



WORLD METEOROLOGICAL ORGANIZATION

**First Meeting of the CHy Task Team
on the**

**WMO Global Hydrological Status
and Outlook System
(HydroSOS)**

**Entebbe, Uganda
29 September 2017**

**FINAL REPORT
October 2017**

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1. OPENING OF MEETING AND ADOPTION OF THE AGENDA

1.1 The meeting was attended by 13 participants. The list of participants is given in **Annex 1** to this report. Mr Alan Jenkins chaired the meeting.

1.2 The Task Team discussed the draft agenda and made some minor revisions. The final agenda was adopted (**Annex 2**).

2. OVERVIEW OF OUTCOMES ON THE INITIAL PLANNING MEETING

2.1 Mr Jenkins provided a brief summary of the outcomes of the Initial Planning Meeting, indicating that in his view, as well as from comments he had received, the meeting had been very successful. He expressed that, in his perception, the outcomes were very clear from the meeting on what could be achieved and what we are not aiming to achieve. He summarized that one possible view of the pilot phase could be described as focusing on: 1) status (or nowcasts) of current conditions for the globe; and 2) 10-30 day outlooks. He noted that there might be concern with undertaking activities in the 0-10 day horizon, as this could be viewed as being flood forecasts, which might be a cause of concern from national services who were already performing that function. He then requested participants to discuss what could be the focus of the pilot phase.

2.2 Some participants indicated that having the system covering the 0-10 day horizon would be very helpful for improved water resources management, as many countries lack such information and products. In doing so, care would be needed not to duplicate efforts being undertaken on short and medium term forecasting by those Members performing this service and in ensuring that the system was consistent with their desires (e.g., 0-10 day outlooks should not conflict with national products and warnings). As well, some participants noted that it would be most helpful if the horizon would also be extended beyond 30 days to 3 months, as this, for example, was cited as being needed for the Lake Victoria pilot, while also being of benefit to other regions of the world. To underline this, some participants stressed that the system and its products should be designed to assist water resources management including operation of reservoirs. Some reflected that the needs of this major user group should help inform the system requirements.

2.3 It was concluded that outlooks spanning the 0 to 3 month range would be most desirable and that in the pilot phase of the initiative, attention be placed on how this can be achieved and the practicalities in so doing. An example was cited that it would not be possible at this juncture to run global models at high spatial resolution at hourly time steps or finer temporal resolutions. However, if systems are doing this, say for the pilot areas at the river basin scale, this could be incorporated into the outlooks.

2.4 It was noted that there had been a teleconference the preceding evening with representatives of CBS to provide them with an overview of the outcomes of the HydroSOS Initial Planning Meeting, held in Entebbe from 26-28 September 2017, just prior to the Task

Team meeting. CBS representatives indicated that they very much wanted to collaborate with CHy on the initiative and had requested the CHy Task Team to provide a list of variables and scales that would likely be needed. The Task Team thought this was an excellent opportunity to elaborate the requirements that would satisfy hydrological requirements as discussed above and during the preceding meeting on what was being termed within the WMO community as a seamless system for the status and outlook to seasonal timeframe. The importance of the need to push the envelope on requirements by the hydrological and water resources management communities was noted.

2.5 There was enthusiasm for the project in general and its pilots. It was mentioned that there may be interest in exploring an additional pilot basin application in Region IV, specifically in a transboundary basin shared by three countries in Central America, during the initial pilot phase of the HydroSOS. It was indicated that this possibility would be discussed during the next meeting of the Regional Association (RA) IV Working Group on Hydrology. It was also felt that an additional transboundary basin pilot would be looked upon positively as it would help reinforce linkages between CHy and the RA Working Groups on Hydrology.

2.6 When considering the 0-10 day horizon of the HydroSOS, it was mentioned that there needed to be close collaboration with other hydrological forecasting initiatives. It was mentioned that this could be achieved through the WMO Flood Forecasting Initiative – Advisory Group, which is next meeting in Geneva 5-7 December 2017. It was stressed that although this group is chaired by the President of CHy, the HydroSOS initiative would need to be on the next agenda, so that other Commissions and initiatives would be made aware of its current plans and requirements.

