Regional Association I: 1. Hydrological forecasting techniques  
(Africa) 2. Integrated flood management  
3. Hydrological instruments and methods of observation

Regional Association II: 1. Use of hydrological models  
(Asia) 2. Use of remote sensing applications in hydrology and water resources management  
3. New methodologies in water resources assessment

Regional Association III: 1. Discharge measurements and stream gauging stations  
(South America) 2. Hydrological instruments and methods of observation  
3. Hydrological forecasting techniques

Regional Association IV: 1. Operation and maintenance of automatic stations  
(North America, Central America and the Caribbean) 2. Extreme event analysis  
3. Flood forecasting

Regional Association V: 1. Integrated water resources management  
(South-West Pacific) 2. Remote sensing in hydrology  
3. Discharge measurements and stream gauging stations

Regional Association VI: 1. Data processing and quality control  
(Europe) 2. Flood forecasting  
3. Hydrological modelling

As and when new surveys on training needs are conducted at the next sessions of the Working Groups on Hydrology and Water Resources of the Regional Associations, the above regional priorities will be revised accordingly.

Note: Surveys for Regional Associations IV and VI are now under way. The data presented is that of the previous intersessional period.

Resolution 7 (CHy-14)

WORK PROGRAMME AND STRUCTURE OF THE COMMISSION FOR HYDROLOGY

THE COMMISSION FOR HYDROLOGY,

Noting:

(1) Resolution 12 (Cg-XVI) – Hydrology and Water Resources Programme,

(2) The report of the president of the Commission for Hydrology (CHy),

(3) The reports of the members of the Advisory Working Group (AWG), which the Commission established at its thirteenth session,

(4) The report of the Secretary-General regarding the activities of the Commission during its previous intersessional period,

(5) The other resolutions adopted by the Commission during the present session;
Recognizing:

(1) The valuable role played by the experts of national agencies in implementing the activities of the Commission,
(2) The benefits of regular communication across all aspects of the hydrological work of WMO;

Decides:

(1) To adopt the five thematic areas contained in Annex 1 to this resolution, together with the corresponding sets of activities and expected outputs and outcomes contained therein, as a priority for the work of the Commission in the next intersessional period;
(2) To re-establish the AWG of the Commission for Hydrology, which will also act as the Steering Committee for the project on Assessment of the Performance of Flow Measurement Instruments and Techniques, with the terms of reference given in Annex 2 to this resolution;
(3) To continue the four Open Panels of CHy Experts (OPACHE) and update them to cover the areas listed in Annex 2 to this resolution, which can be further divided into sub-themes or otherwise as required;
(4) To support and encourage the participation of the AWG members and relevant experts in the Inter-Programme Expert Teams managed by other Commissions where these contribute to the workplan of CHy;
(5) To establish the following general terms of reference applicable to the AWG and other experts:

(a) The members of the AWG shall ensure that the relevant sections of the Technical Regulations (WMO-No. 49), the Guide to Hydrological Practices (WMO-No. 168), the manuals on hydrology and water resources, and other guidance material relevant to their particular areas of responsibility are reviewed, and appropriate proposals for revisions and/or additions are included in future editions of these publications;

(b) The members of the AWG and experts shall take account of relevant international agreements and conventions and of the activities of other international organizations working in fields related to theirs when fulfilling the tasks specified in their individual terms of reference;

(6) To invite the following experts to serve as members of the AWG in the capacities indicated below:

– Mr Harry Lins (United States of America) – President of CHy
– Mr Zhiyu Liu (China) – Vice-president of CHy
– Mr Paul Pilon (Canada) – Quality Management Framework – Hydrology
– Mr Tony Boston (Australia) – Data Operations and Management
– Mr Sung Kim (Republic of Korea) – Water Resources Assessment
– Mr Antonio Cardoso Neto (Brazil) – Water Resources Assessment
– Mr Johnson Muturi Maina (Kenya) – Hydrological Forecasting and Prediction
Requests the WMO Secretariat to provide short quarterly web updates on the activities of the Hydrology and Water Resources Programme (HWRP);

Urges Members to nominate additional experts to OPACHEs and to facilitate the voluntary contribution of their members to the activities of the Commission.

Note: This resolution replaces Resolution 7 (CHy-XIII), which is no longer in force.

