United Nations Educational, Scientific and Cultural Organization

World Water Assessment Programme

Sustainable Development Goals

UN WATER

Report of the Inception Meeting on 'World Water Development Report' 2020

19-21 September 2018

UNESCO Programme Office, Villa Colombella, Perugia, Italy

Table of CONTENTS

1. Introducion **3**

2. Summary of Discussions **3**

2.1 Opening and welcome 3
2.2 Introduction to the WWDR2020 Theme and Background documents 3
2.3 Session 1: Main Messages 4
2.4 Discussion on Leading Topics 4
2.5 Session 2: Content structuring – the Skeletal Table of Contents (ToC) 5
2.6 Recap Day 1 and Objectives for Day 2 and discussion 6
2.7 Production Work-plan 6
2.8 Commitments from Lead Agencies and Contributors 7
2.9 WWDR 2020 Draft Table of Contents 7
2.10 Knowledge sharing 14
2.11 Closing remarks 14

3. Annexes **14**

3.1 Workshop Agenda 15
3.2 WWDR 2020 Literature review 17
3.3 WWDR 2020 storyline 23
3.4 WWDR 2020 Main messages 28
3.5 Group Outcomes on Main Messages 29
3.6 WWDR Generic Structure 31
3.7 Principle parts of the report 32
3.8 Group Outcomes on Annotated Table of Contents 33
3.9 Groups for breakout sessions 41
3.10 List of participants 44
3.11 Organization Acronyms 45

1 INTRODUCTION

Over 40 representatives of UN agencies and partners of UN-Water gathered at UNESCO World Water Assessment Programme (WWAP) Secretariat on 19-21 September to discuss the content and structure of the United Nations World Water Development Report (WWDR) 2020.

Following the decision at the UN-Water Senior Programme Managers meeting in February 2017, the WWDR 2020 will be dedicated to the theme **"Water and Climate Change"**. The **objective** of the workshop was to reach a common understanding on the scope, overall content and general structure of the WWDR 2020 and on the modalities for its production, including task distribution among committed Lead Agencies and Contributing Agencies.

2 SUMMARY OF DISCUSSIONS

Thursday 20 September 2018

2.1 - OPENING AND WELCOME

WWAP welcomed the participants and presented the objectives of the meeting and agenda (see Annex 1). WWAP recalled that the WWDR is a UN-Water report coordinated and produced by the UNESCO World Water Assessment Programme (WWAP) in collaboration with UN-Water members and partners and external contributors. Where initially the WWDR was a three-year extensive status report, in August 2012, UN-Water approved a new periodicity and structure for the WWDR series. The Report thus became an annual (around 100+ page) thematic publication on the status, use and management of freshwater resources globally.

2.2 - INTRODUCTION TO THE WWDR2020 THEME AND BACKGROUND DOCUMENTS

WWAP introduced the WWDR2020 by building on the condensed **literature review** (Annex 2), the draft '**storyline**' (Annex 3), and an initial compilation of potential '**main messages**' (Annex 4). Taking account of comments received from UN-Water members, these background documents prepared by WWAP constituted the discussion material for the workshop by describing the theme and scope of the WWDR2020, highlighting several technical considerations and illustrating sources of information. The 2020 Report seeks to address the critical linkages between **water and climate change** in the context of the broader sustainable development agenda. The report intends to focus on the challenges, opportunities and potential responses to climate change – in terms of adaptation, mitigation and improved resilience – that can be addressed through enhancing water resources management and improving access to water supply and sanitation services for all. In doing so, the report will address two of the most critical crises the world will face over the next several decades: Water (in)security and climate change.

2.3 - SESSION 1: MAIN MESSAGES

The purpose of the session was to identify a set of key messages to be applicable to (nearly) all chapters and sections and guide the authors throughout the report. Participants divided into four groups to work on proposals taking into account the messages prepared in the background document. A discussion followed the presentations from each of the groups (see Annex 5 for group outcomes).

Participants expressed the need to clarify the main target audience of the report in order to draft more relevant and adapted messages. WWDR **primarily targets policy and decision makers**, but this report was seen as an **opportunity to reach out to the climate community** and other relevant sectors. This would mean adopting a framework that speaks to stakeholders in both the water and climate community and that illustrates how water relates to the climate language and contributes to the Paris agreement, for instance in relation to adaptation, mitigation and loss and damage. It would also be useful to guide water projects in better integrating climate resilience aspects.

Some participants suggested reaching out to a broader audience with language that is more accessible, reaching out to the people affected and being more appealing to the media. WWAP recalled a previous WWDR experience in developing **targeted messages for a variety of stakeholders**, which could be something to consider for this WWDR.