2.7 Participants shared the view that the HydroSOS initiative will aim to make use and further build upon the products and services available from the NHMSs, and that the system development work will be designed for use by the NHMS for operations and service delivery. This was considered important for adoption and success of the initiative, given the NHMSs' responsibilities as the sole authoritative voice for hydrological data.

3. ESTABLISHING THE WORK PLAN FOR HydroSOS

3.1 There was a brief discussion on the HydroSOS draft pilot phase work plan structure. The draft structure was revised during the meeting, and it appears as **Annex 3**. It was noted that this structure should be considered a living document, as it is anticipated that it will periodically be revised and updated, with the latest versions being available on the HydroSOS website. It was also stressed that the draft structure would be revised to reflect a number of points raised and that some work plans should consider:

- the Task Team is responsible for managing the initiative and its overall role in coordinating all Work Packages should be captured in the structure diagram. Under Work Package 1, CEH along with CHy's Secretariat will act as the project office and help in the coordination of meetings, project communications, and project documentation and reporting;
- recognition of the need to seek funding to support the initiative;
- the need to include a new work package on training and capacity building;
- the three pilots, namely global, South Asia and Lake Victoria, will have commonalities that need to be scoped out for benchmarking the performance of

status and outlook products from river basin scale and national/global scale model formulations, and to ensure similar approaches are being employed throughout. The definition of such methods/protocols will largely take place under Work Packages 3a/b/c/d;

- the methods work packages will need to reflect needs of pilots for data, NWP and climate products to drive the river basin and global scales hydrological modelling efforts, which was referred to “as ensuring appropriate product flow to the pilots”; tools will need to be developed within Work Package 3d for such data streams to be made available for river basin scale and global scale implementations.
- under Work Package 2, communications with the UN High-Level Expert Panel on Water and Disaster/UNSGAB might be pursued as an external linkage and was viewed as a possible source of funding;
- there is a strong linkage between Work Packages 2 and 3, especially those relating to the use of NWP, sub-seasonal and seasonal outlooks available through NHMS’ in different regions;
- under Work Package 2, there is the need to engage NMHSs, with one route being through the regions (i.e., RA Working Groups on Hydrology);
- with respect to Work Package 3a, the Vice-president of CHy, Mr Silvano Pecora should be engaged early in these efforts given the role of WHOS in “Data Sources and Exchange Methods” and that pragmatic solutions would need to be used in addition to WIGOS/WHOS;
- leads of Work Packages 2 and 4 need to work closely together;
- need to work out data flows and add forecast product flows from centres for pilots;
- the Lake Victoria Pilot discussions indicated the need to have lake level outlooks;
- making best use the GDPFS and “super users” (e.g., global and regional forecast centres) in providing model outputs;
- need to include reservoir management routines, if possible, when undertaking hydrological modelling and to ensure the products meet such operational needs; it was noted that access to such information can be challenging for the global system and river basin scale application;
- remove item 1c in Work Package 3b;
- Work Package 3c item 4c should read “Implementing climate (global pilot) and hydrological (South Asia and Lake Victoria pilots) forecast verification methods;
- Work Package 3d should be given early attention to avoid higher costs if considered later in pilot phase implementation, and consideration should be given to the use of the Meteorological, Climatological and Hydrological (MCH) database management system, which is available free-of-charge through WMO to its Members; and
- Work Package 3d should make efforts to link to existing data centres, as appropriate, would need to reflect different system architectures and capabilities in different regions, and should reflect needs of all pilots.

Specifically regarding the new Work Package on Training and Capacity Building, it was noted:

- guidelines and technical documentation should be sufficient to allow other pilots to grow, with specific attention to be given on how to obtain climate predictions and their use in hydrological modelling including post processing and verification procedures;
- make maximum advantage of the internet, but be cognisant of weaknesses for various Members, particularly for delivery of products;

- the need for materials on how national services should interpret products, and how they can make value-added linkages with the water resources management sector;
- the possible need for materials to allow water resources management community to take best advantage of the new products and national services being provided through HydroSOS; and
- making use of e-learning technologies, possibly looking to COMET as an example of how it might be achieved.