Annex 1 to Resolution 7 (CHy-14)

WORK PROGRAMME OF THE COMMISSION FOR HYDROLOGY

Thematic Areas

The Programme of Work of the Commission for Hydrology will focus on the following five thematic areas that fall under the mandate of WMO:

1. Quality Management Framework – Hydrology (QMF–H);
2. Data Operations and Management;
3. Water Resources Assessment;
4. Hydrological Forecasting and Prediction;
5. Water, Climate and Risk Management.

The activities under each thematic area include those recommended by the previous Advisory Working Group, together with those added by the session. The contribution of the outcomes within each thematic area to the WMO expected results is also highlighted.

Thematic Area 1: Quality Management Framework – Hydrology (QMF–H)

List of activities

(a) Continue implementation of the project to assess the performance of flow measurement instruments and techniques against WMO standards, commenced during the previous intersessional period;
(b) Compile, develop and disseminate guidance material on methods for evaluating the uncertainty associated with the measurement of hydrological variables;
(c) Provide background material to National Hydrological Services (NHSs) explaining why they should use standardized methods in their data collection;
(d) Facilitate the development of policies, frameworks and information sources to promote standardization of and guidance on the most suitable equipment and technologies in order to achieve high levels of reliability, user training effectiveness and other economies of scale;
Coordinate a review of standards used in hydrology and water resources, issued by the International Organization for Standardization (ISO) and other entities, and specify what the joint ISO/WMO standards will be, and how they will be established;

Monitor and report on new technologies in hydrology and water resources and make recommendations for future actions in this regard;

Review material for the Technical Regulations (WMO-No. 49);

Coordinate and promote the provision of guidance to NHSs for implementation of a Quality Management System (QMS), linked to the WMO Quality Management Framework (WMO-QMF), including case studies where possible;

Review and revise relevant HWRP documents (with no QMF logo) from a QMF perspective in order to add basics of operational hydrology;

Provide guidance material on the calculation of rating curves.

Expected outputs/outcomes – Contribution to Expected Result 3

Additional guidance and information on the quality and performance of flow measurement instruments and techniques;

Identification of hardware and, as appropriate, compilation of software to support the requirements of NHSs in hydrometry, including discharge measurement and estimation;

Additional guidance material for NHSs in the areas of Quality Management, uncertainty analysis, standardized methods and rating curves;

Guidance on the development and adoption of joint ISO/WMO standards for hydrological purposes;

Up-to-date technical regulations (Technical Regulations, Vol. III: Hydrology (WMO-No.49)) that are relevant to the roles and responsibilities of Members.

Thematic Area 2: Data Operations and Management

Guide the implementation of Resolution 3 (CHy-14) – Proposed adoption of WaterML 2.0 as a standard;

Monitor and report on new developments dealing with data management issues, such as observations, data exchange and protocols, data transfer formats, data information, the WMO Information System (WIS) and the WMO Integrated Global Observing System (WIGOS);

Review progress in the exchange of hydrological data and products and, if required, propose additional guidance to data suppliers on data that should be exchanged, including harmonization of exchange practices and protocols for the provision of feedback on data use, suitability and benefits;

Provide guidance, advice and training with regard to the spatial estimation of rainfall and other hydrological parameters, including the use of remote sensing devices such as radars and satellites.

Expected outputs/outcomes – Contribution to Expected Results 3 and 4

Internationally agreed standards, formats and protocols for the transfer of hydrological data and information;

Increased exchange of hydrological and related data at national, regional and international levels;

Guidance on improved methods of estimation of areal precipitation and other related hydrological variables.
Thematic Area 3: Water Resources Assessment (WRA)

List of activities

(a) Finalize the Manual on Water Resources Assessment (surface and groundwater) including assessment of water availability and use, and of water resources for water-scarce regions;

(b) Compile and document guidelines on optimization, such as geospatial techniques as applied to hydrological networks (surface water, groundwater, soil moisture, etc.);

(c) Develop approaches for continuous tracking of current water resources availability using appropriate information technology;

(d) Monitor and report on methodologies for the calculation of design discharge (including probable maximum flood) for hydraulic structures, taking into consideration climate variability and change, and make recommendations for future actions in this regard;

(e) Consider producing guidance material to determine adequate ranges of environmental flows that will maintain or achieve good ecological status in all water bodies, along with guidelines on the formulation of related policies for water ecosystem management;

(f) Review and provide advice on how the Commission could contribute to the topic of water sharing/allocation, specifying the advantages and disadvantages of the different approaches and, importantly, in what conditions/environments they may be more widely useful;

(g) Undertake an investigation of modelling approaches to the characterization and prediction of water availability and use.

