3.1 Four professionals of the staff from Hidroex participated of the "Program of Professional Exchange Activities" with staff members at UNESCO-IHE. Delft, Netherlands, 17-28 May 2013.

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

3.3.4.1 Faro - International Seminar on Global Water Issues and Ecohydrology (organization University of Algarve, International Centre for Coastal Ecohydrology ICCE, Hidroex and other partners),

3.3.4.2 Partnership with International Hydroinformatics Centre – Itaipu, Brazil – mutual visits and attendance on workshops – Groundwater workshop and Water Condominium workshop.

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

3.4.1 Hidroex has the support of The International Hydrological Programme for Latin America - IHP/LAC since the beginning of its activities in aiding the development of the Center, participating in the meetings of its Governing Board and formal partnerships for the development of educational and training activities in Latin America.

3.4.2 IHP/LAC. Joint organization of a volume of the journal AquaLac.

3.4.3 International Scientific Cooperation Agreement between IHP/LAC and Hidroex. Objective: conducting courses and

training activities in the area of water resources in Uruguay and Brazil. Signed on August 2013.

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

3.5.1 Hidroex has the support of the Brazilian IHP National Committee (COBRAPHI) since the beginning of the project, which had technical merit approved in 2007. COBRAPHI is assisted in the work of creation and consolidation of Hidroex and accompanied meetings of the Governing Board of the Centre. Hidroex participates in meetings of COBRAPHI seeking help COBRAPHI and other Brazilian institutions in the implementation of the IHP.

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

3.6.1 Hidroex is partner and develops activities with the UNESCO Chair on Water, Women and Development, created in 2006 at the Federal University of Ouro Preto, Minas Gerais, Brazil. The program values the respect to water resources, the environment and diversity; to education; teamwork; volunteerism; forming networks, and especially, women's skills.

4. Communication

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

4.1.1 Technical Cooperation Agreement signed among EMBRAPA, ANA, SECES and Hidroex. Objective: Structuring, implementation and consolidation of the Nucleus of Reference and Innovation on Irrigation and Water Resources (NURII) in Frutal, MG. Signed on March, 2012

4.1.2 Cooperation Agreement signed between the National Council for Scientific and Technological Development (CNPq) and Hidroex. Objective: support and complement to the scientific and technological activity in areas defined between CNPQ and Hidroex. Signed on May, 2012

4.1.3 Cooperation Agreement signed between EMATER and Hidroex. Objective: combined efforts to perform actions and activities of common interest, related with the development of projects and programs of science and technology base applied to the management of natural resources, with an emphasis on conservation and utilization of water resources. Signed on May, 2012

4.1.4 Cooperation Agreement signed between the Federal University of Juiz de Fora (UFJF) and Hidroex. Objective: mutual technical cooperation for the development of education, research and innovation activities in scientific areas. Signed on October, 2012

4.1.5 Cooperation Agreement signed between the National Water Agency (ANA) and Hidroex. Objective: promote the training of members of National Water Resources Management System (singreh) and support actions to be developed under the IHP and the member countries of the CPLP. Signed on November, 2012

4.1.6 Protocol of Understanding signed between Caio Martins Foundation and Hidroex. Objective: combine efforts for the implementation of the Center for Revitalizing of São Francisco River in the city of Buritizero. Signed on December, 2012

4.1.7 Munich / Prague - official Mission – Legislative Assembly of Minas Gerais - ALMG – 15-23 January, 2013

4.1.8 Praia - Audience with the Minister Antonio de Aguiar C Leon Silva; Signature of Memorandum of Understanding between the Ministry of Higher Education, Science, Technology and Innovation of the Republic Of Cape Verde and Hidroex (Objective: technical cooperation with purpose for the implementation of projects and programmes of common interest); participation in the closing ceremony of the Water Quality Training – 08-09 February, 2013

4.1.9 Scientific International Cooperation Agreement signed among National Institute for Water (INA) and the Hidroex. Objective: conducting courses of education and training in water resources in Argentina and Brazil. Signed on June, 2013

4.1.10 Maputo – participation in 11th Symposium on Hydraulics and Water Resources of Portuguese Language Countries (SILUSBA)- 23 May – 06 June, 2013

4.1.11 Buenos Aires - opening of the course Integrated Watershed Management (partnership with the Argentine National Institute of Water – INA)- 07-09 July, 2013

4.1.12 Delft - UNESCO-IHE Governing Board, November 2013

4.1.13 Technical Cooperation Agreement signed among SECTES, UEMG, Hidroex and the University of Münster (Westfälische Wilhelms-Univesitat Munster). Objective: promote scientific, artistic and technological cooperation for research, education and extension activities. Signed on March, 2014

4.2 Policy documents and advice

4.2.1 HIDROEX is one of the executive bodies of the Brazilian National Water Policy (Act n.º 9.433, of January 8, 1997), developing research, courses and other training activities, thereby supporting the other members of the National Water Resource Management System (SNGRH).

4.2.2 Similarly, the HIDROEX also runs the Minas Gerais State Water Policy (Act n.º 13.199, of January 29, 1999), as an entity belonging to the State Executive whose expertise relates to the management of water resources , through actions and research, technological development and training of human resources activities, primarily related to water resources.

4.2.3 Workshop: Organization of Three Hundred Water Users in the Parnaíba River Basin in the City of Centralina, MG. This interactive workshop which was held in October 2012 and included the participation of 300 water users, involved UNESCO-IHE, Emater Farmers Union, and the Rio Paraiba River Basin Committee. Its aim was to promote joint resolution to existing and potential conflicts surrounding access to and use of water resources.

5. Update on Centre Operations

5.1 Membership of the Board of Governors between designated period

5.1.1 Members in 2012:

- UNESCO/IHP
  - Nominated: Blanca Elena Jiménez-Cisneros
  - Alternate: Miguel da França Dória
- National Water Agency (ANA):
  - Nominated: Dalvino Troccoli Franca;
  - Alternate: Antônio Félix Domingues;
- Institutions operating in areas related to the Center:

- Nominated:Valter Vilela Cunha – Sanitation Company of Minas Gerais - COPASA;
- Alternate:: Roberto Lira – Usina Caeté;
- Nominated:Alexandre Francisco Maia Bueno – Energy Company of Minas Gerais State – CEMIG;
- Alternate:: Wagner Soares Costa – Federation of Industries of the State of Minas Gerais – FIEMG;

- Representative of the Federal Government:
  - Nominated: Alexandre Navarro - Ministry of National Integration;
  - Alternate: Marco Antônio Fonseca – Geological Survey of Brazil - CPRM;
- Designated members:
  - Representative of Minas Gerais Water Management Institute – IGAM:
    - Designated: Cleide Izabel Pedrosa de Melo;
    - Alternate: Daniela Diniz Faria;
  - Representative of Minas Gerais State Government**:**
    - Designated: Paulo Romano – Minas Gerais State Secretariat for Agriculture, Livestock and Food Supply;
    - Alternate:: Vicente José Gamarano – Minas Gerais State Secretariat of Science, Technology, and Higher Education;
  - UNESCO members:
    - Latin America and Caribe:
      - Designated: Francisco Rodriguez (Dominican Republic) - Centre for the Sustainable Management of Water Resources in the Caribbean Island States - CEHICA;
      - Alternate: Daniel González (Uruguay) - National Director of Water OF MVOTMA;
    - Africa:
      - Designated: Roda Sansão Nuvunga Luís (Mozambique), Ministry of Science and Technology of Mozambique;
      - Alternate: António Filipe Lobo de Pina, (Cape Verde) University of Aveiro;
    - Europe:
      - Designated: Luís Chicharo, International Center for Coastal Ecohydrology (Portugal);
      - Alternate: Manuela Moreira da Silva, International Center for Coastal Ecohydrology (Portugal).

5.1.2 Change in membership in 2014:

- National Water Agency (ANA):
  - Nominated: Antônio Félix Domingues;
  - Alternate: Bruno Pagnoccheschi;
- Representative of Minas Gerais Water Management Institute – IGAM:
  - Designated: Marilia Carvalho de Melo;
  - Alternate: Jeane Dantas de Carvalho;

5.2 Key decisions made (attach minutes of meetings)

5.2.1 First meeting (2012):

- Approval of the Bylaws of the Governing Board
- Appointment of Executive Secretary of the Governing Board

- Presentation of the Multiannual Investment Plan, the Proposed Annual Budget and Accountability of HIDROEX
- Organization of the HIDROEX Advisory Scientific Council
- Work Plan 2013.

5.2.2 Second meeting (2013):

- Change in the bylaws of the Governing Board;
- Presentation on actions to e-learning in the Water Education Program.
- Approval of Accountability 2012
- Initiated the process of transforming HIDROEX from its current category 2 status to category 1 status. This process was undertaken within the context of the goals of the IHP and particularly IHP phase VIII as well as to better meet the demands of the Member States to provide greater access to water education for all levels of society. The starting point was the work accomplished to date but within a new institutional model which includes broad societal water education as well as a specific emphasis on the countries of the Portuguese-speaking community (CPLP). A concept proposal was prepared and approved by the IHP Bureau in April 2014 in an out-of-session meeting after being reviewed an supported by the Brazilian Government. It will be submitted to the IHP-IGC in June of 2014 for review. Work plan 2014

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)

6.1.1 Many of the projects which have been developed by Hidroex, and its partners, have proven to be a safer path to harmonizing development and the environment, combining the improvement of people's living standards, patterns of output and consumption with conservation and protection of life-support systems. Some outputs are already reflected at the community behavior towards a more sustainable approach.

6.1.2 Characterization of River Environment. The study of the river environment, especially on water quality and aquatic biodiversity, has allowed the community, especially the rural one, to know about the state of degradation or conservation of their watershed and what interventions are required for the improvement for the quality of the environment where they live.

6.1.3 Recovery and Conservation of Soil. This study has established a soil management system suited to local conditions and has also worked on a network of associated rural roadways capable of preventing the current erosion caused by water washing. It has benefited almost 300 farmers by helping on advise soil management techniques, use of pertinent techniques, diversification of use of soil etc.

6.1.4 Assistance for Environmental Licensing of Properties (pursuant to requirements of the Forestry Code and the National Register of Properties). To facilitate the environmental adaptation of rural properties in the area under examination, farmers have been supplied with relevant information or even carrying out activities designed to speed up environmental licensing. Besides making farm owners aware of their

environmental duties and rights, properties that need to obtain or renew their environmental licenses are being surveyed, inventoried and geo-referenced. In almost 300 farms, the Sustainability Indicators in Agroecosystems have been applied and a good overview of the environmental situation of the region has been achieved. One very positive impact of such study was the trust relationship acquired little by little between scientists and community.

6.1.5 Forest Inventory. Native species have been quantified and qualified in the studied region, and we know by now that less than 10% of the native vegetation still remains. Fact that indicates intervention to change the present situation.

6.1.6 Urban Waters. Through this study it was possible to identify the main drainage problems in the study area and what will happen in the future if nothing is done to reverse the present reality. Four scenarios were created about the urban growth and the carrying capacity of the urban drainage system.

6.1.7 Water history and culture in the region – recovery of the local culture. Through this work the community was invited to rediscover its own history and raise good practices and popular lore, which have been long forgotten or buried under the consumerist model of society. The work was centered in the local history and culture itself. People were invited to talk about what they lived and what they learned with past generations. This scenario of possible dialogues, in which visions of the past and the future join each other, made the participation of the common citizen in the town's effort to rediscover itself possible. More than a work of historical recovery, it is a work about creating opportunities for people to realize themselves as individuals that build and transform their town's history. This has allowed to rescued the reality arising from the relationship between nature -in special, water - and society.

6.1.8 Water and Food Security. A workshop and a 10 months course on Agroecology, organized by Hidroex, have allowed a process of culture change to be implemented. By the demonstration of interest and by the change on the behavior of the people involved, towards a more sustainable agriculture, we can testify the success of the initiative.

6.1.9 The Impact of Education on Water Management. This study has monitored the changes that might potentially occur in the community's behavior concerning the rational use of water through activities of water education. It has allowed the development of an Index of Environmental Perception which will be used to evaluate whether the community will indeed transform through environmental education or not.

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

6.2.1 The activities of UNESCO-HIDROEX during this reporting period include training of some 350 water professionals in structured courses in Brazil, Latin America and Africa, as well as training of approximately 700 teachers and 1000 students in courses on water education and vocational training.

6.2.2 Specifically, the Sister-Schools Program approached 160 children from the reality of daily life lived in Brazil and Cape Verde and increased their understanding about the relationships of people with water, giving some of them the

opportunity to travel and see the countries involved in the project.

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

6.3.1 Hidroex provides technical support and participates in Watershed Committees at its headquarters region.

6.3.2 Hidroex is an alternate member of State Council of Environmental Policy of Minas Gerais - COPAM;

6.3.3 Hidroex is an alternate member of the *State Water Resources* Councilof Minas Gerais - CERH-MG;

6.3.4 Hidroex provided support in specific cases of changes in legislation and procedures relating to the management of Brazilian and state waters. The Center issued legal position on a bill that was proceeding through the Brazilian Parliament (called National Congress) that dealt with the percentage of funds that are transferred to Member States by the economic activity of the hydroelectric power generation sector.

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

7.1 Operational Plan (attach if available)

7.1.1 HIDROEX have inserted their activities in public planning of the Government of the Minas Gerais State, both in "Minas Gerais Integrated Development Plan" – PMDI (long-term planning, with a backdrop of 20 years), as the "Multiannual Plan for Government Action" - PPAG (medium-term planning, with a backdrop of 4 years). For its annual planning, HIDROEX has prepared annual work plans, which are submitted and approved by the Management Board. **(Attached)**

7.1.2 One of the HIDROEX main operational actions is the implementation of the City of Waters. The City of Waters is located in Frutal, Minas Gerais on the banks of the Rio Grande, the headwaters of the Paraná River, and in the Guarani Aquifer, which is one of the largest groundwater reserves in the world.

7.1.2.1 This facility will serve the interests of both Latin America and the Community of Portuguese=speaking Countries (CPLP) in terms of many water-related priorities identified in IHP-VIII through both its education and research programs and including among other topics: IWRM, waste water treatment, reuse and quality, water security applying advanced technologies to water management, conflict management, and water education at all levels and for all sectors at national, regional and international scales.

7.1.2.2 Phase 1 development: the first phase of the development of the City of Waters includes 19,000m 2 (U.S.$42million investment) serving both the State University of Minas Gerais (UEMG) and Hidroex.

7.1.2.2.1 UEMG (14,000m 2): facilities include 29 classrooms, 5 computer labs, 5 analytical wet labs, and a distance education and audio and video complex (with a master room plus 6 labs). Additionally, there is a library, study lounges for students, prep rooms for academic staff, an administration facility and an auditorium

with seating for 450 people, and public reception and dining facilities.

7.1.2.2.2 Hidroex (5,000m 2): facilities include an administration building, storage room, data processing facility, several classrooms, a research laboratory, meeting rooms, multimedia room and auditorium.

7.1.2.3 Phase 2 development: The second phase in the development of the City of Waters will include an additional 25,000m2 (U.S. $31 million investment) and will be completed in 2014. This phase will add the following facilities to the campus: library and documentation center, 576 dormitory rooms, group study areas, 8 wet labs (physics, chemistry, biology, etc.), administrative offices, data center, and a videoconference complex.

7.1.2.4 Additionally, this phase will include development of an "Olympic Village" sports complex of approximately 27,000 m², including a football field with synthetic grass, gymnasium with indoor sports courts, lap pool, running track with a synthetic rubber floor, showers and toilets.

7.1.2.5 Phase 3 development: The third phase will require an investment of approximately U.S.$ 25 million and is also scheduled for delivery in late 2014. Facilities include: water supply and treatment facility, solid waste treatment facility, irrigation system, fire protection and visual/aesthetic additions such as a 23,000 m² boulevard (physically tying the campus to the city of Frutal), a cultural center of nearly 10,000 m², a road, parking and walkway/bridge/viaduct system, and open lawns totaling approximately 215,000 m². Additionally a third block of classrooms totally 4,560 m² will be added to the UEMG wing of the campus. There will be three lunch stations along the boulevard plus a restaurant of 1,000 m², a guesthouse for up to six visiting scholars will also be included in phase 3 of the development plan.

7.1.2.6 Phase 4 development: An estimated U.S.$9 million will be invested in phase 4 of the development plan scheduled to be completed in 2015. This phase will focus on the development of the Water Condominium (23,000 M2) that will be used by scientists sharing a common research interest, and include offices, a restaurant, and multi-purpose rooms.

7.2 Strategic Plan linked with IHP-VIII (Appendix 2)
(attach strategic plan if available)

7.2.1 The HIDROEX Strategic Plan will be established based on the decisions of the Advisory Scientific Council, which had its first meeting on May 7th, 2014. To date, the Center has worked with the following guidelines as underlying principals:

7.2.1.1 The Water Condominium: The Water Condominium is a unique concept that attracts scientists from around the world interested in addressing complex,

priority research problems requiring inputs from social sciences, natural sciences and engineering disciplines. This concept has the institutional support of the Ministry of Education (MEC), the Ministry of Science, Technology and Innovation (MCTI), and the National Water Agency (ANA). Currently the Water Condominium is composed of 18 institutions undertaking research and education in the priority water sector issues such including, among others, the Federal University of Minas Gerais (UFMG), Federal University of Ouro Preto (UFOP), Federal University of Viçosa (UFV), Federal University of Uberlandia (UFU), Federal University of São João del Rey (UFSJ), Federal University of Vale do Jequitinhonha e do Mucuri (UFVJM), Federal University of the Triangle Region (UFTM), Federal University of Alfenas (UNIFAL), Federal University of Lavras (UFLA), Federal University of Itajuba (UNIFEI), Federal University of Juiz de Fora (UFJF), the State University of Minas Gerais (UEMG), Catholic Pontific University (PUC), Montes Claros University (UNIMONTES), Espirito Santo Federal University (UFES), Higher Technical Institute of Portugal (ISTP), National Water Institute of Argentina, (INA) UNESCO-IHE, and the Brazilian Agricultural Research Corporation (EMBRAPA). This facility will provide general infrastructure to visiting scientists sharing a research interest in a common theme of importance to the research efforts of Hidroex. The idea is to offer a synergistic environment in which groups of scientists can work together, exchange ideas and field-test such concepts. Scientists will be resident in Brazil for indeterminate periods and share the results of their research on common themes with colleague-scientists from around the world. Its outputs will aim to expand a holistic approach to water governance and management by balancing competing demands from diverse interests such as agriculture, industry, environment and domestic stakeholders with the context of climate change, population growth, and other realities confronting human progress. The goal is to help Member States adapt new strategies that will make both their ecosystems and socio-economic systems more resilient to such changes and offer decision-makers clear indications of the implications of decisions they are confronting.

7.2.1.2 Expansion of the staff:

7.2.1.2.1 The State of Minas Gerais will open a national recruitment process to attract up to 20 researchers, 16 administrators and 40 staff with specialties in science and technology disciplines in 2014, in order to establish a core of qualified personnel at Hidroex. The young scientists returning to Brazil with

advanced degrees will also be added to the staff of Hidroex.

7.2.1.2.2 Currently, there are 16 Brazilians studying at UNESCO-IHE; 5 at the MSc level, 4 at the PhD level and 5 undertaking post-doc research. Apart from that, there are 2 PhD students studying at Oregon State University. Most of these students are supported through an agreement with the National Scientific and Technological Development Council (CNPq) through the Science Without Borders program or through the Minas Gerais Research Support Foundation (FAPEMIG). These students are singled-out from the very large numbers of Brazilians studying water resources nationally and abroad, with support from various sources, because they have some affiliation with, and/or mid-term commitment to Hidroex once their studies are completed. When they have completed their studies, they will logically help Hidroex expand its faculty in the near-term. Some, depending on the source of their fellowship funding have a formal commitment to return to Hidroex for a specified period of time. Others, while having no formal commitment have expressed an interest in staff positions at Hidroex. The first group of these students obtained their MSc degree in April of 2014 from UNESCO-IHE.

7.2.1.3 Consolidation of HIDROEX infrastructure (See item 7.1.2);

7.2.1.4 Expansion of short courses in Brazil, Latin America and Africa (CPLP countries);

7.2.1.5 Increase of the number of cities and schools participating in the "Water Education" Program.

8. Strategic Alignment with IHP-VIII

8.1 Focal areas within IHP-VIII the centre plans to contribute to and specific actions the centre will undertake to align its activities with the strategic plan for IHP-VIII (Please see Appendix-2)

8.1.1 The focal areas of IHP-VIII that the HIDROEX wants to initiate or continue with activities are those mentioned in items 2.2 and 2.3.

9. Annexes

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

9.1.1 BERNARDES, C. L.; PEREIRA, D.S.P.; BRITO, L.E.P.F..Transformações espaço-temporais: abastecimento de água na cidade de Frutal - MG (1888 a 1972). Revista GNOSE UEMG. Submetido.

9.1.2 BRANDÃO, L.P.M., FAJARDO, T., ESKINAZI-SANT'ANNA, E. M., BRITO, S. L., MAIA-BARBOSA, P. M. 2012. Fluctuations of the

population of Daphnia laevis Birge 1878: A six-year study in a tropical lake. Brazilian Journal of Biology, 72, 479 - 487.

9.1.3 BRITO, L.E.P.F..; VEDUVOTO, A.M.G.. 2013. O Poção é Logo Ali: memórias e subjetividades na cidade de Frutal (MG). In: I Seminário de História e Cultura: Historiografia e Teoria da História. UFU. Uberlândia, 2013 (Anais – digital).

9.1.4 BRITO, L.E.P.F..; VEDUVOTO, A.M.G..; BRITO, T.A.S.. Por entre frutas e águas – A cidade de Frutal na memória de antigos moradores. Revista História Oral. Submetido.

9.1.5 BRITO, S. L., MAIA-BARBOSA, P. M., PINTO-COELHO, R. M. 2013. Length-Weight Relationships and Biomass of the Main Microcrustacean Species of Two Large Tropical Reservoirs in Brazil. Brazilian Journal of Biology, 73 (3), 593-604.

9.1.6 BRITO, T.A.S. ; MEGANCK, R. ; LOPES, R. . 2013. Hidroex International Centre an example of water cooperation. In: UNESCO. (Org.). Free Flow Reaching Water Security Through Cooperation. 1ed.Paris: UNESCO-Tudor Rose. v. 1, p. 119-122.

9.1.7 CORGOSINHO, P.C. ; SCHIZAS, N. . 2013. Archeolourinia shermani, a new genus and species of Louriniidae (Copepoda: Harpacticoida) from a Caribbean mesophotic zone. Journal of the Marine Biological Association of the United Kingdom (Print), v. 93, p. 651-657.

9.1.8 CORGOSINHO, P.H. . 2012. Gen. et sp. nov. a new Nannopodidae Brady, 1880 (Copepoda: Harpacticoida) from submersed sands of Pontal do Sul (Paraná, Brazil). Journal of Natural History, v. 46, p. 2865-2879.

9.1.9 CORGOSINHO, P.H.C.; Ranga REDDY, Y. . 2012. Redefinition of the genus Siolicaris Jakobi, 1972, with redescription of S. sioli (Noodt, 1963) comb. nov. and S. jakobi (Noodt, 1963) comb. nov. from South America, and S. sandhya (Ranga Reddy, 2001) comb. nov. from India (Copepoda, Harpacticoida, Parastenocarididae). Zootaxa (Auckland. Print), v. 3493, p. 49-71.

9.1.10 CORGOSINHO, P.H.C. ; PREVIATTELLI, D.; Martínez Arbizu, P. . 2012. Establishment of a new genus for Parastenocarisitica (copepoda, harpacticoida) from El Salvador, Central America, with discussion of the Parastenocaris fontinalis and P. proserpina-groups. Iheringia. Série Zoologia (Impresso), v. 102, p. 401-411.

9.1.11 GASTAUER, M.; MESSIAS, C.; MEIRA NETO, J.A.A. 2012. Floristic composition, species richness and diversity of campo rupestre vegetation from the Itacolomi State Park, Minas Gerais, Brazil. Environment and Natural Resource Research 2, 115-128.

9.1.12 GASTAUER, M.; TREIN, L.; SCHUMACHER, W. 2012. Enhancing Biotic Resource Protection in Nettersheim: Successful Integration of Forestry and Agriculture in Nature Conservation Concerns. Environmental and Natural Ressources Research 2, 61.

9.1.13 GASTAUER, M. TREIN, L.; MEIRA NETO, J.A.A.; SCHUMACHER, W. 2013. Evaluation for biotope´s importance for biotic resource protection by the Bonner Approach. Ecological Indicators 24, 193.

9.1.14 GASTAUER, M.; MEIRA NETO,ALVES, J.A. 2013. Avoiding inaccuracies in tree calibration and phylogenetic community analysis using Phylocom 4.2. Ecological Informatics 15, 85.

9.1.15 GASTAUER, M.; MEIRA NETO, J.A.A. Interactions, environmental sorting and chance as determinants of phylostructure: Disentangling overlapping factors through distinct analysis of pedo-environments. Folia Geobotanica, aceito.
9.1.16 GASTAUER, M.; MEIRA NETO, J.A.A. How many species are there in the Itacolomi State Park? Neotropical Conservation and Biology, aceito.
9.1.17 GASTAUER, M.; MEIRA NETO, J.A.A. Community Dynamics in a Species-Rich Old-growth Forest Patch from Viçosa, Minas Gerais, Southeastern Brazil. Acta Botanica Brasilica, aceito.
9.1.18 GASTAUER, M.; MEIRA NETO, J.A.A. Analise da estrutura filogenética de comunidades no Cerrado: Uma introdução. Fitossociologia do Brasil II. Métodos e estudos de casos, aceito.
9.1.19 GEORGE, K.H. ; VEIT-KÖHLER, G. ; ARBIZU, P.M. ; SEIFRIED, S. ; ROSE, A.; WILLEN, E. ; BRÖHLDICK, K.; CORGOSINHO, P.H.; DREWES, J. ; MENZEL, L.; MOURA, G.; SCHMINKE, H. , 2013. Community structure and species diversity of Harpacticoida (Crustacea: Copepoda) at two sites in the deep sea of the Angola Basin (Southeast Atlantic). Organisms Diversity & Evolution (Print), v. 1, p. 1-1
9.1.20 MAIA-BARBOSA, P. M., MENEDEZ, R. M., PUJONI, D. G. F., BRITO, S. L., AOKI, A. BARBOSA, F. A. R. Checklist of Zooplankton from natural lakes of the middle Rio Doce basin, Minas Gerais, Brazil. Artigo aceito para publicação pela revista Biota Neotropica.
9.1.21 MONTONE, R. C. ; ALVAREZ, C.E. ; BÍCEGO, M.C.; BRAGA, E.S.; BRITO, T. A. S.; CAMPOS, L. S.; FONTES, R.F.C.; CASTRO, B.M. ; CORBISIER, T. N. ; EVANGELISTA, H. ; FRANCELINO, M.; GOMES, V.; ITO, R.G.; LAVRADO, H.P.; LEME, N.P. ; MAHIQUES, M.M.; MARTINS, C.C.; NAKAYAMA, C.R ; NGAN, P.V.; PELLIZARI, V.H.; PEREIRA, A.B.; PETTI, M. A.V.; SANDER, M.; SCHAEFER, C. E.G.R. ; WEBER, R.R. . 2013. Environmental Assessment of Admiralty Bay, King George Island, Antarctica. From Pole to Pole. 1ed.: Springer Berlin Heidelberg, v. 2, p. 157-175.
9.1.22 NERI, A.V., SCHAEFER,C.E.G.R., SOUZA,A.L., FERREIRA-JR,W.G., & MEIRA-NETO,J.A.A. 2013. Pedology and plant physiognomies in the cerrado, Brazil. Anais da Academia Brasileira de Ciências, 85(1), 87-102.
9.1.23 PINTO-COELHO, R.M. ; CARDOSO, E. L. . 2013. Ordenamento da aquicultura no reservatório de São Simão.. 1. ed. Belo Horizonte: EPAMIG, v. 1. 67p.
9.1.24 PINTO-COELHO, R.M. 2012. Atlas da Qualidade de Água do Reservatório da Pampulha. 1a. ed. Belo Horizonte, MG: RECÓLEO - Coleta e Reciclagem de Óleos Vegetais Editora, 2012. v. 1. 52p .
9.1.25 SCHWARTSBURD, P.B. & SMITH, A. 2013. Novelties in Serpocaulon (Polypodiaceae). J. Bot. Res. Inst. Texas 7(1): 85 – 93.
9.1.26 SCOT A. KELCHNER. BAMBOO PHYLOGENY GROUP. 2013. Higher level phylogenetic relationships within the bamboos (Poaceae: Bambusoideae) based on five plastid markers. Molecular Phylogenetics and Evolution, http://dx.doi.org/10.1016/j.ympev.2013.02.005

9.1.27 VEDUVOTO, A.M. G.; BRITO, L.P.F.; BRITO, T.A.S.. Seguindo os cursos d'água: Povoamento e organização socioespacial de Frutal nos séculos XIX e XX. BOLETIM GOIANO DE GEOGRAGIA- UFG. Submetido.

9.1.28 Compilation of publications presented at the workshop Water Related Disasters, organized by Hidroex. The papers were published at AquaLAC in the last volume of Aqua-LAC, Vol. 4, Nº 2, Set. 2012.

9.1.28.1 Editorial - Tânia Brito – Hidroex.

9.1.28.2 José Roberto B. Champs - Urban Flooding in Belo Horizonte. Ocurrences, Control and Protective Measures. p. 1-8.

9.1.28.3 Homayoun Motiee, Alireza Salamat and Edward E. Mc Bean - Drought as a Water Related Disaster: A Case Study of Oroomieh Lake p. 9-18.

9.1.28.4 Stênio de Sousa Venâncio and Luis F. Resende dos Santos Anjo - Computational Model for Analysis Spread in Flood Channels Urban Drainage, p. 19-28.

9.1.28.5 Silvio Jorge C. Simões, Isabel C. de Barros Trannin - GIS Application in Flood Management - A Case Study: Paraiba do Sul Basin, Southeast Brazil, p. 29-44.

9.1.28.6 Mauro Naghettini - Application of Scale Invariance Properties of Rainfall for Estimating the Intensity-Duration-Frequency Relationships at Uberaba, in South-central Brazil, p. 45- 60.

9.1.28.7 Miguel F. Doria and Camila Arêas - Flood-related Risk Education and Communication, p.61-68.

9.1.28.8 Marcelo Gomes Miguez and Osvaldo Moura Rezende - Urban Drainage Trends - A Pathway Towards More Sustainable Solutions, p. 69-83.

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

9.2.1 Education for Water (4) – A interdisciplinary perspective - capacity building of elementary school teachers. Duration: 16 hours. Where: Uberaba, Frutal, Buritizeiro and Pirapora (Brazil);

9.2.2 Integrated Watershed Management (4) - . Where: Frutal and Brasília (Brazil), Buenos Aires (Argentina) and Montevidéu (Uruguai)

9.2.3 Integrated Flood Risk Management: concepts, approaches and challenges. (1) Where:Del Cauca, Colômbia.

9.2.4 Water Quality Training (4) - Where: Praia City (Cape Verde), Belo Horizonte (Brazil), Maputo (Mozambique), Santa Fé (Argentina)

9.2.5 Leadership Training for Management of Watershed Committees (2) – Where: Centralina e Frutal (Brazil);

9.2.6 Climate and Management of Extreme Events (1) – Where: Maputo (Mozambique);

9.2.7 Workshop on Application of GIS, held at Hidroex in October 2012 (1);

9.2.8 Course on Agroecology, for farmers, students and community in general, held at Hidroex, from September 2013 to May 2014. (1)

9.2.9 Program: UNESCO-Hidroex Yara Lins Ecocidadania Center: June to December 2013. This program involved nearly 1000

young people from Frutal in an ongoing series of art and crafts workshops to promote the aspects of good citizenship as well as a better understanding of environmental issues and their relationship to quality of life issues.

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

Appendix-2

Overview of the Core Programme Themes of the Eighth Phase of the IHP (2014-2021)
WATER SECURITY: ADDRESSING LOCAL, REGIONAL, AND GLOBAL CHALLENGES

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

- Focal area 1.1 - Risk management as adaptation to global changes
- Focal area 1.2 - Understanding coupled human and natural processes
- Focal area 1.3 - Benefiting from global and local Earth observation systems
- Focal area 1.4 - Addressing uncertainty and improving its communication
- Focal area 1.5 - Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

- Focal area 2.1 - Enhancing sustainable groundwater resources management
- Focal area 2.2 - Addressing strategies for management of aquifers recharge
- Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
- Focal area 2.4 - Promoting groundwater quality protection
- Focal area 2.5 - Promoting management of transboundary aquifers

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

- Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources
- Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends
- Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution
- Focal area 3.4 - Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity
- Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution

THEME 4: WATER AND HUMAN SETTLEMENTS OF THE FUTURE

- Focal area 4.1 - Game changing approaches and technologies
- Focal area 4.2 - System wide changes for integrated management approaches
- Focal area 4.3 - Institution and leadership for beneficiation and integration
- Focal area 4.4 - Opportunities in emerging cities in developing countries
- Focal area 4.5 - Integrated development in rural human settlement

THEME 5: ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

- Focal area 5.1 - Hydrological dimension of a catchment– identification of potential threats and opportunities for a sustainable development
- Focal area 5.2 - Shaping of the catchment ecological structure for ecosystem potential enhancement ─ biological productivity and biodiversity
- Focal area 5.3 - Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services
- Focal area 5.4 - Urban Ecohydrology – storm water purification and retention in the city landscape, potential for improvement of health and quality of life
- Focal area 5.5 - Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

- Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector
- Focal area 6.2 - Addressing vocational education and training of water technicians
- Focal area 6.3 - Water education for children and youth
- Focal area 6.4 - Promoting awareness of water issues through informal water education
- Focal area 6.5 - Education for transboundary water cooperation

Annex 1

Hidroex Work Plan 2013 (in Portuguese)

Organização
das Nações Unidas
para a Educação,
a Ciência e a Cultura

HidroEX
EXCELÊNCIA EM ÁGUAS
Sob os auspícios da
UNESCO

PLANO DE ATIVIDADES DO UNESCO-HIDROEX PARA O ANO DE 2013

UN WATER
Dia Mundial da Água
2013
Ano Internacional
da Cooperação da Água

GOVERNO DE MINAS
CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR

GOVERNO FEDERAL
BRASIL
PAÍS RICO É PAÍS SEM POBREZA

Organização das Nações Unidas para a Educação, a Ciência e a Cultura

HidroEX EXCELÊNCIA EM ÁGUAS

Sob os auspícios da UNESCO

PLANO DE ATIVIDADES DA FUNDAÇÃO UNESCO-HIDROEX

PARA O ANO DE 2013

Organização das Nações Unidas para a Educação, a Ciência e a Cultura

HidroEX
EXCELÊNCIA EM ÁGUAS
Sob os auspícios da UNESCO

Belo Horizonte

Dezembro/2012

1. OBJETIVOS PRIORITÁRIOS E FUNÇÕES DA FUNDAÇÃO UNESCO-HIDROEX

- Contribuir ativamente para o fortalecimento da excelência em pesquisa aplicada em gestão de recursos hídricos;

- Desenvolver a aplicação de ferramentas apropriadas de educação e capacitação, com respeito às características culturais das comunidades, buscando a melhoria do uso dos recursos hídricos;

- Contribuir para atingir as Metas de Desenvolvimento do Milênio das Nações Unidas, as prioridades do PHI – VII e VIII, e os Compromissos da UNESCO com o Desenvolvimento Sustentável apresentado na Rio+20;

- Capacitar técnicos e profissionais envolvidos com água;

- Promover educação para o setor não formal, com ênfase no envolvimento de "stakeholders" nos processos de decisão e o papel da água para se atingir o desenvolvimento sustentável;

- Desenvolver parcerias e trabalho em rede com instituições de ensino e pesquisa, centros, cátedras da UNESCO e outros organismos envolvidos com a gestão dos recursos hídricos;

- Implementar programa de trabalho em parceria com os países da CPLP, Comunidade dos Países de Língua Portuguesa;

- Implementar programa de trabalho com países da América Latina e Caribe, em parceria com PHI-LAC;

- Contribuir para associações e fóruns nacionais e internacionais;

- Prover apoio técnico e científico ao Sistema Brasileiro de Gestão de Recursos Hídricos e à Política Brasileira de Recursos Hídricos;

- Prover assessoria técnica e científica aos promotores de política, comunidades e profissionais;

- Implementar e gerenciar um centro de informação e portal na Internet, focado nas práticas de gestão da água, tecnologias disponíveis, pesquisa aplicada e experiências bem sucedidas;

- Fortalecimento institucional por meio de capacitação, pesquisa e desenvolvimento de parcerias;

- Desenvolver e contribuir para o trabalho institucional em rede;

- Prover serviço de consultoria em seu campo de especialidade técnica incluindo pesquisa aplicada.

2. PLANOS E PROGRAMAS DE TRABALHO 2013

As atividades programáticas finalísticas da Fundação UNESCO-HIDROEX para o ano de 2013 serão apresentadas segundo as áreas:

2.1 Capacitação e Educação

2.2 Pesquisa

2.3 Polo UNESCO-HIDROEX de Revitalização do rio São Francisco

2.4 Condomínio Temático

2.5 Ano Internacional de Cooperação em Água

2.1 CAPACITAÇÃO E EDUCAÇÃO

2.1.1 Cursos de Capacitação de Curta Duração

- **"Gestão Integrada de Bacias Hidrográficas",** em seis áreas pilotos do Estados de Minas Gerais e Rio de Janeiro, sob a coordenação técnica do IHE e compostos pelos módulos: Princípios da Gestão Integrada de Recursos Hídricos; O Sistema Fluvial e as interferências humanas; Governança e Leis das Águas, para líderes de comitês de bacias, universitários, técnicos e gestores de recursos hídricos de instituições públicas, privadas e universidades.

- **"Monitoramento e Avaliação de Qualidade de Água"** em três áreas piloto do estado de Minas Gerais, sob a coordenação técnica do IHE, com módulos teóricos e prática de laboratórios, para técnicos e gestores de recursos hídricos de instituições públicas, privadas e universidades.

- **"Eventos Naturais Extremos - Gestão de Riscos",** em quatro municípios do Estado de Minas Gerais e na Região Serrana do Rio de Janeiro, sob a coordenação técnica do Centro de Categoria 2 da UNESCO de Tsukuba/Japão para técnicos municipais e estaduais de gestão de áreas urbanas, comandos da Defesa Civil e do Corpo de Bombeiros e líderes de comitês de bacia.

- "**Educação para as Águas - numa perspectiva interdisciplinar**", continuidade de implantação das etapas do programa nas escolas públicas dos dois municípios pilotos do Estado de Minas Gerais e inserção de dez outros municípios da bacia do rio Grande. O referido projeto objetiva transformar o conhecimento teórico sobre a Água em experiências vivenciadas, que permitam mensurar qualidade, economia e preservação

ambiental para o cotidiano das famílias e sociedade. A ferramenta pedagógica principal é a Cartilha Cousteau, elaborada especialmente para este projeto de educação e distribuída para todos os alunos das escolas piloto.

- "**Formação de lideranças para a gestão de Comitês de Bacias"**, dez cursos voltados para um público alvo composto de produtores rurais, líderes comunitários, membros de associações de usuários de água e técnicos de administrações públicas municipais, visando sua articulação e organização para a gestão integrada dos comitês de bacias de áreas piloto nos estados de Minas Gerais, Goiás e Rio de Janeiro.

- **"Educação Ambiental para a Produção Sustentável"** para pequenos produtores rurais de quinze municípios que compõem o Consórcio Intermunicipal do rio Grande.

2.1.2 Projetos Especiais de Capacitação Técnica, Organização Socioambiental e Cultural:

Implantação do Programa de Capacitação do Projeto "Mitigação de Mudanças Climáticas, Restauração da Biodiversidade e Recuperação dos Serviços Ecossistêmicos da Mata Atlântica na Bacia do Rio Paraíba do Sul", com recursos do Fundo Global para o Meio Ambiente- BID (Global Environment Facility - GEF), com cerca de sete cursos a serem definidos, bem como os municípios da bacia hidrográfica nos estados do Rio de Janeiro e Minas Gerais.

Projeto de continuidade das etapas de implantação do "Consórcio Intermunicipal dos Municípios do Rio Grande- CIBARG" com vistas a fortalecer as comunidades de trinta municípios da Bacia do rio Grande, em Minas Gerais, para o desenvolvimento de um

Plano de Gestão Sustentável Regional, incluindo atividades de cursos de capacitação por demandas identificadas.

Projeto "Ecocidadania - Oficinas de Arte e Ofícios" com vista a desenvolver programas de inclusão social, profissional e ambiental aos cidadãos das áreas de abrangência do UNESCO-HIDROEX. As oficinas incluem capacitação em múltiplas modalidades de arte, cursos de reciclagem, de informática e de idiomas (inglês e espanhol).