4. TERMS OF REFERENCE FOR THE CHy TASK TEAM

4.1 The Terms of Reference (ToR) were reviewed and minor modifications were made to them. The ToR appear in **Annex 4**. These will be shared by the Chair of the Task Team with the President of the Commission for Hydrology to seek his approval.

4.2 It was noted that the proposed Terms of Reference has the Work Package leads being members of the Task Team, as their close involvement in the work of the Task Team is needed for success. Participants were requested to provide the names of potential experts who could fulfil this role to the Chair of the Task Team, Mr Alan Jenkins, copying the Secretariat.

4.3 It was emphasized that the mandate of the Task Team expires with CHy-17, and that there were only approximately 3.5 years remaining for the Task Team to deliver on its work plans.

5. REPORT OF MEETING AND NEXT MEETING

5.1 Mr Pilon indicated that the WMO Secretariat Staff would prepare a draft of the meeting report over the next few weeks and would share it with Mr Harry Dixon, as lead developer of the work package structure, so that the revised document on the Work Package Structure could be incorporated into the report as **Annex 3** and to ensure, in particular, accuracy of the report on those matters.

5.2 The next face-to-face meeting of the Task Team is planned for late February to early March of 2018 to help develop more detailed work plans and to coordinate activities. It is anticipated that Work Package leads will be appointed by end of this October, allowing ample time for them to become familiar with the initiative prior to the meeting. As well, once appointments have been made, the meeting location will be determined.

**CHy TASK TEAM ON THE WMO GLOBAL HYDROLOGICAL STATUS AND OUTLOOK
SYSTEM (HydroSOS)
(Entebbe, Uganda, 29 September 2017)**

LIST OF PARTICIPANTS

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WMO Global Hydrological Status and Outlook System (HydroSOS)

Meeting of the CHy Task Team on HydroSOS

AGENDA

*29 September 2017
Laico Hotel, Entebbe, Uganda*

Friday 29 September

- 09:00 Overview of the outcomes of the HydroSOS Initial Planning Meeting [Alan Jenkins]
- 10:00 Establishing the Work Plan for HydroSOS [Harry Dixon]
The Group will agree on each WP action, deliverable and responsible individuals.
- 11:00 Break
- 11:10 Establishing the Work Plan for HydroSOS (continued)
- 12:30 Discussion on the Terms of Reference for the CHy Task Team [Alan Jenkins]
The Group will agree on the ToR for the CHy Task Team to be reviewed and approved by the Advisory Working Group.
- 12:50 Report of the HydroSOS-CHy Task Group Meeting [Paul Pilon]
- 12:55 Next Meeting of the HydroSOS-CHy Task Group [Paul Pilon]
- 13:00 Final remarks and way forward into 2018 Global Conference on Prosperity through Hydrological Services in May 2018 [Alan Jenkins]
- 13:15 Closure [Alan Jenkins]
- 14:00 Lunch

WMO GLOBAL HYDROLOGICAL STATUS AND OUTLOOK SYSTEM (HydroSOS)

