FLOOD & DROUGHT MANAGEMENT TOOLS

Awareness workshop: Understanding the value of a DSS

Report

30 September 2015

Accra, Ghana

Table of Contents

1. Executive summary

There is a growing sense of urgency around the need to improve resilience within river basins, and for this to become a critical part of water management plans. The increased frequency and unpredictability of floods and droughts is a priority concern across scales from transboundary to local, along with the other multiple drivers that cause depletion and degradation of shared water resources.

The Flood and Drought Management Tools (FDMT) project (http://fdmt.iwlearn.org/) is financed by the Global Environment Facility (GEF) International Waters (IW) and implemented by UNEP, with the International Water Association (IWA) and DHI as executing agencies. The project is developing a computer software-based decision support system (DSS) with tools to support planning from the transboundary basin to water utility level by including better information on floods and droughts. The project is being implemented from 2014 - 2018, and 3 pilot basins (Volta, Lake Victoria and Chao Phraya) have been identified for development and testing of the DSS.

Understanding how to use and apply the information developed through the DSS is seen as a vital aspect of the future operational use and sustainability of the FDMT project. Therefore capacity development with key stakeholders (e.g. basin organisation and utilities) focusing on what the information from the DSS means and how to apply across different scales is an important step; a step in the right direction to ensure the future use of the developed methodology.

As the DSS is developed, the project will hold a series of awareness workshops for commissioners, senior advisors, policy makers and decision makers, across scales, to:

- Provide an overview of the relevance of the DSS for providing scientifically sound information for managing floods and drought
- Explain the meaning and relevance of the DSS outputs
- Develop an understanding of how to use and apply the information in decision making
- Develop and implement follow up mechanisms to continue to engage the target group

As part of the WSP Africa Network Meeting from September 29th to October 2nd, 2015 in Accra, Ghana, the FDMT project organised a 1 day awareness workshop on September 30th, 2015 to enhance the levels of understanding around the capabilities and potential uses of the FDMT DSS in facilitating the inclusion of information about floods, droughts and future scenarios into planning across scales.

…

Il existe un sentiment d'urgence croissant concernant la nécessité d'améliorer la résilience dans les bassins fluviaux, et d'en faire un élément essentiel des plans de gestion de l'eau. L'augmentation de la fréquence et l'imprévisibilité des inondations et des sécheresses est une préoccupation prioritaire à l'échelle transfrontalière autant qu'au niveau local, ainsi que d'autres facteurs causant l'appauvrissement et la dégradation des ressources en eaux partagées.

Le projet 'Outils de gestion des inondations et des sécheresses' (FDMT) (http://fdmt.iwlearn.org/) est financé par le Global Environment Facility (GEF) International Waters (IW) et mis en œuvre par le PNUE (UNEP), en collaboration avec l'International Water Association (IWA) et lDHI, en tant qu'agences d'exécution. Le projet vise à développer un système informatique (DSS) pour les bassins et les services publics, en faisant usage d'outils dans un système de soutien décisionnel qui permettra l'intégration des informations sur les inondations et les sécheresses lors de la planification. Le projet est mis en œuvre de 2014 à 2018, et trois bassins pilotes (Volta, Lac Victoria et Chao Phraya) ont été identifiés pour le développement et les essais du DSS.

Bien comprendre l'utilisation et l'application des informations développées à travers le DSS est considéré comme un aspect essentiel de l'utilisation future et de la viabilité des Outils de gestion des inondations et des sécheresses. Par conséquent, l'étape du développement des capacités en collaboration avec les principaux intervenants, avec une attention particulière sur la signification des

informations provenant du DSS et leur application à différentes échelles, est primordiale; une étape dans la bonne direction pour assurer l'utilisation de la méthodologie développée à l'avenir.