Several groups agreed that messages should reflect a **stronger call for action, and the urgency to act** and take responsibility. Proposals included having a very clear and direct message to stress that tackling climate change will not be successful without adequately addressing water.

There was a common understanding that messages should not focus on re-describing the problem but be more **action-oriented, presenting 'solutions',** with real links to case studies and concrete examples. These responses should be a combination of what needs to be done now with a wider perspective on long-term actions, linking to commitments under the 2030 Agenda for Sustainable Development. Responses could also include bottom- up approaches looking at emerging civil society movements for community level climate change adaptation and mitigation. They could also highlight the linkages to broader sustainable development ie water solutions create jobs (economic resilience) and increase food security.

A number of targets in the Sendai agreement and Agenda 2030 are to be met in 2020, which is an opportunity for the messages of the report to inform and guide this process, for instance bringing examples and what needs to happen next.

Messages could **more strongly refer to risks**, short-term risks as well as the slow onset risks of climate change. Also risks or cost of no action, and no alignment (or non-cooperation) across sectors and geographical levels. The link between climate change and migration is key, as part of risk, and should be included. It should be emphasized who is at most risk and how climate change (CC) impacts differently on various groups in terms of their access to water, and how those more affected by climate change are not those who are directly responsible for it (climate justice). This could be an opportunity to **link with messages from WWDR 2019 on 'Leaving no one Behind'**.

2.4 - DISCUSSION ON LEADING TOPICS

Taking into account the WWDR Generic Structure as decided in 2012 (See Annex 6), participants explored possible 'Leading Topics', essentially potential chapters or section headings.

A number of participants suggested framing the report looking at how it can act as a **guideline to achieving the 2030 targets, Sendai Agreement and Paris agreement**. Using the language of the Paris agreement would increase the impact on the climate community. Important to note that countries are already including water in their National Determined Contributions (NDC), which represent their commitments to implement the Paris agreement. The rationale could include how sectors like agriculture, industry and energy can become more climate resilience through actions in the water domain.

The report should be a **guide for concrete actions and illustrate what are the key challenges and how to face them**. Messages need to be more concrete: identify hotspots (for instance, SIDS) and use them as examples throughout the report.

Some organizations called for a chapter to present a people centered approach and look at **climate and human interactions**. This would have a focus on people and on how water solutions increase resilience of communities.

It was noted that **climate finance** is on the rise; this report can provide a rationale to make use of this finance in water projects and to make the case for how water solutions bring long-term benefits to economy and finance.

2.5 - SESSION 2: CONTENT STRUCTURING – THE SKELETAL TABLE OF CONTENTS (TOC)

Based on the outcomes of the earlier plenary, the main messages and elements of the storyline, the working groups reviewed the 'Principle parts of the Report' document (See Annex 7). Each group addressed one of the principle parts and made recommendations about how different chapters (or possibly critical sections) could be organized and what major/essential content elements each chapter should include.

The rapporteurs presented the main outcomes of each group (See Annex 8), a summary of which is presented below:

Part 1. Baseline and Background

Prologue: State of resource (water availability, demand, quality, disasters & extremes) + overview of the potential impacts of climate change on water resources and the hydrological cycle.

Introductory Chapter: What the report is about (scope and objective of the report), for whom it has been prepared, why it is important, and where it fits as part of the global efforts to address the issues of climate change and sustainable development.

- **Place the report in the global context and agreements**: SDG, Paris Climate Agreement, Sendai Framework for Disaster Risk Reduction (SDRR), the Water Conventions. Clear presentation of what this report means in relation to other processes. Go beyond Paris Agreement and address NDCs. Key numbers and figures for SDRR.

- **Present progress, gaps and next steps based on the 2030 agenda and Paris agreement**: With the report coming out in 2020, it should reflect on where we are now, what is next, what is missing, policy based. 2020 – Paris Agreement goes into force – how can the report be a contribution to this? Water issues are a main priority for countries in their NDCs, so how can water management support the implementation of that – looking at adaptation, mitigation, loss and damage; human rights based approach (HRBA), climate justice and finance with the enabling factors: capacity development, education, raising awareness, governance.

- **Water and climate rationale for sustainable development**: Illustrate how climate is impacting the overall 2030 Agenda and the role of water as a strong enabling factor to reach the 2030 Agenda (i.e. cross cutting through practically all the SDG's). Address interrelations of climate – water – people – environment – economics.

- What is the **driving element between climate and water and how humans are impacted or agents of change**, with dimensions of security and development. Take into account WMO's yearly state of the global climate and the IPCC reports on 1.5 C temperature increase (to be released in October 2018). Present the different scales, time, and space. How water issues can impact (improve or hinder) the 1.5 C global warming limit objective.