Expected outputs/outcomes – Contribution to Expected Result 3

(a) Manual on Water Resources Assessment;

(b) National Meteorological and Hydrological Services (NMHSs) provided with tools and techniques for the optimization of their hydrological data collection and related networks;

(c) Tools and techniques for continuous tracking of current water resources availability;

(d) Revised guidance material on determining design floods, including flood frequency analysis;

(e) A comprehensive report on environmental flows (e-flows) including case studies;

(f) Improved guidance and advice on drought monitoring and management, and design information for hydrological purposes;

(g) Guidance on approaches to water sharing/allocation;

(h) Guidance on the methods for and benefits of prediction of water availability and use.

Thematic Area 4: Hydrological Forecasting and Prediction

List of activities

(a) Continue to provide guidance on the further implementation of the flood forecasting initiatives, including the Flash Flood Guidance System (FFGS) with global coverage, the Coastal Flood Inundation Demonstration Project (CFIDP) and the Severe Weather Forecasting Demonstration Project (SWFDP);

(b) Review and, if required, update approaches to urban flood forecasting and early warning;

(c) Prepare a comprehensive report on large-scale flood inundation analysis and prediction models;

(d) Assist in the preparation of a Manual on Flood Risk Mapping (including vulnerability and hazard);
Assist in the promotion and application of the Manual on Low-flow Estimation and Prediction (WMO-No. 1029) and the Manual on Flood Forecasting and Warning (WMO-No.1072), and in related training;

Compile and provide guidance material on streamflow forecasting, including application of ensemble methods, using hydrological modelling linked to numerical weather prediction, radar rainfall nowcasting products and satellite-based estimates of precipitation;

Compile case studies and provide guidance on extended hydrological prediction for water resources management, including information on related climate drivers;

Promote and assist in the use of the distance-learning and advanced training module on flood forecasting and hydrological prediction;

Identify good practices and make recommendations for ways forward in drought prediction;

Collect examples of good practice in the dissemination of flood and drought information to the public, and compile and provide guidance on flood and low-flow warning signal approaches;

Identify good practices and make recommendations for ways forward in hydrological aspects of debris flow forecasting.

Expected outputs/outcomes – Contribution to Expected Results 3 and 7

(a) Availability of new techniques and better assimilation of available data into hydrological models to support improved flood forecasting capabilities;

(b) Assistance to, and guidance in, disaster mitigation and risk management in support of the role and responsibilities of NMHSs;

(c) Guidance and case studies on the application of extended hydrological prediction capabilities;

(d) Improved guidance on how to deal with floods and droughts at the national and regional levels, including information dissemination;

(e) Improved guidance in forecasting droughts at the regional, national and local levels;

(f) Increased cooperation and coordination with other relevant groups and agencies, which will increase the effectiveness of CHy activities.

Thematic Area 5: Water, Climate and Risk Management

List of activities

(a) Assist in the implementation of water-related initiatives within the Global Framework for Climate Services (see Resolution 1 (CHy-14) – Contribution of the Commission for Hydrology to the Global Framework for Climate Services), liaising as appropriate with the Joint CCI/CAgM/CHy Expert Group on Climate, Food and Water (JCEG-CFW), the Executive Council Working Group on Climate and related Weather, Water and Environmental Matters (EC-WG-CWE) and beyond WMO;

(b) Prepare guidance material on how to use regional climate modelling (i.e. long-term climate scenarios) in strategic hydrological management;

(c) Prepare a comprehensive report on downscaling approaches for hydrological applications and their associated uncertainties, including commenting on existing case studies;

(d) Prepare a state-of-the-art report/bibliography on hydrological analysis and modelling approaches in data-sparse conditions;

(e) Compile guidance material and detailed procedures on essential steps in the analysis of vulnerability to water-related impacts, especially in relation to adaptation to climate variability and change;

(f) Provide advice and guidance on the availability of climate data and climate model results for undertaking impact studies in support of adaptation to climate variability and change.
Expected outputs/outcomes – Contribution to Expected Result 3

(a) Improved information on both the water sector contribution to and requirements from the Global Framework on Climate Services;
(b) Guidance material on the use of regional climate modelling and thus improved strategic hydrological management;
(c) Increased knowledge and guidance on the approaches used in downscaling and the implications for hydrological modelling;
(d) Guidance material that will enable improved water resources management in vulnerable situations.