Lors du développement du DSS, le projet organisera une série d'ateliers de sensibilisation à l'intention des dirigeants, des hauts conseillers, des décideurs etc., afin de:

- Présenter la pertinence du DSS pour la fourniture des informations scientifiquement fiables pour la gestion des inondations et des sécheresses; et
- Expliquer la signification et la pertinence des informations du DSS
- Développer une compréhension de l'utilisation et de l'application des informations lors des prises de décisions
- Développer et mettre en œuvre des mécanismes de suivi pour continuer à engager le groupe cible

Dans le cadre de la réunion du Réseau WSP Afrique du 29 Septembre au 2ème Octobre 2015 à Accra, Ghana, le projet FDMT a organisé un atelier de sensibilisation le 30 Septembre, 2015 pour améliorer le niveau de compréhension des parties prenantes (en particulier des dirigeants, des hauts conseillers, des décideurs etc.) des capacités et utilisations potentielles du DSS/FMDT afin de faciliter l'intégration des informations sur les inondations, les sécheresses et les scénarios futurs dans la planification aux différents niveaux niveaux.

2. Project background

The Flood and Drought Management Tool (FDMT) project is funded by the Global Environment Facility (GEF) International Waters (IW) and implemented by UNEP, with the International Water Association (IWA) and DHI as the executing agencies. The project aims at developing methodologies and tools within a decision support system (DSS) to facilitate the inclusion of information about floods, droughts and future scenarios into Integrated Water Resources Management (IWRM) planning, Water Safety Planning (WSP), Transboundary Diagnostic Analyses (TDA) and Strategic Action Plans (SAP). The project is being implemented from 2014 - 2018, and 3 pilot basins (Volta, Lake Victoria and Chao Phraya) have been identified for development and testing of the DSS.

The project responds to a growing sense of urgency around the need to improve resilience within river basins, and for this to become a critical part of water management plans. Consequently, the IW focal area of the GEF has identified the increased frequency and unpredictability of floods and droughts as a priority concern in transboundary contexts, along with the other multiple drivers that cause depletion and degradation of shared water resources.

Based on these issues, the project is designed to develop a methodology for basins, which uses tools within a decision support system that will allow the integration of information on floods and droughts into planning across scales. The project will integrate information on climate including floods and droughts for planning at both transboundary and national basin and local (specifically water utilities) levels by providing tools for both scales within a single DSS.

The DSS being developed will be a piece of software containing various technical functionality in the form of ‘tools’. The DSS is being tested and validated with available data at both basin and local levels in 3 different pilot basins; however it will be available for all other GEF IW basins. This also includes training modules available at the end of the project to ensure that methods can be applied to other basins. The aim is to develop an approach that interfaces with existing planning practices and the project will support planning activities related to TDA/SAP, IWRM or WSP, but will not embrace all activities within the planning methods.

3. Awareness workshop

3.1 Overview of workshop

Understanding how to use and apply the information developed through the DSS is seen as a vital aspect of the future operational use and sustainability of the Flood and Drought Management Tools project. Therefore capacity development with key stakeholders focusing on what the information from the DSS means and how to apply across different scales is an important step.

As the DSS is developed, the project is holding a series of awareness workshops for commissioners, senior advisors, policy makers, decision makers, etc. to provide the following:

- Overview of the relevance of the DSS for providing scientifically sound information for managing floods and drought; and
- Explain the meaning and relevance of the DSS outputs
- Develop an understanding of how to use and apply the information in decision making
- Develop and implement follow up mechanisms to continue to engage the target group

Objective
The objective of the awareness workshop in Accra was to enhance the levels of understanding by those focusing on water supply (in urban areas) including utilities, government advisors and decision makers of the capabilities and potential uses of the FDMT DSS in (1) supporting WSPs and (2) including information about floods, droughts and future scenarios into WSPs.

Expected outcome of the workshop
The expected outcome of the workshop was that target stakeholders will understand what the information from the FDMT DSS and how this information can be used in decision making around flood and drought management planning across scales. For the project this will be an opportunity to ensure that the outcomes from the DSS are imbedded into the actual workflow, and position the DSS as a tool to be used in decision-making.

Target group
The target group of this awareness workshop is those involved in the WSP Africa Network, as well as Ministries of Health, Environment and Water.

3.2 Awareness workshop

On September 30th, 2015, the FDMT held the awareness workshop as part of the WSP Africa Network meeting from September 29th to October 2nd, 2015 in Accra, Ghana.