PILOT PHASE WORK PACKAGE STRUCTURE

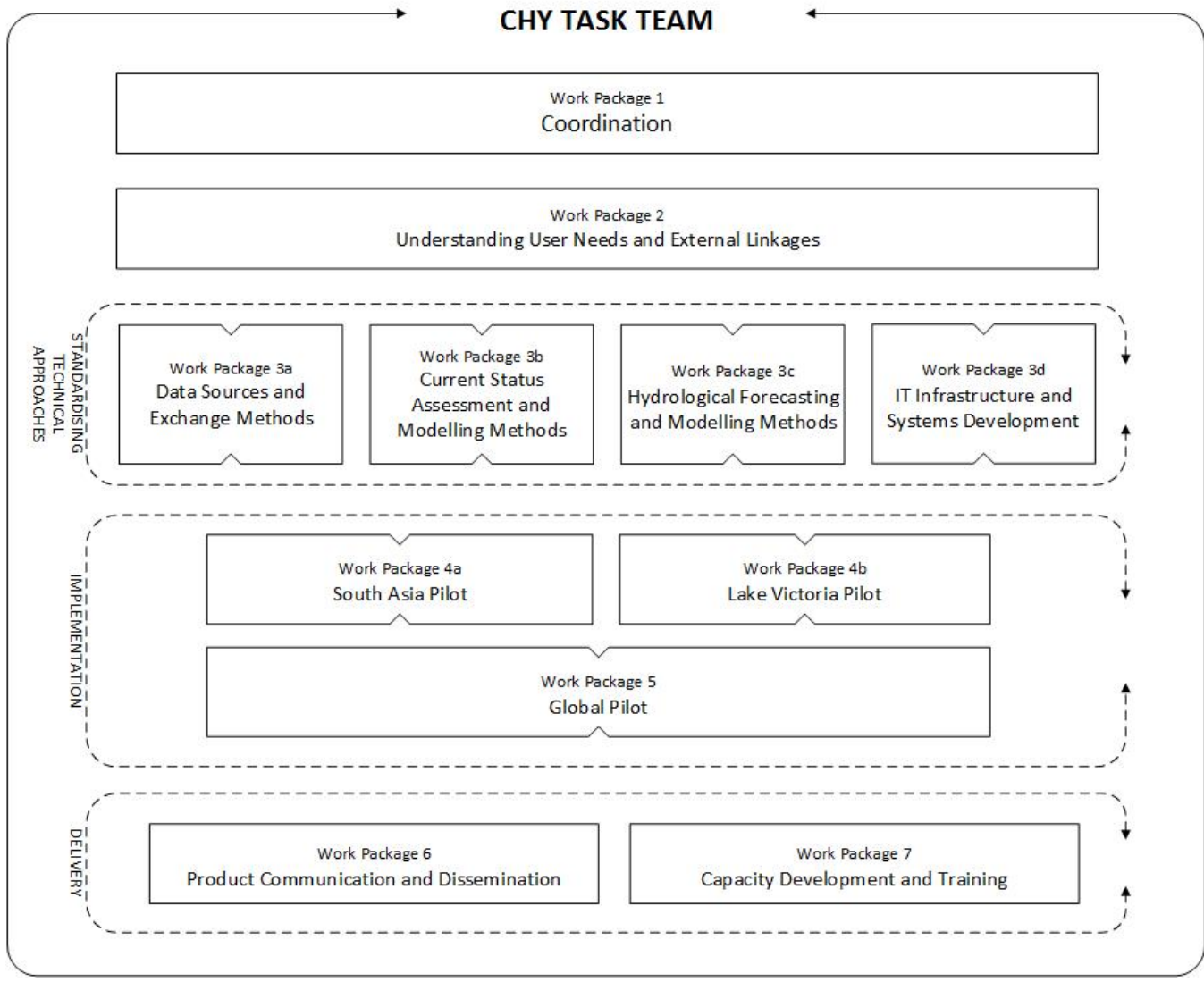
This document outlines the programme structure which will be used to deliver the WMO HydroSOS initiative's pilot phase. It will be updated and further developed by the Task Team as planning of the initiative is taken forward and as such should be seen as a 'living' document.

Governance

The HydroSOS is delivered on behalf CHy by a Task Team comprising of the initiative's Work Package Leaders and CHy Advisory Working Group Members. The Task Team have the responsibility of overseeing the successful implementation of all aspects of the Pilot Phase. The Task Team's Chair (Alan Jenkins) is appointed by the President of CHy to oversee and coordinate the group's work in line with a defined set of Terms of Reference.

Overall Structure

The HydroSOS Pilot Phase will be structured around a series of discrete but interlinked Work Packages which will develop the framework, methods and infrastructure required for the system and also implement a number of pilots both regionally and globally. The interactions between these work packages are not shown on the below diagram but it is anticipated that there will be very close links maintained between the different part of the initiative – particularly between those Work Package which are standardising technical approaches and those which are implementing the pilot projects.



Work Package Details

The tables on in the remainder of this document outline the key activities and deliverables expected in each Work Package. The exact programme of activities will be defined by the Work Package Leaders once appointed.