- **Facts, numbers, causes and effect, setting the scene**: Matrix of available information related to water - when, how, timescale. Address the gaps: set the scene and projections. Overview of potential impacts of CC on water resources and hydrological cycles; groundwater, glaciers, soil water and moisture, source to sea – impacts on the oceans and seas. Geopolitical context: population growth, migration, consumption patterns, security issues. Decisions are being made under uncertainty – how to best use the information available to improve management and deal with climate change. Economic inputs; role and responsibility of the business sector.

- Present **clear scope and objective** of the report: What is the focus, the added value. Set the scene in terms of **governance**, especially if main messages are aimed at decision makers.

Part 2. Challenges and Opportunities for adaptation and mitigation in water management

What can be done through improved water management to better adapt to CC, to increase the efficiency and robustness of water management infrastructure (including Operation & Maintenance), and to contribute to CC mitigation via water resources management, water supply and sanitation services, and disaster risk reduction.

- It was suggested to organize the chapter around the **possible responses** for key issues faced by policy makers: Proposed sections:
  - Resilience of supply (ecosystems, rivers, aquifers, wetlands)
  - Changes in demand (population growth, urban/rural, agriculture and industry)
  - Water quality (pollution, sanitation, saline intrusion)
  - Resilience to extreme events (floods and droughts)
  - Managing disaster risk (reducing existing risk and preventing the creation of new risk)

- Within each section the following subdivision (**response/solution oriented**) could be addressed:
  - Data and monitoring
  - Infrastructure available/needed
  - Governance
  - Adaptation actions (to address existing risks and avoid emerging ones)
  - Mitigation (lowering the climate footprint of water management activities)
  - Financial mechanisms
  - Technical optimization

The need to include case studies was stressed – to add examples of successful and not successful stories and of how countries/sectors are adapting decision-making.

Part 3. Challenges and Opportunities for adaptation and mitigation for major water use sectors

Different water use sectors face different challenges with respect to water and CC. There are opportunities to improve CC adaptation and contribute to CC mitigation (i.e., 'responses').

What are the main sectors, and what are the main options/opportunities that can be pursued by each one?

- **Sector silos versus cross-sectoral issues**
  It was recognized that there are linkages between sectors, such as the water-energy-food nexus, and common synergies and challenges. In this respect consideration was given to organizing the material in terms of water quality, quantity, availability, productivity and so on.
- **Sectors as a preferred approach**
  - It was felt that potential readers would be working in conventional sectors and therefore be looking for the section of their particular interest. Moreover, based on previous WWDR experience, the material would be easier to research, organize, write and present in this way. It was felt that cross-cutting issues would be difficult to synthesize.
  - Given the word limitation and that every sector could not be reasonably covered, it was thought that the "Big 3": agriculture, industry and energy as the principal users of water, should be prioritized. Within these, a limited number of major challenges, such as water stress (quantity, scarcity), accessibility, and quality, should be described. These would be addressed by solutions, giving the pros and cons, and noting opportunities. Examples might be: for energy - water intensity and renewables; for industry - value chain pressure, risks and (un)certainity, water use reductions, water footprints and consumer pressure; for agriculture – no monoculture, technology, drought resistant crops, irrigation and some focus on high as well as low-income countries.
  - The relationship between adaption and mitigation should be in the discussion, for example renewables using less water can lead to energy and GHG reductions.
  - Some review of other larger sectors, such as ecosystems, tourism, mining and transportation, should be included, possibly as boxes.

- **Nexus Section**
  - Recognizing that there are linkages and cross-sectoral concerns, challenges, issues and solutions, a short separate section at the end was proposed to highlight these points, perhaps including some discussion of IWRM for CC in terms of sectors.

The need to include case studies was stressed – to add examples of successful and not successful stories and of how countries/sectors are adapting decision-making.

Part 4. An enabling environment for change and progress

The call for adaptation to CC in water management has been happening for over 15 years. Why has progress been so slow? The CC mitigation opportunities of improved water management are less well known. Progress will require concerted action along several different fronts.

What needs to be done, and by whom, in terms of governance and institutional frameworks, financing, innovation and R&D, capacity development, education and awareness raising, participation and cross-sectoral coordination, etc.?