Cross-cutting issues

The following cross-cutting issues will be taken into account in the development of the Work Programme and in the implementation of the Programme activities:

(a) Methods for data-sparse areas

Methodologies that will be applicable in data-sparse area must be identified and included under many of the thematic areas, for example, water resources assessment, flood forecasting, seasonal flow forecasting, etc.

(b) World Hydrological Observing System (WHYCOS)

WHYCOS addresses cross-cutting topics as all of its projects cover activities related to data collection and transmission; development of information systems that provide specific services, products and knowledge on water resources assessment; hydrological forecasting; flood management and integrated water resources management. Activities under each of the thematic areas assist in general in the development of material in support of the WHYCOS projects. They form the main vehicle for both human and infrastructure capacity-development in NHSs.

(c) Capacity-building

Capacity-building is a key expected result of all activities in the CHy Work Programme, for this reason all activities would contribute to capacity-building initiatives across all thematic areas.

(d) Modelling

The requirement for modelling is implicit in all thematic areas. AWG members should consider the advantages and disadvantages of modelling approaches in their area of application. This should include not only consideration of what hydrological modelling can do for hydrologists directly, and for end-users, but also the value of feedback to atmospheric and other relevant types of modelling.

(e) Communication of uncertainty

Uncertainty is also a cross-cutting issue and AWG members should, where possible, take into consideration methods of determining and communicating uncertainty in their respective activities.

(f) Communication mechanisms

In all thematic areas, data reporting, sharing and dissemination in a timely manner is of great importance. In this regard, the use of appropriate information technology should be considered.

(g) Regional Associations

The activities of Regional Associations, and in particular the Regional Association Working Groups on Hydrology, or their equivalent, should be coordinated within the overall thematic area activities
and effective communication should be maintained between the thematic areas and the working groups, as appropriate.

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**Annex 2 to Resolution 7 (CHy-14)**

**STRUCTURE OF THE COMMISSION FOR HYDROLOGY AND TERMS OF REFERENCE OF THE ADVISORY WORKING GROUP MEMBERS**

The Advisory Working Group (AWG) will consist of the following:

1. President: Mr Harry Lins)
2. Vice-president: Mr Zhiyu Liu
3. Thematic Area 1: Mr Paul Pilon
4. Thematic Area 2: Mr Tony Boston
5. Thematic Area 3: 2 members, Mr Antonio Cardoso Neto and Mr Sung Kim
6. Thematic Area 4: 2 members, Mr Johnson Muturi Maina and Mr Yuri Simonov
7. Thematic Area 5: Mr Jan Danhelka
8. Chair of the Intergovernmental Council of the International Hydrological Programme of UNESCO (ex-officio member): Mr Johannes Cullman

**ORGANIGRAM**
The members of the AWG responsible for a particular thematic area would carry out their activities with support from the relevant Open Panel of CHy Experts (OPACHEs) established by the Commission at its thirteenth session. It is proposed that the OPACHE on Basic Systems support the activities of Thematic Areas 1 and 2, namely Quality Management Framework – Hydrology and Data Operations and Management. The OPACHEs for the other three thematic areas would remain unchanged. The Commission urged interested members to join the OPACHEs and support the Programme of Work.

**TERMS OF REFERENCE**

While developing the activities, it should be ensured that the cross-cutting issues, that is, methods for data-sparse areas, need and outreach of the World Hydrological Cycle Observing System (WHYCOS) and capacity-building requirements, modelling, communication of uncertainty, communication technology, and cooperation with Regional Associations will be taken into account.