Work Package 1	Coordination
Activities	<ol style="list-style-type: none"> 1. Facilitate the work of the Task Team (including organising meetings, taking minutes); 2. Arranging Work Package meetings; 3. Internal project communication; 4. Setting project documentation and reporting frameworks; 5. Development of a resourcing and funding strategy for the initiative; 6. Overseeing development of the post 2019 implementation plan; 7. Coordinating the Pilot Phase report; 8. Provision of regular reports on the initiative's progress to the CHY President, Advisory Working Group and other WMO bodies as required; 9. Coordinating global awareness raising efforts, including involvement in the May 2018 WMO Water Conference.
Deliverables (with timescales)	<ol style="list-style-type: none"> 1. 2. 3. Project website and communications portal; 4. 5. 6. Post 2019 implementation plan; 7. Final report on Pilot Phase; 8. 9.
Skills Required	Programme governance, Project management, communications
Lead	Task Team Chair - Alan Jenkins (CEH) Work Package Leader - Tanya Warnars (CEH)
Possible Contributors	WMO Secretariat – Paul Pilon, Dominique Berod, L Roberto Silva Vara Relevant AWG Members - Narendra Kumar Tuteja (Australia), Tom Kanyike (Uganda), Harry Dixon (UK)
Possible Funding Source	UK NERC International Opportunities Fund

Work Package 2	Understanding User Needs and External Linkages
Activities	<ol style="list-style-type: none"> 1. Undertake mapping of other similar initiatives which HydroSOS might interface with; 2. Undertake stakeholder needs assessment; 3. Work with other Work Packages to establish key linkages with other areas of WMO activity, including: <ol style="list-style-type: none"> a. engagement with key stakeholders such as NMHSs who aren't currently involved in the initiative and Regional Association Working Groups on Hydrology; b. exploring interactions with WMO initiatives such as the Severe Weather Forecast Demonstration Projects in Africa and South Asia; GFCS, WIGOS, GDPFS; 4. Engagement with external stakeholders including: <ol style="list-style-type: none"> a. Potential future users of the Status and Outlook System b. Related scientific initiatives and hydrological testbeds currently under development.
Deliverables (with timescales)	<ol style="list-style-type: none"> 1. Initiative mapping 2. Stakeholder workshops (including at least one each in Africa and South Asia pilot regions) and stakeholder service requirement specification (short report) 3. Communications across the WMO Community 4. External stakeholder meetings in Years 2 and 3 5. User engagement plan and engagement material
Skills Required	<p>Knowledge of the key user communities.</p> <p>Knowledge of the WMO system and NMHS requirements.</p> <p>It is particularly important that those working on this Work Package interact closely with other aspects of the initiative.</p>
Lead	
Possible Contributors	<p>It is important that those contributing to this work package include nominees from the Lake Victoria and South Asia pilot work packages and NMHS representatives.</p>
Possible Funding Source	

Work Package 3a Data Sources and Exchange Methods	
Activities	<ol style="list-style-type: none"> 1. Identify suitable data sources based upon specs from Work Packages 3b, 3c, 4 and 5. Including: <ol style="list-style-type: none"> a. Meteorology data – observations, forecasts and hindcasts (retrospective forecasts); identify suitable meteorology data sources as listed in WMO SHP Guidelines. Links with regional WIGOS and GDPFS nodes. b. Hydrology data – observations and hindcasts (inc. Links with WHYCOS, WHOS, etc..) c. Geo-spatial data – location specific datasets for the demonstration project 2. Define data format standards (preferably netcdf and/or HDF5 compliant; link with WHOS WaterML2 formats for hydrology data) – linking with WP3d. 3. Define data QA/QC protocols – linking with WP3d. 4. Help Work Packages 4 and 5 in sourcing and processing datasets for Pilots – including helping to specific short-term interim data sharing solutions where longer-term WIGOS approaches cannot be immediately implemented.
Deliverables (with timescales)	<ol style="list-style-type: none"> 1. Reliable and routine data streams established 2. Data format protocols 3. QC/QC protocols 4.
Skills Required	Input from CBS on meteorological data. WHOS expertise.
Lead	
Possible Contributors	
Possible Funding Source	