Continuidade do Projeto "Mediação de Conflitos de Usos de Água na Bacia do Rio Piedade/Bacia do Prata", por meio da articulação e promoção do diálogo entre os usuários, com vistas à resolução dos conflitos de usos múltiplos de água, que incluem: levantamento de dados de todas as áreas da bacia; reunião coordenada pelo UNESCO-HIDROEX para um estudo de caso com especialistas e orientação de procedimentos e condutas técnicas; treinamento de usuários para gestão do uso de água; colaboração na implementação de um Plano de Gestão da Bacia.

2.1.3 Formação e Pós-Graduação

Implantação do Curso de Mestrado em "Sustentabilidade Socioeconômica Ambiental", em parceria com a Universidade Federal de Ouro Preto – UFOP.

Treinamento técnico de curta duração para quatro pesquisadores do UNESCO-HIDROEX no UNESCO INSTITUTE OF WATER EDUCATION - IHE, em Delft, para aperfeiçoamento metodológico do exercício de suas atividades, sob a orientação do PHI.

Seleção e encaminhamento de cinco bolsistas de pós-graduação em áreas de Recursos Hídricos demandadas pelo UNESCO-HIDROEX para o IHE/Delft, através do Programa "Ciência sem Fronteiras /CNPQ" e contrato UNESCO-HIDROEX, IHE e Ministério de Ciência, Tecnologia e Inovação.

2.1.4 Ações previstas - internacionais:

As ações previstas dão cumprimento aos compromissos assumidos pelo UNESCO-HIDROEX de atuar nos países da América Latina -PHI LAC e da CPLP. Serão oferecidos os seguintes cursos de capacitação de curta duração:

- "Monitoramento e Avaliação de Qualidade de Água" em Cabo Verde, África, para profissionais da área de recursos hídricos de instituições públicas e privadas.
- "Gestão Integrada de Bacias Hidrográficas", em Moçambique, África, para técnicos da área e em parceria com o Instituto de Águas de Moçambique/Ministério de Ciência e Tecnologia.

Programa de Cooperação Técnica para Capacitação a ser implantado na Argentina, Uruguai, Paraguai e Brasil, em comemoração ao "Ano Internacional de Cooperação em Água", com cursos a serem promovidos, conjuntamente, nos quatro países:

- "Gestão Integrada de Bacias", sob a coordenação do IHE e instrutores dos quatro países.
- "Gestão de Riscos Naturais Extremos", sob a coordenação técnica do Centro UNESCO de Tsukuba/Japão e instrutores dos quatro países.
- "Legislação de Águas Transfronteiriças", sob a coordenação do Centro UNESCO de Dundee/Escócia e instrutores dos quatro países.

2.1.4 Projetos Especiais

Participação consorciada com o IHE e África do Sul na execução do projeto "Development of a Technical-Professional Training System for the Management of Services and Infrastructure in Water and Sanitation", em Moçambique, com etapas programadas para visitas técnicas e workshop no Brasil.

2.2 PESQUISA

2.2.1 Programa Água Pra Toda Vida

Continuidade das ações do Programa *Água Pra Toda Vida*, implementado no final de 2011, cujo objetivo é construir um modelo de gestão sustentável, pautado na restauração do equilíbrio entre o desenvolvimento e a melhoria na qualidade de vida da população do município de Frutal, sede do UNESCO-HIDROEX, e a conservação dos recursos naturais hídricos da região. Estão sendo desenvolvidos 13 projetos de pesquisa, envolvendo 60 pesquisadores e 15 instituições. Este Programa deve beneficiar uma população de mais de 53 mil habitantes e servir de modelo a ser replicado em outros municípios, favorecendo outros milhares de habitantes.

2.2.2 Projeto de Pesquisa, Controle da Qualidade das Águas e Revitalização do rio Grande

Trata-se de um projeto de pesquisa e desenvolvimento, com o apoio financeiro da Companhia Energética de Minas Gerais (CEMIG). O projeto possibilitará a elaboração de uma metodologia de avaliação ambiental com a finalidade de subsidiar a proposição de diretrizes de intervenções para revitalização ambiental do rio Grande. É

o primeiro passo para a implantação de uma metodologia aplicada para recuperação dos ambientes degradados, a qual é voltada para a identificação das fragilidades locais e das potencialidades para recuperação. Os objetivos gerais do projeto são:

- Avaliação da qualidade das águas do reservatório da UHE Volta Grande, incluindo o Balanço de Massa para os parâmetros fósforo e nitrogênio;
- Criação de um índice de integridade biótica para reservatórios, integrando os compartimentos coluna d´água e sedimento através da utilização de parâmetros tanto da comunidade zoobentônica como da fitoplanctônica, bem como o índice de Qualidade das Águas de Reservatórios – IQAR;
- Comparação entre a evolução do uso do solo na bacia de contribuição lateral do reservatório e a qualidade das águas.

O projeto encontra-se em fase inicial e seu encerramento está previsto para agosto de 2015. Para o ano de 2013 estão previstas ações que subsidiem a elaboração do relatório parcial e a preparação de artigos de divulgação. Essas ações recaem sobre: realização de coletas e análises biológicas e de água; avaliação do uso e ocupação dos solos da bacia de drenagem; análises integradas dos dados obtidos; reuniões para discussões dos resultados e elaborações de relatórios técnicos.

2.2.3 Ordenamento Sustentável do Reservatório de Marimbondo – Rio Grande

Está em elaboração um projeto de ordenamento sustentável do reservatório de Marimbondo no Rio Grande. O reservatório de Marimbondo (Furnas S.A.) possui uma área de 438 quilômetros quadrados, com um volume total de mais de 6 bilhões de metros cúbicos. Os municípios na área do reservatório são Planura, Frutal e Fronteira

em Minas Gerais; Icém, Guaraci, Colômbia, Altair e Barretos em São Paulo, com uma população total de 217.241 (IBGE, 2010).

Assim como a grande maioria dos reservatórios de grande porte localizados no estado de Minas Gerais, o reservatório de Marimbondo já tem um histórico de problemas ambientais como assoreamento e mineração, eutrofização (floração de algas já observada), introdução de espécies exóticas de peixes e invertebrados, sobrepesca das espécies nativas, lançamento de lixo (especialmente vindo do Rio Pardo) e remoção da mata ciliar.

O projeto surgiu da necessidade de se realizar um inventário mais atualizado de ictiofauna e de se conhecer aquele ecossistema como um todo - suas características e vulnerabilidades. Adicionalmente, o zoneamento do reservatório permitirá o ordenamento das atividades de pesca, respeitando sua capacidade de suporte e otimizando o uso de suas águas.

2.2.4 Espécies Invasoras: a invasão do Mexilhão Dourado no Rio Grande

Uma das grandes preocupações no momento é a invasão do *Limnoperna fortunei* (Mexilhão Dourado) no reservatório de Marimbondo, no rio Grande. Esta espécie traz enormes transtornos ambientais, sociais e econômicos para as regiões infestadas. No reservatório em questão, a invasão foi detectada há poucos meses, porém já com consequências desastrosas. Em uma ação coordenada pelo UNESCO-HIDROEX, várias instituições se unem para enfrentar o problema e elaborar programas de pesquisa que devem resultar em soluções potenciais de adaptação à colonização pelo *L. fortunei*.

2.2.5 Valoração dos Serviços Ambientais das Zonas Úmidas brasileiras

Está sendo firmada uma parceria entre o UNESCO-HIDROEX, Universidade do Estado de Minas Gerais e o Ministério do Meio Ambiente para a realização de um estudo sobre as Zonas Úmidas, visando avaliar a efetividade dos instrumentos de preservação destas áreas e os serviços ambientais prestados por elas, dentre esses, sua contribuição para a manutenção da biodiversidade e dos recursos hídricos, na forma de recarga dos aquíferos, regime de chuvas e controle de enchentes. Zonas Úmidas são ecossistemas de elevada biodiversidade e complexidade sistêmica, imprescindíveis para o fornecimento de serviços ecológicos fundamentais para as espécies de fauna e flora e para o bem-estar de populações humanas. Algumas dessas áreas têm tamanha importância ecológica que são protegidas por um organismo internacional – a Convenção de Ramsar. Consideradas de importância internacional, 2062 áreas úmidas em todo o mundo foram designadas sítios Ramsar, no âmbito da Convenção de Ramsar, que conta com a participação de 163 países. No Brasil foram designados 11 sítios Ramsar, que serão as áreas abordadas neste estudo.

2.3 POLO UNESCO-HIDROEX DE REVITALIZAÇÃO DO RIO SÃO FRANCISCO

O Polo propõe-se a atuar como uma plataforma de encontro e diálogo entre diferentes instituições públicas e privadas, de âmbito científico, cultural e ambiental que operam na bacia do rio São Francisco, aliando diferentes estruturas num projeto comum. Além de ações efetivas para a revitalização da bacia do rio São Francisco e conservação dos recursos hídricos, abrem-se novas hipóteses de entendimento e valorização da comunidade da região que assume um

papel ativo no desenvolvimento da sustentabilidade da bacia. Em sua primeira fase de atuação, o Polo vem desenvolvendo os projetos listados a seguir.

2.3.1 Estudo Técnico-Científico de um Trecho do Rio São Francisco para fins de Revitalização Ambiental.

O projeto é desenvolvido pela parceria Fundação Centro Tecnológico de Minas Gerais (CETEC) e UNESCO-HIDROEX, com apoio financeiro da Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG). Sua execução começou em 2011 e deverá ser encerrado em dezembro em 2013. O objetivo principal é o desenvolvimento de uma metodologia de avaliação ambiental simplificada para a proposição de diretrizes de intervenções para revitalização ambiental do rio São Francisco entre os trechos delimitados a montante pela barragem da usina hidrelétrica de Três Marias e a jusante pela sua confluência com o rio das Velhas, próximo ao município de Pirapora/MG.

Para 2013, estão previstas ações que englobam a elaboração do diagnóstico integrado dos aspectos físicos e de uso do solo, cobertura vegetal, qualidade das águas superficiais, impactos antrópicos e a apresentação por meio de técnicas de geoprocessamento. Também estão previstas reuniões temáticas envolvendo as populações das cidades ribeirinhas para a apresentação dos resultados e o envolvimento das comunidades locais, além de um seminário técnico para proposição de diretrizes para recuperação e conservação da área de estudo.

2.3.2 Projeto de Pesquisa e Controle da Qualidade das Águas do Rio São Francisco.

Projeto executado pelo UNESCO-HIDROEX, em convênio com a CEMIG. Com este projeto, pretende-se inserir uma nova abordagem de avaliação da qualidade das águas, pesquisas e capacitação no trecho entre os municípios de Pirapora e Manga, na divisa de Minas Gerais com Bahia. Está prevista a inserção de um Barco Pesquisa-Escola nesse trecho do rio. Tendo a embarcação como alicerce, a avaliação da qualidade das águas será realizada de forma inovadora pela criação de um Índice de Integridade Plâncton-Bentônica. O barco também será utilizado como ferramenta para ações de educação para as águas e atenderá do os onze municípios lindeiros ao rio São Francisco.

O projeto naval do barco encontra-se em fase final de elaboração. Para o ano de 2013 está prevista a sua construção e início das atividades de campo.

2.3.3 Espaço de Integração do Polo UNESCO-HIDROEX de Revitalização do Rio São Francisco

Para a consolidação desse espaço, o Polo utilizará como sede um prédio histórico da Fundação Caio Martins (FUCAM) localizado no centro do município de Buritizeiro às margens do rio.

Ocupando esse espaço, o Polo exercerá também a função de informar, sensibilizar e mobilizar a população em torno do tema água, oferecendo muitas vezes um espaço de reflexão e questionamento sobre a situação passada, presente e possíveis cenários

futuros relacionados às diferentes áreas de interesse: meio ambiente, recursos hídricos, ciência, cidadania e cultura.

Para 2013 estão previstas ações para a elaboração do projeto executivo de adequação do prédio e aquisição dos equipamentos necessários, após o que o projeto será levado ao Ministério da Integração Nacional que já assegurou recursos financeiros na ordem de R$ 7.000.000,00 (2.592.112,00 €).

2.3.4 Gestão Integrada de Microbacias Hidrográficas no Semi-árido Mineiro

Elaboração e desenvolvimento de projeto em parceria com a Secretaria de Estado Extraordinária para o Desenvolvimento dos Vales do Jequitinhonha, Mucuri e do Norte de Minas (SEDVAN) para a gestão integrada da bacia hidrográfica do rio Estreito (bacia do rio São Francisco), visando o desenvolvimento de bases para o desenvolvimento sustentável e o uso múltiplo dos recursos hídricos no semi-árido mineiro.

Este projeto irá realizar uma avaliação ambiental da região abrangendo a qualidade da água, aspectos climáticos, uso do solo, cobertura vegetal e interfaces com agropecuária e extração mineral; será feito o mapeamento do uso do solo com o objetivo de avaliar impactos sobre quantidade/qualidade dos recursos hídricos. Estas informações integrarão um banco de dados georreferenciados e de informações secundárias sobre a bacia. Propõe-se também criar uma Agência de Desenvolvimento da Bacia do Estreito, composta por: Centro de Fomento e Crédito, Centro de Biotecnologia Vegetal e pelo Centro de Educação para as Águas.

2.4 CONDOMÍNIO TEMÁTICO

O Condomínio Temático das Instituições de Ensino Superior, Pesquisa e Desenvolvimento da Cidade das Águas visa, principalmente, a facilitação dos contatos e a cooperação entre as diversas instituições e organizações componentes do mesmo, a saber: UNESCO-HIDROEX, Universidade Federal de Minas Gerais (UFMG), Universidade Federal de Lavras (UFLA), Universidade Federal de Viçosa (UFV), Universidade Federal de Ouro Preto (UFOP),Universidade Federal de Uberlândia(UFU), Universidade Federal do Triângulo Mineiro (UFTM), Pontifícia Universidade Católica de Minas Gerais (PUC-MG), Universidade Federal de Alfenas (UNIFAL), Universidade Federal de Itajubá (UNIFEI), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA).

Entre as finalidades do Condomínio Temático estão o estabelecimento de programas de desenvolvimento de recursos humanos para o setor de água e a promoção da elaboração de projetos de pesquisa e atividades de extensão voltadas para as diferentes demandas relacionadas aos recursos hídricos. Citam-se as atividades já em desenvolvimento:

2.4.1 Centro de Ciências Ambientais Floresta-Escola:

O Centro de Ciências Ambientais Floresta-Escola é uma parceria entre a UNESCO-HIDROEX e a Universidade Federal de Viçosa. Este centro pretende aproximar a sociedade da biodiversidade por meio de espaços interativos e percepções espacial-temporais; a troca de informações entre o público e corpo técnico; a condução de pesquisas, construindo redes nacional e internacional de cooperação. Dois laboratórios já foram instalados e as atividades de pesquisa já se iniciaram.

2.4.2 Água e Agricultura

Na temática relacionada à água, agricultura e segurança alimentar, a Fundação UNESCO-HIDROEX vem atuando em parceria com a Secretaria de Estado de Agricultura, Pecuária e Abastecimento de Minas Gerais (SEAPA), a Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA) e a Agência Nacional de Águas (ANA). Destacam-se as seguintes ações:

2.4.2.1 Núcleo de Referência e Inovação em Irrigação e Recursos Hídricos – NURII

O NURII tem suas ações voltadas para a governança e gestão de águas e uso de solos; treinamento em manejo de águas e reuso de água na agricultura; tecnologias para a sustentabilidade na agricultura; zoneamento agroecológico com foco na gestão

territorial; e desenvolvimento e fortalecimento do conhecimento para uso sustentável dos recursos hídricos.

Em 2013 estão previstos atividades para o início do projeto de certificação do uso eficiente de água e energia em irrigação – esse será o principal projeto da Embrapa no NURII. A realização de um workshop de articulação para desenvolvimento de projeto de modelagem em bacias experimentais. Com a participação de representantes do Brasil, Argentina, Paraguai, Uruguai e Bolívia. Também, serão realizados cursos de capacitação de irrigantes em manejo de irrigação.

2.4.2.2 Edital Conjunto de Ciência, Tecnologia e Inovação em Água e Agricultura

A FAPEMIG e o Estado de Minas Gerais lançarão em 2013 um edital para financiar projetos de pesquisa que visem à gestão, o uso racional e sustentável dos recursos hídricos e o desenvolvimento e transferência de Tecnologias facilitadoras à implantação do Plano Diretor de Agricultura Irrigada do Estado de Minas Gerais e à ampliação das ações do Núcleo de Referência e Inovação em Irrigação e Recursos Hídricos (NURII). O valor total de recursos destinados será de R$ 6.000.000,00 (2.221.810,00 €)

2.4.2.3 Indicadores de Sustentabilidade em Agroecossistemas – ISA

Apoio a Secretaria SEAPA para aplicabilidade da metodologia ISA. Trata-se de um sistema integrado para a aferição do desempenho econômico, social e ambiental de estabelecimentos rurais com o objetivo de auxiliar a gestão do espaço rural e a

elaboração, execução e monitoramento de políticas, planos, programas e projetos de estímulos à adoção de práticas e arranjos produtivos que visem conciliar crescimento econômico, inclusão social e o uso racional dos recursos naturais e a sua proteção.

2.4.3 Prospecção África e América Latina

Em 2013, será realizada a prospecção de interesses comuns entre os centros de categoria II do Brasil e de outros países da América Latina e de países de língua portuguesa da África para a construção de uma agenda de pesquisa conjunta em questões relacionadas à água.

2.5 ANO INTERNACIONAL DE COOPERAÇÃO EM ÁGUA

Por decisão da Assembleia Geral das Nações Unidas em dezembro de 2010, o ano de 2013 foi declarado Ano Internacional de Cooperação em Água. O UNESCO-HIDROEX, como Centro de Categoria II sob os auspícios da UNESCO, participa das comemorações coordenadas pelo Secretariado do PHI e desenvolverá no Brasil, em parceria com os países da CPLP e América Latina e Caribe, um programa de eventos e ações que mobilizem a sociedade em torno do tema. Como o foco da UNESCO-HIDROEX é Educação, Capacitação e Pesquisa Aplicada em Águas, todos os seus programas e projetos contribuem significativamente com os objetivos definidos para a comemoração do Ano e do Dia Internacional de Cooperação em Água. Além disso, todo o material de divulgação do UNESCO-HIDROEX passará a incorporar a logomarca do Ano.

3 FORTALECIMENTO DO UNESCO-HIDROEX

3.1 IMPLANTAÇÃO DA CIDADE DAS ÁGUAS

As obras do complexo da Cidade das Águas já estão em andamento. Os serviços de terraplenagem e fundações já foram concluídos. Até dezembro de 2013, os prédios dos laboratórios, alojamentos e biblioteca estarão em fase de acabamento. O montante de recursos financeiros previsto para a conclusão das obras é de R$ 55.717.000,00 (20.632.105,00 €). Os laboratórios contarão com modernas estruturas para educação, pesquisa e ensino a distancia em nível de excelência. Para a compra dos equipamentos o Ministério Ciência, Tecnologia e Inovação já aprovou recursos R$16.290.000,00 (6.039.372,00€)

3.2 IMPLANTAÇÃO DE QUADRO DE PESSOAL TÉCNICO – PROFESSORES E PESQUISADORES.

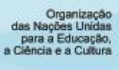
Para cumprir seus compromissos programáticos, o UNESCO-HIDROEX contará com diversificada estrutura de recursos humanos além da já existente.

Vinculado ao Plano de Carreira de Ciência e Tecnologia, o Governo de Minas Gerais autorizou a contratação de técnicos, gestores e pesquisadores, cujo processo de admissão se dará no prazo de cinco anos, mediante provimento por concurso público.

O trabalho desenvolvido em parceria com a Universidade do Estado de Minas Gerais - UEMG *Campus* Frutal permitirá a oferta de oito doutores para atuação no "Mestrado em Ciências Ambientais - Linha de Pesquisa em Recursos Hídricos, Uso e Ocupação dos Solos", cujo processo está em andamento.

No âmbito do Condomínio Temático, estarão em curso projetos de pesquisa e cursos de pós-graduação que agregarão pesquisadores, professores e estudantes ao UNESCO-HIDROEX.

No Programa Ciência sem Fronteiras, foi assinado acordo de cooperação com o Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) que prevê o intercâmbio internacional de pesquisadores com o apoio do UNESCO-IHE Instituto de Educação para as Águas, sediado em Delft, Holanda.



Organização
das Nações Unidas
para a Educação,
a Ciência e a Cultura

HidroEX
EXCELÊNCIA EM ÁGUAS

Sob os auspícios da
UNESCO

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Annex 2

Hidroex Work Plan 2014 (in Portuguese)

Organização
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para a Educação,
a Ciência e a Cultura

HidroEX
EXCELÊNCIA EM ÁGUAS

Sob os auspícios da
UNESCO

PLANO DE ATIVIDADES DO HIDROEX PARA O ANO DE 2014

UN WATER
Dia Mundial da Água
2013
Ano Internacional
da Cooperação da Água

GOVERNO DE MINAS
CIÊNCIA, TECNOLOGIA
E ENSINO SUPERIOR

GOVERNO FEDERAL
BRASIL
PAÍS RICO É PAÍS SEM POBREZA

3. OBJETIVOS PRIORITÁRIOS E FUNÇÕES DO HIDROEX

- Contribuir ativamente para o fortalecimento da excelência em pesquisa aplicada em gestão de recursos hídricos; incentivar e participar de cursos de pós-graduação e de programas de formação de recursos humanos;

- Desenvolver a aplicação de ferramentas apropriadas de educação e capacitação, com respeito às características culturais das comunidades, buscando a melhoria do uso dos recursos hídricos; utilizar educação a distância e videoconferência para maior democratização do acesso ao conhecimento;

- Contribuir para atingir as Metas de Desenvolvimento do Milênio das Nações Unidas, as prioridades do PHI–VIII, e os compromissos da UNESCO com o Desenvolvimento Sustentável apresentados na Rio+20;

- Educação para as Águas como pilar do desenvolvimento sustentável;

- Capacitar técnicos e profissionais envolvidos com água;

- Promover Educação para as águas como chave para a Segurança em Água, em sentido amplo e em todos os níveis, com ênfase no envolvimento de "stakeholders", formadores de opinião, setores de formação e implementação de políticas públicas;

- Desenvolver parcerias e trabalhos em rede com instituições do Condomínio Temático em Água, centros, cátedras da UNESCO e outros organismos envolvidos com a gestão dos recursos hídricos;

- Implementar programa de trabalho em parceria com os países da CPLP, Comunidade dos Países de Língua Portuguesa em sintonia com o PHI-VIII;

- Implementar programa de trabalho com países da América Latina e Caribe, em parceria com UNESCO-LAC e em sintonia com o PHI-VIII;

- Apoiar e participar de associações e fóruns nacionais e internacionais;

- Prover apoio técnico e científico ao Sistema Brasileiro de Gestão de Recursos Hídricos e à Política Brasileira de Recursos Hídricos em

estreita colaboração com a ANA – Agência Nacional de Águas e o IGAM – Instituto Mineiro de Gestão das Águas;

- Prover assessoria técnica e científica aos promotores de política, comunidades e profissionais;

- Implementar e gerenciar um centro de informação e portal na Internet, focado nas práticas de gestão da água, tecnologias disponíveis, pesquisa aplicada e experiências bem sucedidas;

- Fortalecimento institucional por meio de capacitação, pesquisa e desenvolvimento de parcerias;

- Desenvolver e contribuir para o trabalho institucional em rede;

- Prover serviço de consultoria em seu campo de especialidade técnica incluindo pesquisa aplicada.

- Prioridade na formação e permanente aperfeiçoamento de um corpo de professores e pesquisadores do HIDROEX, caminhando para a excelência no nível internacional;

- Consolidar e manter em permanente atualização a infraestrutura de laboratórios, educação, biblioteca;

- Concluir a implantação do projeto da Cidade das Águas UNESCO HIDROEX, concebido pelo urbanista Jaime Lerner.

4. PLANOS E PROGRAMAS DE TRABALHO 2014

As atividades programáticas finalísticas da Fundação HIDROEX para o ano de 2014 serão apresentadas segundo as áreas:

2.1 Capacitação e Educação

2.2 Pesquisa

4.1 CAPACITAÇÃO E EDUCAÇÃO

4.1.1 CURSOS DE CAPACITAÇÃO DE CURTA DURAÇÃO

- **"Gestão Integrada de Bacias Hidrográficas" -** continuidade de execução de cursos em quatro (4) municípios pilotos do Estado de Minas Gerais (e outros a serem demandados nos demais estados brasileiros), compostos pelos módulos: Princípios da Gestão Integrada de Recursos Hídricos; O Sistema Fluvial e as interferências humanas; Governança e Leis das Águas para líderes de comitês de bacias, universitários, técnicos e gestores de recursos hídricos de instituições públicas, privadas e universidades.

- **"Monitoramento e Avaliação de Qualidade de Água" -** continuidade de execução de cursos em três (3) áreas piloto do Estado de Minas Gerais, com módulos teóricos e prática de laboratórios, para técnicos e gestores de recursos hídricos de instituições públicas, privadas e universidades.

- **"Eventos Naturais Extremos - Gestão de Riscos" -** continuidade de cursos em dois (2) municípios de Minas Gerais (e outros demandados por demais estados brasileiros) para técnicos municipais e estaduais de gestão de áreas urbanas, comandos da Defesa Civil e do Corpo de Bombeiros e líderes de comitês de bacia.

- "**Educação para as Águas - numa perspectiva interdisciplinar**", continuidade de implantação das etapas do programa nas escolas públicas e inclusão de mais 10(dez) municípios pilotos do Estado de Minas Gerais da bacia do Rio Grande. O referido projeto objetiva transformar o conhecimento teórico sobre a Água em experiências vivenciadas, que permitam mensurar qualidade, economia e preservação ambiental para o cotidiano das famílias e sociedade. A ferramenta pedagógica principal é a Cartilha Cousteau, elaborada especialmente para este projeto de educação e distribuída para todos os alunos das escolas piloto.

- **Ecohidrologia e Sustentabilidade** – execução do curso em três (3) áreas piloto de Minas Gerais e demais estados brasileiros (se demandados) com uma abordagem holística dos problemas ecohidrológicos tendo a bacia hidrográfica como unidade de gestão, voltados para usuários de bacias, membros de comitês e de universidades.

- **Saneamento Básico na gestão dos recursos hídricos** – execução do curso em três (3) municípios de Minas Gerais buscando auxiliar na compreensão dos problemas na gestão e planejamento sustentáveis de sistemas de águas urbanas, o uso de sistemas de informações geográficas, ciclo hidrológico e química aquática. Promover o desenvolvimento de estratégias para a Gestão Integrada de Águas Urbanas e a avaliação das consequências num contexto social, econômico e ambiental mais amplo.

- **Tratamento e reuso de águas residuais -** execução do curso em duas (2) áreas piloto da região do Triângulo Mineiro para público de empreendimentos industriais, principalmente de Usinas Sucro-alcooleiras.

- **Tratamento de Água subterrânea** – execução de um (1) curso na sede do HIDROEX, em Frutal, para a compreensão da ocorrência de águas subterrâneas, classificação e propriedades de aquíferos em diferentes configurações geológicas e dos conceitos relacionados à armazenagem, recarga e descarga de água subterrânea;

- **Implementação de planejamento ambiental –** execução de três (3) cursos nos municípios núcleos do Consórcio Intermunicipal: Frutal, Uberaba e Passos voltados para líderes de comitês de bacias e administradores municipais.

- **Gestão e tratamento de efluentes industriais -** execução de dois (2) cursos na região do Triângulo Mineiro para público de indústrias regionais e legisladores.

- **Gestão, Negociação e mediação em conflitos de água -** execução de três (3) cursos em Minas Gerais (e outros que forem demandados) voltados para usuários de água e membros de comitês organizados de bacias.

- **Recuperação de rios** – execução de cursos em duas (2) áreas piloto, sendo uma no Rio São Francisco e outra no Rio Grande voltados para usuários de águas, produtores rurais e membros de comitês.

- **Gestão de água em condições de seca e escassez de água -** – execução de curso em um (1) município piloto do norte do Estado de Minas Gerais

- **Políticas Ambientais e de Água** – execução de dois (2) cursos a serem realizados em Frutal e outro município piloto de Minas Gerais, voltado para legisladores, membros do Ministério Publico e administradores públicos.

- **Formação de lideranças para a gestão de Comitês de Bacias"** - execução de seis (6) cursos voltados para um público alvo composto de

produtores rurais, líderes comunitários, membros de associações de usuários de água e técnicos de administrações públicas municipais, visando sua articulação e organização para a gestão integrada dos comitês de bacias de áreas piloto nos estados de Minas Gerais, Goiás e Rio de Janeiro.

- **Educação Ambiental para a Produção Sustentável -** continuidade de cursos para pequenos produtores rurais de dez (10) municípios que compõem o Consórcio Intermunicipal do rio Grande

4.1.2 PROJETOS ESPECIAIS

- **ACORDO DE COOPERAÇÃO DO HIDROEX COM A UNESCO E A ADASA (Agência Reguladora de Água, Saneamento e Energia do Distrito Federal) PARA A EXECUÇÃO DE UM PROGRAMA DE CAPACITAÇÃO EM RECURSOS HÍDRICOS E PROMOÇÃO DE ESTUDOS DE CASOS RELEVANTES -** Este é um projeto será executado em dois (2) anos e visa promover um treinamento básico para o nivelamento de quadro funcional da ADASA, particularmente para os técnicos envolvidos diretamente com as atividades operacionais da empresa, com vistas ao entendimento teórico e prático do escopo dos trabalhos desempenhados.

O projeto inclui:

MÓDULO DE NIVELAMENTO DE EQUIPE composto de cursos de:

a) Fundamentos e Diretrizes de Gestão de Recursos Hídricos;
b) Hidrologia Básica;
c) Hidrogeologia Básica;
d) Ecologia em Ambientes Aquáticos numa perspectiva interdisciplinar;
e) Princípios de Saneamento Básico aplicados na gestão dos recursos hídricos;
f) Educação e Saúde Ambiental no contexto dos recursos hídricos;

MÓDULO AVANÇADO para público interno e externo da Agência Reguladora:

a) Curso de Gestão Integrada de Bacias
b) Monitoramento e Avaliação de Qualidade de Água
c) Gestão de Risco de Eventos Extremos
d) Educação para as Águas
e) Desenvolvimento de estudos sobre expertise nacional e internacional em relação ao uso da água

f) Desenvolvimento de estudo de viabilidade para uma usina termelétrica alimentada com resíduos sólidos urbanos (Brasil)
g) Curso de Capacitação sobre Desenvolvimento de Política de Gerenciamento e Destino Final de Resíduos Sólidos – voltado para profissionais em cargos gerenciais;.
h) Curso de Capacitação para Desenvolvimento de Política de Gerenciamento de Resíduos Sólidos no Distrito Federal
i) Estudos de experiências exitosas sobre Pagamento por Serviços Ambientais – PSA (modelo PSA mineiro – catadores)
j) Legislação aplicada a recursos hídricos
k) Hidrometrista
l) Gestão Financeira aplicada aos recursos hídricos
m) Parceria Público Privada – PPP na gestão dos recursos hídricos
n) Gestão das Organizações de Água

- Participação consorciada com o IHE e África do Sul na execução do projeto "Development of a Technical-Professional Training System for the Management of Services and Infrastructure in Water and Sanitation", em Moçambique, com etapas programadas para visitas técnicas e workshop no Brasil;

- No Programa Ciência sem Fronteiras, continuidade do intercâmbio internacional de pesquisadores com o apoio do UNESCO-IHE - Instituto de Educação para as Águas, sediado em Delft, Holanda;

- Implantação do NÚCLEO DE CIÊNCIAS no Espaço de Ecocidadania, voltado para a inserção e integração da sociedade local, universidades e escolas, em todos os níveis.

4.1.3 PROJETOS ESPECIAIS DE CAPACITAÇÃO TÉCNICA, ORGANIZAÇÃO SOCIOAMBIENTAL E CULTURAL

- Implantação do Programa de Capacitação do Projeto "Mitigação de Mudanças Climáticas, Restauração da Biodiversidade e Recuperação dos Serviços Ecossistêmicos da Mata Atlântica na Bacia do Rio Paraíba do Sul", com recursos do Fundo Global para o Meio Ambiente - BID (Global Environment Facility - GEF), com cerca de sete (7) cursos a serem definidos, bem como os municípios da bacia hidrográfica nos estados do Rio de Janeiro e Minas Gerais.

- continuidade das etapas de implantação do Projeto do "Consórcio Intermunicipal dos Municípios do Rio Grande - CIBARG" com vistas a

fortalecer as comunidades de trinta (30) municípios da Bacia do Rio Grande, em Minas Gerais, para o desenvolvimento de um Plano de Gestão Sustentável Regional, incluindo atividades de cursos de capacitação por demandas identificadas.

- Projeto "Ecocidadania - Oficinas de Arte e Ofícios" com vista a desenvolver programas de inclusão social, profissional e ambiental aos cidadãos das áreas de abrangência do HIDROEX. As oficinas incluem capacitação em múltiplas modalidades de arte, cursos de reciclagem, de informática e de idiomas (inglês e espanhol);

- Continuidade do Projeto "Mediação de Conflitos de Usos de Água na Bacia do Rio Piedade/Bacia do Prata", por meio da articulação e promoção do diálogo entre os usuários, com vistas à resolução dos conflitos de usos múltiplos de água, que incluem: levantamento de dados de todas as áreas da bacia; reunião coordenada pelo HIDROEX para um estudo de caso com especialistas e orientação de procedimentos e condutas técnicas; treinamento para a promoção da articulação e capacitação entre os usuários de água dentro da bacia do Rio Piedade para que se viabilize a elaboração de um plano de gestão dos recursos hídricos da bacia. Além de apoio nos diálogos necessários para gestão do uso de água; busca-se colaborar na implementação do citado plano.

4.1.4 FORMAÇÃO E PÓS-GRADUAÇÃO

- Implantação do Curso de Mestrado em "Sustentabilidade Socioeconômica Ambiental", em parceria com a Universidade Federal de Ouro Preto – UFOP até abril/2014

4.2 PESQUISA

4.2.1 **NÚCLEOS TEMÁTICOS DO CONDOMÍNIO TEMÁTICO DAS ÁGUAS** - Serão consolidados os dez (10) Núcleos Temáticos criados no âmbito do **Condomínio Temático das Águas**, a saber: GOVERNANÇA E GESTÃO DAS ÁGUAS, HIDROGEOLOGIA, HIDROLOGIA AMBIENTAL, ECOHIDROLOGIA, ÁGUA E AGRICULTURA, ÁGUA E ENERGIA, TECNOLOGIAS AMBIENTAIS, GEOMÁTICA, EDUCAÇÃO PARA AS ÁGUAS, HISTÓRIA E CULTURA DA ÁGUA. Pesquisadores de 15 instituições parceiras estão se mobilizando para desenvolver projetos conjuntos em cada uma dessas áreas temáticas.

4.2.2 **ÁGUA PRA TODA VIDA** - Será dada a continuidade e concretizada a primeira fase dos treze (13) projetos que compõem o Programa ÁGUA PRA TODA VIDA, implementado no final de 2011, cujo objetivo é construir um modelo de gestão sustentável, pautado na restauração do equilíbrio entre o desenvolvimento e a melhoria na qualidade de vida da população e a conservação dos recursos naturais hídricos da região:

1) Adequação Socioeconômica e Ambiental das Propriedades Rurais;
2) Georreferenciando Microbacias: um Diagnóstico para Sustentabilidade;
3) Gestão Integrada de Água e Solos: Conservação e Recuperação de Solos e Estradas Vicinais;
4) Sistema de Conservação Genética: inventariando fragmentos florestais e promovendo a restauração da vegetação nativa do Cerrado;
5) Zoneamento Agroecológico do Município de Frutal;
6) Caracterização do Ecossistema Aquático;
7) Manejo das Águas Pluviais Urbanas em Frutal;
8) Mapeamento das Doenças de Veiculação Hídrica na Cidade de Frutal;
9) Reciclando Vidas: transformando um problema ambiental em ação social;
10) Pagamento por Serviços Ambientais: estabelecimento de uma estratégia para a região do Triângulo Mineiro;
11) O Impacto da Educação na Gestão da Água;
12) Museu da Água;
13) História e Cultura da Água – Pelos Caminhos da Água

4.2.3 **FLORESTA-ESCOLA** - Será implementado o Centro de Ciências Ambientais FLORESTA-ESCOLA, e dada continuidade a 23 projetos ora em andamento:

1) Distribuição das espécies entre a Mata de Galeria e o Cerrado senso stricto: Filtros ambientais e interações interespecíficas;
2) Estudos de poluição em um fragmento florestal em Frutal, MG ;
3) Análise do vizinho mais próximo e índices de competição na Mata Atlântica;
4) Variação espacial das espécies num fragmento na Floresta-Escola na margem do Rio Grande;
5) Invasão biológica de *Acacia sp.* em Mussunungas;
6) Estrutura filogenética de três trechos na Serra de Brigadeiro;
7) Anatomia vegetativa, com ênfase em estruturas secretoras, aplicada a taxonomia e filogenia da tribo *Prockieae, Salicaceae*;
8) Anatomia histoquímica e ultraestrutura de espécies medicinais de *Croton, Euphorbiaceae;*
9) Estrutura filogenética e ecologia funcional em diferentes fisionomias de Campinarana, Mussununga e Restinga;
10) Análise da estrutura filogenética de samambaias do 2º planalto paranaense: savana vs. Floresta com Araucária;
11) Diversidade funcional e estrutura filogenética de Cerrado;
12) Turnover de diversidade filogenética em um gradiente de acidez na Europa;
13) Morfoanatomia funcional do Cerrado;
14) Dinâmica da decomposição e ciclagem de nutrientes em zonas ripárias: o papel ecológico da riqueza de espécies e a contribuição das populações individuais;
15) Efeito da inundação sobre a germinação e desenvolvimento de plântulas;
16) *Serpocaulon rex* e *Thelypterisserrata*: uma convergência evolutiva?;
17) Distúrbios ambientais podem alterar a anatomia de espécies de Mimosa?;
18) Análise ultraestrutural em folhas de duas espécies de gramíneas acumuladoras de ferro;
19) Estudos filogenéticos em *Merostachys (Poaceae);*
20) Comparação da diversidade genética de espécies de *Bambusoideae (Poaceae)*: Vicariância ou radiação em refúgios;
21) Flora de Pteridófitas e Licófitas da região do FEFP, Frutal, MG;

22) Implantação de uma coleção viva de bambus na Cidade das Águas;
23) Towards a standardized biodiversity-oriented ecological zoning and classification using USGS´s-Hydrologic Unit approach

4.2.4 **ESTUDOS EM RESERVATÓRIOS** - Será dada continuidade ao projeto:

- Controle da Qualidade das Águas e Revitalização do rio Grande (P&D em parceria com a CEMIG);

Serão implementados os programas:

- Ordenamento Sustentável do Reservatório de Marimbondo – Rio Grande
- Espécies Invasoras em reservatórios

4.2.5 **SISBIOTA-BRASIL -** Será finalizado o projeto:

- Biodiversidade de microcrustáceos de água doce em campos rupestres;

4.2.6 **NÚCLEO DE ÁGUA E AGRICULTURA - Parcerias do Condomínio Temático:** Foram submetidas as seguintes propostas, que estão ainda sob avaliação em editais de cinco fontes de financiamentos diferentes:

1. Impactos das mudanças climáticas e do uso da terra nos recursos hídricos de bacias hidrográficas do estado de Minas Gerais. Parcerias: Unimontes, Embrapa Cerrados, UFU, HIDROEX, Epamig, Embrapa Milho e Sorgo, UEMG

2. Inovações tecnológicas para monitoramento de bacias hidrográficas: ferramentas para a agricultura sustentável – um caminho para a segurança alimentar. Parcerias: HIDROEX, Embrapa Instrumentação Agropecuária, UEMG

3. Parâmetros de qualidade ambiental em áreas sob atividade agrícola que interferem na capacidade de infiltração em áreas de recarga de bacias hidrográficas mineiras Parcerias: UNIFAL, EMBRAPA Agrobiologia, HIDROEX, UFLA, UEMG

4. Estimativa da pegada hídrica das principais atividades agropecuárias do município de Frutal (MG) e suas alternativas para a sustentabilidade Parcerias: HIDROEX, Embrapa Instrumentação Agropecuária, UEMG

5. Hidropedologia e capacidade de recarga hídrica em microbacias do cerrado Parcerias: UFRRJ, HIDROEX, UEMG

6. Recuperação da voçoroca do Marinhaninho em Frutal, MG. Parcerias: HIDROEX, GD8, Prefeitura Municipal de Frutal

7. Rede Frutal Orgânico. Proposta apresentada ao Ministério da Agricultura no âmbito do *Plano Nacional de Agroecologia e Produção Orgânica – Planapo.*

4.2.7 **AGROECOLOGIA -** Um dos temas que tem se fortalecido substancialmente dentre as atividades desenvolvidas pelo HIDROEX é agroecologia. Em setembro de 2013, foi realizado um Seminário sobre o tema e foi dado início a um curso de dez (10) meses em Agroecologia para produtores rurais. A iniciativa foi tão bem recebida que devido à procura outras turmas foram formadas. Estuda-se agora a implementação de um mestrado no tema.

4.2.8 **ESTUDO TÉCNICO-CIENTÍFICO DE UM TRECHO DO RIO SÃO FRANCISCO PARA FINS DE REVITALIZAÇÃO AMBIENTAL**.