Tuesday, 29th September 2015:

- **Morning session**: **IWA Making a Difference in Africa**: Formal opening of the week in which IWA presented an overview of its strategy, activities and programmes in the Africa region.
- **Afternoon session**: **The Annual Africa Water Safety Plan Network meeting**: Meeting to share experiences and lessons learned among partners, and explore opportunities for scaling up WSP implementation across Africa. The session was organised with the support from the United States Environment Protection Agency (USEPA) and the OPEC fund for International Development (OFID).

Wednesday, 30th September 2015: **The Flood and Drought Management Tool (F&DTM) project Awareness workshop**

Thursday (1st) to Friday (2nd) October 2015:

- **Water Safety Plan (WSP) and Sanitation Safety Plan (SSP) workshops**: Workshops with the objective of enhancing awareness and advocating for the uptake and scale-up of the WSP and SSP as the approaches of choice for drinking water quality management. They workshops were organised by IWA in collaboration with the World Health Organization

(WHO). The Friday meeting, supported by USEPA gathered information on the current water quality laboratories' capacity and needs in West Africa. This is part of a bigger project that aims to enhance the proficiency of participating laboratories through the use of the best available methods by trained personnel for production of high quality analytical data.

Flood and Drought Management Tools – Awareness workshop

Water Resource Commission (WRC) – Bob Alfa

WRC has not undertaken drought management as their focus is primarily on flood issues. Drought management is part of their mandate, but they are starting with flood management. Also, long-term drought forecasting is not available at the moment. Floods usually occur around September/October in the northern region of Ghana where the White Volta, shared with Burkina Faso, flows (studies do not include the Burkina Faso area). Low flow does not necessarily imply a drought.

Flood Modelling can provide information to map floods. It can also provide the necessary means for flood forecasting which is fed into the flood early warning system. The modelling can also be used to see what impact certain mitigations measures can have. For example, Pwagla dam and Nasia dams could aid in mitigating floods. Information from the flood early warning system can be passed on to the disaster agency which can use this information to prepare for oncoming floods.

The flood management framework has National Disaster Management Organization (NADMO) as the leading coordinator for disaster management and the Water Resource Commission sitting on the Flood Management Committee. Data is taken from GMet, analysed and passed onto NADMO for planning. GMet have an agreement with satellite data agencies and are also looking at getting more sustainable information for Ghana.

Ghana Water Company Limited (GWCL) – Jonas Jabulo

GWCL operates more than 86 systems and several in the Volta Basin. As a water utility, GWCL needs to take into account flood and drought events. The availability of water influences how to manage/operate infrastructure and machinery and considering the impacts of flood and drought events on the quality of water is essential for the well-being of consumers.

Climate change models indicate that users in the Volta Basin will need to adapt to greater fluctuation in water availability. When there have been serious floods, some of the intake points were completely flooded, which had to be recovered. New equipment needed to be purchased which is expensive. Mitigation requires both short- and long-term planning to predict floods and droughts. Innovative approaches such as floating intakes are being implemented and alongside the WSP approach, there is a need for preventative maintenance plans.

NADMO communicates the information to GWCL and WRC on water availability and potential floods. This information is used for planning purposed.

National Office for Water and Sanitation / Office National de l'Eau et de l'Assainissement (ONEA)

ONEA's focus is in Ouagadougou (Ziga dam). In 1988, Burkina Faso experienced a serious drought forcing ONEA to find an alternative source for drinking water, so the Ziga dam was commissioned and constructed at a cost of 150 billion CFA. Following serious flooding in 2009, a crisis management committee was set up.

The design of Ziga dam took into account drought conditions (2 seasons without rain) by trying to improve the storage through ground reservoirs and 14 above ground. Farmer associations are used to manage the area around the dam. Famers are used to sensitise the community (project called Managing Wetlands, in 12 villages).

At the Ziga dam, there are water quality laboratories. The site uses fish to consume algae. There are monitoring system which monitors iron and manganese at the bottom of the dam. On the basis of this analysis, they decide to choose the intake point. There have been no major problems and maintenance is limited to once a year.