**President of the Commission for Hydrology**

Terms of reference

(a) To undertake the duties required of a president of a WMO technical commission in accordance with WMO General Regulation 186;

(b) To chair meetings, as required, within the above duties including, for example, the CHy AWG and the WHYCOS International Advisory Group (WIAG);

(c) To represent CHy within WMO, in cooperation with other United Nations agencies, especially UNESCO, and at a range of other meetings, workshops and conferences;

(d) To coordinate the CHy activities for implementation of the GFCS, or to delegate an AWG member responsible for this coordination (Resolution 1 (CHy-14) – Contribution of the Commission to the Global Framework for Climate Services);

(e) To promote recognition and increase awareness of the role of WMO in international cooperation in the field of hydrology and water resources;

(f) To ensure that the activities of Regional Associations, and in particular the Regional Association Working Groups on Hydrology, are coordinated with the overall activities of the Commission and that effective communication is maintained between the Commission and the working groups;

(g) To ensure that joint activities with the other technical commissions (TCs) are coordinated to the satisfaction of CHy and that there is effective communication between the Commission and the other TCs;

(h) To monitor changes in the operation and management of National Meteorological and Hydrological Services (NMHSs), including product delivery and public awareness in the field of hydrology and water resources.

**Vice-president of the Commission for Hydrology**

Terms of reference

(a) To assist the president of the Commission in the light of his terms of reference, as and when requested;

(b) To assist the AWG in fulfilling its duties in relation to the Hydrological Operational Multipurpose System (HOMS), in agreement with the new approach described in paragraph 11.17 of the general summary;

(c) To coordinate the editing and production of publications prepared on behalf of CHy;

(d) To identify and lead actions with regard to the education and training requirements of Commission activities under the adopted Strategy on Education and Training in Hydrology and Water Resources and the Quality Management Framework–Hydrology;

(e) To monitor and report on the updating of the Hydrological Information Referral Service (INFOHYDRO);
(f) To promote data rescue and protection activities in NMHSs;
(g) To support the development and promotion of guidance material on the estimation of the economic benefits of NMHSs.

Member leading activities associated with Thematic Area 1:

Quality Management Framework – Hydrology (QMF–H)

Terms of reference

(a) To lead, monitor, report and provide advice on the activities of Thematic Area 1, as indicated in the Work Programme (Annex 1 to Resolution 7 (CHy-14) – Work programme and structure of the Commission for Hydrology);
(b) To liaise, as necessary, with relevant bodies of WMO, such as the Commission for Aeronautical Meteorology and groups working on WMO and related quality management frameworks and systems, the International Organization for Standardization (ISO) and other United Nations agencies, with regard to quality management;
(c) To develop and implement capacity-building initiatives based on the activities undertaken within Thematic Area 1;
(d) To report on activities at each AWG meeting and as requested by the president of CHy.

Note: While developing the activities, it should be ensured that cross-cutting issues are taken into account.

Member leading activities associated with Thematic Area 2:

Data Operations and Management

Terms of reference

(a) To lead, monitor, report and provide advice on the activities of Thematic Area 2, as indicated in the Work Programme (Annex 1 to Resolution 7 (CHy-14));
(b) To provide a focal point and liaise, as necessary, with relevant areas of WMO such as WHYCOS, the WMO Integrated Global Observing System (WIGOS) and the WMO Information System (WIS); the Open Geospatial Consortium (OGC) and the Global Terrestrial Network – Hydrology (GTN-H);
(c) To represent the Commission for Hydrology on the WIAG and the Steering Committee of the Global Runoff Data Centre (GRDC);
(d) To assist in the activities of the Global Precipitation Climatology Centre (GPCC), the International Data Centre on the Hydrology of Lakes and Reservoirs (HYDROLARE) and the International Groundwater Resources Assessment Centre (IGRAC);
(e) To develop and implement capacity-building initiatives based on the activities undertaken within Thematic Area 2;
(f) To report on activities at each AWG meeting and as requested by the president of CHy.

Note: While developing the activities, it should be ensured that cross-cutting issues are taken into account.