O projeto é desenvolvido pela parceria Fundação Centro Tecnológico de Minas Gerais (CETEC) e UNESCO-HIDROEX, com apoio financeiro da Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG). Sua execução começou em 2011 e deverá ser encerrado em dezembro em 2014. O objetivo principal é o desenvolvimento de uma metodologia de avaliação ambiental simplificada para a proposição de diretrizes de intervenções para revitalização ambiental do rio São Francisco entre os trechos delimitados a montante pela barragem da usina hidrelétrica de Três Marias e a jusante pela sua confluência com o rio das Velhas, próximo ao município de Pirapora/MG.

Para 2014 estão previstas reuniões temáticas envolvendo as populações das cidades ribeirinhas para a apresentação dos resultados e o envolvimento das comunidades locais, além de um seminário técnico para proposição de diretrizes para recuperação e conservação da área de estudo. Também em 2014, será realizada uma avaliação ambiental rápida

(RAP) da qualidade das águas do rio São Francisco de Pirapora até Manga (divisa com a Bahia).

2.2.9 PROJETO DE PESQUISA E CONTROLE DA QUALIDADE DAS ÁGUAS DO RIO SÃO FRANCISCO.

Projeto executado pelo UNESCO-HIDROEX, em convênio com a CEMIG. Com este projeto, pretende-se inserir uma nova abordagem de avaliação da qualidade das águas, pesquisas e capacitação no trecho entre os municípios de Pirapora e Manga, na divisa de Minas Gerais com Bahia. Está prevista a inserção de um Barco Pesquisa-Escola nesse trecho do rio. Tendo a embarcação como alicerce, a avaliação da qualidade das águas será realizada de forma inovadora pela criação de um Índice de Integridade Plâncton-Bentônica. O barco também será utilizado como ferramenta para ações de educação para as águas e atenderá onze municípios lindeiros ao rio São Francisco.

Para o ano de 2014 está prevista a inauguração do barco e as primeiras expedições científicas para coleta e análise de água e comunidades biológicas.

Annex 3

UFOP/Hidroex – MSc - Socio-economic Sustainable Development - Public call with the rules for the selection of candidates (in Portuguese)

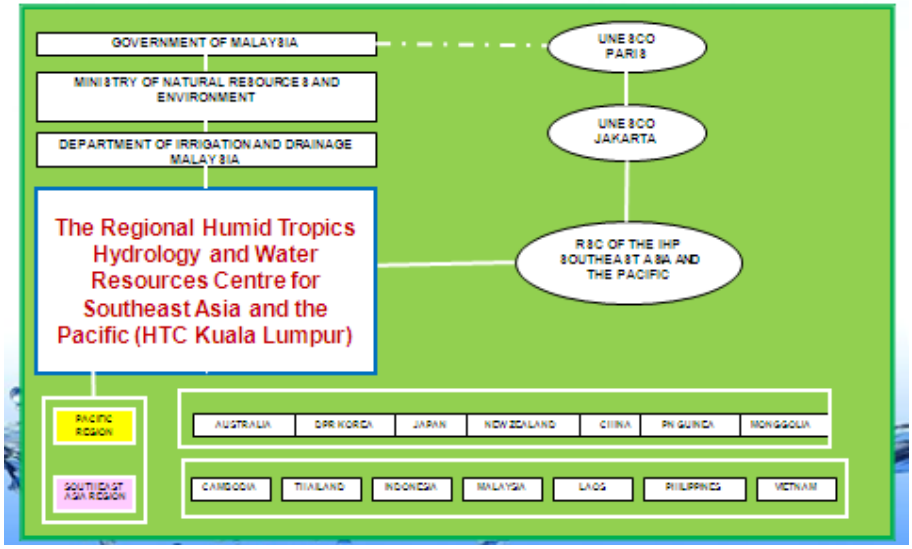
Biennial Reports by UNESCO's Water-Related Centres on Activities Related to the IHP in the Period June 2012 – May 2014 for the 21th Session of the IHP Intergovernmental Council

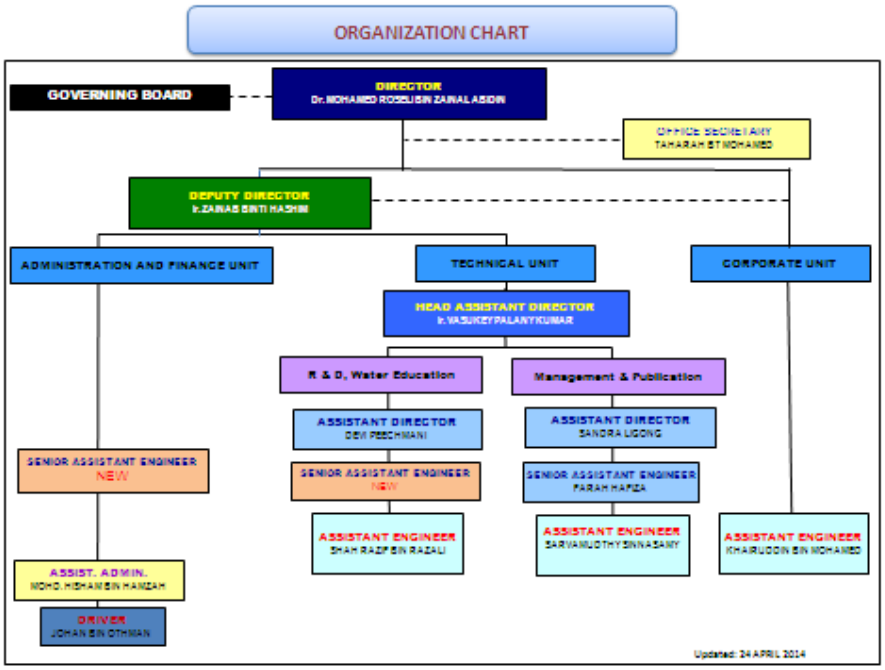
United Nations
Educational, Scientific and
Cultural Organization

HUMID TROPICS CENTRE KUALA LUMPUR

The Regional Humid Tropics Hydrology and Water Resources Centre for Southeast Asia and The Pacific

THE RELATIONSHIP OF HTC WITHIN UNESCO, UNDER DID, NRE AND IHP NATIONAL COMMITTEE OF MEMBER COUNTRIES



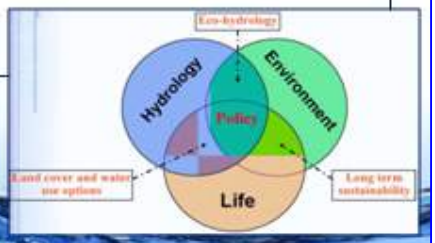


OBJECTIVES:

- promote a conducive atmosphere for collaboration through technology and information exchange, education and sciences;
- increase scientific technologies knowledge about the hydrological cycle; and
- promote and increase scientific and technological knowledge about urban stormwater management, ecohydrology, humid tropics and water education.

Hydrology is a field which cover, the entire history of the cycle of water on earth

1. water cycle
2. physical and chemical properties
3. responses to human activities



Transformation in HTC: (Since June 2009)

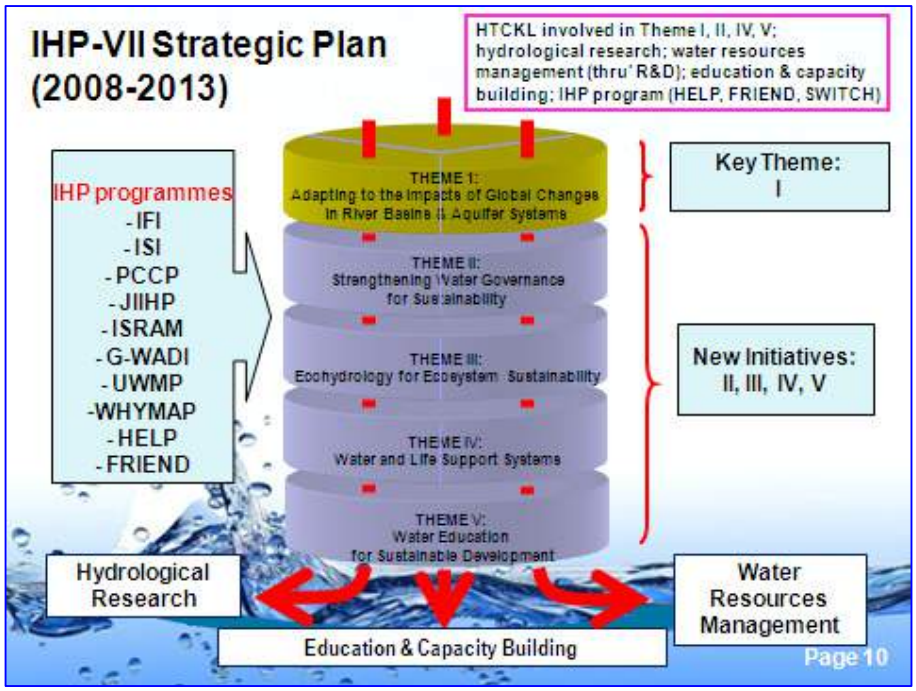
Decide on Focal Area

- Integrated Water Resources Management (IWRM), Urban Stormwater Management, Ecohydrology, River Waste Water Management, Humid Tropics and Water Education
- The scope of activities includes applied research, advising, continuing education and software development.

Obligations and functions

- to coodinate the implementation of cooperative hydrological and water resources research projects and activities.
- to network with IHP National Committees and other similar centres for exchange of scientific and technical information on research results;
- to organize training courses, seminars, workshops and meetings for knowledge and technology transfer; and
- to produce related hydrological and water resources publications and media for distributions.

TRANSFORMATION, ASPIRATION VALUE, CREATIVITY, INNOVATION


IHP-VII Strategic Plan (2008-2013)
HTCKL involved in Theme I, II, IV, V; hydrological research; water resources management (thru' R&D); education & capacity building; IHP program (HELP, FRIEND, SWITCH)
IHP programmes
- IFI
- ISI
- PCCP
- JIIHP
- ISRAM
- G-WADI
- UWMP
-WHYMAP
- HELP
- FRIEND
THEME I: Adapting to the Impacts of Global Changes in River Basins & Aquifer Systems
THEME II: Strengthening Water Governance for Sustainability
THEME III: Ecohydrology for Ecosystem Sustainability
THEME IV: Water and Life Support Systems
THEME V: Water Education for Sustainable Development
Key Theme: I
New Initiatives: II, III, IV, V
Hydrological Research
Water Resources Management
Education & Capacity Building
Page 10


UNESCO-IHP Cross-Cutting Program (in conjunction with UNESCO IHP-VII STRATEGIC PLAN (2008-2013); Water Dependencies Systems Under Stress and Societal Responses for the themes and focal areas of Themes 1, 3, 4 and 5)
UNESCO-IHP CROSS-CUTTING PROGRAMMES RELATED TO HTCKL
1. UNESCO SWITCH-in-Asia: Urban Water Management; SWITCH – Sustainable Water Management Improves Tomorrow's Cities Health.
2. AP FRIEND; Asia Pacific Flow Regimes from International Experimental and Network Data.
3. UNESCO-HELP River Basin (Langat River): Hydrology for the Environment, Life and Policy.
• The SWITCH-*in-Asia* *Initiative provides an integrated and innovative concept* towards the development of sustainable water management in urban areas.
Page 19

IHP-VIII Strategic Plan 2014-2021

Cognizant of the lead role played by the International Hydrological Programme (IHP) for almost four decades in the development of hydrology as a science and integrated water resources management tools at the global level.

HTCKL involved in Theme I, III, IV, V and VI

Biennial Reports by UNESCO's Water-related Centres on activities related to the IHP in the period (June 2012- May 2014)

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)		Ir. Hjh. Zainab bt Hashim Deputy Director Sandra Ligong Assistant Director
E-mail		htckl@water.gov.my
Address		No. 2, Jalan Ledang, Off Jalan Duta, 50480 Kuala Lumpur, Malaysia.
Website		http://htckl.water.gov.my
Location of centre		city/town : Kuala Lumpur country : Malaysia
Geographic orientation *		☐ global ☒ regional
Region(s) (for regional centres)		Southeast Asia and The Pacific
Year of establishment		15 Years (since 1999)
Year of renewal assessment		2012
Signature date of most recent Agreement		
Themes Of activities during reporting period	Focal Areas ♦	☐ groundwater ☒ urban water management ☐ rural water management ☐ arid / semi-arid zones ☒ humid tropics ☐ cryosphere (snow, ice, glaciers) ☐ water related disasters (drought/floods) ☐ Erosion/sedimentation, and landslides ☒ ecohydrology/ecosystems ☐ water law and policy ☐ social/cultural/gender dimension of water ☐ transboundary river basins/ aquifers ☐ mathematical modelling ☐ hydroinformatics ☐ remote sensing/GIS ☒ IWRM ☐ Watershed processes/management ☐ global and change and impact assessment ☐ mathematical modelling ☒ water education ☒ water quality ☐ nano-technology ☐ waste water management/re-use ☐ water/energy/food nexus ☐ water systems and infrastructure ☒ other: (please specify) Storm water management, Water Hazard
	Scope of Activities ♦	☐ vocational training ☐ postgraduate education ☐ continuing education ☐ public outreach ☒ research ☐ institutional capacity-building ☒advising/ consulting

* check on appropriate box
♦ check all that apply

	☒ software development ☐ data-sets/data-bases development ☐ 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
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/ Asia-Pacific IHP HELP and Ecohydrology/Regional Sejahtera ESD Network (RSEN)
Governance	☒ director and governing board ☒ 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 __year(s) ☒ 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) : 13 number of staff who are water experts: 3 number of visiting scientists and postgraduate students:3
Annual turnover budget in USD	Operational =USD 345,000 Programmes and Activities =USD 380,000

2. Activities undertaken in the framework of IHP in the period June 2012 – May 2014

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII/VIII (Appendix-1 and 2) and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.

There are currently 5 candidates of Ph.D Students doing their research with HTCKL's R&D Project. One student had completed Master's Degree in 2012 with a research title **Sensitivity Analysis on the Estimation of Evapotranspiration Model, Penchala River Basin (working group: Urban Ecohydrology)** Meanwhile in 2013, Three students had completed Master's Degree with research title **Evaluation of Green Roof as an Option of Green Technology for Urban Stormwater Quantity and Quality Control, Monitoring Program of MSMA Stormwater Management Ecohydrology Project at HTCKL and Erosion Risk Potential Categorization Along Langat River** and one student had completed Bachelor Degree with a research title **Effectiveness of Green Roof in Controlling Rate of Surface Water and Water Quality at HTCKL**. All of the students are under The Director of HTC as their external supervisor.

[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

2.2 Research activities that directly contributed to the IHP-VII and/or IHP-VIII activities

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

HTC carry out its R&D activities according to its first two functions under Article II (i.e. (a) to coordinate the implementation of cooperative hydrological and water resources research projects and activities, and (b) to network with IHP National Committees and other similar centres for exchange of scientific and technical information on research results) and the UNESCO-IHP cross-cutting programmes of SWITCH-in-Asia: Urban Water Management; as well as UNESCO-HELP River Basin (Langat River).

The R&D carried out is also in conjunction with Phase IHP-VII for the themes and focal areas of Theme 1, Theme 3 and Theme 4 for 2012 -2013 and in conjunction with Phase IHP-VIII (2014-2021) for the themes and focal areas of Theme 1, Theme 3, Theme 4, Theme 5 and Theme 6. The main focuses are in stormwater management, river management and waste water management.

Most of the R&D are being carried out through collaboration and networking with local universities and under the R&D committee of Malaysian National IHP programmes.

The R&D in conjunction with phase IHP-VII (8 Nos) carried out are as per table below:

- **Benefits to UNESCO-IHP Programme, Regionally and Internationally**

No.	Title	Remarks
1.	**Monitoring Hydraulic Performance of Stormwater Management Ecohydrology (SME) at HTCKL**	**SWITCH - completed**
2.	**Upscaling of Stormwater Management Ecohydrology (SME) at Catchment Level (Langat River) (under UNESCO-SWITCH-in-Asia: UWM and UNESCO-HELP Basin**	**SWITCH & HELP - ongoing**
3.	Erosion Risk Categorization Potential at Langat River	HELP - completed
4.	Agricultural Non-Point Source Pollution and Impact on Reservoir (Sembrong Dam) Sedimentation and Water Quality	Phase IHP-VII : Theme 1 - ongoing
5.	Urban Ecohydrology for Resilient Environment (UCOREN) Penchala River – Working Group 2: Component Ecohydrology	Phase IHP-VII : Theme 3 - ongoing
6.	Monitoring Rainwater Harvesting System (RWHS) Effectiveness in Perhentian Island	Phase IHP-VII : Theme 1 - completed
7.	Construction of a Large Scale Solar Still System for Treatment of Sanitary/Domestic Wastewater at Perhentian Island	Phase IHP-VII : Theme 3 & 4 - completed
8.	Remediation of Pollution from Large Point Sources for Hiliran River	Phase IHP-VII : Theme 3 & 4 - completed

PHOTOS:

PHOTO OF R&D No.1

PHOTO OF R&D No. 2

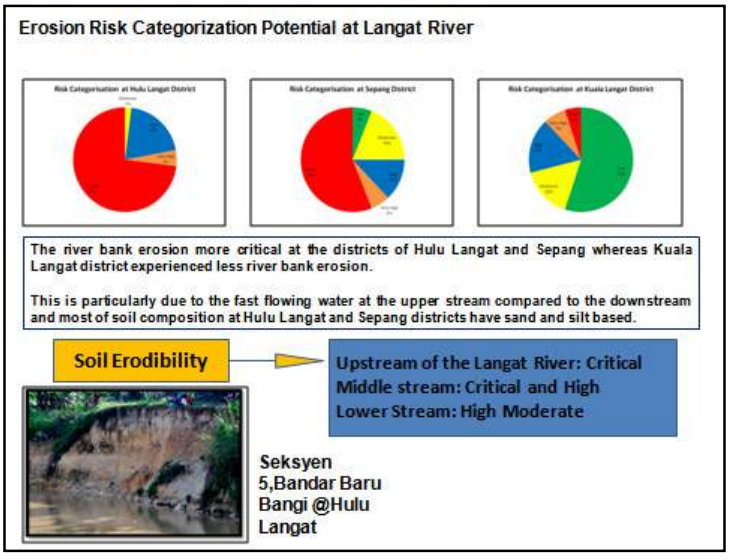


PHOTO OF R&D No. 3

PHOTO OF R&D No. 7

PHOTO OF R&D No. 8

The R&D or Activities in conjunction with phase IHP-VIII carried out are as per table below:

IHP VIII Themes	No.	Activities/Action Plan
THEME 1 : Water related Disasters and Hydrological Change	1)	Geospatial technology for equipment used in visualization, measurement, and analysis of earth's features, involving such systems as GPS (Global Positioning Systems), GIS (Geographical Information Systems), and RS (remote sensing), example in the forecasting of erosion induce landslide at hilly area and river corridor.
	2)	The hydrological climate change effect in flood management, such as the development of IDF curve.
	3)	Improving the techniques of flood design and management through understanding natural river ecosystem and making space for water
	4)	Artificial Bio-Macropore for Enhancing Soil Infiltrability for Urban catchment at HTCKL and Langat-HELP River Basin
THEME 3: Addressing Water Scarcity and Quality	1)	Desalination of seawater for drinking and domesting water use in small islands such as using the step solar still system technique. Working with IOC.
	2)	Innovation in improving point source water pollution to water resources using various biofilter techniques. Also water recycle for general use. Bye product as fertilizer.
	3)	Collaboration and exchange of scientific, technical and policy relevant information for total water cycle management - Integrated Water Resource Management, Sustainable Urban Drainage Systems, treating stormwater to improve water quality and others in the AP region.
	4)	Study on Performance of Gross Pollutant Trapping Devices Vs. Life Cycle Cost And Gross Pollutant Management Strategies Knowledge Portal Case Study Putrajaya. Aims to collect performance data for selected device used to remove gross pollutants from within the urban drainage network.
THEME 4: Water and Human Settlements of the future	1)	A water based recreational site to a rural community as well as to others through Rural River Rejuvenation (R3) which means of bringing aquatic life back to rural rivers and cleaning up their waters so as to be fit for recreation.
	2)	A novel approach to reuse Alum Sludge for pottery manufacturing as well as to explore the possibility to be used as a building material in order to ensure better environmental sustainability as well as sound economical value. Alum Sludge is a potential environmental threat that is produced massively during the process of treating drinking water.
	3)	Agricultural Non-Point Source Pollution and Impact on Reservoir Sedimentation and Water Quality. Non-point source (NPS) pollution occurs as water moves across the land or through the ground and picks up natural and human-made pollutants, which can then be deposited in lakes, rivers, wetlands, coastal waters, and even groundwater.
THEME 5: Ecohydrology, Engineering Harmony for a Sustainable World	1)	Ecohydrology expert system of lake management using wireless sensor of real time monitoring (effectiveness of wireless sensor networks in real-time application, prototype system for real time monitoring and predicting several ecological parameter, expert system for ecological succession)
	2)	Eco-Friendly Integrated Green Technology Expert System for Sustainable Green Infrastructure (GENIUS)
	3)	Upscaling water security to meet local, regional and global challenges such as SME
	4)	Green technology in enhancement of local area.
	5)	Evaluation Of Potential Evapotranspiration Models for a Tropical Urban Catchment. Analysing potential evapotranspiration (PET) methods to determine which provided the most accurate estimate in an urban area. An Assessment of Biophysical Processes.
	6)	Decision Support System (DSS) Software for MSMA Integrated Stormwater Management Ecohydrology (MSMA- ISME) based on MSMA-ISME at HTCKL and Upscaling MSMA-ISME at Langat-HELP basin

THEME 6: Water Education, Key for Water Security	1)	Multi-stakeholder initiatives in bringing together schools, universities, the media, NGO's, businesses, public authorities and other stakeholders. Focus on education in contributing sustainable development of the regions and communities such as through The Regional Centre of Expertise on Education for Sustainable Development; Regional Sejahtera ESD Network (RSEN)
	2)	Providing an innovative storm water and water quality management technologies, best management practices and policy options to counter negative effects of urbanization.
	3)	Promoting and enhancing Ecohydrology and HELP approaches, knowledge

Notes: Once the R&D projects and programmes completed, the output will be either or combinations in the form of technical reports, technical guidelines, papers, proceedings, posters and innovation products.

PHOTOS:

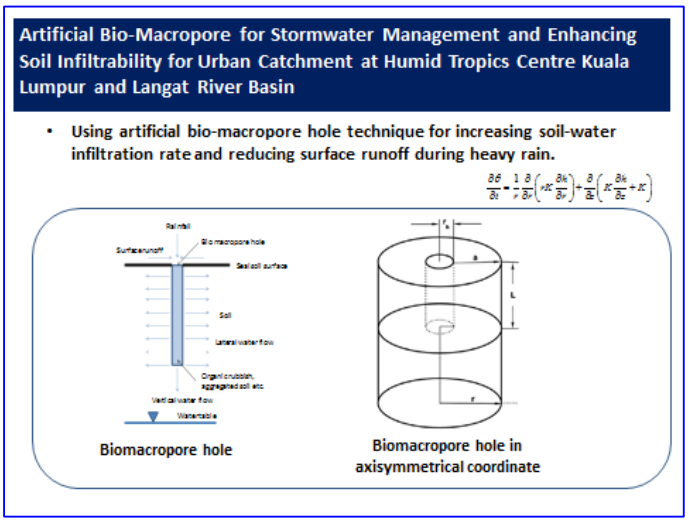


PHOTO OF THEME 1, NO. 4

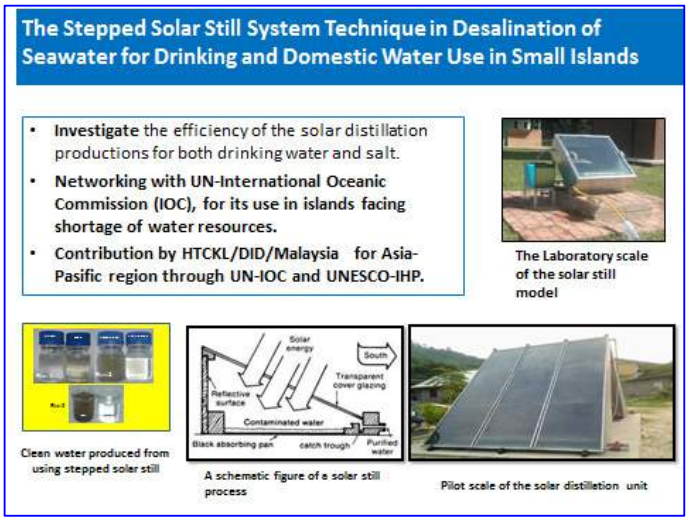
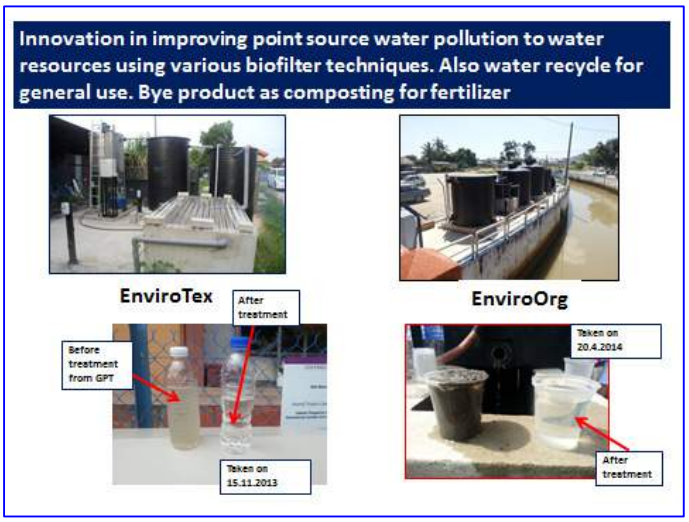


PHOTO OF THEME 3, NO. 1



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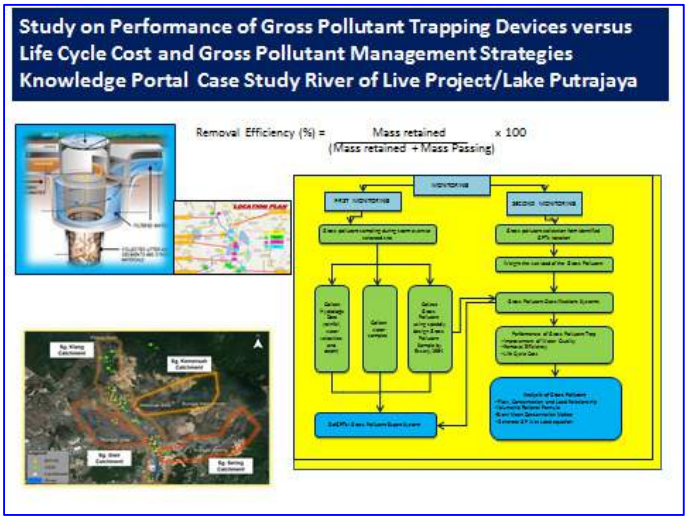

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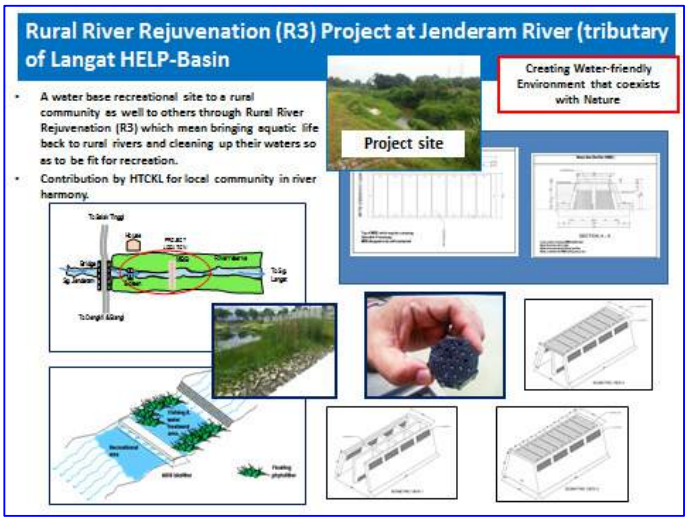

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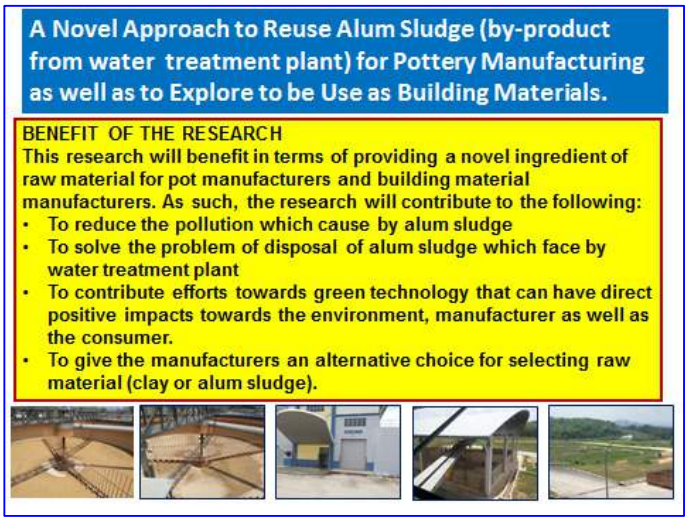

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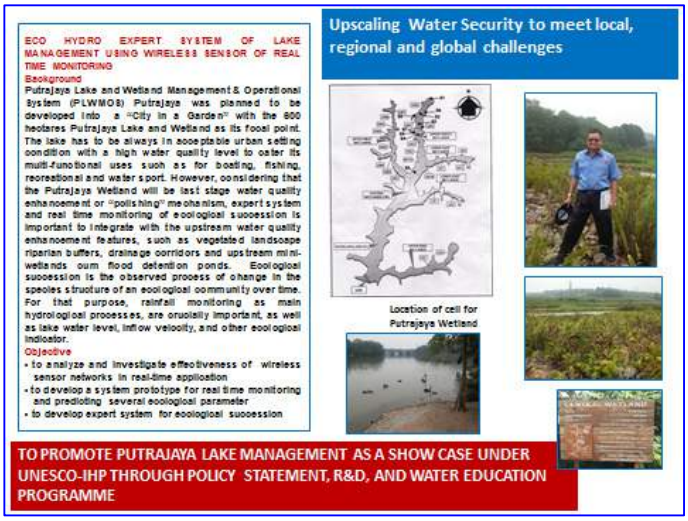
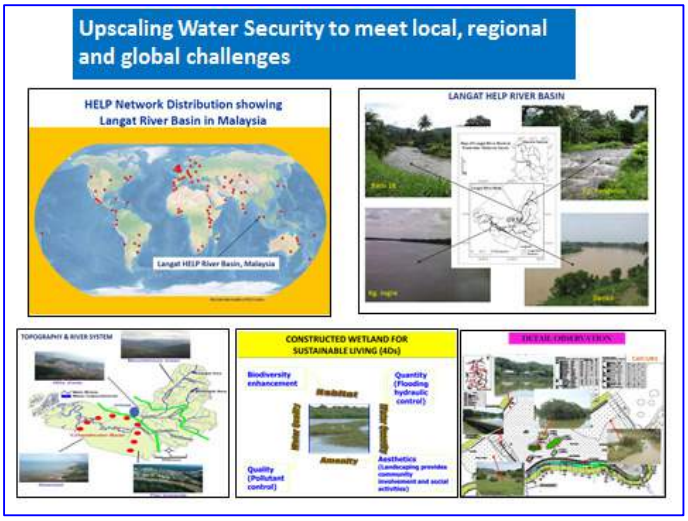


PHOTOS OF THEME 5, NOS. 1&3



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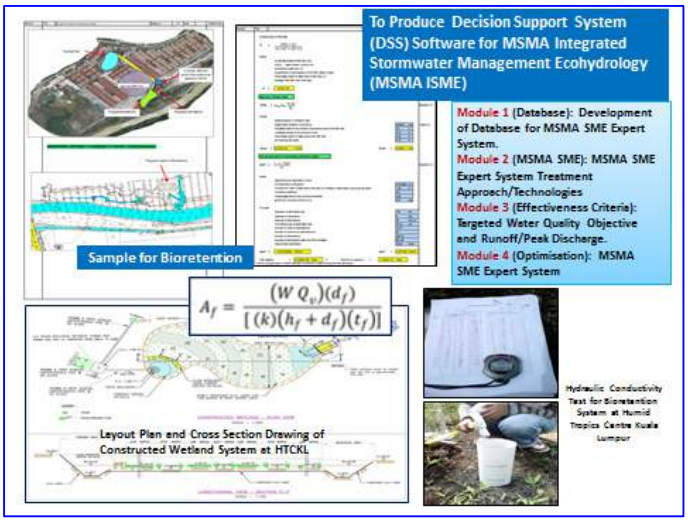


PHOTOS OF THEME 5, NO. 6

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

- Conducted Seminar on Geospatial Related Disaster and Problems: Issues, Challenges and Prevention at Avillion Admiral Cove, Port Dickson, Negeri Sembilan on 4th & 5th June 2012
- Conducted Seminar on Integrated Urban Water Management Using MSMA Stormwater Management Ecohydrology as part of SWITCH Program: From Theory until Implementation at Heritage Hotel, Cameron Highlands, Pahang on 2nd & 3rd July 2012
- Participate & organize The 2nd International Conference on Water Resources (ICWR2012) in Conjunction with 20th UNESCO-IHP Regional Steering Committee Meeting for Southeast Asia and the Pacific was held at the Bayview Hotel Langkawi, Malaysia from 5th - 6th November 2012.
- Organised Best Thesis Award (PhD; Masters; Undergraduate) in Hydrology and Water Resources for Malaysia's Universities and Higher Learning Institution in conjunction with Malaysia World Water Day 2013

- Conducted Seminar on Geospatial Disaster and UNESCO-HELP Basin: Water Co-Operation, Security and Geohazards at Cititel Midvalley, Kuala Lumpur, 17TH – 18TH June 2013.

- Participate in Malaysia World Water Day 2014, Putrajaya, Malaysia, on 22nd March 2014.
- Conducted 1st National Conference on Non-Point Sources Pollution (NPS2014) at Vivatel Hotel, Kuala Lumpur on 13th & 14th May 2014

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
  - Attended 3rd Asia Pacific Climate Change Adaptation Forum: Mainstreaming Adaptation into Development – United Nations Environment Programme (UNEP), Incheon, Republic of Korea,18th - 20th March 2013
  - Attended the Executive Development Programme (for young officers, Grade 41 – 44, Central Official Training Institute (COTI), Republic of Korea 6th – 20th April 2013
  - Attended The Sustainability Science Workshop: A Science Based Approach to Realise the Future We Want For All Istana Hotel, Kuala Lumpur, Malaysia, 4th & 5th April 2013**,**
  - Attended the 23rd IHP Training Course: Ecohydrology for River Basin Management under Climate Change, Kyoto,Japan, 2nd -13th December 2013

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
  - Attended the 20th Intergovernmental Council (IGC)

UNESCO – IHP, Paris

- Attended 20th Regional Steering Committee (RSC) Meeting for South East Asia and The Pacific UNESCO IHP held in Langkawi from 08th – 09th November, 2012.
- Attended "21st Regional Steering Committee Meeting UNESCO-IGP Southeast Asia & the Pacific held in Gyeongju Rep. of Korea from 30 Sept 2013 -5 Oct 2013
- Attended Strategic Meeting of Asia-Pacific IHP HELP and Ecohydrology Gran Mahakam Hotel Jakarta, Indonesia, 2nd & 3rd December 2013.

- National
  - Malaysia National Committee for International Hydrological Programme Meeting (MIHP)
  - Science Committee Meeting, twice yearly for organization affiliate to UN and UNESCO
  - Attended the launching of Regional Sejahtera ESD Network (RSEN) and appointed as Council Member at Malaysia Science University, 30th May 2014 (related to UN programme on sustainable development)

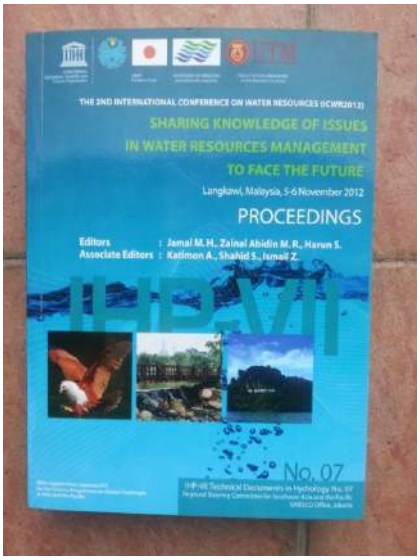
3.3 Collaboration and networking with other UNESCO category 1 or 2 institutes/ centres

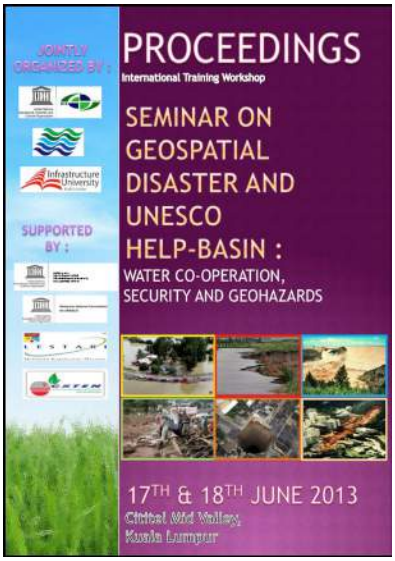
3.3.1 cross-appointment of directors of the category 1 or 2 institutes or centres on the governing board

-

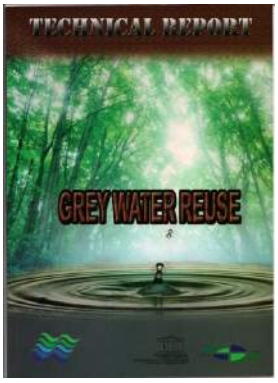
3.3.2 exchange of information on activities such as training/educational materials, and funding opportunities

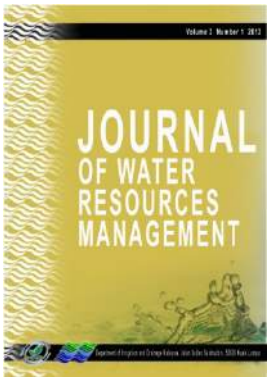
- Proceedings
  - Proceeding of The 2nd International Conference on Water Resources (ICWR2012): Sharing Knowledge of Issues in Water Resources Management to Face the Future, IHP-VII Technical Documents in Hydrology N0. 07, 2012
  - Proceeding of Seminar on Geospatial Disaster and UNESCO-HELP Basin: Water Co-Operation, Security And Geohazards





- Publications/ Reports
  - Journal of Water Resource Management, Vol. 1, No. 1, December 2012
  - Technical Report: Greywater Reuse, 2012
  - Technical Report: Green Roof, 2012
  - Journal of Water Resource Management, Vol. 1, No. 2, December 2013
  - Technical Report: Porous Pavement 2013
  - Technical Report: Constructed Wetland 2013





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

- Data Archive
  Asia Pacific FRIEND - Asian Pacific Water Archive
  - Central Node : HTC KL
  (http://htckl.water.gov.my)

3.4 Relationships with the UNESCO field and regional 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 and with other organizations of other countries

- 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

- Through cross-cutting programmes:

- UNESCO SWITCH (Sustainable Water Management Improves Tomorrow's Cities Health)-in-Asia: Urban Water Management

- APFRIEND (Asia Pacific Flow Regimes from International Experimental and Network Data)

- UNESCO-HELP (Hydrology for the Environment, Life and Policy) River Basin

➢ Through giving lectures such as Integrated Water Resources Management and Integrated Flood Management.

➢ Through conducted seminars and workshops.

➢ Through proceedings and technical guidelines publications.

➢ Through meetings on conducted research.

4.2 Policy documents and advice

➢ Attended a discussion on draft of policy document for Putrajaya Lake and Wetland; Regional Lake Networking-Establishing ASEAN Lake Network, 10th March 2014.

5. Update on Centre Operations

5.1 Membership of the Board of Governors between designated period

- IHP National Committee Chairman of Southeast Asia and Pacific
- Co-ordination Committee

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)

- MSMA Stormwater Management Eco-hydrology (MSMA SME)
  - Porous and Permeable Pavement System
  - Greywater Reuse System
  - Constructed Wetland System
  - Rain Water Harvesting System
  - Green Roof System
  - Bioretention System

Note: Her Excellency Madam Irina Bokova, Director General UNESCO had visited HTCKL on 21st May 2013. She had officially launched the UNESCO-SWITCH in Asia: MSMA Stormwater Management ecohydrology at HTCKL by releasing fish into the constructed wetland & signing of plaque.

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

- Many lecturers, university students and others (from overseas including UNESCO and local) visit HTCKL to see and gain knowledge through our integrated Stormwater Management Ecohydrology (SME) and R&D programmes/projects.