Based on a method implemented in Morocco with success was the introduction of a Chinese plant and non-native fish. This method was chosen as it has a low impact on the dam. And rduced the number of fish at the laboratory.

Ziga dam has reached it limit of production. As such, ONEA is moving to a second phase to increase the production capacity to up to 9,000 m^3/hr. Furthermore, any time there is a flooding, the power may be cut off, affecting the potential for water treatment. As such ONEA have set up its own energy network for Ziga, which guarantees reliable supply in case of power shortage. Also have generators for pumping and treatment.

Drought Planning with the use of a DSS (Remote sensing / Seasonal forecast)
When evaluating drought there is a need for spatial, near real-time and reliable data. However, many issues exist in terms of availability and quality of data. For example, when using remote sensing data it can be difficult to understand because of format and type.

There is a need to develop tools to download remote sensing data or in real-time using QGIS. These tools can be used to evaluate what the current drought status is (or provide a drought warning); information included can be on climate (rainfall), soil moisture, vegetation – assess whether these are higher or lower than normal. NDVI provides information on biomass, SWI information on moisture content in the upper part of the soil and TRMM on rainfall. There are 2 other vegetation based products available. Vegetation cover needs to be combined with root depth, but would need to have data and calculations for this.

Satellite information can provide information at specific locations and across time. Seasonal forecast products are becoming more available and better quality, functioning much like weather forecasting products but for long-term periods; up to 9 months. Drought indices can be developed which can also forecast rainfall onset and crop yield. Remote sensing products require a computer connected to the internet and QGIS, and can download, on regular basis, information. However, there is a need to know the reliability of product which is why it is important to test the forecast with historical observations to see whether it is aligned. Furthermore, it is possible to identify areas affected by different types of drought. We can look at a drought affected area, and see what is the potential impact (for example in rainfed agriculture area). Statistical analysis can also be used to compare the current value of data sources compared to what it would normally be.

Water Safety Planning (WSP)
The DSS being developed in the Flood and Drought Management Tools project will support WSP with technical tools. Different types of data can be incorporated into the system, and information on climate change will be integrated in 2016/2017.

The focus will be on the graphical interface, a way to visualise the components of the WSP process (components of WSP on top of a GIS map with various layers).

Group work
The objective of the group work was to integrate and improve the understanding of how flood and drought related issues into water safety planning (WSP). The purpose will be to on how flood and drought issues should be integrated into the WSP process.

The group work is divided into sections related to the different WSP modules. For each of the sections a number of different flood and drought related issues were discussed.

1. Describe the water supply system

How do floods and droughts affect the water supply system including upstream of the intake?

- Qualitative impact on water supply – degradation of the quality of water; microbiological.
- Lack of availability of infrastructure and equipment to manage flood and drought events
- Water source will be polluted during flood events
- High cost of water purification – need more money to purify polluted water
- Degradation of water source by biological substances
- Need to use alternative sources

- Quantitative aspects – lack of available machinery and infrastructure because of facility being flooded; pipeline breakages
- Electricity companies – problem during flood events, but also during drought there will be a drastic cut down on electricity production

How can flood and drought information be used in describing the water supply system (maps)?
Information on flood and droughts can be useful when describing the water supply system to determine the real status of water supply potential in a country and to identify alternative sources of water. Furthermore, the information on the quantity and quality of water can be useful in planning and implementing water treatment projects and stress the need to protect water sources.

In order to evaluate the risk of different hazards data availability and quality is essential. Information on population change, change in infrastructure, land use changes, surface water levels and groundwater, etc. are essential to address potential risks of hazards. It is also important to note that most hazards occur outside of the water utility, it would be useful if water utilities could verify information regarding potential hazards occurring outside the utility, which have a significant impact on their operations.