Work Package 3b	Current Status Assessment and Modelling Methods
Activities	<ol style="list-style-type: none"> 1. Develop a specification for data requirements & methods to be used in the assessment of current hydrological status (surface water flows and storages, soil moisture & groundwater) at global, regional and basin scales, including defining common indicators to be used. 2. Assist Work Packages 4 and 5 in the development of status assessment products for the pilots and define how global and national/regional information will be linked. 3. Work with Work Packages 3a and 3d to develop required workflows
Deliverables (with timescales)	<ol style="list-style-type: none"> 1. Data requirements specification 2. Report on status assessment methods to be implemented
Skills Required	
Lead	
Possible Contributors	
Possible Funding Source	

Work Package 3c

Hydrological Forecasting and Modelling Methods

<p>Activities</p>	<ol style="list-style-type: none"> 1. Specifications for data requirements & fit for purpose methods for sub-seasonal to seasonal forecasting based upon user needs and EHP Guidelines (WMO guidelines under review). 2. Model calibration and data assimilation: using observation hydrological and meteorological datasets 3. Forecast verification and cross-validation, including linking global and regional forecasts. 4. Assist Work Packages 4 and 5 in: <ol style="list-style-type: none"> a. Downscaling and post process of climate forecasts b. Hydrological modelling and post process of water availability forecasts c. Implementing climate (as necessary) and hydrological forecast verification methods for all pilots 5. Work with Work Package 3a & 3d to develop required forecasting workflows.
<p>Deliverables (with timescales)</p>	<ol style="list-style-type: none"> 1. Data requirements specification 2. Report on forecasting and modelling methods to be implemented
<p>Skills Required</p>	
<p>Lead</p>	
<p>Possible Contributors</p>	
<p>Possible Funding Source</p>	

Work Package 3d

IT Infrastructure and Systems Development

<p>Activities</p>	<ol style="list-style-type: none"> 1. Develop a data storage & retrieval systems, including Data storage and size requirements, specifications for the technology stack (e.g. open source and platform independence compliance) 2. Develop wrappers and workflows for modelling methods and tools for: <ol style="list-style-type: none"> a. hydrological status assessments (with Work Package 3b) b. hydrological forecasts (with Work Package 3c) 3. Develop prototype system tools and workflows for model implementation e.g. calibration and data assimilation, verification and forecasting 4. Work with Work Packages 4 and 5 to develop and install End-to-end prototype assessment and forecast system in Pilots – including engaging with those NMHSs who are involved to assess current and potential systems. 5. Work with work package 6 to help specify a web portal for the dissemination of all products. 6. System documentation: for post 2019 operationalisation phase i.e. TROPS – Transitioning Research to OPerationS.
<p>Deliverables (with timescales)</p>	<ol style="list-style-type: none"> 1. Design and development of operationally ready forecast system
<p>Skills Required</p>	
<p>Lead</p>	
<p>Possible Contributors</p>	<p>Knowledge of existing WMO systems will be required.</p>
<p>Possible Funding Source</p>	

Work Package 4 a & b Regional Pilots

<p>Activities</p>	<ol style="list-style-type: none"> 1. Coordinate Pilot project implementation with Work Package 1 2. Produce a Concept Note and outline Work Programme for the Pilot 3. Maintain links with relevant Regional Association Working Groups on Hydrology and NMHSs. 4. Develop functional and non-functional specifications for Pilot implementation 5. Work with Work Package 3a to establish local data streams for the initiative 6. Implementation of status assessment and forecasting techniques and procedures from Work Packages 3b and 3c in regional pilot areas 7. Work with Work Package 3d to develop the IT infrastructure and systems needed for delivering the pilot, including: <ol style="list-style-type: none"> a. Provide input to website wireframes b. Infrastructure support for system installation 8. Publish case study and support adoption
<p>Deliverables (with timescales)</p>	
<p>Skills Required</p>	
<p>Lead</p>	
<p>Possible Contributors</p>	
<p>Possible Funding Source</p>	

Work Package 5 Global Pilot	
Activities	<ol style="list-style-type: none"> 1. Coordinate Pilot project implementation with Work Package 1 2. Develop functional and non-functional specifications for global pilot implementation – bringing together outputs from regional pilots, pre-existing status assessments/outlooks and global scale modelling products. 3. Work with Work Package 3a to establish global data streams for the initiative including regional pilots 4. Implementation of status assessment and forecasting techniques and procedures from Work Packages 3b and 3c in global pilot 5. Work with Work Package 3d to develop the IT infrastructure and systems needed for deliver the pilot, including: <ol style="list-style-type: none"> a. Provide input to website wireframes b. Infrastructure support for system installation 6. Publish case study and support adoption
Deliverables (with timescales)	
Skills Required	
Lead	
Possible Contributors	
Possible Funding Source	