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

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

7.1 Operational Plan (attach if available)

HTCKL will continue to perform and carry out its obligation under Article 2 of the Agreement related to – coordinating the implementation of cooperative hydrological and water resources research projects and activities; networking with IHP National Committees and other similar centres for exchange of scientific and technical information on research results; organizing training courses, seminars, workshops and meetings for knowledge and technology transfer; and producing related hydrological and water resources publications and media for distributions.

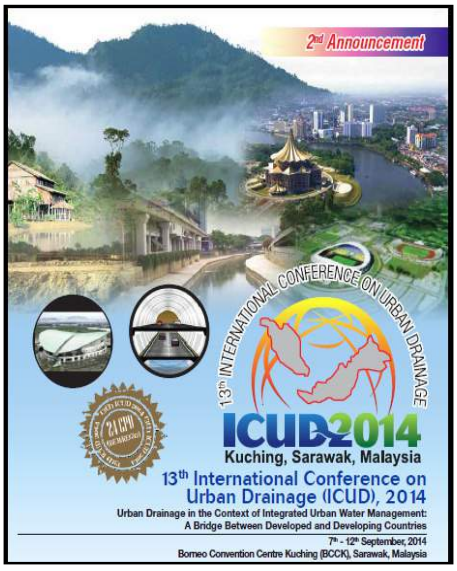
Functions of each units in HTCKL (Annex I)

7.2 Strategic Plan linked with IHP-VIII (Appendix 2)
(attach strategic plan if available)

- HTCKL Focus Area on R&D based on UNESCO IHP VII Themes (2008 -2013) and UNESCO IHP VIII Themes (2014 – 2021) (Annex II)

  HTCKL will continue to contribute in stormwater management, ecohydrology, river basin management, waste water management through its R&D programmes and through the three cross-cutting programmes i.e. UNESCO SWITCH (Sustainable Water Management Improves Tomorrow's Cities Health)-in-Asia: Urban Water Management; APFRIEND (Asia Pacific Flow Regimes from International Experimental and Network Data) and UNESCO-HELP (Hydrology for the Environment, Life and Policy) the Langat River Basin.

  This year (2014) HTCKL become one of the organizer for the 13th International Conference on Urban Drainage (ICUD2014). This event will be held in, Borneo Convention Centre Kuching, Sarawak**,** Malaysia from 8th - 11th Sept 2014.It is also **Water Management Component Workshop on Comparative Studies of Applying Ecohydrology and IWRM in Asia and Africa through UNESCO Category 2 Water Centres in Asia and Africa;** which is Collaboration with Asia Pacific Center for Ecohydrology (APCE), Capital National University (CNU) Beijing China, Regional Centre for Integrated River Basin Management (RC-IRBM) Kaduna Nigeria, Malaysia National Commission for UNESCO, Malaysian IHP National Committee and local partners of HTC.



16 papers related to Water Security (UNESCO-IHP Strategic Plan VIII) involving HTCKL Working Groups from five (5) projects will be presented as below:

Water Education: Papers in 2014 from LRGS Urban Water Cycle Processes, Management & Societal Interactions Projects) for 13th ICUD

S/N	Authors	Year	Title	Conference Title	Location	Date	Project
1	Goh, H. W., Lau, T. L., Foo, K. Y., Zakaria, N. A.	2014	Preliminary Study on Potential Additives in Filter Media of Bioretention for Nutrient Removal.	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	1
2	Takaijudin, H., Ab Ghani, A., Zakaria, N.A	2014	Preliminary Study on the Impacts of Variation Engineered Soil Composition in Bioretention on Hydraulic Performance	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	1
3	Mohd Sidek, L., Muha, N. E., Beecham, S. , Zainal Abdin, M. R. and Mohd Puad, A. H.	2014	Evaluation of Bioretention System Performance for Treatment of Storm Water Runoff.	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	1
4	Muha, N. E., Mohd Sidek, L., Basri, H., Beecham, S. and Zainal Abdin, M. R.	2014	A Field Evaluation of Bioretention System Flow and Pollutant Treatment Under Tropical Climate	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	1
5	Mohammadpour, R., Shaharuddin, S., Chang, C.K., Zakaria, N.A. &	2014	Nitrogen Removal Assessment by Multivariable Statistical Technique in Free Surface Wetland	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak,	7-12 September 2014	2

Water Education: Papers in 2014 from LRGS Urban Water Cycle Processes, Management & Societal Interactions Projects) for 13th ICUD

S/N	Authors	Year	Title	Conference Title	Location	Date	Project
6	Mohd Noor, N. A., Mohd Sidek, L., Beecham, S., Zainal Abdin, M. R., Mohd Puad,A. H. and Ali, Z.	2014	Performance Evaluation on Small Scale Constructed Wetland as Water Quality Improvement under Tropical Climate	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	2
7	Johari, N. E. B., Abd. Talib, S., Ab. Ghani, A., Ab. Wahid, M. and Chang, C. K.	2014	Performance of Constructed Wetland on Nutrient Removal in Tropical Climate	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	2
8	A. Othman, M., Ab. Ghani, A., Foo, K. Y. and Chang, C. K.	2014	Long Term Rainfall Analysis for Estimating Water Quality Volume for Major Towns in Malaysia	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	2
9	Hayder, G. , L. Sidek, H.A. Mohiyadeen, H., Basri, Mohd Noh, N., Ahmad, F. and Lim Chow Hock	2014	Water Quality Index Score of Different Biomedia for River Water Treatment	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	3

Water Education: Papers in 2014 from LRGS Urban Water Cycle Processes, Management & Societal Interactions Projects) for 13th ICUD

S/N	Authors	Year	Title	Conference Title	Location	Date	Project
10	H.A. Mohiyadeen, Hayder, G. , L. Sidek, H., Basri, Mohd Noh, N., Ahmad, F. and Lim Chow Hock	2014	Biological Carrier Physical Performance Study for River Purification Plant	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	3
11	Harizah Haris et al.	2014	Study of Water Quality at Sungai Penchala	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	3
12	Zainudin, W.M., et al	2014	Monitoring Penchala River Water Quality Using Remote Sensing and GIS	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	3
13	Basri, H., Lariyah, M.S., et al.	2014	Study on Effectiveness and Performance of Gross Pollutant Traps for Stormwater Quality Control for Sungai Penchala	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	3

Water Education: Papers in 2014 from LRGS Urban Water Cycle Processes, Management & Societal Interactions Projects) for 13th ICUD

S/N	Authors	Year	Title	Conference Title	Location	Date	Project
14	Lai, C. H., Chan, N. W., Phang, W. L. and Zakaria, N. A.	2014	Challenges in Non- Revenue Water Management in Perlis State, Malaysia	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	5
15	Chan, N. W.	2014	The N-Park Water Saving Project-A Participatory Approach in Urban Water Management	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	5
16	Lai, C. H., Chan, N. W. and Phang, W. L.	2014	Domestic Water Saving Practices as an Urban Water Demand Management Strategy in Penang, Malaysia	13th International Conference on Urban Drainage (ICUD) 2014	Borneo Convention Center Kuching (BCCK), Sarawak, Malaysia	7-12 September 2014	5

8. Strategic Alignment with IHP-VIII

8.1 Focal areas within IHP-VIII the centre plans to contribute to and specific actions the centre will undertake to align its activities with the strategic plan for IHP-VIII (Please see Appendix-2)

The R&D carried out is in conjunction with Phase IHP-VII for the themes and focal areas of Theme 1, Theme 3 and Theme 4 for 2012 -2013 and in conjunction with Phase IHP-VIII (2014-2021) for the themes and focal areas of Theme 1, Theme 3, Theme 4, Theme 5 and Theme 6. The main focuses are in stormwater management, river management and waste water management.

Most of the R&D are being carried out through collaboration and networking with local universities and under the R&D committee of Malaysian National IHP programmes.

9. Annexes

9.1 List of publications released by the centre (there can be overlap with those listed in 3.3.2 above)

- Proceedings
  - Proceeding of The 2nd International Conference on Water Resources (ICWR2012): Sharing Knowledge of Issues in Water Resources Management to Face the Future, IHP-VII Technical Documents in Hydrology N0. 07, 2012
  - Proceeding of Seminar on Geospatial Disaster and UNESCO-HELP Basin: Water Co-Operation, Security And Geohazards
- Publications/ Reports
  - Journal of Water Resource Management, Vol. 1, No. 1, December 2012
  - Technical Report: Greywater Reuse, 2012
  - Technical Report: Green Roof, 2012
  - Journal of Water Resource Management, Vol. 1, No. 2, December 2013
  - Technical Report: Porous Pavement 2013
  - Technical Report: Constructed Wetland 2013

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

- Conducted Seminar on Seminar on Geospatial Related Disaster and Problems: Issues, Challenges and Prevention at Avillion Admiral Cove, Port Dickson, Negeri Sembilan on 4th & 5th June 2012
- Conducted Seminar on Integrated Urban Water Management Using MSMA Stormwater Management Ecohydrology as part of SWITCH Program: From Theory until Implementation at Heritage Hotel, Cameron Highlands, Pahang on 2nd & 3rd July 2012
- Participate & organize The 2nd International Conference on Water Resources (ICWR2012) in Conjunction with 20th UNESCO-IHP Regional Steering Committee Meeting for Southeast Asia and the Pacific was held at the Bayview Hotel Langkawi, Malaysia from 5th - 6th November 2012.
- Organised Best Thesis Award (PhD; Masters; Undergraduate) in Hydrology and Water Resources for Malaysia's Universities and Higher Learning Institution in conjunction with Malaysia World Water Day 2013
- Conducted Seminar on Geospatial Disaster and UNESCO-HELP Basin: Water Co-Operation, Security And Geohazards at Cititel Midvalley, Kuala Lumpur, 17TH – 18TH June 2013Participate in Malaysia World Water Day 2014, Putrajaya, Malaysia, on 22nd March 2014.

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

Appendix-2

Overview of the Core Programme Themes of the Eighth Phase of the IHP (2014-2021)
WATER SECURITY: ADDRESSING LOCAL, REGIONAL, AND GLOBAL CHALLENGES

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

- Focal area 1.1 - Risk management as adaptation to global changes
- Focal area 1.2 - Understanding coupled human and natural processes
- Focal area 1.3 - Benefiting from global and local Earth observation systems
- Focal area 1.4 - Addressing uncertainty and improving its communication
- Focal area 1.5 - Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

- Focal area 2.1 - Enhancing sustainable groundwater resources management
- Focal area 2.2 - Addressing strategies for management of aquifers recharge
- Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
- Focal area 2.4 - Promoting groundwater quality protection
- Focal area 2.5 - Promoting management of transboundary aquifers

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

- Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources
- Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends
- Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution
- Focal area 3.4 - Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity
- Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution

THEME 4: WATER AND HUMAN SETTLEMENTS OF THE FUTURE

- Focal area 4.1 - Game changing approaches and technologies
- Focal area 4.2 - System wide changes for integrated management approaches
- Focal area 4.3 - Institution and leadership for beneficiation and integration
- Focal area 4.4 - Opportunities in emerging cities in developing countries
- Focal area 4.5 - Integrated development in rural human settlement

THEME 5: ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

- Focal area 5.1 - Hydrological dimension of a catchment– identification of potential threats and opportunities for a sustainable development
- Focal area 5.2 - Shaping of the catchment ecological structure for ecosystem potential enhancement ─ biological productivity and biodiversity
- Focal area 5.3 - Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services
- Focal area 5.4 - Urban Ecohydrology – storm water purification and retention in the city landscape, potential for improvement of health and quality of life
- Focal area 5.5 - Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

- Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector
- Focal area 6.2 - Addressing vocational education and training of water technicians
- Focal area 6.3 - Water education for children and youth
- Focal area 6.4 - Promoting awareness of water issues through informal water education
- Focal area 6.5 - Education for transboundary water cooperation

Annex I

FUNCTION CHART OF THE REGIONAL HUMID TROPICS HYDROLOGY AND WATER RESOURCES CENTRE FOR SOUTHEAST ASIA AND THE PACIFIC (HTC KUALA LUMPUR)

DIRECTOR

DEPUTY DIRECTOR			HEAD OF ASSISSTANT DIRECTOR
IMPLEMENTATION ANF COORDINATION SECTION		ADMINISTRATION UNIT	**INFORMATION AND COMMUNICATION SECTION**
R & D IMPLEMENTATION UNIT	COORDINATION UNIT		
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 disclinary 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	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	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.	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

DEPUTY DIRECTOR			HEAD OF ASSISSTANT DIRECTOR
IMPLEMENTATION ANF COORDINATION SECTION		ADMINISTRATION UNIT	**INFORMATION AND COMMUNICATION SECTION**
R & D IMPLEMENTATION UNIT	COORDINATION UNIT		
NAHRIM. 4. To extend technical expert advice for research programme of HTCKL which is executed from development funds. 5. To identify latest technology in the field of hydrology and water resources. 6. To promote output of the research through presentation of papers and publication of journal globally, regional and local- a. Outline WSUD b. Operational manual and maintenance of WSUD 7. To prepare research papers and identify products those are suitable for commercialization and prepare the action plan. 8. Monitoring the strategic plan for water centres under the auspices of UNESCO. 9. To implement human capitalization in the field of Water Education as to strengthen development for Southeast	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)". . 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. 6. To evaluate programmes executed as meets the expectation of UNESCO IHP. 7. To prepare strategic plan and action for UNESCO Water Centres staff exchange. 8. To prepare 10 Year Report of HTCKL which compromising of R&D, networking output, training, workshop and publication of technical papers and journal. 9. To prepare documents for evaluation of HTCKL according to TOR by		research agencies in the field of hydrology and water resources locally, regionally and globally. 5. To legislate strategies for strengthening the network cooperation between UNESCO water family and local experts in the field of hydrology and water resources. 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). 7. To execute AP FRIEND project phase II. 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).

DEPUTY DIRECTOR			HEAD OF ASSISSTANT DIRECTOR
IMPLEMENTATION ANF COORDINATION SECTION		ADMINISTRATION UNIT	**INFORMATION AND COMMUNICATION SECTION**
R & D IMPLEMENTATION UNIT	COORDINATION UNIT		
Asia and the Pacific including Malaysia. 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 RM1.4million 2010) 11. To prepare R&D report and also guidelines on design of WSUD.	UNESCO. 10. To prepare Policy and Guidelines on:- a. UNESCO Reference document b. Strategic Framework of HTC 11. Preparing suggested 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.		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 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.

			HEAD OF ASSISSTANT DIRECTOR
IMPLEMENTATION ANF COORDINATION SECTION		ADMINISTRATION UNIT	**INFORMATION AND COMMUNICATION SECTION**
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			HEAD OF ASSISSTANT DIRECTOR
IMPLEMENTATION ANF COORDINATION SECTION		ADMINISTRATION UNIT	**INFORMATION AND COMMUNICATION SECTION**
R & D IMPLEMENTATION UNIT	COORDINATION UNIT		
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			HEAD OF ASSISSTANT DIRECTOR
IMPLEMENTATION ANF COORDINATION SECTION		ADMINISTRATION UNIT	**INFORMATION AND COMMUNICATION SECTION**
R & D IMPLEMENTATION UNIT	COORDINATION UNIT		
RM1.4million 2010) 22. To prepare R&D report and also guidelines on design of WSUD.	25. To supervise HTCKL building and monitor training program for HTCKL staff. 26. Coordinate in the organization of workshop, seminar and symposium in national and international category.		for Hydrology, River Management, Coastal Management and Urban Drainage. 23. To implement and monitoring the Management Quality System of MS ISO 9001:2008. 24. To manage library and technical document database, publications, proceedings and research papers.

ANNEX II

EXAMPLES OF HTCKL FOCUS ON R&D UNDER 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 proramme
- 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, biodetention 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

Theme 5: Water education for sustainable development

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

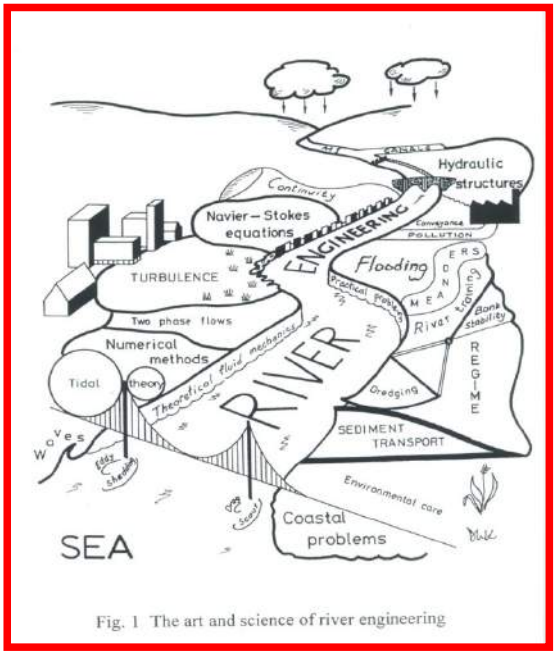


Fig. 1 The art and science of river engineering

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 categorize 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

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 guranteed – 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 fenomena – point source and non point source
- Instrumentation for laboratories and testing fasilities.
- Automation and software development.
- Sedimentation at river mouth – the need for breakwater and dredging.

Format for Biennial Reports by UNESCO's Water-related Centres on activities related to the IHP in the period (June 2012- May 2014)

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. Katsuhiko MURASE
E-mail		icharm@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 *		☒ global ☐ regional
Region(s) (for regional centres)		
Year of establishment		2006
Year of renewal assessment		2011
Signature date of most recent Agreement		July 2013
Themes Of activities during reporting period	Focal Areas ♦	☐ groundwater ☐ urban water management ☐ rural water management ☐ arid / semi-arid zones ☐ humid tropics ☐ cryosphere (snow, ice, glaciers) ☒water related disasters (drought/floods) ☒ Erosion/sedimentation, and landslides ☒ ecohydrology/ecosystems ☐ water law and policy ☐ social/cultural/gender dimension of water ☐ transboundary river basins/ aquifers ☒ mathematical modelling ☐ hydroinformatics ☒ remote sensing/GIS ☐ IWRM ☐ Watershed processes/management ☒ global and change and impact assessment ☐ mathematical modelling ☒ water education ☐ water quality ☐ nano-technology ☐ waste water management/re-use ☐ water/energy/food nexus ☐ water systems and infrastructure ☐ other: (please specify) _____
	Scope of Activities ♦	☐ vocational training ☒ postgraduate education ☐ continuing education ☐ public outreach ☒ research ☒ institutional capacity-building ☒ advising/ consulting ☒ software development ☐ data-sets/data-bases development

* check on appropriate box
♦ check all that apply

	☐ other: (please specify) _____
Support bodies [1]	Ministry of Land Infrastructure and Transport and Tourism
Hosting organization [2]	Public Works Research Institute
Sources of financial support [3]	National Budget
Existing networks and cooperation [4]	IFI,
Governance	☒ director and governing board ☐ 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) ☒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) : 51_____ number of staff who are water experts: 31_____ number of visiting scientists and postgraduate students: _____
Annual turnover budget in USD	4.5 million

2. Activities undertaken in the framework of IHP in the period June 2012 – May 2014

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII/VIII (Appendix-1 and 2) and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.

ICHARM offered the following educational activities as shown in the table;

Category	Course title	Duration	Num. of Participant	Collaboration
Ph.D. Program (3 years)	Disaster Management	2010.10-2013.9	1	GRIPS (National Graduate Institute for Policy Studies)
		2011.10-2014.9	3 (2 were dropped out)	
		2012.10-2015.9	2	
		2013.10-2016.9	3	
M.Sc. Program (1 year)	Water-related Disaster Management Policy Program	2011.10-2012.9	19	JICA (Japan International Cooperation Agency),
		2012.10-2013.9	12	

[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

		2013.10-2014.9	12	GRIPS

Ph.D. Program

In October 2010, ICHARM and GRIPS jointly launched the Ph.D. program. This was the first and challenging attempt since PWRI establishment. The broad aim of the program is to nurture professionals who can train researchers and take leadership in planning and implementation of national and international strategies and policies in the field of water-related risk management.

This program is planning to accept one to three students per year. The program examines and selects candidates who have motivation and capabilities for doctoral level work, and are willing to take the lead for implementing water-related risk management learned at ICHARM after completion of this program. Until now, one Japanese student has graduated, and six students are in the program.

ICHARM/PWRI employed some Ph.D. students for ICHARM Research Assistant positions. This provides an excellent opportunity for them to learn and experience the practical work of ICHARM while they carry out their own research.

M.Sc. Program

In 2007, ICHARM launched a one-year master's course "Water-related Disaster Management Course of Disaster Management Policy Program" in collaboration with GRIPS and JICA. This program was designed to provide trainees from developing countries with the mastery of knowledge and technology on flood-related disasters. A Master's degree in disaster management is granted after the completion of the program. The program consists of lectures and practical assignments in the first semester, and the completion of Master's thesis concerning their flood disaster mitigation projects in the second. Field surveys are included in each semester.

From October 2011 to September 2013, ICHARM implemented two batches of the program and 31 students in total have conferred a Master's degree. Training programs has been improved annually. Based on the results of the post-training evaluation by students, the 2012-2013 course was the most satisfying of all conducted in the past five years. Now 12 students are studying in ICHARM.

Follow-up activity

Follow-up activities of ICHARM are intended to encourage ex-students to promote their water-related risk management projects. Especially, follow-up seminars allow ex-trainees to update their knowledge about advanced technologies in the field, to visualize issues they may face in their daily work、and discuss them among the participants.

Follow-up activities allow ICHARM to disseminate information about future training opportunities at ICHARM and to recruit new students to ICHARM training programs.

List of conducted follow-up activities

Date	Follow-up activity	Venue
Feb. 13-14, 2013	Seminar on Sediment Hydraulics and River Management	Dhaka, Bangladesh
Mar. 10-13, 2014	Follow up session and meeting	Kuala Lumpur, Malaysia

Internship

ICHARM has been actively accepting college students for short-term internship and researchers from overseas institutes, providing opportunities for them to deepen their research interests intensively. A total of 10 students and researchers used these opportunities between June 2012 and May 2014.

List of Internship

Duration	Number, Nationality	Research Theme
July 2012	1 from Japan	Rainfall analysis
Aug 2012	1 from Japan	Observed data collection by ADCP
Oct 2012	2 from Thailand	Flood simulation
Nov 2012	2 from the Philippines	Flood inundation analysis
Apr. to July 2013	1 from Guatemala	Japanese flood countermeasures
Sep. 2013	1 from the Philippines	RRI model
Oct. 15 to Nov. 9, 2013	1 from Iran	BTOPMC
Nov. 5 to 15, 2013	1 from Vietnam	RRI model

2.2 Research activities that directly contributed to the IHP-VII and/or IHP-VIII activities

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

1. Overview of ICHARM research activities

The basic policy for ICHARM's research activities is to reduce damage induced by water-related disasters around the world.

More specifically, it has prioritized research needed to implement water-related risk management in developing countries. When the center was first established, the focus was more on research to understand rainfall and runoff characteristics, which is essential to assess flood risk. In recent years, however, it has been expanding the research scope covering assessment of flood damage risk and risk management including development and implementation of effective countermeasures.

The following describes main research achievements of ICHARM.

2. Development and dissemination of Integrated Flood Analysis System (IFAS)

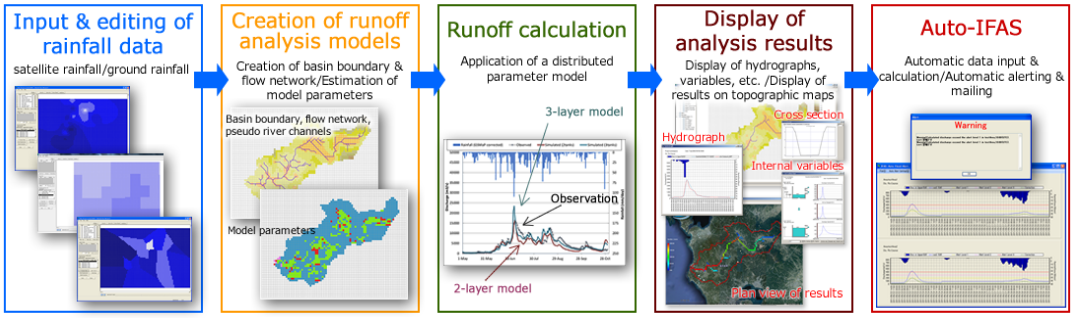


Figure: Calculation flow of IFAS

The Integrated Flood Analysis System (IFAS) is designed to help create a runoff analysis model easily by using topographic and land-use data which cover almost the entire globe and are available free of charge via the Internet.

With IFAS alone, users can conduct a series of tasks necessary for runoff analysis including data acquisition, model creation, rainfall-runoff analysis and result display. With an additional module named Auto-IFAS, the system is capable of executing automatic functions such as downloading satellite rainfall information, loading ground rainfall information, performing runoff calculation, issuing a warning, etc. With these automatic functions, users can built a real-time flood forecasting and warning system though the functions are minimal as a device for such a purpose.

IFAS with this additional module is very useful even in areas with limited Internet access. It can perform calculation while collecting data regularly according to a predetermined time schedule. In this way, the network and the computer can avoid being overloaded with information processing, which thus enables fast runoff calculation and quick flood forecasting and warning.

The IFAS execute file is downloadable free of charge on the ICHARM website at http://www.icharm.pwri.go.jp/Research/ifas/)

Since the official launch in December 2008, the traffic to this download site has been increasing every year as IFAS has gone through several upgrades.

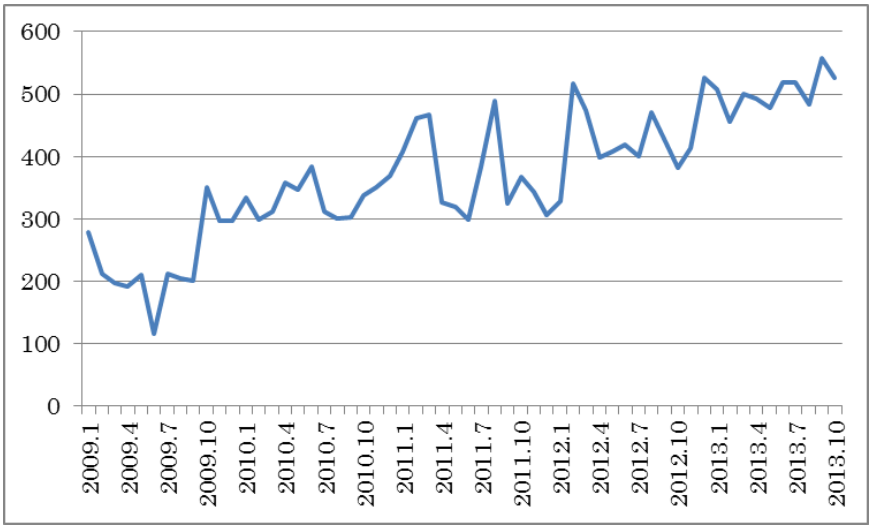


Figure: Changes in the number of access to the IFAS website

3. Development of RRI model

Conventional flood prediction models, which mainly focus on rainfall-runoff processes in mountainous areas, have difficulties in simulating floods on low-lying areas with large-scale inundations, such as the 2010 Pakistan and 2011 Thailand floods. In addition, although it is important to quickly simulate a large-scale behavior of floodwaters in global-scale flood risk assessment and large-scale flood prediction, conventional models are not capable of quickly estimating river discharge and flooding from rainfall information. They can only predict river discharge.

To overcome this disadvantage, ICHARM has been developing a new numerical model called the Rainfall-Runoff-Inundation (RRI) model. The model simulates various hydrologic processes including rainfall-runoff, stream-flow propagation, and inundation over floodplains in an integrated manner.

By using the RRI model, we can assess future flood risks for different regions under different climate conditions including climate change. The model may also be applied to large-scale flood prediction on a near real-

time basis by using satellite-based topography, land-use and rainfall information in a similar manner to the IFAS procedure.

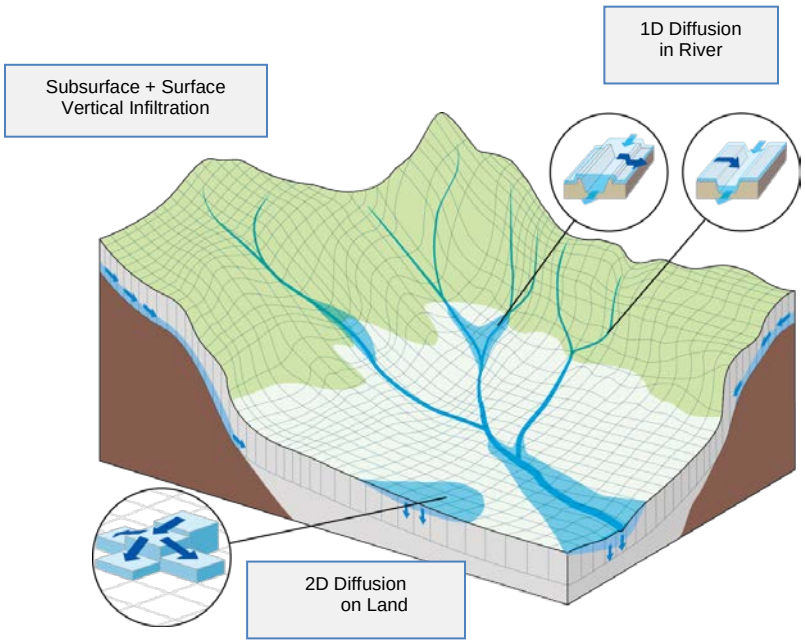


Figure: Schematic diagram of RRI Model

4 Contribution to MEXT research program "SOUSEI"

The Ministry of Education, Culture, Sports, Science, and Technology (MEXT) has launched the Program for Risk Information on Climate Change (SOUSEI program), which carries on the work of the previous program. This project began in FY2012 and will continue for five years. The aim of this program is to generate information to evaluate the probability of the occurrence of the extreme climate changes and the risk of various scenarios, disasters, damage, etc., and to play a role in risk management.

The project's specific research is divided into five themes. ICHARM is a member institute of Theme D: Precise impact assessments on climate change. ICHARM's subject is the "Development of risk assessment and adaptation strategies for water-related disaster in Asia."

This will eventually lead to the development of a methodology for socio-economic impact assessment, which will include methods for the global- and basin-scale assessment of flood and drought hazards as well as for the assessment of social vulnerability to those hazards. Coupled with multiple scenarios of the fifth-generation CMIP and GCM-based climate projections, the methods will make such assessments viable by improving previously-developed technologies for bias correction, global flood runoff analysis and inundation hazard analysis.

5 River discharge measurement

ICHARM is developing and disseminating a next-generation discharge measurement system that ensures highly reliable measurements while requiring less labor and cost. The system under development is unique in that automated measurement using fixed current meters such as non-contact current meters (radio current meters) is combined with an acoustic Doppler current profiler (ADCP) for accuracy control. Through observational experiments, the system has been proven applicable even to severe flow regimes,

typically seen in Japanese steep rivers. We are further exploring methods to observe river bed fluctuations by use of this advanced automated system.

6 Development of Water and Energy Transfer Processes (WEP) model

The Water and Energy Transfer Processes (WEP) model was originally developed as a basin-scale water cycle model. Responding to the recent need for the management of nutrient load and runoff in closed water bodies, ICHARM has been further improving the WEP model into a basin-scale water/material cycle model by adding the function of simulating the behavior of nitrogen and phosphorus in both dissolved and particulate forms.

7 Flood Risk Assessment

Risk assessment is generally conducted through a series of analyses on possible hazards, vulnerability to and countermeasures for the hazards. ICHARM carries out risk assessment, based on one of the most important institute principles: localism. We started the process with thorough local investigation in each target basin to understand its physical, social and economic conditions, while also using advanced hydrological and hydraulic modeling technology. We then assess the impact of socioeconomic risk on a basin and propose effective countermeasures to cope with such risk.

8 ICHARM Research & Development (R&D) Seminars

The ICHARM R&D Seminar is a series of seminars irregularly held to improve ICHARM's activities and update the expertise of its research staff.

As many as 8 R&D seminars were organized from June 2012 to March 2014.

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

In the duration from June 2012 to May 2014, ICHARM offered the following training activities as shown in the table;

Course title	Duration	Num. of Participant	Collaboration
Capacity Development for Integrated Flood Risk Management in Pakistan	2012.5	6	UNESCO
	2013.5	5	
Capacity Development for Flood Risk Management with IFAS	2012.7-8	13	JICA
	2012.12	7	
	2013.7-8	16	
IFAS Local Workshop	2012	255	
	2013	114	

Short-term training/workshop program

Short-term training programs were mainly conducted jointly with JICA. Participants learnt knowledge and technologies relevant to water-related disaster risk management for a period of several weeks. ICHARM has made efforts to recognize the latest water-related problems in developing countries and improve course contents and teaching staff to meet the needs of trainees.

1 JICA training program "Capacity Development for Flood Risk Management with IFAS" (JFY2012- JFY2014)

The program was designed to enhance individual flood-coping capacities and eventually to contribute to flood damage mitigation in their countries. To create as great synergy as possible with JICA's current and future local flood projects, the following two conditions were considered:

- The target basins were those also selected for JICA local projects.
- The target participants were selected from three categories of responsible personnel (meteorologists, river administrators, disaster management officials for public evacuation) who are currently working at organizations involved in the JICA local projects.

2 Short-term workshop "Capacity Development for Integrated Flood Risk Management in Pakistan" (JFY2012 and JFY2013)

The workshop was originally organized as part of a project, "Strategic Strengthening of Flood Warning and Management Capacity of Pakistan," which was launched in response to the 2010 severe flood event in Pakistan. The project was funded by the Japanese government through UNESCO. In 2012 and 2013, ICHARM welcomed totally 11 participants of middle- to high-ranking officials of the Pakistani government.

The participants praised the workshop for its excellent contents and organization. They were particularly impressed with river management in Japan, including how steadily plans are put into action. They also commented that retarding basins like the one they saw at Watarase retarding basin should be effective for flood control in the Indus River basin.

3 IFAS Local Workshop

ICHARM has been conducted not only IFAS development, but also its dissemination throughout the world on several occasions. In the duration from June 2012 to May 2014, ICHARM trained IFAS to 369 participants all over the world.

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 Flood Initiative (IFI)

IFI is a framework to promote collaboration in flood management among international organizations such as UNESCO, WMO, UNU and UNISDR. IFI focuses on research, information networking, education and training, community empowerment, and technical assistance in various areas including integrated flood management.

ICHARM has been serving as its secretariat since its establishment.

2 Contribution to UNSGAB

The United Nations Secretary General's Advisory Board on Water and Sanitation (UNSGAB) is an independent body established in March 2004 by United Nations Secretary-General, Mr. Kofi Annan, to give him advice as well as to galvanize action on water and sanitation issues.

Mr. Kenzo Hiroki, ICHARM principal and a member of the UNSGAB, has contributed to the activities jointly with MLIT. As a part of the activities, on March 6, 2013, ICHARM supported a special high-level session on water and disasters, convened by the UN Secretary-General H.E. Mr. Ban Ki-moon. This event marked the first high-level UN thematic event discussing issues at the nexus of water and disasters.

3 Asia-Pacific Knowledge hub

In June 2008, the Asia-Pacific Water Forum (APWF) officially acknowledged ICHARM as a Knowledge Hub with particular focus on disaster risk reduction and flood management.

As a Knowledge Hub, ICHARM is expected to promote local application of high value-added know-how and research results in order to realize water security in the Asia-Pacific region under the framework of the APWF.

4 Typhoon committee

The Typhoon Committee is an inter-governmental body organized under the joint auspices of the Economic and Social Commission for Asia and the Pacific (ESCAP) and the World Meteorological Organization in 1968 in order to promote and coordinate the planning and implementation of measures required for minimizing the loss of life and material damage caused by typhoons in Asia and the Pacific.

Mr. Minoru Kamoto, chief researcher of ICHARM, took a role of the chairperson of the hydrology working group.

ICHARM implemented a project of the Flood Disaster Preparedness Indices (FDPI), which can measure the capacity of disaster preparedness by communities, and reported in 2012.

5 Agreement with organizations

Since its establishment, ICHARM has signed a research partnership agreement with 13 overseas institutes to make collaborative efforts to address water issues around the world. In 2013, to include droughts and other water issues in cold regions, it concluded such an agreement with research institutes in Iran and Russia.

Table: List of ICHARM partners

1	Korea	Korea Disaster Prevention Association(KDPA)
2	U.S.A.	Bureau of Reclamation of the Department of the Interior of the United States of America
3	Netherlands	UNESCO-IHE Institute for Water Education(UNESCO-IHE)
4	Iran	Regional Centre on Urban Water Management(RCUWM-TEHRAN)
5	Philippines	Flood Control and Sabo Engineering Center (FCSEC)
6	Japan	Yamanashi University
7	CHINA	International Research and Training Center on Erosion and Sedimentation (IRTCES)
8	Brazil	HydroEx
9	Indonesia	Tsunami & Disaster Mitigation Research Center (TDMRC)
10	Japan	Kyoto University
11	Lao PDR	Mekong River Commission (MRC)
12	Iran	The Iran water and power resources development company(IWPC), Ministry of Energy, Tehran, I.R.IRAN
13	Russia	State Hydrological Institute (SHI)

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 20th session of the Intergovernmental Council (June 2012)

The 20th session of the Intergovernmental Council of the International Hydrological Programme (IHP) was held at the UNESCO Headquarters in Paris from 4 to 7 June 2012. Eight delegates from Japan, including ICHARM Deputy Director Shigenobu Tanaka and Chief Researcher Toshio Okazumi, attended the session.

Council members discussed the strategic plan for the eighth phase of IHP (IHP-VIII, 2014-2021) and other proposals such as the establishment of new category II centers.

The IHP Secretariat reported the progress of the project entitled "Strategic Strengthening of Flood Warning and Management Capacity of Pakistan", which is now being implemented by ICHARM and other relevant organizations. Deputy Director Tanaka expressed his gratitude for the support provided by the IHP Secretariat and the determination to produce expected output for the country.

In the discussion on the strategic plan for the eighth phase of IHP, Okazumi pointed out that it will become more important to apply remote sensing technology such as IFAS to water issues in developing countries.

UNESCO evaluates ICHARM as the most active among the existing category II centres, and moreover, the IHP Secretariat sometimes referred to ICHARM as "Star Centre" during the session.

ICHARM will continue to promote various activities in accordance with the IHP strategic plan to mitigate flood damage in the world.

UNESCO Strategic and High-Level Meeting on Water Security and Cooperation (September 2013)

Within the framework of the International Year of Water Cooperation 2013, UNESCO IHP organized a strategic and high-level meeting on water security and cooperation followed by the IHP implementation strategy meeting at the Kenya School of Monetary Studies in Nairobi on September 11-13, 2013. ICHARM Director Kuniyoshi Takeuchi and four researchers attended the conference from ICHARM. This meeting was divided into three segments:

(1) The High-level panels on Water Cooperation and Security in Africa was held on Day 1, which focused on the state of cooperation on freshwater in the African region/continent, and highlighted existing modalities of cooperation, opportunities and barriers, as well as its linkages with water security. ICHARM hosted a plenary session entitled the "Water Science, Education and Governance for the Future We Want," and provided the chance to discuss current views regarding the water components of the post-2015 agenda. As a keynote speaker, Director Takeuchi pointed out emerging consensus from the water community for the post-2015 development agenda, highlighted the need for a stand-alone water goal, and stressed the importance of IHP-VIII to frame goals around water security.

(2) The IHP-VIII implementation was central to discussions on Day 2. UNESCO Regional hydrologists and the vice-chairpersons of the International Hydrological Program Intergovernmental Council (IHP-IGC) were invited to input regional implementation challenges and success stories. IHP-VIII task force coordinators then introduced the IHP-VIII strategic plan and collected feedback. Finally, all participants were requested to attend parallel sessions on six IHP-VIII themes and identify areas of priority to which they would like to contribute. ICHARM joined Theme 1 (Water Related Disasters and Hydrological Changes) and made the IFI flagship project (the project to support benchmarking flood risk reduction at global, national and local levels) included in the list.

(3) On Day 3, interactive discussions were held on how IHP-VIII should be addressed in collaboration with UNESCO's water family. Hence, participants made various opinions including ongoing problems, strategies, education programs, and cooperation modalities.

Aside from official events, ICHARM invited 15 C2C representatives to an informal lunch meeting on Day 2. Takeuchi advocated launching active collaboration among C2C and introduced the IFI and its first flagship project launched in last March as an opportunity for collaborative

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
- 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

ICHARM and UNESCO-IHE are now renewing the existing memorandum of Understanding.