2. Identify hazards and assess the risk

What are the hazards associated with the water source during a drought or flood event?
- Drought:
    - Reduction in quantity
    - Reduction in quality
    - Failure of equipment
    - Power interruption to the plant
- Flood:
    - Reduction in quantity
    - Reduction in quality
    - Failure of equipment
    - Power interruption to the plant
    - Pollution of alternative sources

What are the other hazards associated to the entire water supply system?
- Lack of clean water
- Health hazards for staff and surrounding population
- Socioeconomic hazards associated with the decrease of available water
- Impact on food security
- Material failure
- Treatment cost increase
- Population displacement
- Drought related hazards as fire
- Flood related hazards as land slide

What available information/indicators exist to evaluate the risk of the mentioned hazards?
- Historical weather data
- Historical extreme events
- Damage information from previous events
- Population change
- Environmental change
- Level or trend of water level in aquifer/surface water
- Level or trend in water quality parameters

3. Control measures

What control measures are used for flood and drought events?
- Flooding
    - Alerts from NADM) (Disaster management agency – Ghana)
    - Spill excess water to prevent damage of the dam, but this affects downstream users

    - Relocation of affected people
    - Establishment of early warning systems
    - Land management – however, in Ghana this is difficult as most of the land belong to Chiefs and therefore there is a need to negotiate with them on land planning and management
    - Afforestation along river banks (by WRC and Forestry Commissions)
    - Liaise with power supply providers to secure energy for water treatment plants
    - Construction of canals which can divert water during flooding – this is done by the Irrigation development Authority in Ghana

- Drought
    - Dredging of dams to store more water – with equipment or manually
    - Dry season management plans which includes monitoring of water levels, effective water rationing and public announcements
    - During the dry season, iron content increases and there is a need to use potassium permanganate for treatment
    - When there are low dam levels, then the abstraction rates are managed
    - Weed around intake to reduce the chance of fire
    - Water trucking
    - Awareness raising of water situation
    - Use of alternative sources
    - Monitoring station checking water levels and providing information
    - Reduced irrigation

- National/Basin level
    - Control measures depend on the country and the agencies involved
    - In French West African Countries, there is the Organization for Response to Extreme Crises which is a civil safety organisation that coordinates people, funds, equipment, etc in a disaster
    - There is a move towards controlled urbanisation which needs to involve different government departments as well as private sector and civil society. There also needs to be coordination with the basin organisations (e.g. Niger Basin Authority and OMVS)
    - Basin organisations manage the water resources among users, so for example, if the river levels are too high, they will release water from the reservoirs. They also alert utilities and other when dam levels are low so as to control abstraction.
    - Coordinating efforts among organisations involved in floods and drought management can be part of a mitigation strategy
    - Watershed restoration but this is a control measure that needs to be coordinated by the basin authority or water resource agency

Other control measures are focused on chemical and biological influences. However, flooding and droughts can affect water quality. In the case of flooding, increased turbidity levels mean implementation of effective chemical usage or shutting down treatment plants.

Control measure are prioritised on the basis of human health implications, costs and time to implement. Furthermore, water supply and chemical treatment to ensure safe water has to happen, this is often the first priority. Within the dry season management plans (Ghana) the control measures are prioritised with associated costs and this is assessed by the head office of Ghana Water to decide on implementation

Implementation of control measures depends on what the measure is. Ghana Water funds some of the control measures, but sometimes regional administration also contributes. The electricity company of Ghana will be involved in securing power supply during crises to ensure water treatment. Regulators are involved in implementation as well.

In Guinea, the Ministry of Health is in charge of public health. They check the quality of water, food security and disease control.

How are the different stakeholders collaborating on implementing flood and drought control measures?

Stakeholder collaboration is often fragmented but there are examples of collaboration on control measures

- In Ghana and other countries there are disaster management committee at the regional level which include relevant institutions to prepare and respond to floods, etc. These committees meet on a monthly basis.
- In Ghana there is coordination between the Ministry of Water Resources and Ministry of Agriculture on management of dams
- In Liberia, the WASH consortium consisting of government agencies, NGO, donors and civil society coordinate interventions on the water sector. Civil society is essential for mobilisaton, awareness and pressuring government. But an obstacle is the sharing of information on water resources in order to make decisions.
- Stakeholder consultations on implementing control measures are coordinated by basin authorities or basin boards. For example, in Ghana, the basin boards include Ghana Water. In Burkina Faso, there are water committees around each dam including all the users (farmers, fishers, water supply, etc.).
- In Senegal, the Water Resource Agency has a technical committee for management of surface water and groundwater. They committee has involvement of different agencies that use water. The aim is to have something like a WSP at the national level.