- Paris Agreement and NDCs have created a space to talk about adaptation, of which water is an important part. This means **governance and institutional frameworks** need to be clearly explained and identified. What change we want to see (shared vision and framing of the problem) and how to get there: what enabling environments are required to implement the international commitments and agreements (UNFCCC, SDGs, Sendai etc.)?
- The intention is to encourage **collective action** (focus on governance): how different actors can contribute to change process, how to encourage a feeling of shared responsibility, rather than a feeling that we are combatting nature. Showcase how different alliances can contribute.
- **Political will is key**. To make it happen also means putting finances into the actions- alignment of public sector budgets, or other communities such as business (BAFWAC) or climate investors, recognizing that adaptation measures take a long time to implement.
- Discuss unlocking **of finances**, valuing water. Include multiple perspectives. SDG13 includes target of 100 Billion USD[1] annually for developing countries- how is that implemented and used, how to unlock that for water?
- To what extend are we working with climate change or dealing with mismanagement – attribution, the risk of climate being a scapegoat for poor governance.
- Governance should include **accountability.**
- Action is at the local level, empowerment and **participatory approaches** are needed
- Bring out examples – inspire and challenge others.
- Obstacles are conflicting interests at political level, and from investors and consumers
- Use alliances beyond the water domain – e.g. cities – there are many frontrunners (CDP, 100 Resilient Cities, C40, etc.)

[1] Target 13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible.

Friday 21 September 2018

2.6 - RECAP DAY 1 AND OBJECTIVES FOR DAY 2 AND DISCUSSION

The draft Annotated Table of Contents (AToC) integrating comments from the previous day was presented, followed by a discussion.

General comments included the need for a rationale of how all cycles, water, carbon, etc., work together towards sustainable development. Some explanation of how the CC mechanism works. Instead of regional chapters, perhaps good cases studies in the report could suffice, as often regions have many different situations. It was also suggested to use one good example per region that is described in some detail (different from the case and boxes with real world examples throughout the report), preferably an example of an integrated approach (e.g. Lake Chad). To adequately address Part 4, it would be important to have access to the initial chapters and key messages to work back from there.

The discussion then focused on the different parts of the report. The main comments are integrated in the draft ToC at the end of the document.

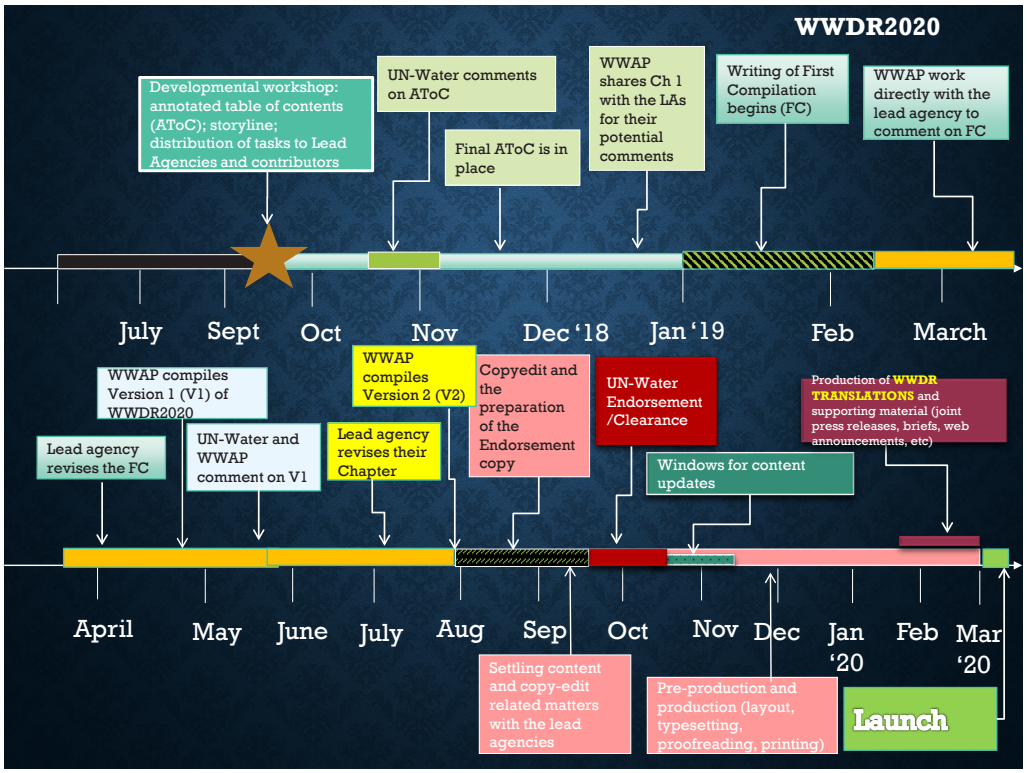
2.7 - PRODUCTION WORK-PLAN

The WWDR production calendar was presented (see below) and the roles and responsibilities of Leading Agencies and Contributors were described in detail. The WWDR production team (as well as participants who have worked directly on the previous WWDR) shared experiences and lessons learned in the past.