Work Package 6**Product Communication and Dissemination**

Activities	<ol style="list-style-type: none">1. Work with Work Package 2 to specify the product requirements for each user group.2. Work with other Work Packages to develop the 'look and feel' of the products.3. Establish and maintain a central WMO website / product dissemination portal for the initiative – in collaboration with Work Package 3d.4. Explore other methods of communicating HydroSOS products to end-users (such as via mobile phone and print media).
Deliverables (with timescales)	<ol style="list-style-type: none">1. HydroSOS website / portal
Skills Required	Input from communications experts will be needed here.
Lead	
Possible Contributors	
Possible Funding Source	

Work Package 7**Capacity Development and Training**

Activities	<ol style="list-style-type: none">1. Develop protocols for HydroSOS training material and user guidance document.2. Assess existing capacity development platforms to establish which could be useful for HydroSOS.3. Work with other Work Packages to develop training material for NMHSs and end-users.4. Establish a capacity development training strategy for HydroSOS's implementation phase post 2020.
Deliverables (with timescales)	<ol style="list-style-type: none">1. Training material protocols2. Training material for NMHSs and users.3. Capacity Development Strategy
Skills Required	
Lead	
Possible Contributors	
Possible Funding Source	

CHy TASK TEAM
on the
WMO GLOBAL HYDROLOGICAL STATUS AND OUTLOOK SYSTEM
TERMS OF REFERENCE

1. Mandate/Purpose

The Task Team will manage the design, implementation and reporting on the pilot phase of the WMO Global Hydrological Status and Outlook System over the 2016-2020 intersessional period. This will be accomplished through the following Tasks:

- (1) Undertake technical scoping of the initiative including the data required and the status assessment, sub-seasonal and seasonal modelling approaches to be used in the initiative (based on the existing WMO Seasonal Hydrological Prediction material).
- (2) Establish reliable and routine data streams for observation monitoring, hindcast and forecast information.
- (3) Design and develop an operationally ready seamless water status and forecasting system.
- (4) Develop at least two demonstration pilot projects in internationally important water management basins around the world.
- (5) To establish the necessary links between this initiative and other related activities, including WMO activities such as GFCS, WIGOS and GDPFS and external scientific initiatives.
- (6) Develop an implementation plan for the System beyond 2020 and present this, and a report on the pilot phase, to the Sixteenth Session of the Commission for Hydrology (CHy).
- (7) Develop a capacity development plan for the initiative to help NMHSs and stakeholders contribute to and benefit from the System.

The Task Team will be supported by the WMO Secretariat and will report at least annually on progress to the CHy Advisory Working Group.

2. Membership

- (1) Chairperson nominated by the CHy Advisory Working Group – *Alan Jenkins*;
- (2) One or more expert from the CHy Advisory Working Group with relevant responsibilities – *Harry Dixon, Tom Kanyike and Narendra Tuteja*;
- (3) Each of the Work Package Leaders

Additional experts, including the President of CHy or other CHy Advisory Working Group members, may be invited to join the Task Team whenever this is deemed necessary to delivery its duties.

Observers such as financial partners and WMO regional hydrological advisors may be invited.

The term of membership coincides with the intersessional period of CHy.

3. Other provisions

The Task Team will periodically review its Terms of Reference. Any changes being recommended by the Task Team require the approval of the President of the Commission for Hydrology, who will take advice from the Task Team Chair and the Advisory Working Group members including those responsible for monitoring the initiative.

The Task Team shall meet at least three times a year, mainly by videoconferences, and with at least two face-to-face meeting during the intersessional period.

The Task Team will determine its own working practices including communication methods, and it will produce minutes/action points.

The Task Team will provide regular updates to the President of the Commission for Hydrology and the Advisory Working Group on the progress of the initiative.