4. Monitoring of control measures

What type of monitoring do you have for flood and drought related incidents (water levels, water intake)?

- Flow rate/water level measuring equipment
- Groundwater table
- Soil moisture content measurement
- Raw water quality (turbidity and colour) and concentration of some compounds (e.g. iron)
- Production volumes

What are indicators used to determine water scarcity/drought and flood events?

- Variation in water level/flows
- Rainfall, evaporation and other climate information
- Vegetation
- Animals/livestock movements
- humidity
- Water quality

When indicator thresholds are exceeded, a number of actions are initiated. Below are the identified actions:

- Check safety of equipment
- Check supply of chemicals (flood)
- Maintenance and spare part of equipment
- Anticipate power shortage
- Alternative water supply sources (tanks) (drought)
- Water conservation campaign/measures

Annex 1 – Agenda

English version

Time	Item	Who
09.00 – 09.15	Welcome and presentation of the workshop objective	Katharine Cross, IWA
09:15-10:15	Aqua Republica http://aquarepublica.com/	Bertrand Richaud, DHI
10:15-10:45	Break	
10:45-11:00	Management of floods and droughts • Planning and management processes at the basin level • Overview of decision making process • Interactions with water utilities	WRC
11:00-11:15	Development and application of water safety planning, and how is/can be used to address floods and droughts	ONEA
11:15-11:30	Development and application of water safety planning, and how is/can be used to address floods and droughts	Ghana Water Company Limited
12:00-12:30	Drought planning with the use of DSS 1. Drought monitoring 2. Seasonal forecast	Oluf Jessen and Bertrand Richaud, DHI
12:30 – 13:30	Lunch	
13:30-14:00	Overview of key features and capabilities of the DSS. The presentation will include examples of: • What is a DSS (briefly) • A brief overview of applicability of Water Safety Planning • Overview of planned developments and stakeholder involvement over the coming months	Oluf Jessen, DHI
14:00 – 16:30	**Objective**: Integrate flood and drought related issues into water safety planning (WSP). The purpose of the group work will be to improve the understanding on how flood and drought issues should be integrated into the WSP process. The group work will be divided into sections related to the different WSP modules. For each of the sections a number of different drought and flood related issues will be discussed. **1. Describe the water supply system** a. How do floods and droughts affect the water supply system including upstream of the intake? b. How can flood and drought information be used in describing the water supply system (maps)? **2. Identify hazards and assess the risk** a. What is the reliability of water sources during a flood and/or drought event? b. What are other drought and flood related hazards (pollution, changed behavior in the use of domestic water, etc.)? c. How can seasonal forecasting or long term forecasting (years) used in evaluating hazards? **3. Control measures** a. What control measures are used for flood and drought events? b. How are the different stakeholders collaborating on implementing flood and drought control measures? **4. Monitoring of control measures** a. What type of monitoring do you have for flood and drought related incidents (water levels, water intake)? b. What are indicators used to determine water scarcity/drought and flood events?	DHI/IWA
	Working break (at 15:00)	