As the WWDR production calendar is extremely tight, the essential need for timely delivery of contributions and various draft chapters was stressed. The time and human resources involved in leading a chapter was also stressed. As such, it was advised that Leading Agencies should not assume full responsibility for more than one Chapter, although they remain most welcome to contribute significantly to other chapters (for example, providing a complete sub-section).

It was agreed that a first draft of Chapter 1 (tentatively titled 'Setting the Stage') will be produced and circulated to all lead agencies by 23 December 2018, in order to help guide the writing of the subsequent chapters.

WWDR production calendar



2.8 - COMMITMENTS FROM LEAD AGENCIES AND CONTRIBUTORS

UN-Water members and partners can contribute to the WWDR 2020 with different roles.

I) Lead Agencies (LAs) are responsible for the production of a substantive part of the report (one chapter or more). This implies that LAs write parts of the Report and coordinate and compile the input from Contributing Agencies (see below). LAs submit the chapter for which they are responsible to the WWAP Secretariat in line with the production calendar.

II) Contributing Agencies (CAs) work in close cooperation with a Lead Agency and/or with the WWAP, and directly provide input in the form of short pieces of text, tables, boxes, figures, examples and references to relevant published material.

Several Agencies volunteered to take the lead (as LA) and/or contribute to various chapters as identified in the Skeletal Table of Contents.

A large number of agencies also volunteered to provide contributions across multiple chapters. These have been listed in the AToC. These agencies and those that did not have a representative at the workshop are welcome to add/revise their commitments as part of the AToC review/comment process.

The UN-Water Expert Group on Climate Change expressed its willingness to contribute material, advice and expertise to all aspects of the WWDR developmental process and particularly serve as a resource reviewing the draft versions of the WWDRs.

The draft Table of Contents below integrates the main comments exchanged during the discussion as well as the proposed leads and contributors, which are **presented in alphabetical order. Final assignments will be agreed upon between the volunteering agencies and WWAP**, based on the final structure and content of the Annotated Table of Contents (AToC) and how these align with the particular fields of expertise of the volunteering agencies and their available resources (i.e. time and qualified staff).

2.9 - WWDR2020 DRAFT TABLE OF CONTENTS

Part 1. Context: Role of water management for climate change mitigation and adaptation in the context of sustainable development

Prologue ('Chapter 0'): The state of water resources in the context of climate change
Lead Agency Volunteers: IHP, WMO, WWAP
Contributors: IAH, ICHARM, IGRAC, IHP, IIASA, RAMSAR, UNDP

Overview of the potential impacts of climate change on water resources and the hydrological cycle.

- Short summary of current empirical evidence of the general impacts of climate change (e.g., GHG emissions and atmospheric concentrations, connection carbon cycle and energy, temperature, radiative fluxes, etc…), unknowns and uncertainty.
- Climate projections and their impacts on:
  - Water availability
  - Water demand
  - Water quality
  - Water-related disasters and extreme events (-> DRR)
  - Water related ecosystems
- based on new '1.5 C temperature increase report', Oct 2018, and yearly 'State of the climate report for COP'
- General status of knowledge about CC and water Trends, attribution problems (climate vs. other global changes), likelihoods, unknowns and uncertainties, tipping points, etc.
- Interlinkages water-energy-carbon cycle
- Geopolitical context: population growth, migration, consumption patterns, security issues
- What we know now compared to 15-20 years ago (anthropogenic impact, CC have been more rapid than expected, …), possible 'hothouse pathways'.

Chapter 1: Climate change, water and sustainable development

[TO BE DEVELOPED FIRST AND SHARED WITH LEAD AGENCIES IN LATE DEC 2018]
Lead Agency Volunteers: IHP, WMO, WWAP
Contributors: IAHS, RAMSAR, UNDP, UNHCR (most vulnerable), UNIDO, WaterLex (most vulnerable), Water.org, World Youth Parliament for Water

What the report is about (scope and objectives of the report), for whom it has been prepared, why it is important, and where it adds value as part of the global efforts to address the issue of climate change.