Members (2) leading activities associated with Thematic Area 3:

Water Resources Assessment (the terms of references will be distributed between the 2 members at the first AWG meeting)
Terms of reference

(a) To lead, monitor, report and provide advice on the activities of Thematic Area 3, as indicated in the Work Programme (Annex 1 to Resolution 7 (CHy-14));

(b) To liaise, as necessary, with relevant areas of WMO, United Nations agencies such as the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Food and Agriculture Organization (FAO) and the United Nations Environment Programme (UNEP), and other relevant groups with regard to water resources assessment activities;

(c) To be the focal point for the Commission's involvement in Integrated Drought Management;

(d) To develop and implement capacity-building initiatives based on the activities undertaken within Thematic Area 3;

(e) To report on activities at each AWG meeting and as requested by the president of CHy.

Note: While developing the activities, it should be ensured that cross-cutting issues are taken into account.

Members (2) leading activities associated with Thematic Area 4:

Hydrological Forecasting and Prediction (the terms of reference will be distributed between the 2 members at the first AWG meeting)

Terms of reference

(a) To co-lead, monitor, report and provide advice on the activities of Thematic Area 4, as indicated in the Work Programme (Annex 1 to Resolution 7 (CHy-14));

(b) To liaise, as necessary, with relevant structures of WMO, in particular the Disaster Risk Reduction Programme, the Commission for Atmospheric Sciences and the Commission for Basic Systems with regard to the WMO Flood Forecasting Initiative, and with other programmes and organizations such as the UNESCO Institute for Water Education (UNESCO-IHE), the International Flood Initiative (IFI), and the International Centre for Water Hazard and Risk Management (ICHARM) with regard to hydrological forecasting and prediction and disaster risk reduction activities;

(c) To represent CHy on the Advisory Group for the WMO Flood Forecasting Initiative;

(d) To develop and implement capacity-building initiatives based on the activities undertaken within Thematic Area 4;

(e) To report on activities at each AWG meeting and as requested by the president of CHy.

Note: While developing the activities, it should be ensured that cross-cutting issues are taken into account.

Member leading activities associated with Thematic Area 5:

Water, Climate and Risk Management

Terms of reference

(a) To lead, monitor, report and provide advice on the activities of Thematic Area 5, as indicated in the Work Programme (Annex 1 to Resolution 7 (CHy-14));

(b) To liaise, as necessary, with relevant structures of WMO, for example, the Global Framework for Climate Services (GFCS) and the Commission for Climatology (CCl), and with other organizations and programmes such as the UNESCO International Hydrological Programme (IHP), UNEP, the International Association for Hydro-Environment Engineering and Research (IAHR) and the International Association of Hydrological Sciences (IAHS) with regard to climate and water activities;
(c) To represent CHy, as determined by the president of CHy, in groups concerned with water, climate and risk management such as GFCS-related and inter-commission groups;
(d) To develop and implement capacity-building initiatives based on the activities undertaken within Thematic Area 5;
(e) To report on activities at each AWG meeting and as requested by the president of CHy.

Note: While developing the activities, it should be ensured that cross-cutting issues are taken into account.

Resolution 8 (CHy-14)

REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION FOR HYDROLOGY

THE COMMISSION FOR HYDROLOGY,

Considering:

(1) That the resolutions adopted prior to its thirteenth session are no longer in force,
(2) That Resolution 7 (CHy-XIII) – Work programme and structure of the Commission for Hydrology, and Resolution 8 (CHy-XIII) – Review of previous resolutions and recommendations of the Commission for Hydrology are now obsolete;

Noting the action taken on the recommendations adopted prior to its fourteenth session;

Decides:

(1) To keep in force Resolution 1 (CHy-XIII) – WMO Quality Management Framework – Hydrology, with the changes to the Annexes adopted by the fourteenth session of the Commission, Resolution 3 (CHy-XIII) — Hydrological forecasting and flood management, and Resolution 6 (CHy-XIII) – WMO Integrated Global Observing Systems and WMO Information System, and not to keep in force any of the other resolutions of its prior sessions;
(2) To note with satisfaction the action taken by the competent bodies on the recommendations of its prior sessions, and to keep in force Recommendation 2 (CHy-IX) – Support to global data centres, Recommendations 1 (CHy-X) – Hydrological networks and 2 (CHy-X) – Participation of women in the work of the Commission (except the text under REQUESTS of Recommendation 2), all other recommendations now being redundant.

Note: This resolution replaces Resolution 8 (CHy-XIII), which is no longer in force.