Time	Item	Who
16:30 – 17:00	Feedback from groups and wrap-up	DHI/IWA

Version française

Heure	Sujet	Qui
09.00 – 09.15	Bienvenue et présentation de l'atelier	Katharine Cross, IWA
09:15-10:15	Aqua Republica http://capnet.aquarepublica.com	Bertrand Richaud, DHI
10:15-10:45	Pause	
10:45-11:00 (10 mins présentation, 5 mins Q&A)	Gestion des inondations et sécheresses • Procédés de planification et gestion à l'échelle du bassin • Aperçu du procédé de prise de décision • Interaction avec les compagnies des eaux	WRC
11:00-11:15 (10 mins présentation, 5 mins Q&A)	Développement et application de plan de sécurité sanitaire, et comment il est/peut être utilisé pour adresser les inondations et sécheresses	ONEA
11:15-11:30 (10 mins présentation, 5 mins Q&A)	Développement et application de plan de sécurité sanitaire, et comment il est/peut être utilisé pour adresser les inondations et sécheresses	Ghana Water Company Limited
12:00-12:30	Planification des sécheresses avec l'utilisation de l'outil d'aide à la décision (DSS) 1. Suivi des sécheresses 2. Prévisions saisonnières	Oluf Jessen and Bertrand Richaud, DHI
12:30 – 13:30	Déjeuner	
13:30-14:00	Vue d'ensemble des caractéristiques et des capacités du DSS. La présentation inclura des exemples de: • Qu'est-ce qu'un DSS (brièvement) • Un bref aperçu de l'application de la planification de la sécurité sanitaire de l'eau • Vue d'ensemble des développements prévus et des parties prenantes au cours des mois à venir	Oluf Jessen, DHI
14:00 – 16:30	Discussion de groupe **Objectif**: Intégrer les questions liées aux inondations et sécheresse dans la planification de la sécurité sanitaire de l'eau (WSP). Le but du travail de groupe sera d'améliorer la compréhension de la façon dont les questions des inondations et sécheresses devraient être intégrés dans le processus de WSP Le travail de groupe sera divisé en sections relatives aux différents modules de WSP. Pour chacune des sections un certain nombre de différentes questions liées aux inondations et sécheresses seront discutées. **1. Décrire un système d'approvisionnement en eau** a. Comment les inondations et les sécheresses affectent le système d'approvisionnement en eau, y compris amont de la prise? b. Comment les informations sur les inondations et sécheresse peuvent être utilisées pour décrire le système d'approvisionnement en eau (cartes) ? **2. Reconnaître les dangers et évaluer les risques** a. Quelle est la fiabilité des sources d'approvisionnement lors d'un événement d'inondation et / ou de sécheresse? b. Quels sont les autres risques liés aux sécheresses et aux inondations (pollution, changement de comportement dans l'utilisation de l'eau domestique, etc.)? c. Comment les prévisions saisonnières ou à long terme	DHI

Heure	Sujet	Qui
	(années) peuvent servir à évaluer les risques? **3. Les mesures de contrôle** a. Quelles mesures de contrôle sont utilisées pour éviter des événements d'inondation et de sécheresse? b. Comment les différentes parties prenantes collaborent à la mise en œuvre des mesures de contrôle des inondations et de la sécheresse? **4. Suivi des mesures de contrôle** a. Quel type de surveillance avez-vous pour les incidents liés aux inondations et sécheresses (niveaux d'eau, la consommation d'eau)? b. Quels sont les indicateurs utilisés pour déterminer la pénurie d'eau / sécheresse et d'inondation événements?	
	Pause	
16:30 – 17:00	Commentaires des groupes et wrap-up	DHI/IWA

Annex 2 – Group work questions

1. **Describe the water supply system**
    a. *How do floods and droughts affect the water supply system including upstream of the intake?*
        i. *What parts of the system does flood and drought impact?*
        ii. *Are alternative water sources mapped?*
        iii. *What other impacts are there which could exacerbate flood and drought and where?*
        iv. *Who is impacted?*
    b. *How can flood and drought information be used in describing the water supply system (maps)?*
        i. *What information is currently used (if any) to map or record current and future droughts? Who provides this?*
        ii. *What additional information is needed and is it available?*
        iii. *How would this information be used in planning?*

2. **Identify hazards and assess the risk**
    a. *What is the reliability of water sources during a flood and/or drought event?*
        i. *In your utility/country what happens to the water source during a flood or drought?*
        ii. *How would your organization use maps of current flood and drought prone areas?*
    b. *What are other drought and flood related hazards (pollution, changed behavior in the use of domestic water, etc.)?*
        i. *In what way are different water users affected by floods and droughts?*
    c. *How can seasonal forecasting or long term forecasting (years) used in evaluating hazards?*
        i. *Is seasonal forecasting or long term forecasting used? Why or why not?*
        ii. *If the information was available, how would such information be used and by whom?*
        iii. *In what form would this information be useful (e.g. data files, maps)?*