- **Objectives and scope**
  Objectives and scope of this report. Societies worldwide are being affected through the hydrological changes as induced by CC. There is an urgent need for adaptation and opportunities for mitigation in water management. Defining 'adaptation' and 'mitigation' (adaptation and mitigation time scales). What this report is not about (or trying to fix).
  Linkage to 'development and security'. How can water support implementation of the Paris agreement (Water issues are a main priority for countries in their NDCS)?
- **A cross-sectoral challenge and the need to integrated assessmen**t
  How CC impacts sustainable development through various sectors (agriculture, energy, industry, cities, livelihoods, ecosystems and the environment) but also across sectors (e.g. water-energy-food-environment nexus). Use of climate information in the water sector. Adapting to CC may require additional trade-offs, but also create opportunities (possible socio-economic benefits).
  The role of water in mitigation but also the negative feedback of mitigation on water what is needed to create resilience of society?
- **Who are the most vulnerable, and where are they?**
  Certain groups are particularly vulnerable to the effects of CC through water. CC (through water) linked to economic crises, conflict, migration, etc. Potential economic impacts (costs and possible benefits) of CC in terms of GDP, needs of developing countries.

Chapter 2: International Policy Agenda

Lead Agency Volunteers: IHP, WMO, WWAP
Contributors: FAO, OHCHR, SIWI, UNDP, WaterLex

Paris Agreement, Sendai Agreement, Agenda 2030 and SDGs, NDCs, International Water Conventions, and where this reports fits.

Are these agreements addressing water and enable 'water solutions' enough? If not, why and what is missing?

Link to water and security

PART 2 – Challenges and opportunities for adaptation and mitigation (GHG) in water management

Lead Agency Volunteers: IHP, WMO, WWAP
Contributors: FAO, OHCHR, SIWI, UNDP, WaterLex

What can be done through improved water management to better adapt to CC, to increase the efficiency, effectiveness and robustness of water management infrastructure (including O&M), and to contribute to CC mitigation. Different water use sectors also face different challenges with respect to water and CC – there are opportunities to improve CC adaptation and contribute to CC mitigation (i.e., sectoral 'responses').

Need of a short introduction on why the structure of this part follows an approach where different stakeholder groups and the key role of interlinkages between the groups (not a 'silo' approach).

> It was also suggested to organize the Chapters under broader subsections 'Adaptation', 'Mitigation', although the modalities of the suggestion were not explored in detail).

Chapter 3: Water supply/availability and quality

Lead Agency Volunteers: IHP, UNU-INWEH
Contributors: FAO, IAHS, IGRAC, IHA, IHE, IWMI, RAMSAR, UNESCO-IHP

> Storage (surface and GW, snow and ice (glaciers), soil water and moisture), supply augmentation (e.g., rainwater and fog harvesting); energy requirements for pumping , inter-basin transfers and desalination; aging infrastructure; impacts on ambient water quality and ecosystems; multipurpose infrastructure (technical optimization), ecosystem services, nature-based solutions (NBS); environment (biodiversity/ecosystems)

Chapter 4: Drinking water supply, sanitation, hygiene and human health

Lead Agency Volunteers: t.b.d.
Contributors: IIASA, IHE, IHP, IWMI, OHCHR, UNU-Flores

> Water purification, sanitation, wastewater treatment and water recycling/reuse, WaSH; energy requirements of various treatment methods; energy savings opportunities through water reuse, recycling and the recovery of useful by-products; NBS; Trends in water-related diseases and other health issues linked to CC; response option of WaSH in health care centers, …
>
> Demonstrate that the WaSH sector need to adapted to climate change, but such changes can be adaptive measures to climate change

Chapter 5: Water-related risk management (floods, droughts, DRR)

Lead Agency Volunteers: UNU-INWEH
Contributors: FAO, GWP, IAHS, ICHARM (early warning), IHE, IHP, IWMI, UNDP, UNISDR, UNU-FLORES, WMO

> Early-warning systems; 'climate-proofing' infrastructure; risk management options (incl. also soft measures like insurances, land use planning etc.); NBS

Chapter 6: Agriculture and food security (incl. fisheries, livestock and forestry)

Lead Agency Volunteers: FAO
Contributors: CDP-BAFWAC, IAHS, IIASA (Biofuel), IWMI, WMO

> Agricultural land management (e.g., increasing carbon storage); increasing irrigation efficiency (for both water and energy); improving rainfed crop productivity and drought resistant crops; reducing/recycling; food waste(?); forestry, livestock, improving Ag in high-income countries (not just LDCs).