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

(Nothing special)

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

(Nothing special)

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

(Nothing special)

4. Communication

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

(Nothing special)

4.2 Policy documents and advice

(Nothing special)

5. Update on Centre Operations

5.1 Membership of the Board of Governors between designated period

Based on the renewed agreement between the UNESCO and the Government of Japan on ICHARM, the Governing Board was established to examine and adopt ICHARM's program and work plan.
Following members are designated as the Governing Board Members from Feb 25th 2014 to the next board meeting;

Takashi Shiraishi,
President, National Graduate Institute for Policy Studies (GRIPS)
Johannes Cullmann,
Chairperson, International Hydrological Programme Intergovernmental Council
Margareta Wahlström,
Special Representative of the Secretary-General for Disaster Risk Reduction (ISDR)
Akihiko Tanaka,
President, Japan International Cooperation Agency (JICA)
Toshiyuki Adachi,
Vice Minister for Engineering Affairs, Ministry of Land, Infrastructure, Transport and Tourism (MLIT)
Taketo Uomoto (Chairperson),
Chief Executive, Public Works Research Institute (PWRI)
Irina Bokova,
Director-General, United Nations Educational, Scientific and Cultural Organization (UNESCO)

5.2 Key decisions made

The Governing Board, which was held on February 25, 2014, examined and adopted the "Rule of Procedure", examined the "ICHARM Activity Report" dated from October, 2010 to March, 2014 (including the plan for February and March, 2014), and examined and adopted the "ICHARM Long-term (around 10 years) and Mid-term (around 5 years) Programmes" and examined and adopted the "ICHARM Work Plan (From April 2014 to March 2016)" that describes the detail of activity plan.
The comments from the members include "clarify the priority of the fields in the broad scope of future activities and achieve the goals by utilizing limited resource effectively", "as a previously established UNESCO center, expecting ICHARM's contribution for cooperation and support with the other UNESCO center (especially for a center in Mexico)", and a suggestion for development of the road map to clarify the achievement of the programme from the member of the ICHARM Governing Board.

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)

RRI Model Receives the 15th Infrastructure Technology Development Award 2013

ICHARM/PWRI was awarded on July 5, 2013, with the 15th Infrastructure Technology Development Award for the recent development of the Rainfall-Runoff-Inundation (RRI) Model. ICHARM Director Kuniyoshi Takeuchi, representing PWRI, and Senior Researcher Takahiro Sayama, who has developed the technology, participated in the awarding ceremony, and were presented with an award certificate and a crystal plaque by Minister of Land, Infrastructure, Transport and Tourism Akihiro Ota.

The award is established to recognize excellent technologies that have recently developed and put into practice in relation to housing and social infrastructure or land management including a wide range of categories such as planning and design, construction, maintenance and management, materials and products, machinery, electronics and communications, and applications of traditional techniques. The RRI Model has been recognized for its novelty and practical application to a JICA project called “Project on a Comprehensive Flood Management Plan for the Chao Phraya River Basin (flood management system development assistance)”. The project was to provide assistance for Thai government to respond to 2011 Chao Phraya River flood where ICHARM started flood simulation to predict the progress of flood, holistically considering the effects of discharge and inundation with the RRI model during emergency response.

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

World handbook on local disaster management experiences
Disaster Management Handbook Published

ICHARM published a booklet entitled “World Handbook on Local Disaster Management Experiences” in March 2013. The handbook illustrates 14 natural hazards, such as tsunami, earthquake, flood and tornado, with many pieces of advice and photos collected from cooperative researchers all over the world.

The handbook is getting worldwide attention. In March 2013, it was used for science teachers in Indonesia to learn disaster management. A total of 400 copies were given out to conference participants of the European Geoscience Unions held at Vienna in April and those of the UN Global Platform for Disaster Risk Reduction held at Geneva in May.

To make it available for people in other countries, foreign researchers at ICHARM are now translating it into Spanish, Russian, and some other languages. The handbook is also downloadable in PDF form. It has been downloaded 635 times in the last one month. In addition, we are discussing more useful ways to use the handbook with UNESCO and the UN Human Settlements Programme.

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

1 Outline

ICHARM has participated in local projects organized by ADB and UNESCO and implemented activities in cooperation with local administrative and research organizations in order to test applicability of several models developed by ICHARM to local basins. Those projects have been successfully implemented despite difficulties in arrangement with local offices and problems in the actual implementation process. The following describes the outline of each project.

2 United Nations Special Thematic Session on Water & Disasters

ICHARM, as a member of the High-Level Expert Panel on Water and Disasters (HLEP/ UNSGAB), supported a special high-level session on water and disasters, convened by the UN Secretary-General H.E. Mr. Ban Ki-moon on March 6, 2013. This event marked the first high-level UN thematic event discussing issues at the nexus of water and disasters. His

Imperial Highness the Crown Prince of Japan and His Royal Highness the Crown Prince of Orange of the Netherlands presented keynote addresses to the assembled audience of 500 experts and officials from UN member states, international organizations, private sector, and civil society.

Overall messages from the Special Session reflected the consensus that water-related disasters, increasing in frequency and severity as the climate and human demographics shift, are a significant barrier to sustainable development and that linkages between water disasters and poverty are undeniable. Speakers and panelists agreed that integrated and holistic approaches to policy-making are necessary to address water and disasters, and that the international community can do much to guide concrete actions for reducing disaster risk. Many discussed upcoming opportunities to integrate water disaster risk reduction into the post-2015 development agenda, as negotiations are underway to craft policies and goals to succeed the Millennium Development Goals (MDGs), the Kyoto Protocol on Climate Change, and the Hyogo Framework for Action (HFA), all ending in 2015. In particular, inclusion of water and disasters in Sustainable Development Goals (SDGs), a central pillar of the post-2015 agenda, will frame much of the UN's work for decades to come.

ICHARM additionally co-hosted a Side Event to the Special Thematic Session on Water & Disasters on March 5, 2013, bringing together approximately 100 experts from 30 countries and organizations. The objective of the Side Event was to deepen discussions related to water and disasters and to facilitate common understanding and shared vision on key topics leading up to the UN Special Session.

3 ADB Project: Technical Assistance No. 7276, Supporting Investments for Water-Related Disaster Management

Signing a collaborative agreement with ADB in November 2009, ICHARM conducted a project, "Regional Technical Assistance (RETA) 7276: Supporting Investment in Water-Related Disaster Management (TA7276)," which ended in March 2013. This project was planned to build an environment to encourage investment in disaster management in developing countries.

In this project, ICHARM was involved in the following five projects:

1) Bangladesh: Development of a basic plan for a new flood forecasting and warning system
2) Indonesia: Implementation of a satellite-based flood forecasting system in the Solo River
3) Cambodia: Development of a flood vulnerability assessment method for the Mekong flood plain
4) Philippines: Implementation of flood management training using a satellite-based runoff model in the Pampanga and Cagayan rivers.
5) Development of the prototype of flood risk assessment indices for the Asian region

Projects 1 to 4 are efforts to contribute to national flood risk reduction while Project 5 contributes to regional flood risk reduction.

The results of TA7276 are very promising, for the technologies and concepts produced for the projects can be applied to other river basins with some technological customization based on local basin characteristics.

In March 2013, the chief executive of PWRI and the director of ICHARM visited the ADB Regional and Sustainable Development Department to report the results of the TA7276 project. Mr. Chander expressed deep gratitude and highly praised ICHARM for its achievements and hoped for its involvement in future projects as well.

4 UNESCO-Pakistan project

In late July 2010, the monsoon brought a record rainfall over northern Pakistan and caused the worst flood in the past 80 years. The flood had serious damage on the area, affecting 20.3 million people in total, killing 1,985 and damaging or destroying 19 million houses.

As a part of the restoration effort from this flood disaster, UNESCO started a project called "Strategic Strengthening of Flood Warning and

Management Capacity of Pakistan" in July 2011. This comprehensive project consisted of three components, and ICHARM was assigned to two of these components: technical assistance and capacity development.

In the first component, for local customization of advanced technology in partnership with local practitioners, ICHARM assisted local engineers in flood control by implementing Indus-IFAS in collaboration with the Meteorological Agency of Pakistan and other local agencies with support from UNESCO. Indus-IFAS was specifically designed to fit the conditions and needs of the Indus River basin by combining IFAS and the RRI model.

In the other component, ICHARM provided the opportunity to participate in its M.Sc. program and short-term training programs for 11 government administrators such as the Pakistan Meteorological Department, the Pakistan Space and Upper Atmosphere Research Commission and other agencies.

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

7.1 Operational Plan (attach if available)

7.2 Strategic Plan linked with IHP-VIII (Appendix 2)
(attach strategic plan if available)

ICHARM shall contribute to the IHP-VIII activities based on the ICHARM's program and work plan which were examined and adopted by the ICHARM Governing Board.

8. Strategic Alignment with IHP-VIII

8.1 Focal areas within IHP-VIII the centre plans to contribute to and specific actions the centre will undertake to align its activities with the strategic plan for IHP-VIII (Please see Appendix-2)

9. Annexes

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

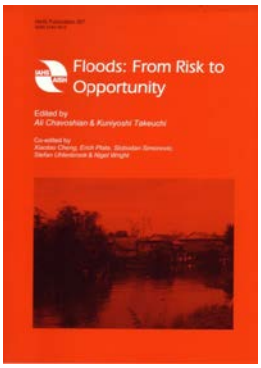
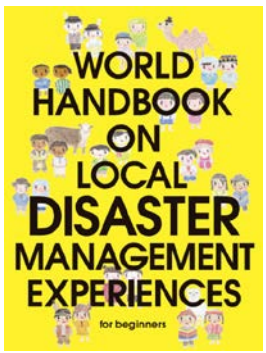
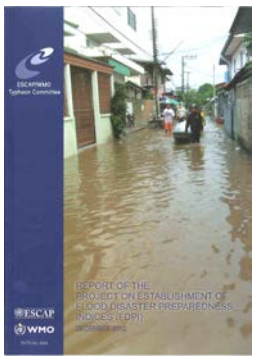
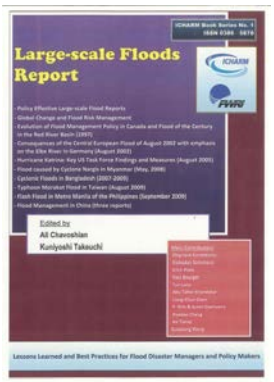
ICHARM has been active in trying to disseminate research results or new findings through various channels, such as submission of papers to internationally recognized journals, contribution to book chapters, and publication of various reports as shown in the following table.

Table: List of Papers

	2013	2012
Book	1	1
Journal	12	4
Paper	12	8
Abstract or Conference	10	18
Articles or Others	4	7
PWRI Technical Note/PWRI research report	2	4
Total	**41**	**42**

ICHARM has especially published the following books and leaflets related to water disasters.

Table: List of Publication

IAHS Red Book "Floods: From Risk to Opportunity" 	HANDBOOK on Local Disaster 	Report of the Project on Establishment of Flood Disaster Preparedness Indices (FDPI) 	Large-scale Floods Report 
IAHS Publication No. 357 (2013), ISBN 978-1-907161-35-3, 480 pages	Leaflet, 2013, 38 Pages	Typhoon Committee, Leaflet, 2012 26 Pages	Book, 2012, 232 Pages
Dr. Ali Chavoshian, Dr. Kuniyoshi Takeuchi, Mr. Minoru Kamoto	Dr. Megumi Sugimoto	Mr. Tadashi Nakasu, Mr. Toshio Okadumi, Mr. Yoshikazu Shimizu	Dr. Ali Chavoshian, Dr. Kuniyoshi Takeuchi

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

Category	Course title	Duration	Num. of Participant	Collaboration
Ph.D. Program (3 years)	Disaster Management	2010.10-2013.9	1	GRIPS
		2011.10-2014.9	3 (2 were dropped out)	
		2012.10-2015.9	2	
		2013.10-2016.9	3	
M.Sc. Program (1 year)	Water-related Disaster Management Policy Program	2011.10-2012.9	19	JICA, GRIPS
		2012.10-2013.9	12	
		2013.10-2014.9	12	
Short Training Course/Workshop (several weeks)	Capacity Development for Integrated Flood Risk Management in Pakistan	2012.5	6	UNESCO
		2013.5	5	
	Capacity Development for Flood Risk Management with IFAS	2012.7-8,	13	JICA
		2012.12	7	
		2013.7-8	16	
	IFAS local workshop	2012	255	
		2013	114	

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

Appendix-2

Overview of the Core Programme Themes of the Eighth Phase of the IHP (2014-2021)
WATER SECURITY: ADDRESSING LOCAL, REGIONAL, AND GLOBAL CHALLENGES

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

- Focal area 1.1 - Risk management as adaptation to global changes
- Focal area 1.2 - Understanding coupled human and natural processes
- Focal area 1.3 - Benefiting from global and local Earth observation systems
- Focal area 1.4 - Addressing uncertainty and improving its communication
- Focal area 1.5 - Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

- Focal area 2.1 - Enhancing sustainable groundwater resources management
- Focal area 2.2 - Addressing strategies for management of aquifers recharge
- Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
- Focal area 2.4 - Promoting groundwater quality protection
- Focal area 2.5 - Promoting management of transboundary aquifers

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

- Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources
- Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends
- Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution
- Focal area 3.4 - Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity
- Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution

THEME 4: WATER AND HUMAN SETTLEMENTS OF THE FUTURE

- Focal area 4.1 - Game changing approaches and technologies
- Focal area 4.2 - System wide changes for integrated management approaches
- Focal area 4.3 - Institution and leadership for beneficiation and integration
- Focal area 4.4 - Opportunities in emerging cities in developing countries
- Focal area 4.5 - Integrated development in rural human settlement

THEME 5: ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

- Focal area 5.1 - Hydrological dimension of a catchment– identification of potential threats and opportunities for a sustainable development
- Focal area 5.2 - Shaping of the catchment ecological structure for ecosystem potential enhancement ─ biological productivity and biodiversity
- Focal area 5.3 - Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services
- Focal area 5.4 - Urban Ecohydrology – storm water purification and retention in the city landscape, potential for improvement of health and quality of life
- Focal area 5.5 - Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

- Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector
- Focal area 6.2 - Addressing vocational education and training of water technicians
- Focal area 6.3 - Water education for children and youth
- Focal area 6.4 - Promoting awareness of water issues through informal water education
- Focal area 6.5 - Education for transboundary water cooperation

Format for Biennial Reports by UNESCO's Water-related Centres on activities related to the IHP in the period (June 2012- May 2014)

1. Basic information on the centre

Name of the Centre		IGRAC, International Groundwater Resources Assessment Centre
Name of Director		Neno Kukurić
Name and title of contact person (for cooperation)		Neno Kukurić
E-mail		info@un-igrac.org
Address		Westvest 7 2611AX Delft, The Netherlands
Website		www.un-igrac.org
Location of centre		city/town Delft country The Netherlands
Geographic orientation *		X global regional
Region(s) (for regional centres)		
Year of establishment		2011 as a UNESCO centre (IGRAC exists since 2003)
Year of renewal assessment		
Signature date of most recent Agreement		15 November 2011
Themes Of activities during reporting period	Focal Areas ♦	**x groundwater (GW)** ☐ urban water management ☐ rural water management ☐ arid / semi-arid zones ☐ humid tropics ☐ cryosphere (snow, ice, glaciers) ☐ water related disasters (drought/floods) ☐ Erosion/sedimentation, and landslides ☐ ecohydrology/ecosystems X water law and policy x social/cultural/gender dimension of water **X transboundary river basins/ aquifers** ☐ mathematical modelling ☐ hydroinformatics ☐ remote sensing/GIS ☐ IWRM ☐ Watershed processes/management X global and change and impact assessment ☐ mathematical modelling ☐ water education ☐ water quality ☐ nano-technology ☐ waste water management/re-use ☐ water/energy/food nexus ☐ water systems and infrastructure ☐ other: **GW monitoring and assessment**
	Scope of Activities ♦	☐ vocational training ☐ postgraduate education ☐ continuing education X public outreach ☐ research X institutional capacity-building X advising/ consulting X software development x data-sets/data-bases development ☐ other: **GW monitoring and assessment**

* check on appropriate box
♦ check all that apply

Support bodies [1]	Government of the Netherlands
Hosting organization [2]	IGRAC is an independent foundation and has no hosting organisation
Sources of financial support [3]	Grant from the Government of the Netherlands and projects carried out in cooperation with UNESCO-IHP
Existing networks and cooperation [4]	IAH, GTN-H, GEO, GWP, ..
Governance	X director and governing board (and foundation board) ☐ other: (please specify) _____ Link to election of board members to the IHP Intergovernmental Council (IGC) and hosting country IHP National Committee via the Governing Board and the Director of the Centre Frequency of meetings: once every 1 year x Existence of UNESCO presence at meetings
Institutional affiliation of director (?!)	Director of IGRAC
Number of staff and types of staff	total number of staff (full-time, or equivalent) : six FTE (+ short contracts) number of staff who are water experts: six number of visiting scientists and postgraduate students: interns
Annual turnover budget in USD	800.000-1.000.000

2. Activities undertaken in the framework of IHP in the period June 2012 – May 2014

IGRAC was established as a UNESCO Category 2 centre in October 2011 during the 7th UNESCO-IHP phase (IHP VII) running from 2008 to 2013. Although a latecomer to the programme, IGRAC activities could easily match some of the IHP VII focal areas, especially within the themes:

- Adapting to the impacts of global changes on river basins and aquifer systems: for example through the GRAPHIC[5] programme, and
- Strengthening water governance for sustainability: for example through the GEF Groundwater Governance project.

The main contribution of IGRAC was through the programme on Internationally Shared Aquifer Resources Management (ISARM). The ISARM programme (www.isarm.org) is about transboundary aquifers (TBA) which at present is the main topic of IGRAC activities. The vast majority of IGRAC TBA activities is conducted under the umbrella of the IGRAC programme (e.g. development of the Transboundary Aquifers of the World map) or is related to the ISARM (e.g. GEF projects like the Dinaric Karst Aquifer System Project (DIKTAS) for 4 countries in the Balkan or the Transboundary Waters Assessment Programme (TWAP) which comprises a world-wide assessment of transboundary aquifers). Total IGRAC contribution to the projects conducted through the UNESCO-IHP in 2013 was about 500.000$.

[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
[5] GRAPHIC: Groundwater Resources Assessment under the Pressures of Humanity and Climate Change

IGRAC also contributed to another Associated Programme called WHYMAP (World-wide Hydrogeological Mapping and Assessment Programme); last year, WHYMAP produced the map 'River and Groundwater Basins of the World'.

There is a strong relationship between availability of groundwater data & information and effectiveness of many IHP-VII activities. In accordance to its mission, IGRAC took the initiative to strengthen the cooperation with National IHP committees on the topic of data & information availability. Supported by the Delegation of the Netherlands and the IHP Secretariat, this initiative resulted in Resolution XX-2 of the Intergovernmental Council of IHP (June 2012). The Resolution calls for support of Global Groundwater Information System (GGIS) which is developed and maintained by IGRAC. The GGIS is continuously under development (for more info: IGRAC report 2013 and IGRAC Work Plan 2014.) in the last two years, especially implementation of the Global Groundwater Monitoring Network (GGMN) programme progressed rapidly.

IGRAC regularly provides contributions to World Water Assessment Programme (WWAP). The focus of the 5th edition of the World Water Development Report was water and energy and IGRAC made several contributions to the report including sections on hydraulic fracturing (fracking), energy used for purification of groundwater, and energy used for extraction and transport of groundwater. IGRAC also developed an in-depth case study of hydropower in karst in collaboration with leading regional experts.

In 2012, IGRAC took an active role in the preparation of the 8th phase of the IHP (2014-2021) called 'Water security: Responses to local and global challenges'. This was done in good cooperation with the National UNESCO IHP Secretariat of the Netherlands and the IHP Secretariat in Paris. In 2013, IGRAC was involved in several preparation-related activities, including the final one, a UNESCO Joint Strategic and High-level Meeting on Water Security and Cooperation, held in Nairobi in September 2013. In this important meeting, a session on 'Theme 2 of IHP-VIII: Groundwater in a changing environment' was moderated by IGRAC. Theme 2 consists of five focal areas, namely:

- Enhancing sustainable groundwater resources management,
- Addressing strategies for management of aquifers recharge,
- Adapting to the impacts of climate change on aquifer systems,
- Promoting groundwater quality protection, and
- Promoting management of transboundary aquifers.

Due to early and continued involvement in the IHP-VIII preparation process, IGRAC was able to encourage incorporation of all IGRAC's main activities into the programme. Hence, groundwater governance, internationally shared aquifers, groundwater monitoring and managing aquifer recharge are some of the core activities of the five focal areas in theme 2 on groundwater. Also, a topic of Groundwater in River Basin management, advocated by IGRAC and broadly supported by national IHP representatives, is now fully addressed in the programme. All the activities mentioned above are already on-going but their scope (i.e. contribution to the UNESCO IHP) will certainly increase in the coming eight years (duration of this phase is eight years).

In 2013, IGRAC started an initiative to increase cooperation with other UNESCO water centres, particularly in the field of water cooperation, water governance and water diplomacy. A joint meeting of the IGRAC Governing Board and the representatives of several UNESCO water centres was organised in December 2013 in Delft.

3. Annexes

3.1 IGRAC Report 2013
3.2 IGRAC Work Plan 2014
3.3 IGRAC Evaluation Report (Biannual)

Format for Biennial Reports by UNESCO's Water-related Centres on activities related to the IHP in the period (June 2012- May 2014)

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 100048
Website		http://www.irtces.org
Location of centre		city/town Beijing____country _China_____
Geographic orientation *		☑ global ☐ regional
Region(s) (for regional centres)		
Year of establishment		1984
Year of renewal assessment		2011
Signature date of most recent Agreement		2005
Themes Of activities during reporting period	Focal Areas ♦	☐ groundwater ☐ urban water management ☐ rural water management ☐ arid / semi-arid zones ☐ humid tropics ☐ cryosphere (snow, ice, glaciers) ☐ water related disasters (drought/floods) ☑ Erosion/sedimentation, and landslides ☐ ecohydrology/ecosystems ☐ water law and policy ☐ social/cultural/gender dimension of water ☐ transboundary river basins/ aquifers ☑ mathematical modelling ☐ hydroinformatics ☐ remote sensing/GIS ☑ IWRM ☑ Watershed processes/management ☐ global and change and impact assessment ☑ mathematical modelling ☑ water education ☐ water quality ☐ nano-technology ☐ waste water management/re-use ☐ water/energy/food nexus ☐ water systems and infrastructure ☐ other: (please specify) _____
	Scope of Activities ♦	☑ vocational training ☑ postgraduate education ☑ continuing education ☐ public outreach ☑ research ☑ institutional capacity-building ☑ advising/ consulting ☐ software development

* check on appropriate box
♦ check all that apply

	☑ data-sets/data-bases development ☐ other: (please specify) _____
Support bodies [1]	Ministry of Water Resources, China
Hosting organization [2]	
Sources of financial support [3]	sources of main budgetary: Ministry of Water Resources Other sources: Ministry of Science and Technology, National Natural Science Foundation, UNESCO, IRTCES service rendered
Existing networks and cooperation [4]	● 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 Engineering and Research (IAHR) ● International Association of Hydrological Science (IAHS) ● Universiti Teknologi Mara (UiTM), Malaysia ● National Centre for Computational Hydroscience and Engineering of the University of Mississippi (NCCHE), USA ● National Hydroelectric Power Corporation LTD. (NHPC), India ● ICHARM, Japan ● RCUWM, Iran ● ICIWaRM, USA ● Elsevier
Governance	☑ director and governing board ☐ 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) ☑ 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) : _16_____ number of staff who are water experts: _13_____ number of visiting scientists and postgraduate students: _4_____
Annual turnover budget in USD	0.9 million USD

2. Activities undertaken in the framework of IHP in the period June 2012 – May 2014

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII/VIII (Appendix-1 and 2) and WWAP

[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

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

The IRTCES is located in the campus of China Institute of Water Resources and Hydropowr Research (IWHR) and have a close ties with the IWHR. IRTCES offers a portfolio of graduate degrees (Masters and PhD levels) in collaboration with IWHR. The degree courses on offer are delivered in the IWHR, Tsinghua University and IRTCES. Current students include:

- 3 PhD students.
- 2 Master students.

2.2 Research activities that directly contributed to the IHP-VII and/or IHP-VIII activities

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

Research projects finished (Project name, financial supportor, project duration)

- Common technology on rural water resources conservation in China, Ministry of Water Resources, 2010.01-2011.12
- Variation of water flow and sediment and its influence on salt water intrusion in the Pear River Mouth, Ministry of Water Resources, 2009-2012
- Study on common technologies of soil loss estimation in soil disturbance of engineering construction, Ministry of Water Resources, 2010.01-2012.12
- Study on systems of laws and regulation in soil and water conservation, Ministry of Water Resources, 2012.01-2012.12
- Process review and future policies of soil and water conservation in China, Ministry of Water Resources, 2011.06-2012.12
- Planning on non-engineering measures of soil and water conservation, Ministry of Water Resources, 2010.12-2014.01
- Study on construction of prevention and control mechanism against corruption in the field of soil and water conservation, Ministry of Water Resources, 2012.07-2012.12
- Program of soil and water conservation for the first phase construction of ore terminals in bulk cargo ports in Huanghua, Enterprise, 2011.07-2012.06
- Acceptance of soil and water conservation for the motorway between Chengde city and the boundary of Chengde city and Tangshan city, Enterprise, 2011.10-2014.01
- Study on soil and water conservation policies in main countries over the world, China Institute of Water Resources and Hydropower Research, 2012.01-2012.12
- Strengthen infrastructure construction of irrigation and water conservancy to improve the supply of agricultural products, Research Office of the State Council, 2012.04-2013.12
- Program of soil and water conservation for the fourth phase construction of coal ports in Huanghua, Enterprise, 2013.03-2013.12
- Acceptance of soil and water conservation for the motorway between Mohe county and Beijicun village, Enterprise, 2012.04-2013.10
- Water and Sediment Allocation Theory and Techniques for River Basin, National Natural Science Foundation of China, 2011.01-2013.12
- Study on water and sediment regulation of irrigation districts of Lower Yellow River, Ministry of Water Resources, 2009.10-2012.10
- Study on key technology solving problems of local deposition sections of the Lower Yellow River, Ministry of Water Resources, 2009.9~2012.9
- Evolution process of flash flood in mountain area and formation mechanism of flood disasters, National 973 Key project, 2011.1~2012.12

Research projects being carried out (Project name, financial supportor, project duration)

- Collaborative Study on Changes in Runoff and Sediment loads of Global Rivers and Integrated River Sediment Management,Ministry of Science and Technology, PR China, 2014-2017.
- Research on Key technologies of soil erosion on disturbed surface under the action of wind, Ministry of Science and Technology, 2012.01-2014.12
- Variation trend of runoff and sediment load and its influence factors, Changjiang Water Resources Commission survey planning and Design Institute, 2012-2014
- Sediment transportation study in different space scale , Changjing River Scientific Research Institute, 2012.04-2014.12
- Study on assessment methods of soil and water conservation target-oriented responsibility system for local governments , Ministry of Water Resource, 2014.01-2014.12

- Acceptance of soil and water conservation for the motorway between Yichung city and Suihua city, Enterprise, 2012.05-2014.12
- Acceptance of soil and water conservation for the motorway between Bei'an city and Heihe city, Enterprise, 2012.05-2014.12
- Acceptance of soil and water conservation for the motorway between Neijiang city and Jigedaqi county, Enterprise, 2012.05-2014.05
- Acceptance of soil and water conservation for electric power plant in Yangcheng county, Enterprise, 2012.10-2014.10
- Strategy for water and sediment variation of China main rivers, China Institute of Water Resources and Hydro-power Research , 2012.01-2015.12
- Study on bank collapse mechanism and prediction model for lower reaches of key water control project, National Natural Science Foundation of China, 2013.01-2016.12
- Study on Fluvial Processes modeling and regulation techniques of TGP and its lower reaches, Key Projects in the National Science & Technology Pillar Program during the Twelfth Five-year Plan Period, 2012.06-2015.12
- Study on mechanism of water and sediment coupled allocation in the irrigation districts of the Lower Yellow River, National Natural Science Foundation of China, 2014.01-2016.12
- Study on ruonff and sediment loads, water-sediment relation and changes in erosion and sedimentation of the Yellow River, Ministry of Water Resources, 2012.6~2014.12
- Study on optimizing water and sediment allocation in the Lower Yellow River, Key Projects in the National Science & Technology Pillar Program during the Twelfth Five-year Plan Period, 2011.11~2015.6
- Study on Lower Yellow River channel reconstruction and floodplain management, Ministry of Water Resources, 2013.5~2015.4

Please refer to publications listed under section 9.1.

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

N/A

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 International Sediment Initiative (ISI) Technical Secretariat at IRTCES
- World Association for Sedimentation and Erosion Research (WASER) Secretariat at IRTCES
- Water and Soil Conservation Association (WASWAC) Secretariat at IRTCES
- Participation in Network of Regional Water Knowledge Hub in Asia-Pacific Region
- Participation in Network of Asian River Basin Organization (NARBO)
- Partnership with International Association for Hydro-Environment Engineering and Research (IAHR)
- Partnership with International Association of Hydrological Sciences (IAHS)
- Partnership with Universiti Teknologi Mara (UiTM), Malaysia
- Partnership with National Centre for Computational Hydroscience and Engineering of the University of Mississippi (NCCHE). USA
- Partnership with National Hydroelectric Power Corporation LTD. (NHPC), India
- Partnership with Regional Centre on Urban Water Management (RCUWM), Iran
- Partnership with International Centre on Qanats and Historic Hydraulic Structures (ICQHS), Iran
- Partnership with International Centre for Water Hazard and Risk Management (ICHARM), Japan
- Partnership with International Center for Integrated Water Resources Management (ICIWaRM), USA
- Partnership with Elsevier

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 37th session of the General Conference of UNESCO, Paris, November 5-20, 2013: As a representative of the Chinese delegation, IRTCES Dr. Liu Cheng participated in the SC Commission meeting (Natural sciences) of the conference. Dr. Liu attended a conference side-event the high-level panel session “Climate Change Impacts on Water Resources and Adaptation Policies in Mountainous Regions” that took place on November 13, 2013.
- The 20th session of IHP Intergovernmental Council, Paris, 4 to 7 June, 2012: IRTCES Deputy Director Prof. Hu Chunhong and Prof. Liu Cheng participated in the session. They also attended a Meeting of UNESCO water-related centres held on the evening of 5th June.

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

- UNESCO-IHE Institute for Water Education, the Netherlands
- Regional Centre on Urban Water Management (RCUWM), Iran
- International Centre on Qanats and Historic Hydraulic Structures (ICQHS), Iran
- International Centre for Water Hazard and Risk Management (ICHARM), Japan
- International Center for Integrated Water Resources Management (ICIWaRM), USA
- International Center on Water Security and Sustainable Management (i-WSSM)(establishing Category II Center), Korean

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

- Prof. Gao Zhanyi, formal Deputy Director of the IRTCES, serves as one of the members of the Governing Board of the ICQHS.

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

- Exchange of information on IRTCES’ activities with IHE, ICHARM, RCUWM, ICIWaRM, ICQHS and other related institutes.
- Exchange of information on ISI’ activities throgh ISI Newsletters with over 3000 subscribed experts worldwide.
- Training materials have been uploaded in IRTCES and ISI websites for free downloading.

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

- Discussion on joint activities with IHE, ICHARM, RCUWM, ICIWaRM, and other related institutes.
- Joint research project with ICIWaRM: Collaborative Study on Changes in Runoff and Sediment loads of Global Rivers and Integrated River Sediment Management supported by the Ministry of Science and Technology, PR China.

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

IRTCES keeps closed cooperative relationship with UNESCO Office Beijing. A good and regular communication has been built to exchange ideas and information and discuss some important events and special cases between both sides.

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 lots of 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

Some contacts with related UNESCO chairs.

4. Communication

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

- The 12th International Symposium on River Sedimentation was held in Kyoto, Japan on September 2-5, 2013. IRTCES Prof. Hu Chunhong, Prof. Liu Cheng, Prof. Liu Xiaoying, Prof. Zhang Yanjing and Prof. Chen Yuehong attended the 12th ISRS and delieved technical presentations.
- The 4th International Conferences on Estuaries and Coasts ICEC was held in Hanoi, Vietnam on October 8-11, 2012. IRTCES Prof. Liu Guangquan, Prof. Wang Yangui, Prof. Liu Cheng and Prof. Shi Hongling attended the conference and made technical presentations.
- The 2nd WASWAC World Conference was held in Chiang Rai, Tailand on Sept. 4-7, 2013. IRTCES Prof. Ning Duihu and Mr. Du Pengfei attended the conference and made technical presentations.
- Prof. Hu Chunhong, Secretary-General and Deputy Director of the IRTCES, visited the U.S. Geological Survey (USGS) National Center on December 10, 2012, together with Prof. Chen Jianguo and Prof. Liu Cheng, IRTCES Division Chief and Deputy Division Chief.
- Prof. Ning Duihu, Deputy Director of the IRTCES, participated in the WASWAC Lancon1209 conference “Sustainable land management and climate changes” held in Serbia in September 2012.
- IRTCES Prof. Wang Yangui and Prof. Shi Hongling participated in the 35th IAHR Congress held in Chengdu China and made technical presentations during September 9-13, 2013.
- Communication between IRTCES and ICIWaRM: Prof. Hu Chunhong, DG of IRTCES, Prof. Liu Cheng and Prof. Chen Jianguo, divison chiefs, visited ICIWaRM on December 10, 2012. Dr. William S. Logan, Deputy Director of the ICIWaRM visited the IRTCES on September 16, 2013.
- Prof. Liu Xiaoying participated in the 4th International Congress of ECSSS held in Bari, Italy, from 2 to 6 July 2012 and made technical presentations.
- On April 8, 2014, Newly appointed Permanent Representative of the People's Republic of China to UNESCO, Ambassador Zhang Xiuqin visited the IRTCES.
- On February 6, 2013, Mr. Han Qunli, Director of the Executive Office of UNESCO’s Natural Sciences Sector, visited the IRTCES.
- Dr. Won-Sil Kim and Mr. Moonhwan Sung of the i-WSSM, an establishing Category II center, visited IRTCES on December 19, 2013.
- Prof. Dano Roelvink, UNESCO-IHE, visited IRTCES on November 2, 2012.
- On April 22, 2014, Mr. Hans Dencker Thulstrup, Programme Specialist for Natural Sciences of UNESCO Office in Beijing visited the IRTCES.
- On May 31, 2012, Delegation of the Jasa Tirta I Public Corporation, Indonesia visited the IRTCES for technical exchanges. The delegation members are Mr. Tjoek Walujo Subijanto, President Director of the Corporation; Mr. Harianto, Mr. Alfan Rianto, and Mr. Taufikurrachman.
- Dr. Zhang Hao from the Kyoto University, Japan visited IRTCES on September 12, 2012
- On April 28, 2014, Senior Hydropower Specialist Mr. Pravin Karki of the Word Bank and Climate Change Specialist Ms. Huang Dafei of the World Bank Beijing Office visited the IRTCES.
- International Association for Hydro-Environment Engineering and Research (IAHR) Executive Director Dr. Christopher George visited IRTCES on February 19, 2014.
- Mr. Samran Sombatpanit, WASWAC Bangkok Office, Thailand visited IRTCES in February 2013.
- Mr. Miodrag Zlatic, Belgrade University, Serbia and his 3 colleagues visited IRTCES in June 2013.
- Mr. Karika Kunta, Land Development Department, Thailand and his 4 colleagues visited IRTCES in August 2013.
- Mr. William Critchley the Associated President of WASWAC, UK visited IRTCES in November 2013.

4.2 Policy documents and advice

See list of publications under 9.1.

5. Update on Centre Operations

5.1 Membership of the Board of Governors between designated period

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.

Director: Prof. Kuang Shangfu

Deputy Directors: Prof. Hu Chunhong (Secretary General), Prof. Ning Duihu and Prof. Liu Guangquan

IRTCES' Advisory Council (2005-2011):

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.

New IRTCES Governing Board will be formed after the Agreement between UNESCO and Chinese Government on IRTCES is renewed.

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)

- Contribution to the science development on erosoin and sedimentation: All activities conducted by IRTCES not only focused on study of traditional sediment theories, such as sediment transport, fluvial processes and related topics, but also put great efforts into combination of traditional theories with engineering problems and solution of natural problems in erosion and sedimentation management of river basin. In recent years, IRTCES organized some research projects and important conferences and themed workshops for studying and discussing some key issues and advanced concepts on ecological environment, river system management, river channels training and environmental sedimentation, etc. These activities made a great impact on erosion and sedimentation research in the future.

See list of research projects under 2.2.

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

- Publication of a quarterly *International Journal of Sediment Research.* 29 volumes of the journal have been published till 2014.
- Publication of a quarterly *International Soil and Water Conservation Reearch* since 2013. 4 issues of journal have been published.
- Publication of annual official publication *China Gezatte on River Sedimentation* since 2000. 13 issues of gezatte have been published.
- Organization the triennial International Symposia on River Sedimentation (ISRS). The 12th ISRS was held in Kyoto, Japan with 388 participants from 28 countries/regions on September 2-5, 2013. The next symposium will be held in Germany in 2016.
- Organization the triennial International Conferences on Estuaries and Coasts (ICEC). The 4th ICEC was held in Hanoi, Vietnam on October 8-11, 2012, with 200 participants from 15 countries and regions. The next conference will be held in Omen in 2015.
- Organization the triennial WASWAC World Conference. The 2nd WASWAC World Conference with topic "Threats to land and water resources in the 21st century: prevention, mitigation and restoration"was held in Chiang Rai, Tailand on Sept. 4-7, 2013. More than 300 participants from 24 counties or regions attended this conference.
- Proceedings of above mentioned conferences have been published containing a wealth of knowledge, practical experience and theoretical information.

- Knowledge dissemination throgh WebPages of IRTCES (http://www.irtces.org/), UNESCO-ISI (http://www.irtces.org/isi/), WASER (http://www.waser.cn) and WASWAC(http://www.waswac.org), as well as ISI Newsletters, WASER Newsletters and WASWAC Newsletters.
- Free access database "Global Data on Erosion and Sedimentation" (http://data.irtces.org/).

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

- Synthesis of the ISI Case Study Reports: Case studies prepared as a key component of the ISI, have been produced for the Nile River Basin, the Mississippi River Basin, the Rhine River Basin, the Volga River Basin, the Yellow River Basin, and the Haihe and Liaohe River Basins. These case studies are available online from the ISI website. The synthesis of these existing case studies is intended to provide an accessible overview of sediment problems and sediment management around the world for water managers and policy makers. Key issues relating to sediment management are explored using examples from the various case studies and recommendations for developing management strategies have been extracted from these experiences.
- Technical support to the Sedimentation Panel of the Three Gorges Project under State Council of China: IRTCES is responsible for Sedimentation Panel of the Three Gorges Project. Before and during construction of TGP a large number of research projects including physical and mathematical models on TGP sedimentation problems were organized. The research results and analysis reports were directly submitted to the State Council for decision making on Project operation and utilization.
- China Gazette of River Sedimentation for Ministry of Water Resources: Since 2002 IRTCES has been in charge of editing Gazette of River Sediment in China for collection and analysis of erosion and sedimentation data in main river systems in the country. It provided observation date for governmental decision makers in dealing with problems of river regulation, water resources management and investment.

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

7.1 Operational Plan (attach if available)

(1) Fulfill responsibilities for serving several secretariats:

- For ISI technical secretariat, IRTCES will continue to provide technical services to ISI activities including assisting in organization and arrangement of ISI Steering Committee meeting, update of webpage and Sediment Information system, editing Newsletter and other necessary jobs;

- For WASER and WASWAC secretariats, IRTCES will assist WASER and WASWAC Councils to keep good operation and develop network and related projects.

(2) Conference oganization

- The 13th International Symposium on River Sedimentation to be held in Stuttgart, Germany in 2016.
- The 5th International Conference on Esturies and Coasts to be held in Muscat, Oman in 2015.

(3) Research projects

- Carry out research projects being listed in 2.1.
- Try to win more international research projects and collaborate project.

(4) Publications

- International Journal of Sediment Research
- International Soil and Water Conservation Reearch
- China Gazette of River sedimentation

(5) Training workshops oganization

- To organize International and National training workshop on relevant themes.

(6) Networking

- Collaboration and networking with other UNESCO's water related centers (Category I and II), such as exchange visit and stuff and students exchange.

- Collaboration with ISI to continue ISI case studies.
- Collaboration with IHP member states to further develop the database of Global Date of Erosion and Sedimentation.
- Promote WASER and WASWAC activities and capacity building in networking
- Collaboration with all hubs in Network of Regional Water Knowledge Hub in Asia-Pacific Region, such as exchange visit and mutual supportive of activities

7.2 Strategic Plan linked with IHP-VIII (Appendix 2) (attach strategic plan if available)

Same as the Operational Plan

8. Strategic Alignment with IHP-VIII

8.1 Focal areas within IHP-VIII the centre plans to contribute to and specific actions the centre will undertake to align its activities with the strategic plan for IHP-VIII (Please see Appendix-2)

Sound governance policies, based on well-grounded science, are the precondition to address "water security" challenges in today's setting. Sediment management must be seen as playing a key role in achieving 'water security' at different scales. Across the world, erosion, sediment transport and sedimentation processes have wide-ranging social, economic and environmental impacts. However, there are major gaps in baseline sediment data, in current knowledge and understanding of sediment mobilization, transport and storage and sediment budgets, and in our understanding of socio-economic and environmental impacts. Sediment management strategies and practices must be improved if we are to deal effectively with erosion and sedimentation problems.

Focal areas within IHP-VIII the IRTCES plans to contribute to and specific actions the centre will undertake to: Focal area 1.1, Focal area 1.5, Focal area 3.1, Focal area 3.2, Focal area 5.1, Focal area 6.1, Focal area 6.2, Focal area 6.3 and Focal area 6.4.