3. **Control measures**
    a. *What control measures are used for flood and drought events?*
        i. *When there is a drought or flood event in your utility/country what are the control measures for the affected parts of the system?*
        ii. *How are control measures for flood and drought events different from other control measures?*
        iii. *How do you decide what control measures to implement (cost-benefits analysis)?*
        iv. *How are these implemented and by whom?*
    b. *How are the different stakeholders collaborating on implementing flood and drought control measures?*

4. **Monitoring of control measures**
    a. *What type of monitoring do you have for flood and drought related incidents (water levels, water intake)?*
    b. *What are indicators used to determine water scarcity/drought and flood events?*
        i. *How are indicators selected?*
        ii. *How are these monitored?*
        iii. *What do you do when a threshold is exceeded?*

Annex 3 – Participant list

Last Name	First Name(s)	Company	Position	Country	Email
Kere	Francis D.	ONEA	WSP Team Leader	Burkina Faso	dfkere@yahoo.fr
Kwofie	John Eric	GWCL	WSP Team Leader	Ghana	john.kwofie@ghanawater.info
Jabulo	Jonas	GWCL	Chief Manager, Water Quality Assurance	Ghana	jonasjab@yahoo.com
Alfa	Dr. Bob	Water Resources Commission		Ghana	bobalfa@yahoo.com
Kyekyeku	Yaw Oppong-Boadi	EPA - Ghana	Chief Programme Officer / UNFCCC Focal Point-Ghana	Ghana	koppongboadi@gmail.com, Yaw.oppong-boadi@epa.gov.gh
Ampomah	Brenda	IWA	Programmes Officer	Ghana	Brenda.Ampomah@iwahq.org
Mensah	Millicent	PURC - Ghana	Executive Secretary	Ghana	ssarpong@gmail.com
Akuba	Juliet	PURC - Ghana			
Keita	Tanoundy	Société des Eaux de Guinée (SEG)	Technical Counsellor	Guinea	Ktanoundy@yahoo.fr
Boiro	Mamadou Samba	Société des Eaux de Guinée (SEG)	WSP Team Leader	Guinea	mboiro@segguinee.com
Kourouma	Ibrahima Boh	Ministère de la santé et de l'hygiène publique - Guinea	Representative	Guinea	ibrahimboh@yahoo.fr
Aw	Sadat	SODECI	Director of Water treatment	Cote d'Ivoire	awsadat@sodeci.ci
Usher	Sylvain	AfWA	Executive Secretary	Cote d'Ivoire	susher@afwa-hq.org
Tibatemwa	Sarah	IWA	Director	Kenya	Sarah.Tibatemwa@iwahq.org
Masinde	Kizito	IWA	Programmes Officer	Kenya	Kizito.Masinde@iwahg.org
Cassel	Frankie Nathaniel	LWSC	Deputy Managing Director for Technical Services	Liberia	fncassell@lwsclr.com
Dembele	Abdrahamane	SOMAGEP-SA	Deputy Managing Director	Mali	ADEMBELE@somagep.ml
Issabre	Mamadou El Hadj	SOMAGEP-SA	Chef de département Laboratoire Central	Mali	mamadou.issabre@somagep.ml
Mbaye	Aminanta	SDE	WSP Team Leader	Senegal	mmbaye@sde.sn
Fall	Cheikh Tidiane	IWA	Programmes Coordinator	Senegal	CheikhTidiane.Fall@iwahq.org

McKeown	Rory Moses	WHO		Switzerland	rorymosesmckeown@live.com
Cross	Katharine	IWA	Programmes Manager	Thailand	Katharine.Cross@iwahq.org
Boukerrou	Lakhdar	FIU/USAID WA-WASH	Regional Director		lboukerr@fiu.edu
Sarbah	Graham	Accra Metropolitan Assembly		Ghana	gram5sab@yahoo.com
Amoako-Mensah	Samuel	UNICEF		Ghana	samoakomensah@unicef.org