Chapter 7: Energy and industry

Lead Agency Volunteers: UNIDO
Contributors: CDP-BAFWAC, FAO (TBC), IIASA (Biofuel)

> Water use efficiency and water use reduction for different sectors (incl. mining, different types of energy); biofuels (here or in Chapter 6); value chains, water footprints, CSR and the need of long-term commitments, business models, role of industry 4.0 …

Chapter 9 – Human settlements (incl. water/climate-induced migration)

Lead Agency Volunteers: t.b.d.
Contributors: CDP-BAFWAC, IHP, IWMI, World Youth Parliament for Water

> Building 'resilient' cities (climate smart, water sensitive etc.); 'green cities' provide adaptation, climate change mitigation, and improved water management;…
>
> Settlements in rural areas: challenges and sustainable pathways in light of climate change
> Effects of climate-induced migration on settlements (rural and urban)

Chapter 10 – Integration/NEXUS section

Lead Agency Volunteers: WWAP
Contributors: FAO, GWP, IAHS, IHP, IWMI, UNU-Flores

> IWRM for CC, impacts of NOT addressing CC impacts on energy, industry, etc.
>
> Multiple opportunities through interlinkages (potential nexus, including ecosystems); possible matrix of sectors vs. water impacts and response options to demonstrate interlinkages

PART 3 – Regional Perspectives

Lead Agency Volunteers (assumed): RECs, WWAP
Contributors: GWP, ICHARM, IHE, UNESCO Abuja Office

> *The five different regions (as defined under the UN Regional Economic Commissions) have different challenges regarding water and climate change and unique responses. However, effective solutions might also (with some adaptations) work elsewhere. These will be highlighted in this chapter, which will focus on a limited number of specific examples (i.e., 'case studies') that will showcase 'learning examples' and inspire transfer and action. The description of the case will be more detailed than the references and boxes that will populate the report throughout. They be standardised and cover key aspects link main water management objective related to climate change, co-benefits (e.g. job creation, carbon sequestration, sustainable livelihoods), lessons learned etc. Could feature case studies beyond specific countries ie. Lake Chad which combines a series of water & CC related issues.*

PART 4 – An enabling environment for change and progress

> *The call for adaptation to CC in water management has been happening for over 15 years. Why has progress been so slow? The mitigation (GHG) opportunities through improved water management are less well known. Progress will require concerted action (no 'silo' approach) along several different fronts. Relevant and inspiring cases will be introduced throughout.*

Chapter 11 – Governance + ch 14 Awareness raising, participation, cross-sectoral coordination and political will

Lead Agency Volunteers: UNDP
Contributors: Aquafed, IHE, IHP, ICHARM, IWMI, OHCHR, RAMSAR, WaterLex, Water.org, World Youth Parliament for Water, WMO, [WB as potential major contributor?]

> Refer to OECD water governance framework; CC adaptation (and mitigation) as part of national water policies, and vice-versa (via National Determined Contributions (NDC) and national Adaptation Plans); roles of legal and regulatory frameworks for water and land use management; transboundary issues; roles of different levels of government (global, regional, national, local) and the importance of bottom-up approaches; importance of accountability and transparency; ; Human Rights based approach; attribution problem (what part of the problem is water management, and what part is CC). public (stakeholder) participation; address conflicting interests; consumer awareness and collective action, strengthen political will and follow-up actions.
>
> Roles and responsibility of different actors (everybody's problem) and International Agreements (Agenda 2030, Paris, Sendai, water conventions, etc implementation gaps and challenges.

Chapter 12 – Financing

Lead Agency Volunteers: t.b.d.
Contributors: Aquafed, CDP-BAFWAC, OHCHR, UNDP, Water.org, WMO

> CC adaptation fund; most CC funding used for mitigation – can water management tap into those and what is needed?; insurance (DRR etc.), Green Climate Fund, PPP, investment in climate-sensitive water projects, funding for prevention, blended finance (project specific utilisation of different funding source), importance of long-term sustainable business models (beyond of short-term CSR actions), accounting, what makes a project 'bankable', value water and savings (value of water beyond 'pricing'), no regret investments, …

Chapter 13 – Technological innovation, knowledge (management) and capacity development, R&D

Lead Agency Volunteers: IHP
Contributors: Aquafed, IAHS, ICHARM, IHE, UNDP, WMO

> Monitoring and evaluation (keeping track of the outputs and outcomes of strategies); role of citizen science, knowledge gaps and research needs, obstacles and solutions for flexible/adaptive design and methods, …

Chapter 14 – Concluding remarks

Lead Agency Volunteers: WWAP
Contributors: many …..

> many policy messages, stress the urgency (act now), managing risks, no regret options, many measures support sustainable development in all its facettes. …..

2.10 - KNOWLEDGE SHARING

The meeting ended with a brief exchange on background literature and key reference material (particularly reports, published or soon-to-be), which could be useful for the lead agencies and the contributions.

WWAP requested all participants to send their relevant recent publications that are directly linked to the WWDR 2020 theme. These can be added to the background literature review. If possible provide a short summary of the publication.