9. Annexes

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

Journal Paper

- Chen Jianguo, Wenhao Zhou, Qiang Chen，Reservoir sedimentation and transformation of morphology in the Lower Yellow River during 10 years initial operation of the Xiaolangdi Reservoir， Journal of Hydrodynamics, 2012,24(6): 914-924
- Chen Jianguo, Zhou Wenhao, and Chen Qiang, Channel re-estalishment of in Lower Yellow River in ten years operation of Xiaolangdi Reservoir, Journal of Hysraulic Engineering, 2012, No.02, P.127-135 (in Chinese)
- Chen Jianguo, Zhou Wenhao, Chen Qiang, Considerations on water-sediment regulation in later sediment retaining stage of Xiaolangdi Reservoir, Yellow River, 2012, No. 5, P.1-3 (in Chinese)
- Chen Qiang and Chen Jianguo, Study on water and sediment variation and tendency in the Lower Weihe River, Water Conservancy Science and Technology and Economy, 2012, No. 4, P.45-47 (in Chinese)
- Du Pengfei, Liu Xiaoying, Ning Duihu. Discussion on monitoring methods and prediction models of wind erosion in production and construction projects, Science of Soil and Water Conservation, 2013, 11, 1:117-122. (in Chinese)
- Du Pengfei, Liu Xiaoying. A review of measurement of wind erosion rate in China, Research of Soil and Water Conservation, 2012, 19, 6: 275-281. (in Chinese)
- Du, P. D.E. Walling. Using 210Pb measurements to estimate sedimentation rates on river floodplains. Journal of Environmental Radioactivity, 2012, 103, 59-75.
- Guo Qingchao, Huang Liemin, Chen Jianguo, and Deng Anjun, Formation and development of hump reach in Lower Yellow River Sediment Research, , No. 5, P. 38-42 (in Chinese)
- Hu Chunhong and Chen Jianguo, New exploration on water-sediment variation of river and its barnessing, Water resources and Hydropower Engineering, 2014, No. 1, P.11-15(in Chinese)
- HU Chunhong, Jian-guo CHEN, Qing-chao GUO,Shaping and maintaining a medium-sized main channel in the Lower Yellow River, International Journal of Sediment Research,Vol.27,No.3,Sep 2012,P.259-270。
- HU Chunhong, WANG Yangui, CHEN Senmei, HE Qing. Effect of sediment flux change on intertidal zone in coast line of Zhejiang province. Jounal of Zhejiang Water Technology (in Chinese)

- Liu C, Wang JJ and He Y, 2013. Change in sediment loads in the Lancang-Mekong River and its influencing factors. Advances in Science and Technology of Water Resources, Vol. 33, No. 1, pp. 7-12 (in Chinese)
- Liu C., Sui J.Y., He Y. and Hirshefield F., 2013. Changes in runoff and sediment load from major Chinese rivers to the Pacific Ocean over the period 1955-2010. International Journal of Sediment Research, Vol. 28, No. 4, pp. 486-495.
- LIU Cheng, HE Yun,WALLING Des E et al. Changes in the sediment load of the Lancang-Mekong River over the period 1965-2003[J]. SCIENCE CHINA Technological Sciences, 2013, 56(4): 843-852.
- LU Hongwei, WANG Yangui, SHI Hongling. Study on main techniques of water and sediment resources allocation in irrigation system of the Lower Yellow River. Journal of Hydraulic Engineering, Vol.43 No.12 (in Chinese)
- Ning Duihu, Du Pengfei. Build claim mechanism to control man-made soil loss effectively, Soil and Water Conservation in China, 2012, 9: 3-4. (in Chinese)
- SHI Hongling, HU Chunhong, WANG Yangui, Tian Qingqi. Analysis of trends and reasons of variations in runoff and sediment load of the Huaihe River. Journal of Hysraulic Engineering, Vol.43 No.05 (in Chinese)
- Wang Dangwei, Chen Jianguo, and Fu Xudong, Review of flow resistance of mountain river, Journal of Hydraulic Engineering, 2012, add. 2:12-19 (in Chinese)
- Wang Dangwei, Chen Jianguo, Ji Zuwen, and Hu Haihua, Research on feasibility and quantity of sediment detention in Lower Yellow River, Sediment Research, 2012, No. 5, P.26-32 (in Chinese)
- Wang Dangwei, Chen Jianguo, Ji Zuwen, Method for keeping balance in shallow-water simulation over irregular topography，Chinese Journal of Computational Mechanics, 2012, No. 4, P.604-608 (in Chinese)
- Wang Dang-wei, Liu Xiao-fang, Chen Jian-guo, Ji Zu-wen,The Slop Flux Method For Numerical Balance In Using Roe's Approximate Riemann Silver, Journal of Hydrodynamics,2012,24(1):58-64.
- WANG Yangui, et al. Mechanism and analysis mode of sinking failures of river banks. Advances in Science and Technology of Water Resources, 2012(5)
- XIE JINMING, WU BAOSEHNG, MAO JIXIN, LIU XIAOYING. Study on evaluation model for impacts of sedimentation on reservoir function.2012.12 (in Chinese)
- Zhang Yanjing, Hu Chunhong, Wang Yangui,Variation of runoff and sediment load in the Liaohe River and its influence factors，Yangtze River, No.2, Feb.2014(in Chinese)

Conference Paper

- Chen Jianguo, Wang Chonghao and Wang Yuhai,Modeling of tide-wave-surge induced sediment transport at Wentuozi region in liaodong bay, The Fourth International Conference on Estuaries and Coasts,2012,Hanoi,Vietnam。
- Du Pengfei, Ning Duihu, Liu Xiaoying. Soil and Water Conservation Policies Improvement in China Based on Experiences from Other Counties, The 2nd WASWAC World Conference – Threats to land and water resources in the 21st century: prevention, mitigation and restoration, Chiang Rai, Thailand, 2013.
- Du Pengfei. Advance in floodplain sediment research, The 11th Youth Academic Communication Conference of IWHR, Beijing, China, 2012. (in Chinese)
- HE Yun and LIU Cheng, Experimental study on vortices formation and development process around suction pipe in pump sump. In: Wang Z.Y., Lee J.W.H., Gao J.Z. and Cao S.Y. (eds), Proceedings of the 35th IAHR World Congress. Tsinghua University Press, Beijing, Aug. 2013.
- Jiao Jian, Du Pengfei,. Study on control treatment for non-point source pollution of the upper-river basin of Miyun reservoir based on empirical statistitcal models, Proceedings of the 35th IAHR World Congress, Chengdu, China, 2013.
- Liu Cheng, He Yun and Wang JianJun, 2012. Changes in sediment load of the Lancang-Mekong River and its response to the hydro-power development. Proceedings of the Fourth International Conference on Estuaries and Coasts. Science and Technics Publishing House, Hanoi, Vietnam, Vol. 2: pp. 219-228
- LIU Cheng, HU Chunhong and HE Yun, Total sediment flux entering the sea from major Chinese rivers and rough estimation for global land-ocean sediment flux. In: Fukuoka et al. (eds), Advances in River Sediment Research . Taylor & Francis Group, London, 2013. pp. 1457-1465
- Liu Cheng, Hu ChunHong, Wang YanGui, Zhang YanJing and Shi HongLing, 2012. A global sediment data and information sharing platform and global land-ocean sediment flux. Technical Paper Abstracts of the 5th International Yellow River Forum on Ensuring Water Right of the River's Demand and Healthy River Basin Maintenance.Zhengzhou, China. Sep. 24-28, 2012. pp. 145-146.
- Lu XiXi, Wang JianJun and Liu Cheng, 2012. MODIS-based remote sensing of suspended sediment concentrations of the Middle and Lower Yangtze River, China.Erosion and Sediment Yields in the Changing Environment (Proceedings of a symposium held at the Institute of

Mountain Hazards and Environment, CAS-Chengdu, China, 11-155 October 2012) (IAHS Publ. 356, 2012), pp. 356-363

- SHI Hongling, et al. Analysis on Trends of Runoff and Sediment Load of the Yellow River. Advanced in River Sediment Research, CRC press, Taylor & Francis Group, 2013. 09.
- SHI Hongling, et al. Reasons of the Variations in Runoff and Sediment Load of the Yellow River. Proceedings of the 35th IAHR World Congress. Tsinghua university press，Beijing，2013.08
- SHI Hongling, HU Jian, WANG Yangui. Warping for Sediment Utilization in the Yellow River. Technical Paper Abstracts of the 5th International Yellow River Forum on Ensuring Water Right of the River's Demand and Healthy River Basin Maintenance. Zhengzhou, China. Sep. 24-28, 2012. pp. 161
- SHI Hongling, Tian Qingqi. Effects of the trend of runoff and sediment fluxes on the Yellow River. Proceedings of the Fourth International Conference on Estuaries and Coasts. Science and Technics Publishing House, Hanoi, Vietnam, Vol. 2: pp. 188-194
- WANG Yan-gui, et al. Study on changes of incoming runoff and sediment load of the Three Gorges Project and influence of human activities. Advanced in River Sediment Research, CRC press, Taylor & Francis Group, 2013. 09;
- WANG Yan-gui, et al. Study on Roles of Influence Factors in River Band Failure. Proceedings of the 35th IAHR World Congress. Tsinghua university press，Beijing，2013.08
- Zhang Yanjing, Li Dashan and Wang Guobing，Variation of Scour and silting of sand bar in Modaomen Estuary of Pearl River Delta in China， 4th International Conference on Estuaries and Coasts，8-11 October 2012, Water Resources University, Vietnam

Book Publication

- LIU XIAOYING, YU QIYANG, YANG AIMIN ET. Al. Frontier research on soil erosion and sedimentation in selected countries (in Chinese), 2012.11
- LIU XIAOYING, YANG AIMIN et.al. Frontier research on common technology of rural water resources conservation (in Chinese), 2013.10

Reseach Report

- LIU XIAOYING, YANG AIMIN ET.AL, Report on control technology system development of rural water resources conservation, 2013.01 (in Chinese)
- IRTCES, Variation of water flow and sediment and its influence on salt water intrusion in the Pear River Mouth (in Chinese)
- Ning Duihu, Liu Xiaoying, Zuo Changqing, et al. Research report on common technologies of soil loss estimation in soil disturbance of engineering construction, 2012.12 (in Chinese).
- Ning Duihu, Liu Xiaoying, Du Pengfei, et al. Research report on systems of laws and regulation in soil and water conservation, 2013.01 (in Chinese).
- Ning Duihu, Liu Xiaoying, Chen Yuehong, et al. Research report on Process review and future policies of soil and water conservation in China, 2012.06 (in Chinese).
- Ning Duihu, Liu Xiaoying, Du Pengfei, et al. Report on non-engineering measures of soil and water conservation planning, 2014.01 (in Chinese).
- Ning Duihu, Shen Xuejing, Wang Ruizeng, et al. Resarch report on construction of prevention and control mechanism against corruption in the field of soil and water conservation, 2012.12 (in Chinese).
- Du Pengfei, Ning Duihu, Liu Xiaoying, et al. Resarch report on soil and water conservation policies in main countries over the world, 2012.12 (in Chinese).
- Du Pengfei, Fang Songhai, Ning Duihu, et al. Report on improving the supply of agricultural products through strengthening infrastructure construction of irrigation and water conservancy, 2013.12 (in Chinese).
- IRTCES, Study on water and sediment regulation of irrigation districts of Lower Yellow River, 2012.12 (in Chinese)

9.2 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

Appendix-2

Overview of the Core Programme Themes of the Eighth Phase of the IHP (2014-2021)
WATER SECURITY: ADDRESSING LOCAL, REGIONAL, AND GLOBAL CHALLENGES

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

- Focal area 1.1 - Risk management as adaptation to global changes
- Focal area 1.2 - Understanding coupled human and natural processes
- Focal area 1.3 - Benefiting from global and local Earth observation systems
- Focal area 1.4 - Addressing uncertainty and improving its communication
- Focal area 1.5 - Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

- Focal area 2.1 - Enhancing sustainable groundwater resources management
- Focal area 2.2 - Addressing strategies for management of aquifers recharge
- Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
- Focal area 2.4 - Promoting groundwater quality protection
- Focal area 2.5 - Promoting management of transboundary aquifers

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

- Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources
- Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends
- Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution
- Focal area 3.4 - Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity
- Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution

THEME 4: WATER AND HUMAN SETTLEMENTS OF THE FUTURE

- Focal area 4.1 - Game changing approaches and technologies
- Focal area 4.2 - System wide changes for integrated management approaches
- Focal area 4.3 - Institution and leadership for beneficiation and integration
- Focal area 4.4 - Opportunities in emerging cities in developing countries
- Focal area 4.5 - Integrated development in rural human settlement

THEME 5: ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

- Focal area 5.1 - Hydrological dimension of a catchment– identification of potential threats and opportunities for a sustainable development
- Focal area 5.2 - Shaping of the catchment ecological structure for ecosystem potential enhancement ─ biological productivity and biodiversity
- Focal area 5.3 - Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services
- Focal area 5.4 - Urban Ecohydrology – storm water purification and retention in the city landscape, potential for improvement of health and quality of life
- Focal area 5.5 - Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

- Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector
- Focal area 6.2 - Addressing vocational education and training of water technicians
- Focal area 6.3 - Water education for children and youth
- Focal area 6.4 - Promoting awareness of water issues through informal water education
- Focal area 6.5 - Education for transboundary water cooperation

Format for Biennial Reports by UNESCO's Water-related Centres on activities related to the IHP in the period (June 2012- May 2014)

1. Basic information on the centre

Name of the Centre		Regional Centre for Integrated River Basin Management (RC-IRBM)
Name of Director		Dr. Dogara Bashir
Name and title of contact person (for cooperation)		Dr. Dogara Bashir
E-mail		dogara.nwri@gmail.com
Address		National Water Resources Institute, Mando Road, P.M.B. 2309, Kaduna, Nigeria
Website		
Location of centre		city/town Kaduna_____ country Nigeria_____
Geographic orientation *		☐ global X☐ regional
Region(s) (for regional centres)		West Africa
Year of establishment		2012
Year of renewal assessment		2018
Signature date of most recent Agreement		12th March, 2012
Themes Of activities during reporting period	Focal Areas ♦	X☐ groundwater ☐ urban water management ☐ rural water management ☐ arid / semi-arid zones ☐ humid tropics ☐ cryosphere (snow, ice, glaciers) X☐ water related disasters (drought/floods) ☐ Erosion/sedimentation, and landslides X☐ ecohydrology/ecosystems ☐ water law and policy ☐ social/cultural/gender dimension of water X☐ transboundary river basins/ aquifers ☐ mathematical modelling ☐ hydroinformatics ☐ remote sensing/GIS X☐ IWRM ☐ Watershed processes/management ☐ global and change and impact assessment ☐ mathematical modelling X☐ water education X☐ water quality ☐ nano-technology ☐ waste water management/re-use ☐ water/energy/food nexus ☐ water systems and infrastructure ☐ other: (please specify) _____
	Scope of Activities ♦	☐ vocational training X☐ postgraduate education ☐ continuing education X☐ public outreach ☐ research X☐ institutional capacity-building ☐ advising/ consulting ☐ software development

* check on appropriate box
♦ check all that apply

		☐ data-sets/data-bases development ☐ other: (please specify) _____
Support bodies [1]		Federal Republic of Nigeria
Hosting organization [2]		National Water Resources Institute, Kaduna, Nigeria
Sources of financial support [3]		National Budget
Existing networks and cooperation [4]		
Governance		X☐ director and governing board ☐ 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 _1_year(s) X☐ 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) : _____5____ number of staff who are water experts: ___4_____ number of visiting scientists and postgraduate students: __Nil_____
Annual turnover budget in USD		$440,000 (73,423,000 Naira)

2. Activities undertaken in the framework of IHP in the period June 2012 – May 2014

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII/VIII (Appendix-1 and 2) and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.

a. *University of Ilorin, Nigeria runs M.Sc. (IWRM) Programme developed by RC-IRBM with the support of UNESCO*
b. *African Water Resources Capacity Building (AWaCaB) Programme organized by RC-IRBM under the aupices of UNESCO Regional Office, Nairobi*

2.2 Research activities that directly contributed to the IHP-VII and/or IHP-VIII activities
Water Allocation Studies in the Gurara Basin of Nigeria in collaboration with Jardin Cerni Institute for the Development of Water Resources, Belgrade Serbia
Please include research/applied projects outputs such as publications that directly contributed to the IHP-VII/VIII and WWAP objectives

2.3 Training activities that directly contributed to the IHP-VII/VIII and WWAP objectives
Junior Water Price organized to impact early water education in young scientists in high schools

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] 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

a. Membership of the Steering Committee of Hydro Open-Source Platform for Experts;
b. Contribution to the World Large Rivers Initiatives;
c. NEPAD West Africa Network of Water Centres of Excellence;
d. West African Network for Capacity Building in IWRM; and
e. Steering Committee Member of Global Water Partnership (GWP) – Nigeria.

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)
a. Participation at the 20th IHP-IGC and Membership of Resolution Drafting Committee;
b. Participation at High-Level Strategic Meeting on Water Security and Cooperation;
c. Regional Consultative Meeting on Groundwater Governance for the Sub-Saharan Africa.

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
Two Staff have undergone 6-month study fellowships under the auspices of UNESCO/Polish Government on;
Ecohydrology: and Economic Sociology

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
a. Representation at RC-IRBM Governing Board,
b. National Workshop on Strengthening the UNESCO-IHP and Man and the Biosphere National Committees for Effective Water Governance, Biosphere Reserve Management and Biodiversity Conservation
c. Workshop on Global Micro-Science Experimental Kits organized by the Regional Office in Abuja

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
a. Participation in the 9th Session of UNESCO-IHP National Committee Meeting; and
b. NATCOM-UNESCO Experts Consultation on the UNESCO Draft Medium-Term Strategy 37C/4 for 2012-2014 and Draft Programme & Budget 37C/5 for 2014-2017 on National Sciences Sector MP II

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 between designated period
a. Professor Oladapo AFOLABI CFR Chairman;
b. Dr Osu Inya Otu (UNESCO DG Representative);
c. Professor Patrice Jean JOURDA (ECOWAS Representative from Cote d' Ivoire);
d. Professor Michel Sedogo (ECOWAS Representative form Burkina Faso);
e. Dr Kwabena Kankam-Yeboah (ECOWAS Representative from Ghana);

f. Mr Sunday Dan Ogu (Representative of NEPAD); and
g. Dr Olusanjo A. Bamgboye (NWRI-Host Institution)

5.2 Key decisions made (attach minutes of meetings)

a. Appointment of Interim Secretariat Staff:
- Dr D. Bashir (Acting Director)
- Dr W. A. Alayande, Ag. Coordinator for Research & Networking
- Dr O.O. Yaya, Ag. Coordinator for Training & Education
- Mr B G Yahaya, Administrative Secretary
- Mr S.D. Ahmed, Technical Assistant

b. Appointment of Executive Committee
- Dr Olusanjo A Bamgboye (Chairman)
- Dr D Bashir (member)
- Dr W. A. Alayande (member)
- Dr O.O. Yaya (member)

c. 2014 Work Plan
d. Centre Logo
e. Centre Organogram

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)

a. Resource Person at Global Micro-Science Experimental Kits organized by UNESCO Regional Office, Abuja;
b. Development and Implementation of Modular Curricular for Vocational, Technical and Tertiary Education in Integrated Water Resources Management for use in institutions in Africa; and
c. Contribution to the World Large Rivers Initiatives

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

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

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

7.1 Operational Plan (attach if available)

7.2 Strategic Plan linked with IHP-VIII (Appendix 2)
(attach strategic plan if available)

8. Strategic Alignment with IHP-VIII

8.1 Focal areas within IHP-VIII the centre plans to contribute to and specific actions the centre will undertake to align its activities with the strategic plan for IHP-VIII (Please see Appendix-2)

a. Research and Training Programmes on Integrated Flood Risks Assessment Studies along major transboundary rivers of the sub-region;
b. Research and Training Programmes on Assessment of Impact of Climate Change on Groundwater Resources in Arid, Semi-Arid and Coastal Areas of the sub-region with particular attention to Assessment of Groundwater Resources, impact of climate change on groundwater recharge potentials of selected large and medium dams on transboundary aquifers such as Gundumi-Illo, Chad, Benin, Senegal and Niger Basin and Mapping pollution hazards along major aquifer systems;
c. Managing salinity problems in selected aquifers system (coastal and non-coastal in the sb-region;
d. Organization of the second sub-saharan Africa HELP Basin Workshop; Reseach and Training Programme on the Gurara River Water Allocation Studies; and

e. Research and Training Programmes on Assessment of Reservoir Sedimentation in large and medium dams in the sub-region with particular attention on Assessment of available capacities, impact of climate change on the reservoir inflows and outflows and down stream flooding)

9. Annexes

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

9.2 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
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- Focal area 1.4 - Managing groundwater systems' response to global changes
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- Focal area 2.1 - Cultural, societal and scientific responses to the crises in water governance
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- 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

Appendix-2

Overview of the Core Programme Themes of the Eighth Phase of the IHP (2014-2021)
WATER SECURITY: ADDRESSING LOCAL, REGIONAL, AND GLOBAL CHALLENGES

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

- Focal area 1.1 - Risk management as adaptation to global changes
- Focal area 1.2 - Understanding coupled human and natural processes
- Focal area 1.3 - Benefiting from global and local Earth observation systems
- Focal area 1.4 - Addressing uncertainty and improving its communication
- Focal area 1.5 - Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

- Focal area 2.1 - Enhancing sustainable groundwater resources management
- Focal area 2.2 - Addressing strategies for management of aquifers recharge
- Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
- Focal area 2.4 - Promoting groundwater quality protection
- Focal area 2.5 - Promoting management of transboundary aquifers

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

- Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources
- Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends
- Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution
- Focal area 3.4 - Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity
- Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution

THEME 4: WATER AND HUMAN SETTLEMENTS OF THE FUTURE

- Focal area 4.1 - Game changing approaches and technologies
- Focal area 4.2 - System wide changes for integrated management approaches
- Focal area 4.3 - Institution and leadership for beneficiation and integration
- Focal area 4.4 - Opportunities in emerging cities in developing countries
- Focal area 4.5 - Integrated development in rural human settlement

THEME 5: ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

- Focal area 5.1 - Hydrological dimension of a catchment– identification of potential threats and opportunities for a sustainable development
- Focal area 5.2 - Shaping of the catchment ecological structure for ecosystem potential enhancement ─ biological productivity and biodiversity
- Focal area 5.3 - Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services
- Focal area 5.4 - Urban Ecohydrology – storm water purification and retention in the city landscape, potential for improvement of health and quality of life
- Focal area 5.5 - Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

- Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector
- Focal area 6.2 - Addressing vocational education and training of water technicians
- Focal area 6.3 - Water education for children and youth
- Focal area 6.4 - Promoting awareness of water issues through informal water education
- Focal area 6.5 - Education for transboundary water cooperation

Format for Biennial Reports by UNESCO's Water-related Centres on activities related to the IHP in the period (June 2012- May 2014)

1. Basic information on the centre

Name of the Centre		The Regional Center on Capacity Development and Research in Water Harvesting
Name of Director		Dr.Ahmed Eltayeb Ahmed Elhasan
Name and title of contact person (for cooperation)		Dr.Ahmed Eltayeb Ahmed Elhasan
E-mail		Ahmed_Eltayeb2000@yahoo.com
Address		
Website		
Location of centre		city/town ___Khartoum_____ country Sudan_____
Geographic orientation *		☐ global ☒ regional
Region(s) (for regional centres)		East Africa and Arab countries
Year of establishment		Agreement expected to Enter into Force by 23 may, The latest
Year of renewal assessment		2014
Signature date of most recent Agreement		4/12/2013 still awaiting Entry into force according to article 14
Themes Of activities during reporting period	Focal Areas ♦ (Not applicable)[note]	**the centre participated in a number of regional activities organized by UNESCO Cairo office**r ☐ groundwater ☐ urban water management ☐ rural water management ☒ arid / semi-arid zones ☐ humid tropics ☐ cryosphere (snow, ice, glaciers) ☐ water related disasters (drought/floods) ☐ Erosion/sedimentation, and landslides ☐ ecohydrology/ecosystems ☐ water law and policy ☐ social/cultural/gender dimension of water ☒ transboundary river basins/ aquifers ☐ mathematical modelling ☐ hydroinformatics ☐ remote sensing/GIS ☒ IWRM ☐ Watershed processes/management ☒ global and change and impact assessment ☐ mathematical modelling ☒ water education ☐ water quality ☐ nano-technology ☐ waste water management/re-use ☒ water/energy/food nexus ☐ water systems and infrastructure ☐ other: (please specify) _____
	Scope of Activities ♦	☐ vocational training ☐ postgraduate education ☐ continuing education ☐ public outreach ☐ research

* check on appropriate box
♦ check all that apply

	☐ institutional capacity-building ☐ advising/ consulting ☐ software development ☐ data-sets/data-bases development ☐ other: (please specify) _____
Support bodies [1]	(Not applicable)
Hosting organization [2]	
Sources of financial support [3]	The government of Sudan
Existing networks and cooperation [4]	
Governance (Not yet established, will be possible after the centre establishment is authorized by the legislative bodies of the country and hence the agreement with UNESCO enters into force)	☐ director and governing board ☐ 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 __year(s) ☐ Existence of UNESCO presence at meetings
Institutional affiliation of director	
Number of staff and types of staff (awaiting official procedures establishment)	total number of staff (full-time, or equivalent) : _____ number of staff who are water experts: _____ number of visiting scientists and postgraduate students: _____
Annual turnover budget in USD	

Note because the formalities and procedures to establish the centre are about to be finalize by the legislative bodies of the country in addition, even after signature dec2013 the agreement dosen't yet Entered into Force according to article 14. Hopefully this may be achieved by the end of May 2014). The Agreement of the centre is awaiting the Notification by Sudan, The centre premises and facilities are made ready for commencement of activities once the formal procedures of its establishment are finalized. Hence, not yet has been a stage of review by UNESCO. However, the centre participated in a number of regional activities organized by UNESCO, Cairo office and also some activities nationally under IHP. High level Meeting Water security in Kenya (Sep. 2013), Arab IHP Natcom in Rabat (Oct. 2013), work shop in Nile basin cooperation Tanzania (Dec 2014), World Water Day Khartoum (March 2014), participation program , IGRAC board of directors meeting-delft Dec 2013

2. Activities undertaken in the framework of IHP in the period June 2012 – May 2014

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII/VIII (Appendix-1 and 2) 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-VII and/or IHP-VIII activities
Please include research/applied projects outputs such as publications that directly contributed to the IHP-VII/VIII and WWAP objectives

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

3. Collaboration and linkages

[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

3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies
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)
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
  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
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
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 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)
6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)
6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)

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

7.1 Operational Plan (attach if available)
7.2 Strategic Plan linked with IHP-VIII (Appendix 2)
(attach strategic plan if available)

8. Strategic Alignment with IHP-VIII

8.1 Focal areas within IHP-VIII the centre plans to contribute to and specific actions the centre will undertake to align its activities with the strategic plan for IHP-VIII (Please see Appendix-2)

9. Annexes

9.1 List of publications released by the centre (there can be overlap with those listed in 2.3 above)
9.2 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

Appendix-2

Overview of the Core Programme Themes of the Eighth Phase of the IHP (2014-2021)
WATER SECURITY: ADDRESSING LOCAL, REGIONAL, AND GLOBAL CHALLENGES

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

- Focal area 1.1 - Risk management as adaptation to global changes
- Focal area 1.2 - Understanding coupled human and natural processes
- Focal area 1.3 - Benefiting from global and local Earth observation systems
- Focal area 1.4 - Addressing uncertainty and improving its communication
- Focal area 1.5 - Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

- Focal area 2.1 - Enhancing sustainable groundwater resources management
- Focal area 2.2 - Addressing strategies for management of aquifers recharge
- Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
- Focal area 2.4 - Promoting groundwater quality protection
- Focal area 2.5 - Promoting management of transboundary aquifers

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

- Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources
- Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends
- Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution
- Focal area 3.4 - Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity
- Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution

THEME 4: WATER AND HUMAN SETTLEMENTS OF THE FUTURE

- Focal area 4.1 - Game changing approaches and technologies
- Focal area 4.2 - System wide changes for integrated management approaches
- Focal area 4.3 - Institution and leadership for beneficiation and integration
- Focal area 4.4 - Opportunities in emerging cities in developing countries
- Focal area 4.5 - Integrated development in rural human settlement

THEME 5: ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

- Focal area 5.1 - Hydrological dimension of a catchment– identification of potential threats and opportunities for a sustainable development
- Focal area 5.2 - Shaping of the catchment ecological structure for ecosystem potential enhancement ─ biological productivity and biodiversity
- Focal area 5.3 - Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services
- Focal area 5.4 - Urban Ecohydrology – storm water purification and retention in the city landscape, potential for improvement of health and quality of life
- Focal area 5.5 - Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

- Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector
- Focal area 6.2 - Addressing vocational education and training of water technicians
- Focal area 6.3 - Water education for children and youth
- Focal area 6.4 - Promoting awareness of water issues through informal water education
- Focal area 6.5 - Education for transboundary water cooperation

Format for Biennial Reports by UNESCO's Water-related Centres on activities related to the IHP in the period (June 2012- May 2014)

1. Basic information on the centre

Name of the Centre		Regional Centre for Training and Water Studies (RCTWS)
Name of Director		Prof. Dr. Hisham Mostafa
Name and title of contact person (for cooperation)		Eng. Gamal Shaker
E-mail		Info-@rctws.com
Address		6 October City , St. No.1 , Fourth Industrial Zone , Egypt . P.O. Box 58 , Zip Code 12566
Website		
Location of centre		city/town _____ country ___Egypt_____
Geographic orientation *		☐ global ☒ regional
Region(s) (for regional centres)		Arid and Semi Arid Regions
Year of establishment		12 Years
Year of renewal assessment		2014
Signature date of most recent Agreement		2008
Themes Of activities during reporting period	Focal Areas ♦	☒groundwater ☐ urban water management ☒ rural water management ☒arid / semi-arid zones ☐ humid tropics ☐ cryosphere (snow, ice, glaciers) ☒water related disasters (drought/floods) ☐ Erosion/sedimentation, and landslides ☐ ecohydrology/ecosystems ☒water law and policy ☐ social/cultural/gender dimension of water ☐ transboundary river basins/ aquifers☒ mathematical modelling ☐ hydroinformatics ☒ remote sensing/GIS ☒IWRM ☐ Watershed processes/management ☐ global and change and impact assessment ☒mathematical modelling ☐ water education ☐ water quality ☐ nano-technology ☒waste water management/re-use ☒water/energy/food nexus ☐ water systems and infrastructure ☐ other: (please specify) _____
	Scope of Activities ♦	☒ vocational training ☐ postgraduate education ☒ continuing education ☐ public outreach ☒ research ☒institutional capacity-building ☐ advising/ consulting ☐ software development ☐ data-sets/data-bases development

* check on appropriate box
♦ check all that apply

	☐ other: (please specify) _____
Support bodies [1]	Ministry of Water Resources and Irrigation , Egypt
Hosting organization [2]	Ministry of Water Resources and Irrigation , Egypt
Sources of financial support [3]	• ALECSO • JICA • GTZ • INWENT • IAM-Bari • NICHE
Existing networks and cooperation [4]	• G-WADI/UNESCO • ALECSO • JICA • GTZ • INWENT • IAM-Bari • NICHE
Governance	☒director and governing board ☐ 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 __year(s) ☐ Existence of UNESCO presence at meetings
Institutional affiliation of director	Ministry of Water Resources and Irrigation , Egypt
Number of staff and types of staff	total number of staff (full-time, or equivalent) : ___149_____ number of staff who are water experts: ___10_____ number of visiting scientists and postgraduate students: ___4_____
Annual turnover budget in USD	1000000

2. Activities undertaken in the framework of IHP in the period June 2012 – May 2014

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII/VIII (Appendix-1 and 2) and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.

Education activities undertaken through RCTWS and Funded by NICHE/EGY-115 Project

Strenghtening Managerial Capacity
Exposure visit to the NL (Visit 2 teams of 2staff on the quality management and educational marketing) with partener MsM/UNESCO-IHE/Ecorys , 2013

[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

Identification of the courses/delivery approach

Follow-up training in Modern learning techniques through Workshop on teaching method selection/application in the curriculum by international consultant MSM , Ms. M. Frijns , 2013

Development of the curriculum in 6 technical & 3 management and elective courses

Curriculum development and TOT in the NL through Visit of 18 selected trainers to the NL for support in the development and design of the selected curriculum with partner UNESCO-IHE/MSM by Team of international consultants from UNESCO-IHE: Dr. J. Leentvaar, Dr. J. Houweling; Dr. J. Gupta; Dr. W. Douven, Mr. J. Heun and Dr. I, Popescu &Team of international consultant from MSM: Dr. G. Heeling; Mr. L. Kerklaan , 2013-2014

Development & Piloting of leadership skills Course 1 Implementation and piloting of course 1 (leadership skills) in Egypt by MSM/trainer , 2013

2.2 Research activities that directly contributed to the IHP-VII and/or IHP-VIII activities

Concerning IHP-VIII new strategic plan, and the strategy of the Regional Center for Training and Water Studies of Arid and Semi-Arid Zones (RCTWS) – (Category 2 Centre under the auspices of UNESCO.

RCTWS cooperate with National Water Research Center NWRC, Egypt by scientific studies and researches which was published in an international conferences and journals related to the following Topics to ensure the eighth phase of IHP:

- WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE
- GROUNDWATER IN A CHANGING ENVIRONMENT
- ADDRESSING WATER SCARCITY AND QUALITY
- WATER AND HUMAN SETTLEMENTS OF THE FUTURE
- ECO HYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD
- WATER EDUCATION, KEY FOR WATER SECURITY

Attached you will find the list containing the researches and scientific paper which is published through the period 2008 until now by NWRC, Egypt related to the above topics as we wish to exchange and share the ideas/ studies with the same sisters institutes CATII.

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

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

Regional courses held in RCTWS

Many regional courses have been successfully implemented in RCTWS for Arab and African countries . The titles of these courses are as following:

1. On-farm Water Management "irrigation-drainage"
2. Ground Water Management in the framework of Integrated Water Resources Management.
3. Untraditional Water Resources in Geographical Information Systems and Remote Sensing Arid and Semi-Arid Regions.
4. The Joint Development of Water Resources Management.
5. Role of the Artificial Feeding of Ground Water.
6. Woman Participation in Water Management.
7. Geographical Information Systems and Remote Sensing.
8. Soil salinity management training course

Regional workshops and seminars held in RCTWS

Many regional workshops and seminars have been successfully implemented in RCTWS for Arab and African countries , they included the following subjects:

1. Participation of Private Sector
2. Assessment of Water and Cost Recovery.
3. Gender Related Issues.
4. Decentralization and Institutional Reform.
5. Water Ethics.
6. Crops Water Requirements and Water Strategy.
7. Water as a Right of Each Human.
8. Ground Water Protection and Modeling.
9. Knowledge Mapping or Human Resources.
10. Water in Urban Areas and Modeling in Different Climates.
11. Sustainable Development of Water and Waste Water Management.

National Training Cources by RCTWS

The training courses which organized by the training sector is tailored courses to serve all employees of MWRI in all its sectors to raise their technical and administrative efficiencies with the way which guarantees sustainability.

The training courses on national level are divided into:

- Technical courses for engineers which include: integrated water resources management, water quality and how to conserve, design–operation-maintenance of irrigation structures and channels, mechanics and electricity and methods of control, hydrology of surface and ground water, climate and environment change, administration and assessment of projects, and using of computer in fields of geographical information systems, designing of structures and engineering drawings and graphs.
- Technical courses for technicians and sailors.
- Courses for trainees to be qualified on International Computer Driving Licence (ICDL).
- English courses.
- Management and planning for intermediate and high leaders.
- Financial, administrative and contractual affairs courses.
- One-day seminars which discuss different issues upon current needs.

3. Collaboration and linkages

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

NUFFIC/NICHE-PROJECT AT RCTWS

RCTWS is facing a series of capacity development challenges in this respect. Discussions are ongoing whether the RCTWS will become the Human Resources Development-center of the Ministry or that a separate HRD-sector will be created within the same Ministry.
Therefore the overall objective of the **Nuffic/NICHE-project** is “to increase capacity of RCTWS to provide high quality training for the human resources in the water sector”.

Overall strategy for the RCTWS 2050

Become a modern state-of-the –art learning provider, using advanced technologies and base learning process on most recent research findings in brain & cognitive science.
In specific for the Egyptian water sector, the RCTWS shall become the outstanding knowledge base and learning facilitator, capable to provide knowledge service in whatsoever technology to stakeholder of the Egyptian water sector.
The project offers the possibility to use the efforts made by UNESCO-IHE and the MSM to develop courses on water management and general management.

As far as the renewal of water management related courses is concerned, a first preliminary selection has been made based on the curriculum of short courses and online courses nowadays given by UNESCO-IHE, leading to the next preliminary list.

- Water quality and pollution abatement
- Water policy making
- Water and environmental law and institutions
- River basin management
- Water resource planning
- Hydro Informatics and Geographical Information Systems (GIS)

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)

- "***UNESCO Joint Strategic and High-level Meeting on Water Security and Cooperation***" which held on 11-13 September, 2013 ,Kenya School of Monetary Studies, Nairobi, Kenya With the support of the Government of Kenya and other Partners.
- "***Closing Ceremony of the 2013 International Year of Water Cooperation***", which held in Mexico City, United Mexican states, on 5 and 6 December 2013.
- G Wadi Network , Arabic Networking Organization for Water Resources Management in Arab region " Masqat , Oman 28-29 January,2013.
- Eighth meeting of the Board of Directors of the regional center for water management in urban areas held at Tehran - Iran, from 4-5 September, 2013, which was held at the Ministry of Energy , Iran.
-

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
RCTWS always ready to exchange the training activities and materials with other institutes to spread the information especially Arab and African institutes.

3.3.3 exchange of staff, most notably professionals and students
RCTWS hosts a student's especially from African countries to finish their diplomas in Egyptian universities or finish their advanced courses.

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

RCTWS shared the publication from NWRC with category 2 institute to exchange the knowledge and find a way to implement a joint research projects between RCTWS and category 2 institutes.

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

Continuous communication and consultation with UNESCO Cairo exist. The center was involved and participated in the Arab G-Wadi Network activities

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

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

Strenghtening Managerial Capacity of RCTWS by Exposure visit to the NL by 2 teams trained on the quality management and educational marketing and Exposure on conceptualization of different techniques/processess and experiances in the field of quality management and educational marketing supported by MsM/UNESCO-IHE/Ecorys , 2013.

Establishment of technical infrastructure of RCTWS by Upgrade of existing E- learning infrastructure and existing labs and Needs assessment and support in design of IT insfrastructure, development of equipment maintenance plan by Exposure visit on the Technology Enabled learning that take place in november 2012 supported by UNESCO-IHE.

Development of the curriculum in 6 technical/3 management and elective courses of RCTWS by Curriculum development and TOT in the NL and Visit of 18 selected trainers to the NL for support in the development and design of the selected curriculum supported by UNESCO-IHE/MSM 2013/2014.

4.2 Policy documents and advice

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)

Some technical training courses have been implemented through the cooperation with JICA. The titles of these activities are as following:

- Four training courses for Iraqi engineers in fields of (Operation and Maintenance of Pump Stations, ARC GIS, ERDAS and CAD application).
- A training course on Training-Of-Trainers (TOT) in the field of "Integrated Water Resources Management: Ground Water" which attended by 20 participants from Yemen.
- A training course for engineers in the field of "On Farm Water Management: Irrigation and Drainage" which attended by 20 participants from Nile Basin Countries. This course is holding each year started from 2004. Ministry of Foreign Affairs in Japan approved to continue implementing this course for other three years started from March, 2010.
- A training course for a group of researchers from African countries who have scholarships from (Tiger п) project which funded by European Space Agency (ESA) in the field of "Using of satellites in the field of water resources "which attended by 30 participants.
- A field trip was arranged by TSWRI for a Nigerian group who are members in one of the water associations. The head of the group was one of the ex-ministers of Water Resources Ministry. The group expressed their admiration of the steps which Egypt achieved in the fields of raising the efficiency of: water using, weeding control and preservation of water quality. As a result, a joint training and researching project between the two countries is discussed to be prepared.

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

The plan of the training sector depends on the different needs of all organizations, societies, sectors related to MWRI as well as the needs of other special units of the ministry such as: Water Quality Unit, Contractual Unit, Institutional Reform Unit, Water Awareness Unit and Information System Centre.

The information which the sector needs to put its plan can be collected through: questionnaire forms, meeting with heads of these sectors and units, meeting with the training officials in different places.

This policy results in very fruitful achievements in developing the assessment methods to coincide with the objective of the ministry in capacity building and in preparing cadres to measure the influence of the introduced training courses on the performance of organizations, societies, sectors related to MWRI through the experience and knowledge gained by their staff members who attended these courses.

The methods of training needs assessment were also developed to match with the objectives of the MWRI strategy and the needs of all organizations, societies, sectors related to MWRI which changed to coincide with the ministry strategy. That matching was done through accurate analyses of the training process items during the last 5 years and studying their technical, administrative, financial, institutional and organizational point of views.

The training courses which organized by the training sector is tailored courses to serve all employees of MWRI in all its sectors to raise their technical and administrative efficiencies with the way which guarantees sustainability.

Assessment of courses

The assessment is done through evaluation sheets which indicate the following levels:

- The training program evaluation.
- The instructors evaluation and to what extent the trainees benefit from them.
- Evaluation of accommodation, entertainment facilities and training methods and facilities.

Further assessment has been conducted through contacting with officials from the different sectors, organizations and institutions of the ministry.

Moreover, there are other evaluation forms which have special elements filled by the direct manager to indicate the influence of the training course on the trainer performance in his work.

The training effectiveness is measured regularly within a period from 6 months to one year after holding the training course. This measuring is done by visiting the trainee in his work place to insure from him and from his manager that he can apply in the field of work what he has studied in the training course.

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

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

7.1 Operational Plan (attach if available)

7.2 Strategic Plan linked with IHP-VIII (Appendix 2) (attach strategic plan if available)

Attached RCTWS Strategic Plan Linked with IHP- VIII

8. Strategic Alignment with IHP-VIII

8.1 Focal areas within IHP-VIII the centre plans to contribute to and specific actions the centre will undertake to align its activities with the strategic plan for IHP-VIII (Please see Appendix-2)

RCTWS STRATEGY TOWORDS IHP TRANSITION FROM PHASE VII TO PHASE VIII: ASSURING CONTINUITY WHILE ADDRESSING NEW CHALLENGESRCTWS aims to offer a courses related to the following Topics to ensure the eighth phase of IHP:

- *WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE*

- *GROUNDWATER IN A CHANGING ENVIRONMENT*
- *ADDRESSING WATER SCARCITY AND QUALITY*
- *WATER AND HUMAN SETTLEMENTS OF THE FUTURE*
- *ECO HYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLDWATER*
- *EDUCATION, KEY FOR WATER SECURITY*

RCTWS TOWORDS PUTTING SCIENCE INTO ACTION

The communication between scientists and stakeholders is an important step toward development of community understanding and ownership of risk. Scientists have a responsibility to educate the community they serve regarding the risks for that community, and possible actions the community can take to reduce those risks. Likewise, stakeholders and policy makers have a responsibility to work closely with scientists in the social learning process.
RCTWS cooperate with the National Water Research Centre, Egypt (NWRC) in the field of water researches and studies related to the IHP strategy.

9. Annexes

9.1 List of publications released by the centre (there can be overlap with those listed in 2.3 above)
Attached you will find the list containing the researches and scientific paper which is published through the period 2008 until now by NWRC, Egypt related to the above topics as we wish to exchange and share the ideas/ studies with the same sisters institutes CATII.

9.2 List of training courses conducted (there can be overlap with those listed in 2.1 above)
Attached List of Training cources by RCTWS

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

Appendix-2

Overview of the Core Programme Themes of the Eighth Phase of the IHP (2014-2021)
WATER SECURITY: ADDRESSING LOCAL, REGIONAL, AND GLOBAL CHALLENGES

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

- Focal area 1.1 - Risk management as adaptation to global changes
- Focal area 1.2 - Understanding coupled human and natural processes
- Focal area 1.3 - Benefiting from global and local Earth observation systems
- Focal area 1.4 - Addressing uncertainty and improving its communication
- Focal area 1.5 - Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

- Focal area 2.1 - Enhancing sustainable groundwater resources management
- Focal area 2.2 - Addressing strategies for management of aquifers recharge
- Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
- Focal area 2.4 - Promoting groundwater quality protection
- Focal area 2.5 - Promoting management of transboundary aquifers

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

- Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources
- Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends
- Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution
- Focal area 3.4 - Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity
- Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution

THEME 4: WATER AND HUMAN SETTLEMENTS OF THE FUTURE

- Focal area 4.1 - Game changing approaches and technologies
- Focal area 4.2 - System wide changes for integrated management approaches
- Focal area 4.3 - Institution and leadership for beneficiation and integration
- Focal area 4.4 - Opportunities in emerging cities in developing countries
- Focal area 4.5 - Integrated development in rural human settlement

THEME 5: ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

- Focal area 5.1 - Hydrological dimension of a catchment– identification of potential threats and opportunities for a sustainable development
- Focal area 5.2 - Shaping of the catchment ecological structure for ecosystem potential enhancement ─ biological productivity and biodiversity
- Focal area 5.3 - Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services
- Focal area 5.4 - Urban Ecohydrology – storm water purification and retention in the city landscape, potential for improvement of health and quality of life
- Focal area 5.5 - Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

- Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector
- Focal area 6.2 - Addressing vocational education and training of water technicians
- Focal area 6.3 - Water education for children and youth
- Focal area 6.4 - Promoting awareness of water issues through informal water education
- Focal area 6.5 - Education for transboundary water cooperation

Format for Biennial Reports by UNESCO's Water-relatedCentres on activities related to the IHP in the period (June 2012- May 2014)

1. Basic information on the centre

Name of the Centre		Water for sustainable development and adaptation to climate change
Name of Director		Prof. dr. Milan Dimkic
Name and title of contact person (for cooperation)		Miodrag Milovanovic, Assistant Director Biljana Radojevic, Focal point in UNESCO Headquaters
E-mail		headoffice@jcerni.co.rs
Address		Jaroslava Cernog 80, Pinosava, Belgrade, Serbia
Website		www.jcerni.org/en/activities/wsdac.html
Location of centre		city/town: Belgrade; country:Serbia
Geographic orientation *		☐ global ☒ regional
Region(s) (for regional centres)		Southeast Europe
Year of establishment		2013
Year of renewal assessment		
Signature date of most recent Agreement		April 2013
Themes Of activities during reporting period	Focal Areas♦	☒ groundwater ☐ urban water management ☐ rural water management ☒ arid / semi-arid zones ☐ humid tropics ☐ cryosphere (snow, ice, glaciers) ☒water related disasters (drought/floods) ☒Erosion/sedimentation, and landslides ☒ ecohydrology/ecosystems ☒ water law and policy ☒ social/cultural/gender dimension of water ☒ transboundary river basins/ aquifers ☒ mathematical modelling ☐ hydroinformatics ☒ remote sensing/GIS ☒ IWRM ☒ Watershed processes/management ☒ global and change and impact assessment ☒ mathematical modelling ☒watereducation ☒ water quality ☐ nano-technology ☒ waste water management/re-use ☒ water/energy/food nexus ☒water systems and infrastructure ☐ other: (please specify) _____
	Scope of Activities ♦	☒ vocational training ☐ postgraduate education ☐ continuing education ☒ public outreach ☒ research ☒ institutional capacity-building ☒ advising/ consulting ☒software development ☒ data-sets/data-bases development ☐ other: (please specify) _____

* check on appropriate box
* check on appropriate box
♦ check all that apply

Support bodies [1]	
Hosting organization [2]	Institute for the Development of Water Resources "Jaroslav Cerni"
Sources of financial support [3]	
Existing networks and cooperation [4]	ICPDR, IWA, UNESCO cat II centres, University Beijing,ISRBC, University of Novi Sad
Governance	☒ director* and governing board ☐ 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 __year(s) ☐ Existence of UNESCO presence at meetings
Institutional affiliation of director	Director General of the Institute Jaroslav Cerni, Professor at the University of Novi Sad
Number of staff and types of staff	total number of staff (full-time, or equivalent) : _____ number of staff who are water experts: _____ number of visiting scientists and postgraduate students: _____
Annual turnover budget in USD	

2. Activities undertaken in the framework of IHP in the period June 2012–May 2014

2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VII/VIII(Appendix-1 and 2) and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.

2.1.1 Courses on groundwater at the University of Novi Sad
2.1.2 Groundwater courses at the Institute
2.1.3 Planned courses at the University of Namibia and Politech in Namibia

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

2.2.1. Monograph on water quality and pharmaceuticals as a result of the Water Quality Symposium (about to be published)
2.2.2. Proceedings of the Conference on climate change impact on water resources
2.2.3. Journal "Water Research and Management" as a result of the research activities undertaken by the Centre
2.2.4. Research activities planned to be undertaken in Nambia
2.2.5. Research activities planned in South Sudan related to flood mitigation

[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
* The Centre has been established on the basis of the founding agreement, signed on April 24th 2013 in Paris, by the Director-General of UNESCO and the Republic of Serbia's Government. Considering that the last step is the ratification of this Agreement by the Serbian National Assembly which is currently underway, the other governing bodies of the Centre will be established after the ratification.

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

3. Collaboration and linkages

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

3.1.1. Cooperation with IWA, with WMO, with the University of California related to G WADI activities, with ICPDR, with FAO.

3.1.2. 6th World Water Forum, Marseille, France, 12-17 March, 2012

3.1.3. International Water Week "Nakdong River International Water Week 2012", Andong, Sangju, Republic of Korea, 12-15 September 2012. Prof. Milan Dimkic, PhD attended the event, as a special speaker, and gave a lecture on ''Importance of the Aerobic State of Alluvial Aquifers for Groundwater Use''. Mr Prvoslav Marjanovic, PhD also attended the event as a panelist at the preparatory meeting for the Seventh World Water Forum. The entire event was held under the auspices of the World Water Council, as the first in a series of preparatory meetings for the purpose of organizing the 7th World Water Forum.

3.1.4. World Water Congress, organized by the International Water Association (IWA), held in Busan, Republic of Korea, from 16 to 21 September 2012.

3.1.5. 7th World Water Forum Kick-off Meeting, organized by the Republic of Korea, the World Water Council, Daegu Metropolitan City and Gyeongbuk Province, held in Daegu, Republic of Korea,14-15 May 2013. Center sent representatives, including prof. Milan Dimkić, PhD who took part as an introductory address guest speaker.

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)

3.2.1. UNESCO's mission in Nigeria - UNESCO-IHP International Workshop on "Implementing Modular Curricula for Tertiary, Technical and Vocational Education in IWRM" Kaduna, Nigeria, 21-23- May 2012

3.2.2. UNESCO workshop on flood management in Namibia, Windhoek, 20-23 May 2012. The adopted Route Map on further activities in this field has the Institute set for participating in these activities in the years to come

3.2.3. UNESCO workshop on flood management in Benin, Cotonou 21-23 March 2013 – National capacity building Workshop on hydro-disaster risk management and preparation of the National Plan

3.2.4. The course on water resource management in South Sudan. UNESCO's training and planning Worshop aimed at Developing a road map for integrated water resource management and flood risk control, Juba, South Suda, 27-28 May 2013

3.2.5. UNESCO/ECA Cluster meeting on science policy/water nexus, ECA. Addis Ababa, August 2012

3.2.6. UNESCO meeting on IDI, Tehran, Iran, 19-21 May 2013

3.2.7. UNESCO meetings of UNESCO Chairs and Centres in SEE region, Istanbul 16-17 June 2013

3.2.8. UNESCO meeting of Water Family members in Nairobi, 9-11 September 2013

3.2.9. UNESCO meeting of the closing ceremony of the International Year of Water Cooperation in Mexico City, 5-6 December 2013.

3.2.10. UNESCO's Strategic and High-Level Meeting on Water Security and Cooperation in Nairobi, Kenya (2013)

3.2.11. UNESCO G Wadi International Workshop on Remote Sensing and Eco-Hydrology in Arid Regions, Beijing, 16-19 September 2013

3.2.12. The scientific assembly of 2IE Institute in Burkina Faso April 2013

3.2.13. Participation at UNESCO G Wadi and IDI meeting, Irvine, California, 22-23 April 2014
3.2.14. The 5th African Water Week to be held in Dakar, Senegal, 26-31 May 2014
3.2.15. The stakeholder meetings for 7th WWF to be held in Korea 2014
3.2.16. Regular Participation at the Sessions of the General Conference, Executive Board and IHP Intergovernmental Council

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

- International Institute for Water and Environmental Engineering (2iE) in Burkina Faso
- Beijing based Capital Normal University
- UNESCO Category II Centre in U. S. and the US Army Corps of engineers related to G-WADI activities
- UNESCO Centre for Ecology in Poland
- UNESCO Category II Centre for global change in Germany on G-WADI activities
- IHE
- UNESCO Category II Centre in Nigeria, Kaduna on water education
- ICHARM on flood management and building the flood resilience in Benin, South Sudan
- Centre for Urban Water Tehran on IDI activities

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

3.4.1. Collaboration with UNESCO's Venice 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

3.5.1. Collaboration with IHP National Comittes in SEE region

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

3.6.1.Collaboration with UNESCO's Water Chair at COMSATS University Pakistan, Collaboration with UNESCO's Water Chair at the University of Belgrade, Serbia, Collaboration with UNESCO's Water Chair on water education at Ahhen University, Germany

4. Communication

4.1. Communication and knowledge dissemination activities undertaken in the framework of IHP
4.2. Policy documents and advice

4.2.1. Water Policy document for Serbia made by the Institute

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)

6.1.1. South Sudan, Benin, Namibia, Nigeria projects

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

Conferences organised by the Center:

6.2.1. "Contemporary Issues Of Adaptive Water Management", held in Belgrade on 31 October 2012 under the auspices of the Serbian Academy of Sciences and Arts. The Conference was organised in order to mark UNESCO's approval of the establishment of a Category II Center ("Water for Sustainable Development and Adaptation to Climate Change") under its auspices at the ″Jaroslav Cerni″ Institute in Belgrade. The Conference was attended by many domestic and international scientists, as well as representatives from international organisations: UNESCO, UNDP, IWA and IAWD.

6.2.2. "Emerging Pollutants In Water", held in Belgrade, from July 9th to 11th 2013, at the Serbian Academy of Sciences and Arts. The main themes of the conference were: Analytical methods for identifying emerging pollutants and the products of their transformation; Emerging pollutants' toxicity, and their water-related characteristics (degradability, solubility, sorption…); Emerging pollutants' emmission and treatment; Emerging pollutants' appearance and fate in surface and ground water, as well as mathematical modelling.

6.2.3. "Climate Change Impact On Water Resources″, held in Belgrade on October 17th and 18th 2013, at the lecture halls of Serbian Academy of Sciences and Arts and at the ″Milutin Milanković″ Society. The Conference was organised by UNESCO, UNESCO's Category II Centre "Water for Sustainable Development and Adaptation to Climate Change" (WSDAC) and the ″Jaroslav Cerni″ Institute, and was supported by the Serbian Ministry of Education, Science and Technological Development, the "CC-Ware" international project for South East Europe, the Serbian Academy of Sciences and Arts and the ″Milutin Milanković″ Society. The conference was attended by 30 participants from abroad, as well as 70 domestic ones. Apart from the Europe (Germany, Austria, France, Romania, Slovenia, Croatia, Bosnia and Herzegovina - Republic of Srpska), the conference was also attended by experts from African, Asian and North American countries. At the conference, leading international and domestic experts presented the state-of-the-art methods and latest researches concerning the climate change impact on water resources. Over the course of the conference, there were 50 presentations, out of which 11 papers were presented by posters.

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

6.3.1. Serbian Water Management Strategy

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

7.1. Operational Plan (attach if available)

7.1.1. Namibia and South Sudan proposal to be attached as appendix 3 and appendix 4
7.1.2. Planned Conference in Belgrade: "Milankovitch Anniversary UNESCO Symposium: Water Management in Transition Countries as Impacted by Climate and Other Global Changes, Lessons from Paleoclimate, and Regional Issues", 3-5 September 2014
7.1.3. Planned IWA Specialist Groundwater Conference 2015

7.2. Strategic Plan linked with IHP-VIII(Appendix 2)
(attach strategic plan if available)

8. Strategic Alignment with IHP-VIII

8.1. Focal areas within IHP-VIII the centre plans to contribute to and specific actions the centre will undertake to align its activities with the strategic plan for IHP-VIII (Please see Appendix-2)

8.1.1. Contribution to the theme 1. Water related disasters and global change: through project of building the flood resilience in South Sudan and Integrated flood and drought management plan for the Iishana sub-basin of the Cuvelai-Etosha basin
8.1.2. Contribution to theme 2. Groundwater: Complex studies regarding the use of alluvial aquifers
8.1.3. Contribution to theme 3. Addressing water scarcity and quality; Monograph on pharmaceuticals and water quality (to be published)
8.1.4. G Wadi regional centre for Europe
8.1.5. Contribution to IDI through activities undertaken in Oman related to irrigation (to be formulated)
8.1.6. Contribution to theme 4. Water and human settlement, planned mission to Cambodia and Philippines to undertake studies on water resources assessment and master plan for particular cities.
8.1.7. Contribution to theme 5. Ecohydrology
8.1.8. Contribution to theme 6. Water education, Planned Master courses in Namibia and Benin within the WISCAL project (Water and Climate Change in West Africa)

9. Annexes

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

9.1.1. "Water Research and Management" Journal
9.1.2. Book of Abstracts of UNESCO Conference on Climate Change Impacts on Water Resources, Belgrade, 2013
9.1.3. Proceedings of UNESCO Conference on Emerging Pollutants in Water, Belgrade, 2013
9.1.4. Proceedings of Conference Contemporary Issues of Adaptive Water Management, Belgrade, 2012

9.2. 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 ANDAQUIFER 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
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- 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

Appendix-2

Overview of the Core Programme Themes of the Eighth Phase of the IHP (2014-2021)
WATER SECURITY: ADDRESSING LOCAL, REGIONAL, AND GLOBAL CHALLENGES

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

- Focal area 1.1 - Risk management as adaptation to global changes
- Focal area 1.2 - Understanding coupled human and natural processes
- Focal area 1.3 - Benefiting from global and local Earth observation systems
- Focal area 1.4 - Addressing uncertainty and improving its communication
- Focal area 1.5 - Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

- Focal area 2.1 - Enhancing sustainable groundwater resources management
- Focal area 2.2 - Addressing strategies for management of aquifers recharge
- Focal area 2.3 - Adapting to the impacts of climate change on aquifer systems
- Focal area 2.4 - Promoting groundwater quality protection
- Focal area 2.5 - Promoting management of transboundary aquifers

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

- Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources
- Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends
- Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution
- Focal area 3.4 - Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity
- Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution

THEME 4: WATER AND HUMAN SETTLEMENTS OF THE FUTURE

- Focal area 4.1 - Game changing approaches and technologies
- Focal area 4.2 - System wide changes for integrated management approaches
- Focal area 4.3 - Institution and leadership for beneficiation and integration
- Focal area 4.4 - Opportunities in emerging cities in developing countries
- Focal area 4.5 - Integrated development in rural human settlement

THEME 5: ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

- Focal area 5.1 - Hydrological dimension of a catchment– identification of potential threats and opportunities for a sustainable development
- Focal area 5.2 - Shaping of the catchment ecological structure for ecosystem potential enhancement ─ biological productivity and biodiversity
- Focal area 5.3 - Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services
- Focal area 5.4 - Urban Ecohydrology – storm water purification and retention in the city landscape, potential for improvement of health and quality of life
- Focal area 5.5 - Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

- Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector
- Focal area 6.2 - Addressing vocational education and training of water technicians
- Focal area 6.3 - Water education for children and youth
- Focal area 6.4 - Promoting awareness of water issues through informal water education
- Focal area 6.5 - Education for transboundary water cooperation

APPENDIX 3

REPORT on
WSDAC/IJC MISSION TO NAMIBIA
February 7th to February 16th 2014

UNESCO CATEGORY 2 CENTER, Belgrade, Serbia

Jaroslav Černi Institute for the Development of Water Resources, Belgrade, Serbia

WITH PARTNERS

REPORT on WSDAC/IJC MISSION TO NAMIBIA

February 7th to February 16th 2014

Mission Objective: Support to Namibian Water Sector

Belgrade, March 2014

CONTENTS

ACKNOWLEDGEMENTS

The Mission wishes to thank the Government of the Republic of Namibia for facilitating the Mission, enabling the visit to the Cuvelai-Etosha Basin and arranging many meetings with people throughout the Mission.

The Mission team especially appreciates the State and National authorities who met with them. Above all Hon. Marco Hausiku, Deputy Prime Minister and Hon. John Mutorwa, Minister of Agriculture, Water and Forestry, who took time to hold discussions within their busy schedules, and who provided invaluable information to the Mission.

Special gratitude also goes to the Ministry of Agriculture, Water and Forestry and other public institutions for providing the Mission team with comprehensive perspectives on the achievements and challenges of the water sector in Namibia. Special appreciations are given to Mr. Harald Koch, Director of Water Resource Management in the Ministry of Agriculture, Water and Forestry (MAWF) for his very valuable observations and suggestions.

The Mission team thanks the Rector of the Polytechnic of Namibia, Prof. Tjama Tjivikua and his colleagues for fruitful and open discussions on possible fields of cooperation.

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The Mission team is also grateful for the large amount of information that has been provided from organizations and individuals before, during and after the visit to the Cuvelai-Etosha Basin. The Mission team in particular thanks the Governors, Councilors and experts from the Regions through which the Cuvelai-Etosha Basin run for their hospitality and constructive guidance during the visit to the region.

The Mission team has also received valuable information and guidance from Dr. G. Schneider, Director of the Geological Survey of Namibia in the Ministry of Mines and Energy.

The Mission team expresses its thanks to Mr. Kintinu Sageus and Ms. Pauline Mufeti from the MAWF as well as Mr. Ferdinand Katire from The Namibian National Commission from UNESCO for accompanying the Mission team throughout its visit, and for ensuring that information was provided in response to the multitude of questions and requests for clarifications about points that came to the Mission team's attention, and for making this important undertaking an unforgettable time.

Last but not least, the Mission team is especially grateful to Ms. Trudie Amulungu, Deputy Permanent Delegate of Namibia to UNESCO for her efforts in organizing the Mission and supporting us throughout its duration.

EXECUTIVE SUMMARY

The Mission of WSDAC/IJC[1] to Namibia took place in February 2014. The Mission was a follow up to several visits by UNESCO and WSDAC/WSDAC/IJC to Namibia. A Road Map[2] has been developed and adopted by the Government of Namibia during the visit in a 2012.

The objectives of the Mission were to examine and understand the current status of tertiary education of relevance for the Namibian water sector and water resources management with special focus on extreme events such as, floods and droughts characterizing the Namibian water environment. Furthermore, the Mission was tasked with exploring potential joint efforts of WSDAC/IJC and the Namibian authorities and institutions towards further development of Namibian tertiary education institutions to meet the needs of the Namibian water sector as well as the development of in house capacity to provide solutions for the current needs related to floods and droughts. Finally, an important objective of the mission was to help the Namibian water sector mitigate the impact of recurring flood and drought events such as in the Cuvelai-Etosha Basin. Technical and scientific support is mainly to be given through hands-on education.

During the Mission a number of meetings were held with the Government of Namibia particularly with the MAWF, the Disaster Risk Management Unit, the Office of the Prime Minister, the University of Namibia, the Polytechnic of Namibia, the Geological Survey of Namibia and other institutions and experts. Furthermore a field visit was organized to the region of Cuvelai-Etosha Basin during which meetings were held with the Regional Governors, and relevant government officials and experts.

The Mission Team expresses its appreciation for the constructive engagement and exceptional hospitality and support offered by the Namibian hosts and counterparts throughout the duration of the visit. We are especially grateful for the detailed information provided to us by all participants in our meetings, especially in relation to floods and droughts in Namibia and current capacity building programs in Namibian tertiary institutions.

After due considerations and analysis the Mission Team believes that focused capacity building initiatives for the Namibian water sector need to be integrated with the implementation of flood and drought management projects geared towards problem solving, which will support the formal academic programs to be delivered by the Namibian tertiary institutions. Furthermore we believe that the most appropriate area for the implementation of these projects is the Cuvelai-Etosha Basin.

The joint cooperative efforts should be implemented through the creation of two independent multidisciplinary Masters Programs, one at the University of Namibia and one at the Polytechnic of Namibia. The two Masters Programs should be broad in perspective and should include hydrogeology, hydrology, environmental engineering, social sciences, water policy and economics. The Master Programs should be open to candidates with different undergraduate backgrounds. The graduates from the new programs will have knowledge and skills needed for the solution of different water sector problems in Namibia and should be able to lead projects on water sector infrastructure development, water management and water sector governance.

The proposed Masters Programs will be jointly developed and implemented by WSDAC/IJC and the Namibian Tertiary institutions. All the materials necessary for the delivery of the two programs will be prepared by joint WSDAC/IJC-Namibian course teams. Following the implementation of the first two cycles of the Masters Programs, the Namibian partners will be capacitated to continue the

[1] Category 2 Centre for Sustainable Development and Adaptation to Climate Change (WSDAC)

[2] See Annex IV

delivery of the two programs independently and this in country capacity is seen as a main future legacy of the joint efforts.

The Cuvelai-Etosha Basin is seen as the most appropriate location for the implementation of capacity building projects due to the fact that the three Regions through which the Basin runs and therefore the most prone to floods and droughts are the most populated part of the country. The area is endorheic (closed) basin, larger than 90,000 km^2 fed by surface and ground water flows from the north (Angola) and the west and south (dolomite and limestone formations). Dominant inflows are from Angola and these waters are the trigger of extensive and prolonged floods in the Cuvelai-Etosha Basin. Due to the fact that there is practically no drainage from the Basin, all water losses occur solely through intensive evaporation and evapotranspiration. As a consequence, there is high mineralization of groundwater and pronounced groundwater quality problems, especially in shallow aquifers. As a result, shallow groundwater use and value is severely limited and in many aspects this represents a limiting factor to regional development.

The Mission Team believes that the solution of the water sector problems in the Cuvelai-Etosha Basin lies in integrated flood and drought management (looking at floods as a resource base) through which adequate flood protection can be achieved while at the same time additional infiltration can be stimulated and planned for, so as to enhance and improve water supply in general and agricultural water supply in particular. The system analysis indicates that flood and drought risk can be reduced by means of several measures comprising: a) hydrological engineering, b) technical solutions and c) modifying current land-use practice. The measures will result in:

- Faster and improved evacuation of flood waters in the settled areas of the Cuvelai-Etosha Basin through the implementation of structural measures;
- Lowering of groundwater levels, reduction of evaporation and consequently reduction of groundwater mineralization. This will at the same time enhance infiltration during floods;
- Innovative treatment/pre-treatment of the part of groundwater to bring its quality to acceptable and usable levels;
- Innovative enhancement of flood water harvesting through infiltration into shallow aquifers;
- Innovative flood and drought management for the environmental protection of the Etosha National Park.

The Mission recommends:

- Development of an Integrated Flood and Drought Management Plan for the Cuvelai-Etosha Basin and
- Implementation of the Pilot Demonstration Project for an area (up to 100 km^2).

The development of the Management Plan and the implementation of the Pilot Project would last three years, and would support two full cycles of capacity building Masters Programs.

The Mission recommends that, following the approval of the Mission Report and proposed activities by the Namibian Authorities by the end of April 2014, WSDAC/IJC submits to the Namibian partners and counterparts a detailed draft Implementation Program with Terms of Reference for all components of the proposed activities (Capacity building, Master Plan, Demonstration Project) in preparation for the joint workshop to be held in Belgrade with participation of the delegates from the Namibian Authorities, the University of Namibia, the Polytechnic of Namibia, NamWater, WSDAC/IJC and its partners. The main objective of this workshop would be to develop a detailed outline of curricula for the two proposed Masters Programs and finalize the Terms of Reference for the Master Plan and Pilot Demonstration Project for the Cuvelai-Etosha Basin so that the project implementation can start in 2014.

1. BACKGROUND TO THE MISSION

The Jaroslav Černi Institute for the Development of Water Resources (WSDAC/IJC) took part in UNESCO's "Training and Planning Workshop to Develop a Roadmap for Integrated Disaster Management in Namibia", which was held in Windhoek in May 2012. The Mission to Namibia, composed of UNESCO and WSDAC/IJC experts, aimed at: (a) providing targeted training in Flood Modelling, and (b) developing a roadmap for integrated disaster management capitalizing on UNESCO's experience with flood management and the expertise from its world-wide network. In particular, the objective of the Roadmap is to guide initiatives for reinforcing the country's capacity in: (i) Education and Capacity Building (Tertiary and Vocational and Education Modular Curriculum); (ii) Knowledge Platform (Data, GIS mapping and Flood Modelling) and (iii) Integrated Disaster Risk Management, including the introduction of conjunctive flood and drought management to recharge and use groundwater optimally, where appropriate, in collaboration with partners.

In 2012, WSDAC/IJC became a Category 2 Centre for Sustainable Development and Adaptation to Climate Change (WSDAC), under the auspices of UNESCO. WSDAC is a center linked to the UNESCO's International Hydrological Programme (IHP) under the Division of Water Sciences in the Natural Science Sector.

During a Mission to Paris in March 2013, Prof. Dr. Milan Dimkic, the Director-General of the Serbian Category 2 Centre paid a visit to the Namibian Permanent Delegation to UNESCO. He was accompanied by Prof. Siegfried Demuth, Chief of UNESCO's Hydrological Systems & Global Change Section in the Water Division, who has been instrumental in UNESCO Flood Initiative in Namibia, and also by two officials from WSDAC/IJC who participated in the 2012 Windhoek workshop. H.E. the Ambassador and Permanent Delegate of Namibia to UNESCO also attended the meeting. During the meeting, reference was made to the above mentioned Roadmap. The Mission was also informed of the forthcoming meeting of the National Working Group that was to discuss topics of the capacity building, including approaches for enhancing curricula of University and Polytechnic of Namibia. Prof. Dr. Dimkic informed the Permanent Delegation that WSDAC/IJC in its capacity as a UNESCO category 2 Centre has the necessary expertise to contribute to the implementation of the Roadmap for integrated disaster risk management in Namibia, and expressed the willingness and preparedness of WSDAC/IJC to undertake a visit to Namibia to discuss other areas related to Water Resources Management with the Namibian Government. This would enable WSDAC/IJC to identify possible fields of collaboration with the Namibian Government.

Among others, a visit to Namibia was proposed to WSDAC/IJC that would provide an opportunity to the Center to consult with the Government and senior officials and open entry points for collaboration in various fields, getting familiar with the country and local conditions. Apart from capacity building, discussions would concentrate on WSDAC/IJC participation in designing flood control measures in the most affected areas in the north of the country (Cuvelai-Etosha Basin), on WSDAC/IJC's prospective participation in projects/programs aimed at improving the country's water sector.

In 2013, WSDAC/IJC made an effort to first gather and systematize information on water resources, geology and hydrogeology of Namibia. On the basis of this information the WSDAC/IJC proposes the fields of collaboration with the Government of Namibia starting with those considered as highest priorities. It is the understanding of the WSDAC/IJC that the primary challenge in Namibia is the anticipation and management of water resources, both during prolonged periods of droughts and floods.

Two preparatory meetings were held in Serbia and at the University of Freiburg, Germany, in order to exchange information on previous and current activities in Namibia.

2. ASSESSMENT OF THE STATE OF AFFAIRS

2.1 Education of water managers in Namibia

The education system in Namibia is based on the premise of education for all. The Ministry of Education in partnership with its stakeholders is committed to providing all Namibian residents with equitable access to quality education programmes.

Namibia has only two tertiary institutions: The University of Namibia (UNAM) and the Polytechnic of Namibia (Poly). The number of students pursuing their studies in the engineering and science fields has continued to grow and becomes more diverse. Education of water managers and engineers is provided at both institutions.

2.1.1 The Polytechnic of Namibia

The Polytechnic of Namibia offers curricula that cut across the academic realm at both undergraduate and postgraduate levels.

The Department of Civil Engineering at Poly, has reviewed it's curriculum in 2004 for the qualifications National Diploma in Civil Engineering, Bachelor of Technology: Civil (Urban), Bachelor of Technology: Civil (Water) and the elective for a SADC M.Sc programme in Integrated Water Resources Management.

Bachelor of Technology: Engineering Civil: water
Studies focus on technologies related to Engineering Mathematics, Engineering Physics & Chemistry, Basic Surveying practices, Soil Mechanics and Material Science, overviews in Water Engineering, Systems Reticulation and Design, Water Purification and Wastewater Treatment, Water Supply and Sanitation concepts, Water Utility and Integrated Water Resources Management, Solid and Liquid Waste Management, key elements of Project Management and Water legislation. All courses have pre-determined competence profiles clearly indicating the competence and skills training through modular lecturing, excursions, self-study, assignments, practices and projects. Students are required to demonstrate their competences through a number of presentations throughout all eight semesters.

Master of Integrated Water Resources Management
The course will be a combination of coursework and a thesis; and therefore, research will be embedded in the whole programme. This Master's degree aims at producing middle and high level professionals who can analyse and produce practical solutions to the water related problems of the country and beyond. The duration of the master programme is four semesters.

Master of Science in Integrated Water Resources Management (IWRM - MMP) Module: Water for People (SADC - cooperation)
The Integrated Water Resources Management Modular Master Programme (IWRM - MMP) is accredited SADC wide and through UNESCO-IHE and meets international standards.

2.1.2 The University of Namibia

The Faculty of Engineering and Information Technology at the University of Namibia (UNAM) offers the professional degree of Bachelor of Science in Engineering (BSC in Engineering). In addition to expansion of physical facilities, the Faculty is developing its postgraduate programmes that will be launched in 2014. The curriculum for the degrees of Bachelor of Science in Engineering consists of a Pre-Engineering Year plus four years of engineering training spread over 8 semesters.

Bachelor of Civil Engineering
The programme for the degree of Bachelor of Science in Civil Engineering (Honours) runs over four academic years. A semester consists of 14 weeks of lectures plus 2 weeks of university examinations. Year 1 of study (semester I and II) is common to all engineering disciplines. From Year 2 to Year 4, students mainly take civil engineering modules. Semester VIII is fully dedicated to Research and Design Projects and thus there are no taught modules in this semester.

2.1.3. Mission findings

Our overall finding is that undergraduate programs currently offered at the Namibian tertiary Institutions are generally covering the needs of the Namibian Water Sector. However, postgraduate programs are not comprehensive enough to meet all the needs for creating capacity to solve Namibia specific Water Sector problems.

Furthermore, we have seen that there is insufficient cross-department and cross-disciplinary cooperation and current programs are offered within existing disciplinary divides and departmental structures. We have not seen cross-department or cross-disciplinary programs in any institution. We have received positive feedback from the University and Polytechnic Management on the idea to establish, at university level, a trans-disciplinary - multidisciplinary center for postgraduate education with a focus on water.

2.2 WATER OF THE CUVELAI-ETOSHA BASIN

2.2.1. General characteristics

About half the Cuvelai Basin lies in Namibia, the remaining northern half in Angola. Within Namibia, the Cuvelai-Etosha Basin (further the Basin) covers some 97,620 km^2, equivalent to 12% of Namibia's surface area.

Much of the Basin is an extremely shallow or flat depression, surrounded by a rim of higher ground in the west and south. In fact, the northern part of the Cuvelai basin represents a mega-fan (a large alluvial fan), where flood water is conveyed through weakly defined channels. The alluvial fan also defines a divergent groundwater flow pattern with increasingly shallower depth to groundwater towards the south and a radial seepage front at the southern fringe. Compared to surrounding areas and much of southern Africa, the Basin is home to a very large number of people, mainly because of the presence of shallow groundwater and relatively fertile soils in many areas.

The Basin is most densely populated area of Namibia and most of the inhabitants live in the rural communities dependent on agriculture. The relatively high and reliable rainfall allows dry land crop farming in addition to cattle and small stock farming. Light industries and businesses have been established in towns like Oshakati and Ondangwa.

Geology
In geologic and tectonic terms, the Basin has a true basin structure, which is more than 500 million years old. The basement is comprised of Precambrian and Cambrian gneisses and granites, whose thickness is several thousand meters according to available data. Over a significant part of the existence of this basin (from the Permian to the end of the Jurassic period), limestones and dolomites were deposited over gneisses and granites, a great portion of which now underlies younger, unconsolidated sediments within the basin. Along the southern and western edges of the basin, at higher elevations, these limestones and dolomites are exposed on the ground surface.

The Basin was filled with material over a long time, when wet and arid sedimentation conditions have been registered, resulting in a highly heterogeneous geological structure. Namely, the higher western and southern edges of the Basin were filled with washed-out coarse crushed material and gravel, while finer material - sand, silt and, in parts, clay - came from the north (Angola). In view of

the above circumstances, as well as the age of the basin, there were times when the depth to groundwater was very small and when evaporation led to the formation of a cemented stratum (calcrete), which is likely discontinuous and acts as a hydrogeological barrier. This stratum was formed at different depths, ranging from the lower reaches of the basin structure to near-surface parts of the terrain. Apart from calcrete, the structure of the basin comprises finer materials, including sands of aeolian and fluvial origin, as well as clay and, in parts, silty material.

These sedimentation conditions led to the formation of different sub-artesian and artesian aquifers, where the dominant direction of groundwater flow is towards to ground surface. Alternating dry and wet periods in the early stages of the basin's existence also played a significant role in the formation of shallow aquifer systems, separated by thin beds of calcrete and clay materials with highly complex lateral relationships, such that today these aquifers are lensoid structures that contain fresh to brackish water.

Climate

The climate in the Basin can be classified as semi-arid with rainfall decreases from 600 mm/a in the north-east to 300 mm/a in the west. In the same direction, potential evaporation increases from 2700 to 3000 mm/a. 96% of the rain falls in the summer months (November – April), the months with the highest temperatures and evaporation rates. The region is characterised with both temporal and spatial variability of precipitation. Uneven rainfall distribution is superimposed by a north-south decrease of rainfall that is caused by influences of the relief.

Surface water

The Basin is endorheic. Of the total amount of flood water flowing into the Basin more than 95 % are lost by evaporation, only a small fraction is stored and available for human use.

Two important surface water systems can be differentiated: the network of Cuvelai Drainage iishana and the Etosha Pan. Most parts of the Cuvelai and the Pan are ephemeral, thus only holding water sporadically. The occurrence, distribution and expanse of surface water are seasonal, depending on where rainfall has occurred.

The entire iishana Zone is about 140 km wide and 180 km from north to south. The iishana are shallow, often vegetated and poorly defined but interconnected flood channels and pans through which surface water flows slowly or may form pools depending on the intensity of the floods. In the east iishana are narrow, while in the west are broad, slowly-flowing and saline because water easily evaporates from their large surface areas. Most of the channels converge in the south, where they fill the Omadhiya Lakes. Other channels have been covered over by wind-blown sands in the drier southern areas. As a result, these southern iishana areas are characterised by tens of thousands of small pans which are only filled by local rain and are generally not connected to each other.

Local heavy rains in the Namibian part of the Basin generally cause localised flooding, while widespread flooding is usually due to extensive heavy rain in higher altitude and higher rainfall areas upstream in Angola. Normally the surface waters are short-lived, evaporating or seeping away over weeks or months, depending on the depth of the water and permeability of the soils.

In recent years (2007 – 2011) the Basin experienced serious flooding which caused the loss of human life, homesteads, crops, livestock and infrastructure, such as roads and canals. These events have highlighted the need for preparedness and mitigation, especially since the most economically vulnerable people are generally hit hardest by flooding.

Floods are not only a major threat in the iishana sub-basin, they are also a key factor for the replenishment of water resources and increase of Water Security. A key gap is the missing potential for detailed mapping and planning and the missing link to groundwater resources management quantity and quality-wise.

Solutes entering the system with flood water eventually accumulate unless they are transformed, degraded or removed. This very specific feature imposes specific constraints on surface and groundwater and specifically on water quality management.

Groundwater

The hydrogeological conditions related to the origin of the Basin have led to the formation of several aquifer systems whose common feature is upward groundwater flow in the center of the basin. Closer to the surface, there are shallow aquifers whose groundwater levels are affected by inflow from deep aquifers, evaporation (which is rather pronounced here), and infiltration of surface water during periods of flood waves.

Deep aquifers are recharged from the western and southern upland edges of the basin, made up of fractured dolomites and karstified limestones. On the other hand, significant recharge of both deep and shallow aquifers comes from the north, from the direction of Angola.

The general directions of groundwater flow within the basin are towards the Etosha Depression, which is the lowest base level of erosion. Current knowledge of the hydrogeological conditions indicates that the flow directions are from the north, south and west, and that there is also some discharge to the east, towards the large Kalahari Basin, to which the Basin belongs.

Groundwater of better quality is found in shallow aquifers in the western and southern parts of the Basin, where direct recharge comes from higher peripheral limestones and dolomites. In the central part of the basin the water is loaded with salt: the water quality improves somewhat in the rainy season, but deteriorates again during dry periods due to high evaporation rates.

In the Basin small amounts of good-quality water are available from shallow, manually dug wells called “omifima”, which provide local drinking water supply. In the given lithological conditions, freshwater lenses are formed during the rainy season.

Groundwater of better quality is generally registered in the deep aquifers of the Etosha Depression. However, the quality of the groundwater in these aquifers deteriorates towards the central part of the basin and this seriously limits groundwater use.

Apart from the groundwater quality issues of both shallow and deep aquifers, small depths to groundwater also pose a problem. They are a result of inflow from the deep aquifers and a lack flood management measures to cope with spacious floods originating in Angola during the rainy seasons. These conditions prevent runoff of both surface water and groundwater from shallow aquifers.

Several environmental changes took place that aggravated both the flood and the water quality issue. Current land use practice involving plowing has increased erosion, and channel morphology has been changed due to sedimentation. As a result groundwater table in the areas between channels has risen, and the overall evaporation increased.

These problems can be reduced by a suitable drainage network, to lower presently high groundwater table and maintain it at a certain depth from the ground surface, which will eliminate the adverse effect of evaporation, land salinization and enable higher infiltration rates during floods. At the same time, such an approach will enable flushing of the upper, surface layers and thus improve soil quality and groundwater quality near the surface.

Drained saline water will be evacuated towards the center of the basin, the Etosha pan. In view of the elevated salinity, treatment (desalination) will be required so that this water can be used for local water supply.

Water supply

Most people and high proportion of livestock obtain water from a network of pipes and boreholes. There are 4,000 km of pipelines all of which radiate out from purification schemes at Olushandja, Outapi, Ogongo and Oshakati. These schemes are fed by water pumped from the Kunene River at

Calueque Dam located just across the border in Angola. The water is then stored and balanced in the reservoir of Olushandja Dam, where the canal supplying water to Oshakati begins. About 82% of all people live in area within 2.5 km of pipeline network. Users are required to pay for water so some of poorer households still use water from shallow wells. This water supply scheme has helped alleviate the water supply situation. Still, it also has an impact on the groundwater level situation and on solute streams towards the basin. A proper management of this scheme needs to be put in place to manage the impacts of water import to the closed basin.

Agriculture

Agriculture in the Basin is dominated by livestock farming, as well as in whole Namibia. Cattle are the most important animal in the region, since they are a source of meat, milk and manure, but also a sign of prosperity. Hence, the majority of cattle are held by 20% of the households. On the other hand, goats and poultry are held by a large number of households.

The main crop product is drought tolerant millet, cultivated mainly for local consumption. The millet fields occupy approximately 90% of the cultivated land. Sorghum, beans, pumpkin and melons are also grown in this area.

The limitative factors for agricultural production are climate, soil and water quality. Agricultural production is climate dependent - a threat to agriculture is not only dryness, but also above-average rainfall combined with highly variable rainfall volumes.

Agricultural production is also limited by the high proportion of sand in the soil, which gives it little capacity for water retention. Nutrients are limited to a thin humus layer and the nitrogen content is very low. Therefore, soils used for crop production require proper soil management. Salinity, high evaporation rates and extreme erosion pose additional dangers.

Water for agricultural use has to fulfill certain standards, either used for crop production or livestock husbandry. Common problems related to water quality in this area are high levels of total dissolved salt, fluorine, chloride, sodium and sulphates. High levels of total dissolved salts make water unsuitable for all agricultural activities. High fluoride content in water is one of limiting factors for livestock consumption, since fluoride exceeds recommended limits by a factor of 1.5 to 3 in around 50% of the samples in the north. Suitable technical measures for fluoride removal can be developed and put in place. Managed aquifer recharge can also reduce the fluoride problem by mixing and dilution with high quality water.

Droughts

Droughts occur on a temporal scale of a single year or even several years (multi-year droughts). Their impact on crops, ecosystems, animal husbandry and livelihood but also on water supply causes high emergency intervention costs and compensation payments. There is a strong interest in reducing the risk of these events and of developing resilient water supply and food production systems that continue operating or remain at least stable at lower productivity during droughts. Mission believes that lowering of the water table and creating additional storage for flood management and artificial/managed flood recharge could be sufficient to mitigate drought.

Conservation areas

The most important is the Etosha National Park, but there are also local conservancies and community forests that are managed for conservation by local residents.

2.2.2. Mission findings

Starting from the fact that the main objective of the Project is to support capacity building while at the same time to solve some of the real life issues, it is clear that the scale of the project must be appropriately determined. For this reason and after careful assessment of the characteristics of the Cuvelai-Etosha Basin (geology, hydrogeology, climate, demography, etc.) the Mission believes that the most suitable area (spatial scale) to study is the **iishana sub-basin of the Cuvelai-Etosha Basin**,

which is characterized by the presence of all components of importance for the water resources management and thus amenable for Integrated flood and drought management and planning. The Mission therefore proposes:

1. Development of **Integrated Flood and Drought Management Plan for the iishana sub-basin** (including Strategic Environmental Assessment). The plan will increase water security in the selected area through integrated flood, drought and water supply management. It will be used as a capacity building tool, since its objective is to develop appropriate and innovative tools, methods and approaches.
2. Development and implementation of Pilot project to address particular water sector problem and integration of such projects into education initiative.

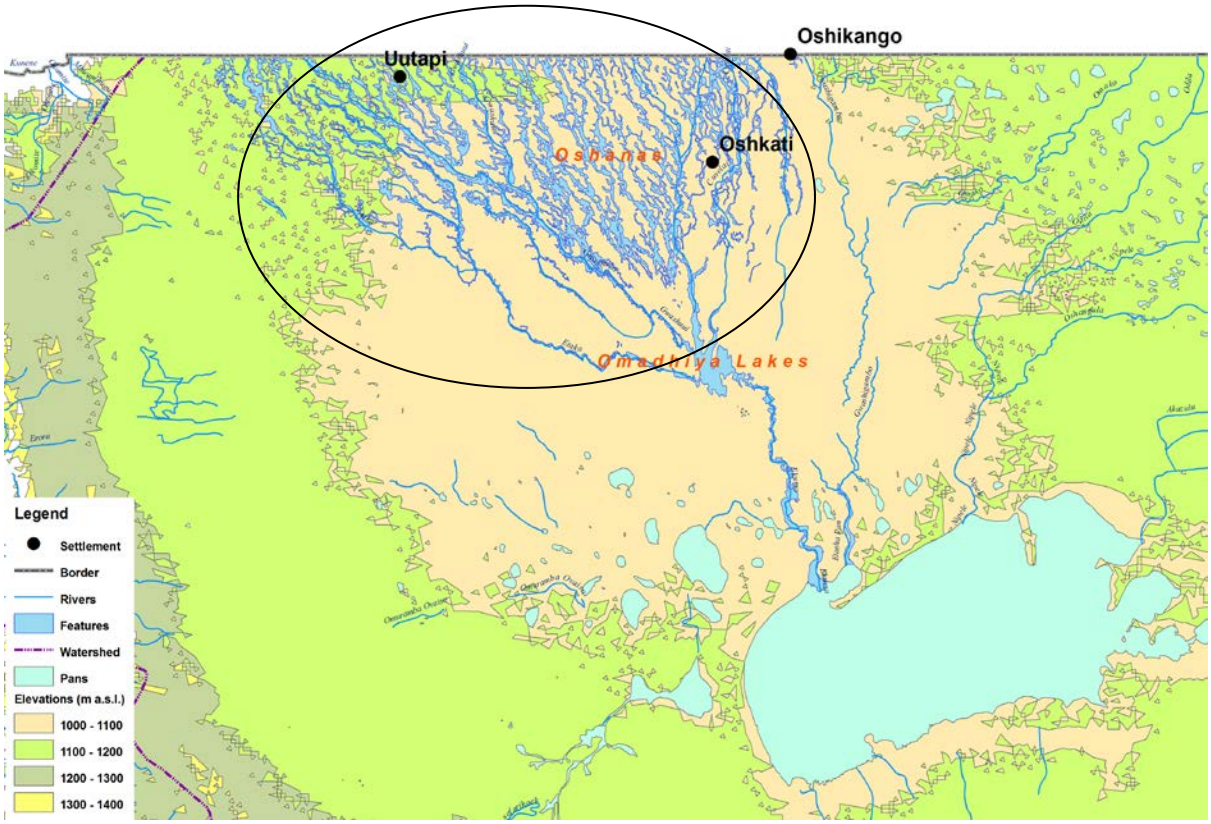


Fig.1: Iishana sub-basin of the Cuvelai-Etosha Basin

Considering the characteristic conditions resulting from hydrology, geology and hydrogeology of the basin, measures that should be considered are:

- Assessment of the main patterns of the surface flow; a detailed digital elevation model is needed and data processing capacity in terms of software, hardware and skill need to be developed to derive information on flow patterns, suitable measures and flood hazard management strategies;
- Land reclamation measures (to improve soil water regime, water retention, recharge); land use practice apparently plays a role in aggravating the situation. A thorough analysis of traditional and current land use practice and of their impact on water resources and sediment transport needs to be carried out;
- Improvement of flow capacity of channels (iishana) and their directing towards potential water harvesting and groundwater infiltration basins;
- Implementation of local flood protection measures;

- Construction of a canal network in combination with horizontal drain pipes in the surface stratum; apart from a transit function, this network will play a drainage role and increase the depth to groundwater, thus minimizing evaporation and reducing salinity of the topmost layers of soil and of the groundwater near the ground surface; it is important that this scheme needs to be operated from downstream to upstream;
- Suitable treatment (desalination) of drained saline water, so that the water can be used for local drinking water supply, irrigation and watering of livestock;
- Evacuation of drained saline water to a suitable recipient;
- Utilization of flood waters for shallow aquifer recharge - flood water preservation and storage in the underground. Thereby, water loss on evaporation is reduced and increased quality of underground water which is stored for use in dry periods;
- Improvement of water infiltration into shallow aquifers, including identification of impervious (calcrete) zones;
- Integrated management of shallow fresh water lenses on top of saline water through dedicated and innovative infiltration practices;
- Use of experimental drought monitoring system which has been developed in collaboration with UNESCO-IHP and Princeton University. The system merges climate predictions, hydrological models and remote sensing data to provide timely and useful information on drought in developing regions where institutional capacity is generally lacking and the access to information and technology prevents the development of systems locally. Key elements of the system are the provision of near real-time evaluations of the terrestrial water cycle and an assessment of drought conditions. The system has already been installed in several African countries.

3. MISSION RECOMMENDATIONS

WSDAC/IJC Mission concluded that a capacity building initiative targeting the Namibian Water Sector is needed. It should be project based and focused on the solution of the specific Namibian challenges, especially in the Cuvelai-Etosha Basin.

WSDAC/IJC Mission also concluded that:

1. The main long-term risks in water sector arise from non-adapted management of water resources and degradation of land use and farming systems. In the Cuvelai-Etosha Basin this risk is imminent as the basin is endorheic.
2. The Integrated Flood and Drought Management Plan for Cuvelai-Etosha Basin should be developed, aiming at reviewing the results of on-going different projects and developing an integrated and innovative framework with additional strategic measures and planning principles. The Plan will offer an adaptive framework and adequate measures for reducing risks, managing surface and groundwater resources and maintaining water quality in this unique basin. Such a plan would be an important step in the implementation of the Namibia 2030 vision (Republic of Namibia, 2004).
3. A Pilot project should be carried out in parallel with the Plan development, to investigate specific circumstances and offer the soundest and innovative solutions.

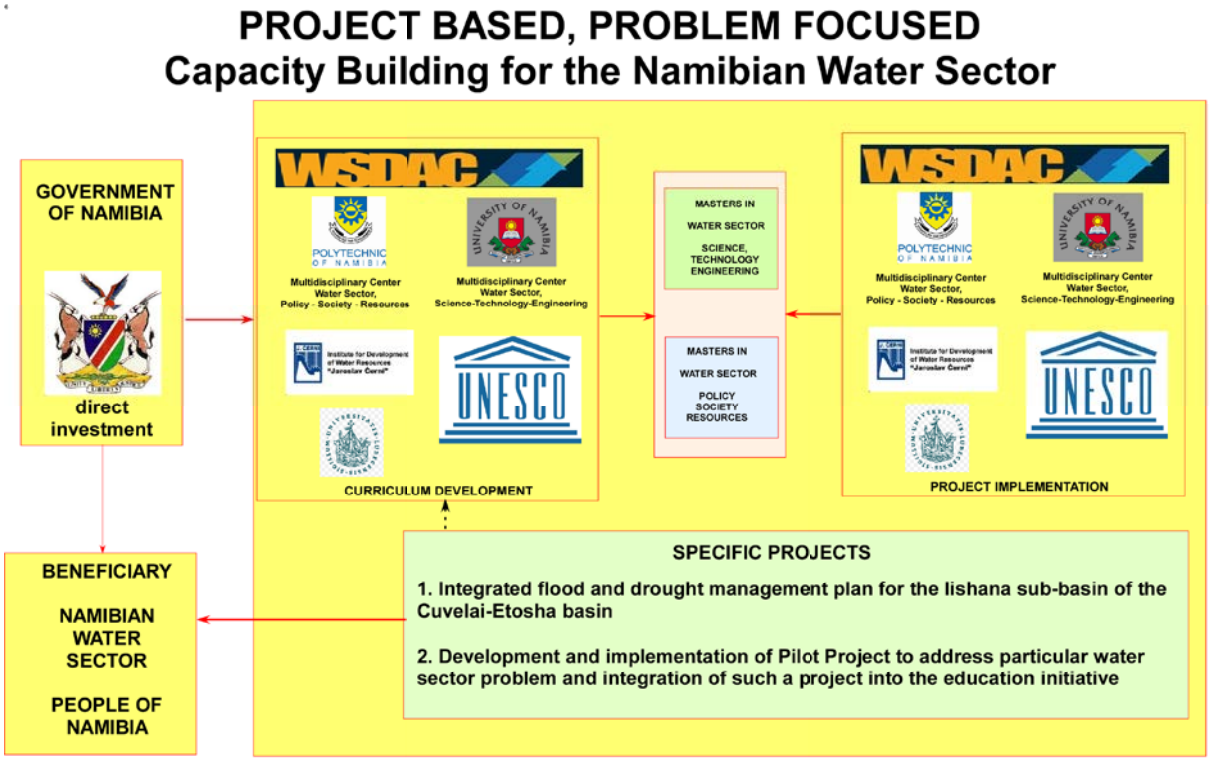
Based on these findings, the Mission Team proposes to the Namibian Government to initiate a **PROJECT** that will be implemented in collaboration with the Namibian institutions. The project should include:

1. **Capacity building at different levels** (formal capacity building at tertiary institutions, strengthening the capacity of professionals in the water sector);
2. Development of **Integrated Flood and Drought Management Plan for the iishana sub-basin of the Cuvelai-Etosha Basin** (including Strategic Environmental Assessment) and its inclusion into formal education initiative. The plan will increase water security in the selected area through integrated flood, drought and water supply management. It will be used as a capacity building tool, since its objective is to develop appropriate and innovative tools, methods and approaches;
3. **Development and implementation of Pilot project** to address particular water sector problem and integration of such project into education initiative. Pilot project should be carried out in parallel with the Plan development.

WSDAC/IJC Mission believes that capacity building of water managers, within the proposed PROJECT, must be:

- Multi-disciplinary in nature and cross-disciplinary in structure
- Country specific to deliver on the actual needs.

The essence of the proposal is summarized in Figure below:



PROJECT objectives

1. To increase capacity of the Namibian Water sector to education and applied research
2. To develop **Integrated Flood and Drought Management plan for the iishana sub-basin of the Cuvelai-Etosha Basin** and use it as a capacity building tool
3. To develop appropriate and innovative, tools, methods and approaches so that water management can be optimized
4. To increase water security in the selected region through integrated flood, drought and water supply management

5. To design and implement technical solutions so as to integrate flood, drought and water supply management for the selected region.

PROJECT implementation

Academic component

Within the envisaged model for capacity building two Master Programs are foreseen. The potential curricula for the two programs are given in Tables 1 and 2 bellow. The actual curricula will be developed in cooperation with Namibian partner institutions, as a part of the PROJECT inception phase.

Table 1 Masters in Water Management Engineering – Polytechnic of Namibia (total of 12 courses for full credit

MODULES		POTENTIAL COURSES
HYDROGEOLOGY (3 courses)		General hydrogeology Hydrogeology of sedimentary basins Selected topics in groundwater
WATER QUALITY END ENVIRONMENT (3 courses)		Surface and groundwater quality Environmental hydrology Hydrology of arid regions
MANAGEMENT OF SURFACE WATER (2 courses)		Flood and Sediment management Drought management
WATER MANAGEMENT AND PLANNING (2 courses)		Water resources management and planning in arid regions Economics and Financing of water projects
ELECTIVE COURSES (6 courses)		Petrology and tectonics Water and waste water treatment and sanitation Irrigation and drainage Water re-use and recycling Transboundary cooperation in water management Groundwater modelling

Table 2 Masters in Integrated Water Management – UNAM (total of 12 courses for full credit)

MODULES		POTENTIAL COURSES
WATER SCIENCES (3 courses)		Hydrology of arid regions Water chemistry General hydrogeology
ENVIRONMENTAL SCIENCES (2 courses)		Surface and groundwater quality Environmental impact assessment for water projects
INTEGRATED WATER RESOURCES MANAGEMENT (2 courses)		Water policy and law Water resources management and planning in arid regions
SOCIO-ECONOMIC ASPECTS OF WATER MANAGEMENT (3 courses)		Economics and Financing of water projects Strategic environmental assessment Transboundary cooperation in water management
ELECTIVE COURSES (4 courses)		Water productivity and energy efficiency Rural water supply Agricultural policy and water resources Public participation in water management and gender issues

Courses should consist of an appropriate blend of formal lectures and project specific work, and should be owned and offered by in country academic institutions - University of Namibia and Polytechnic of Namibia). Both programs are to be delivered over a 2 year period, in partnership with country academic institutions and their staff. The course component is complemented by a Masters level student project which would be a part of the work on the Projects proposed to complement the formal education. It is estimated that, aside from the local lecturing staff for each course, at least 15 students per program could be graduated by each 2 year academic cycle.

Project component

1. Development of **Integrated Flood and Drought Management Plan for the iishana sub-basin** (including Strategic Environmental Assessment). The plan will increase water security in the selected area through integrated flood, drought and water supply management. It will be used as a capacity building tool, since its objective is to develop appropriate and innovative tools, methods and approaches.
2. Development and implementation of Pilot project to address particular water sector problem and integration of such projects into education initiative.

The project will address the whole range of specific circumstances in that area, use the results of the above on-going and accomplished projects that tackled the area, perform additional investigations and propose an innovative approach to water management in this area, consisting both of flood and drought mitigation measures.

For these to be effectively developed and implemented a number of prerequisites must be met:

- Access to detailed topography data (preferably obtained by Lidar survey technique)
- Integration of all available hydrological, geological, hydrogeological and water quality data
- Thorough understanding and mapping of calcrete zones
- Inventory and mapping of shallow and deep groundwater wells and fresh water lenses
- Detailed understanding of the water needs and demand points, now and for the foreseeable future.

PROJECT phases

WSDAC/IJC Mission proposes the following phases of the PROJECT implementation:

1. Inception Phase
    a. Review and integration of existing data and information and identification of gaps
    b. Definition of education curricula
    c. Preparation of Terms of reference for the **Integrated Flood and Drought Management Plan for the iishana sub-basin of the Cuvelai-Etosha Basin**
2. Investigation and Exploration Phase
    a. Analysis of hydrological and groundwater flow processes, salinization and sediment transport
    b. Integrated system analysis of land use, hydrology and groundwater system including the quantitative recharge process and water quality (solute streams)
3. Delivery Phase – Education and Planning in parallel

In addition, a table below briefly describes the sequence of actions that are needed.

EDUCATION	PLAN AND PILOT PROJECTS
Major academic development and accreditation, preparation of course materials	Data Collection and Mapping: Additional data collection in the field and mapping of calcrete zones, mapping of existing shallow and deep groundwater wells and fresh water lenses, analysis of water needs and demand points now and for the foreseeable future, etc.
Setting up of the Institutional framework	Deliberation of the technical solutions for integration of flood, drought and water supply management, etc.
1st cycle of program implementation and courses delivery	Preparation of the Plan for Cuvelai-Etosha Basin
Program review	
2nd cycle of program implementation and courses delivery	Pilot project in Cuvelai-Etosha Basin

The way forward

Following the approval of the Mission Report and proposed activities by the Namibian Authorities, and by the end of April 2014, WSDAC/IJC submits to the Namibian partners and Counterparts a detailed draft Implementation Program and Terms of Reference for all components of the proposed activities (Capacity building, Management Plan, Demonstration Project) in preparation for the joint workshop to be held in Belgrade with participation of the delegates from the Namibian Authorities, University of Namibia, Polytechnic of Namibia, NamWater and WSDAC/IJC and its partners. The main objective of this workshop would be to develop a detailed design of the curricula for the two proposed Masters Programs and final Terms of reference for the Management Plan and Pilot Demonstration Project for the Cuvelai-Etosha Basin so that the project implementation can start in 2014.

ANNEX I COMPOSITION OF THE TEAM

Prof. Dr Milan Dimkic – Head of delegation

Prof. Dr Milan Dimkic is the Director General of the Jaroslav Cerni Institute for the Development of Water Resources from 1999. He is also Professor at the University of Novi Sad, School of Technical Sciences from 2005, where he is teaching following courses at all levels (BSc, MSc and PhD): Basic Principles of Water Management; Groundwater Management; The Use, Protection and Management of Groundwater; and Mass Transport in Groundwater. Prof. Dimkic was born in 1953 in Belgrade, Serbia. He graduated from the University of Belgrade, School of Civil Engineering/Hydraulic Engineering Department where he also received his MSc and PhD. His professional and scientific career is closely linked to Jaroslav Cerni Institute where he founded and developed department of groundwater protection, and dealt with protection and remediation of heavily polluted groundwater resources. Prof. Dimkić's memberships in professional and scientific organizations include: Chairman of the Serbian Water Protection Society; Deputy Head of the Serbian Delegation to the International Commission for the Protection of the Danube River (ICPDR); Vice Chairmen of Groundwater Management Group and Member of the Serbian Delegation to the International Water Association (IWA); Vice-president of Serbian committee for cooperation with UNESCO Hydrological Programme, etc. Prof. Dimkic hosted as Chairman or Co-Chairman several important international conferences and symposia. He has been invited to make numerous presentations on water management at international conventions and meetings, and has held lectures on special topics at various universities, workshops, and conferences. He has also played an active role in the conception and upgrading of several groundwater sources, in the planning and development of diverse hydrotechnical systems, and in the planning of integrated water resources management in Serbia. He is editor (with Heinz-Jürgen Brauch and Michael Kavanaugh) of the book Groundwater Management in Large River Basins. He also published several books, and more than 170 articles in journals and conference proceedings, etc. Prof. Dimkić has made significant scientific contributions in the following areas: groundwater flow in artesian and subartesian aquifers; self-purification processes during groundwater flow; application of special methods to address technical issues associated with groundwater abstraction; quality protection and regeneration of groundwater sources; and management of water resources.

Prof. Dr Prvoslav Marjanovic

Prof. Dr Prvoslav Marjanovic is a Professor of Environmental Protection and Science at the EDUCONS University of Sremska Kamenica in Serbia. He is also working at WSDAC/IJC. He received his BSc Building Technology Degree from the University of Manchester Institute of Science and Technology in Manchester, UK. In 1978, 1982 and 1989, he received his MSc Civil Engineering Degree in Public Health Engineering from the University of Strathclyde, Glasgow, UK, MSc Civil Engineering Degree in Environmental Engineering from the University of Illinois, USA and MSc Ecology from the Department of Environmental Studies at the University of California, USA. In 1989 he received his PhD in Ecology from the Department of Environmental Studies at the University of California, USA. Prof. Marjanovic has broad research interests ranging from water quality and water resources to information systems in water and wastewater technology and management as well as environmental Education. His diverse international experience has given him an opportunity to work in the fields of Water Resources Management, Water Quality Protection and Management, Environmental Protection, Management Policy and Law as well as Solid Waste Management, Environmental Impact Assessment, Limnology, and Solidification and Stabilization. Prof. Marjanovic has extensive teaching experience stemming more than 17 years of teaching in many different countries across the world. He has taught courses at all levels (BSc, MSc and PhD) including the following: Water and Wastewater Treatment, Environmental Management, Design for the Environment, Water Quality, Environmental Engineering Sciences, Water Quality Modelling, Systems Analysis, Solid Waste Management, Pollution Control and Abatement, GIS in Water Management, Water Resources Management, Limnology, Ecology for Engineers, Research Methods, Environmental Project Management, Environmental Impact Assessment etc.

Ass. Prof. Dr Marina Babic Mladenovic

Dr Marina Babic Mladenovic is presently the Managing Director of Department of River Engineering at WSDAC/IJC. She graduated on the University of Belgrade, School of Civil Engineering, Hydraulic Department in 1981, received master's degree in 1991 and doctoral degree in 2006 from the University of Belgrade, School of Civil Engineering. Dr Mladenovic has been involved in many international scientific and research projects and has also managed a number of important research projects within the country on hydrology; water system management; river hydraulics; pollutant and sediment transport in natural watercourses; flood protection; and water management. In 2010, Dr Mladenović was appointed Docent in River Training at the School of Architecture and Civil Engineering, University of Banja Luka, Republika Srpska. As an expert representative of Serbia, she takes part in the work of international forums, and multilateral and bilateral commissions. She is an appointed member of the Flood Protection Expert Group (FP EG) and the Hydromorphology Task Group (HYMO TG) at the International Commission for the Protection of the Danube River and a member of the Permanent Expert Group for Flood Protection (PEG FP) at the International Sava River Basin Commission.

Prof. Dr Christoph Külls

Prof. Dr Christoph Külls is an Professor of hydrology and international water management at the University of Applied Science of Lübeck, he is also teaching environmental hydrology at the University of Freiburg, Germany. He received his PhD at the Julius-Maximilian University of Würzburg in 2000. The title of his doctoral thesis was “Groundwater of the North-Western Kalahari, Namibia - Estimation of Recharge and Quantification of the Flow Systems”. He has professional experience in the isotope hydrology and hydrochemistry (stable isotopes, age determination, inverse hydrochemical modelling) in groundwater hydrology especially in arid regions and in the coupling of human water use with hydrological system characteristics to develop appropriate approaches for resource management. He has worked in Germany, Israel, Jordan, Greece, Cyprus, Brazil, Namibia, South Africa, Burundi, Lithuania and Poland.
Prof. Külls’s major teaching and research areas at under and postgraduate levels are Mass transport and mass balance, Tracer Hydrology and Hydrochemistry, Groundwater hydrology and Project study. He has long experience in international project co-ordination and management.

Prof. Dr Siegfried Demuth

Prof. Dr Siegfried Demuth is a Professor in Hydrology. He received his PhD in Natural Sciences at the University of Freiburg in 1985. From 1985 to 1988 he undertook a research visit to the Centre for Ecology and Hydrology (formerly the Institute of Hydrology) at Wallingford, UK where he developed, in collaboration with a small international group of scientists, UNESCO’s FRIEND project (Flow Regimes from International Experimental and Network Data). Upon his return to the Institute of Hydrology at the University of Freiburg in 1989, he co-developed a fully-fledged curriculum in hydrology. In 1993 he received his ‘Habilitation’ in Hydrology’. In 1999 he was appointed Professor of Hydrology and his principal research fields were low flow analysis, droughts, regionalization and climate change. In 2003 he became Director of the German IHP/HWRP Secretariat until he joined IHP/UNESCO in November 2006 as Chief of the Hydrological Systems and Global Change Section of the Division of Water Sciences. He worked in different capacities in international organisations (WMO, UNESCO and IAHS) and has a strong record of per-reviewed papers in international journals.

Dr Biljana Radojevic

Dr Radojevic received hers PhD in Civil Engineering – Urban Hydrology at the University Claude Bernard – INSA - Lyon, France. She also holds MSc diplomas from the University Pierre and Marie Curies (France), the McGill University, Montreal and the University of Toronto, Canada. Prior to join UNESCO she has had the Academic positions as director of research at the Institute CEMAGREF-France, as Senior Research Associate at Ecole Superieur des Mines des Fontainebleau-France, Teaching assistant at the University of Toronto, Maitre des Conferences at the University Pierre et Marie Curie, France and as a senior researcher at the Centre for Ecology and Hydrology (former Institute of Hydrology) at Wallingford, UK. She has been working on research in flood risk management, solid waste control and optimization, dealing with operational research methods, as well as on the groundwater modeling and using the coupled hydro-geological models in determination of the impact of porous areas on groundwater flow. In 2002 she has joined UNESCO as Senior Programme specialists and has

been working on two major environmental intergovernmental programmes IHP and MAB. She holds UNESCO Chair in 'Knowledge Systems in Integrated Water Resources Management" at the COMSATS University of Science and Technology, Pakistan where she is Assistant Professor on modeling systems since 2012.

ANNEX II ITINERARY/Programme of the WSDAC/IJC Mission to Namibia
8 to 16 February 2014

Saturday, 08 February 2014
Arrival of delegation at Hosea Kutako International Airport

Sunday, 09 February 2014

12h30-14h00	Working lunch at Kalahari Sands Hotel

Monday,10 February 2014

10h00-10h20	Courtesy call on Hon. John Mutorwa, Minister of Agriculture, Water and Forestry
10h20-12h00	Meeting at the Ministry of Agriculture, Water and Forestry
14h30-16h00	Meeting at the Polytechnic of Namibia

Tuesday, 11 February 2014

10h00-12h00	Meeting at the University of Namibia
14h30-16h00	Meeting at the Disaster Risk Management Unit, Office of the Prime Minister

Wednesday, 12 February 2014

06h30	Delegation departure from Eros Airport to Ondangwa Airport
09h00-10h00	Courtesy call on the Governor of Oshana region
10h30-12h00	Meeting with stakeholders
13h30-15h00	Visit to the flood prone areas
17h30	Departures from Ondangwa Airport to Eros Airport

Thursday, 13 February 2014

10h00-12h00	Meeting at Geological Survey of Namibia
18h00-20h00	Official dinner [Hosted by the Minister of Agriculture, Water and Forestry]

Friday, 14 February 2014

08h30-11h00	Courtesy call on Hon. Marco Hausiku, Deputy Prime Minister
11h30-13h00	Debriefing and technical discussion meeting on the way forward at MAWF and key stakeholders

Saturday, 15 February 2014

09h00	Additional consultations with Trudie Amulungu, Deputy Permanent Delegate of Namibia to UNESCO

Sunday, 16 February 2014
Departure from Hosea Kutako International Airport

ANNEX III PHOTOGRAPHS


Working lunch at Kalahari Sands Hotel (Sunday, 09 February 2014)


Meeting in the Ministry of Agriculture, Water and Forestry (Monday,10 February 2014)


Meeting in Polytechic of Namibia (Monday,10 February 2014)




Visit to Cuvelai-Etosha Basin (Wednesday, 12 February 2014)


Official dinner, hosted by the Minister of Agriculture, Water and Forestry (Thursday, 13 February 2014)

ANNEX IV - EXCERPT FROM THE ROADMAP FOR INTEGRATED DISASTER MANAGEMENT IN NAMIBIA

The Roadmap was adopted during UNESCO's "Training and Planning Workshop to Develop a Roadmap for Integrated Disaster Management in Namibia", held in Windhoek from 7 to 11 May 2012. The main groups of activities were as follows:

1. Education and Capacity Building (Tertiary , Vocational and Education Modular Curriculum)

Short-term actions (less than 1 year)

- Specialised education and training of hydrohazard modelling specialists using UNESCO institutes and centres;
- Training of middle level technicians and managers at national and regional levels;
- Updating curricula of UNAM and Polytechnic in cooperation with partners;
- Review and strengthening of community and school education by training regional educational officers.

Medium- to long-term actions (1 to 3 years)

- Short courses and joint Master degree in DRM using UNESCO water education family, e.g. with Jaroslav Cerni Institute;
- Establishment of a Science Chair of DRM at UNAM/Polytech;
- Training for politicians, policy makers, managers and media in hydrohazard risk management;
- Specialised training in transboundary water management.

2. Knowledge Platform (Data, GIS Mapping and Flood Modelling)

Short-term actions (less than 1 year)

- Identify data gaps and availability (commercial and public domain);
- Develop open source knowledge sharing platform; and
- Improve scope of existing hydrometeorological networks and models for flood forecasting

Medium- to long-term actions (1 to 3 years)

- Community based flood inundation mapping using open source software, e.g. HEC series;
- Development of risk and hazard maps by augmenting local data with high resolution topography, e.g. LIDAR 2-3 m;
- Enhancement of precipitation monitoring with remote sensing data;
- Development of operational flood forecasting models

3. Integrated Disaster Risk Management

Medium- to long-term actions (1 to 3 years)

- Prepare and implement integrated disaster risk management plan in a priority pilot (e.g. Cuvelai) region, initially focusing on floods and droughts;
- Use a holistic and participatory approach for prevention, preparedness, response and recovery at all levels in collaboration with Japanese institutes, e.g. ICHARM using Pakistan model Integrated Disaster Risk Management-2
- Introduce conjunctive flood and drought management to recharge and use groundwater optimally, where appropriate, in collaboration with partners;
- Assure transparent data sharing among all stakeholders

APPENDIX 4

PROPOSAL OF FLOOD HAZARD MAPPING TASKS IN SOUTH SUDAN BY UNESCO REGIONAL CENTRE ON WATER RESOURCES, MANAGEMENT AND GLOBAL CHANGE

Proposal
of flood hazard mapping tasks in South Sudan by UNESCO Regional Centre on Water Resources, Management and Global Change

Nearly every year there are floods in South Sudan during the rainy season, which threaten the lives and livelihoods of many people and damage homes, crops and infrastructure. In August 2013 more than 350,000 people were affected by floods.

After the internal conflict in South Sudan, some 700,000 persons were displaced, a large number of whom now inhabit areas in the vicinity of rivers, which were flooded in 2013.

In October 2013, UNESCO's office in Juba proposed a project titled "Increasing Resilience to Floods in South Sudan", in consultation with relevant South Sudanese ministries. The objectives of the project are to improve flood protection in South Sudan by developing an information and early warning system, reduce human and socioeconomic impacts of floods, and establish international cooperation aimed at enhancing integrated management of water resources. The envisioned duration of the project is two years.

Given that additional problems are expected in the rainy season of 2014, UNESCO wishes to undertake a series of emergency activities to mitigate the risk to internally displaced persons and communities in areas most threatened by floods. This will require the development of detailed flood maps and the establishment of an early warning and alert system before the forthcoming rainy season (i.e. before June 2014).

Jaroslav Černi Institute for the Development of Water Resources (JCI) has already expressed its interest and wish to take part in the implementation and problem solving, especially in connection with the development of flood maps of South Sudanese rivers, not later than June 2014.

Jaroslav Černi Institute has acquired available time series of river discharge (maximum, mean and minimum annual) on the White Nile, at gauging stations Mongalla and Malakal for the period of 1912-1982 (source: Global Runoff Data Centre, German Federal Institute of Hydrology). Furthermore, the following data has been provided courtesy of the UNESCO Office in Juba:

- White Nile discharge measurements at Mongalla, ranging from daily, weekly, monthly, to yearly measurements (1903-1984),
- White Nile weekly discharge measurements at Nimule, Juba, Mongala and Bor for the time period from 2008 to mid 2010,
- Mean monthly rainfall measurements on several gauges scattered throughout South Sudan.

A team of JCI experts has reviewed the available hydrological data and data provided so far by UNESCO. The review particularly focused on:

- Monitoring stations in the catchment areas of South Sudanese rivers and the highly relevant White Nile River Basin: the number of stations and their locations, availability of recorded data (water levels and flow rates), and length of time series;
- Weather stations in the catchment areas: the number of stations and their locations, availability of recorded data and lengths of time series.

Unfortunately, we were unable to find any data from the past few years, after 2010, especially for 2013 in view of the disastrous floods that year. Such data are very important for the needed hydrological analyses.

The JCI team has acquired available digital terrain models of South Sudan, the SRTM (Shuttle Radar Topography Mission – NGA and NASA) and ASTER GDEM (Advanced Spaceborne Thermal Emission and Reflection Radiometer Global Digital Elevation Model – METI, Japan and NASA), which are essential for hydrological analyses and the generation of flood hazard maps, have also been reviewed. The precision and level of detail of the outcomes of the effort directly depend on the accuracy of these models.

Our review and analysis indicated that the available data are not sufficient to complete the task in all of South Sudan. There are parts of the country where river basins are ungauged or existing stations have not provided sufficient data. One example is the Sobat River, featuring the largest basin in the State of Jonglei. This would require additional research, for which there is no time given the June 2014 deadline.

It is possible to produce the needed maps using available digital terrain models of South Sudan, but no highly accurate results can be expected.

Based on the current level of knowledge and availability of data, the background information needed to produce detailed flood risk maps over the entire territory of South Sudan is not readily accessible. It will only be possible to prepare flood hazard maps of certain parts of South Sudan and possibly assess the level of risk in the threatened areas.

We therefore wish to inform you that Jaroslav Černi Institute is prepared to produce flood hazard map of:

- The White Nile area (Bahr el Jebel) upstream from the Sud region, from the capital Juba at the upstream end to Bor at the downstream end (region 1 on map); and
- The White Nile area downstream from the Sud region, from the City of Malakal at the upstream end to the border with Sudan at the downstream end (region 3). Implementation depends on data availability.

Additionally, in view of the complexity of the study area, a rough assessment of the threat in the Sud region might be possible, downstream from Bor to Malakal (region 2).

The development of maps for other areas of South Sudan and the tributaries of the White Nile is likely not feasible by June 2014.

The task will be completed in two steps:

1. Hydrological assessment

In order to define reference water levels and discharges at characteristic river cross-sections for the purposes of assessing the flood risk, it will be necessary to undertake a detailed hydrological assessment and define the overall flow regime. The hydrological assessment will be comprised of two stages: preparation of input data and hydrological analysis.

The first stage (preparation of input data) will include the collection of all relevant data and information needed for the hydrological assessment, such as: digital terrain model, weather data, recorded flow rates, soil data, geological data, land cover data, and the like.

The digital terrain model will be needed to identify catchment areas quickly and efficiently and to conduct a geomorphological assessment of the basins and sub-basins. As previously mentioned, the SRTM and ASTER models, which are accessible to the public, will be used

for this activity. Such terrains will first need to be examined so that they can later be used for hydrogeological purposes.

The meteorological data needed for the hydrological assessment include daily, monthly and annual precipitation levels, air temperatures and evapotranspiration rates. The related time series recorded by all existing stations in the considered catchment areas will be required. The time series will first need to be checked and any errors eliminated, and the data gaps closed by correlation. Whenever possible (after the year 1998), satellite-based rainfall predictions, such as those by TRMM (Tropical Rainfall Measurement Mission), will be used to fill the data gaps.

It will be necessary to collect the time series of all recorded water levels and flow rates from stations along the White Nile, upstream and downstream from characteristic sites, to assess the flood risk. As in the case of meteorological data sets, the time series of measured water levels and flow rates will have to be thoroughly checked, any errors removed and gaps filled by correlation. The two most important stations along the White Nile in South Sudan, where long-term monitoring data are available, are those at Mongalla and Malakal, from which it will be necessary to obtain all available water level and discharge time series. Other important stations at which monitoring had been conducted are: Nimule, Juba, Bor and Renk, as well as stations on the major tributaries of the White Nile in South Sudan (primarily the Bar-El-Gazal and Sobat rivers).

Other information needed for a comprehensive study of the hydrological regimes in the considered catchment areas include: soil data, geological data, hydrogeological data, land cover data, etc. These data are generally available in the form of scanned maps, such that they will first need to be georeferenced and digitized.

The collection of hydrometeorological and other data will require the involvement of the national hydrometeorological service and other relevant institutions of South Sudan, as well as international organizations.

The second stage of the hydrological assessment (hydrological analysis) will involve a comprehensive statistical analysis of the time series recorded by the monitoring stations and the development of flood hydrographs at characteristic points to assess the flood risk. The statistical analysis of available time series will iclude the following:

- the definition of the stochastic structure of the available discharge time series (trend, jump and homogeneity analyses),
- the definition of the entire flow regime of the White Nile at Mongalla and Malakal
    - i probability of average discharges,
    - ii intra-annual discharge distribution,
    - iii probability and duration of low flows,
    - iv probability of high flows and
    - v water budget
- the definition of theoretical flood wave hydrographs for several probabilities of occurrence: 0.1%, 1%, 2%, 5%, 10% and 50%.
- a crude estimation of the hydrological effect of flood routing along the White Nile, from Juba to Malakal and the Sudan border.

2. Hydraulic assessment and development of flood hazard maps

The first stage of this activity will also involve the preparation of input data for analysis: digital terrain model, typical high flows and/or flood wave hydrographs, assessment of river channel and floodplain roughness, and other parameters needed for the model.

The hydraulic model will be constructed using HEC-RAS software. The model will be calibrated and validated, depending on the data. Model validation will only be possible if historical data on river floods are provided.

Flood-prone areas will be mapped and flood hazard maps of the study area produced based on the results of hydraulic analyses for identified scenarios.

The outcomes will be presented on maps and/or in reports as required by UNESCO or relevant South Sudanese ministries.

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Bearing in mind the stated facts, the UNESCO Regional Centre on Water Resources, Management and Global Change expresses its willingness to complete all necessary hydrological and hydraulical analyses of the White Nile in South Sudan, within the stated deadlines, in order to determine flood hazard zones for different probabilities of occurrence with reasonable certainty. All results will be presented numerically and graphically, as well as on appropriately scaled maps.

Prof dr Stevan Prohaska
Zoran Knežević
Nikola Zlatanović

UNESCO Regional Centre on Water Resources
Management and Global Change

General director

Prof dr Milan Dimkić

Map No. 4450 Rev.1 UNITED NATIONS
October 2011

Department of Field Support
Cartographic Section