2.11 - CONCLUDING REMARKS

UNESCO WWAP Coordinator thanked all participants and informed that the Minutes of the workshop would be shared shortly, while the **final draft of the Annotated Table of Content will be shared in October for review and comments**. He thanked everybody for the significant contributions during the intense 1.5-day workshop and the very pleasant and constructive atmosphere. This provides the basis for jointly working on an important report that might have significant impact on policy and decision making in the future.

3 ANNEXES

ANNEX 1 - WORKSHOP AGENDA

Wednesday 19 September 2018

19:30	Apericena (ice-breaking buffet dinner)

Thursday 20 September 2018

9:00 - 9:30	**Opening and welcome** *Objectives of the WWDRs; purpose of the meeting; agenda; introduction of participants* Facilitator: Stefan Uhlenbrook
9:30 - 10:00	**Introduction to the WWDR2020 Theme and Background documents** *Scope of the report; intended audience, introduction to breakout session #1* Co-Facilitators: Rick Connor and Jos Timmerman Rapporteur: Engin Koncagul
10:00 - 10:45	Breakout Session #1: **Main Messages** (see Annex 3 for participant groups) *The purpose is to identify a set of messages that will be applicable to (nearly) all chapters and sections, taking account of those proposed in the background document. This may involve adding a few new concise messages and/or eliminating some less essential or redundant ones. (Note that this is NOT meant to be an editing or wordsmithing exercise, NOR are the main messages meant to serve as a 'catch-all shopping list' of issues and topics.)*
10:45 - 11:00	**Coffee break**
11:00 - 11:40	Plenary: **Reporting back from groups on Main Messages** (10 min per group) *A representative of each group shares their one or two most significant addition, change or deletion. (This is not to be a recap of the entire discussion.)* Facilitator: Engin Koncagul Rapporteur: Natalia Uribe-Pando
11:40 - 12:45	Plenary: Discussion on **Leading Topics** *Beginning with the Generic Structure (see Annex 1), participants explore possible 'Leading Topics', essentially potential chapter or section headings. These therefore are meant to include broad categories under which more specific content can be positioned.* Facilitator: Rick Connor Rapporteur: Angela Cordeiro Ortigara
12:45 - 13:45	**Group Picture and Lunch**
13:45 - 14:15	Plenary: Content structuring – the **Skeletal Table of Contents (ToC**) *Based on the outcomes of the earlier Plenary, the Main Messages and elements of the storyline, the ToC will be reviewed and the various 'Leading Topics' are organized into the Generic Structure which will form the basis for the Table of Contents for the report and the next round of Breakout Sessions #2.* Facilitator: Rick Connor Rapporteur: Angela Cordeiro Ortigara
14:15 - 14:45	Breakout Session #2a: **Developing the Annotated Table of Contents (AToC)** (see Annex 3 for participant groups) *Each group addresses one of the four principle parts of the report and makes recommendations about how different chapters (or possibly critical sections) for each part could be organized and what major/essential content elements each chapter should include.*
14:45 - 15:15	Breakout Session #2b: **Developing the AToC** (see Annex 3 for participant groups)
15:15 - 15:45	Breakout Session #2c: **Developing the AToC** (see Annex 3 for participant groups)
15:45 - 16:15	Breakout Session #2d: **Developing the AToC** (see Annex 3 for participant groups)
16:15 - 16:30	**Coffee break**

16:30 - 17:30	Plenary: **Reporting back from groups on AToC** (4 x 10 min (reporting) and 4 x 5 min (discussion) per group) *The Chairs and/or Rapporteurs of each the Main Part breakout sessions present the outcomes from both groups.* Facilitator: Stefan Uhlenbrook Rapporteur: Jos Timmerman
17:30 - 18:00	**Wrap-up of Day 1** by: Stefan Uhlenbrook
18:45	**Bus leaves to Perugia**
20:00	**Dinner in Perugia**

Friday, 21 September

9:00 - 9:45	Plenary: **Recap Day 1 and Objectives for Day 2** and discussion *The draft AToC is presented, followed by a short time comments/Q&A.* Facilitator: Stefan Uhlenbrook Rapporteur: Jos Timmerman
9:45 - 10:30	Plenary: **Production Work-plan** *The WWDR production calendar is presented and explained. The WWAP production team (as well as participants who have worked directly on the WWDR) will also share experiences and lessons learned in the past, all for the purpose of increasing the efficiency and effectiveness of the production process.* Facilitator: Engin Koncagul Rapporteur: Rick Connor
10:30 - 11:00	**Coffee break**
11:00 - 12:00	Plenary: **Commitments from Lead Agencies and Contributors** *Based on the AToC, agencies who will take the lead in developing (and writing) of chapters/sections of the WWDR 2020 are identified. It will be discussed how they can operationalize their contributions and inputs in accordance with the production Work-plan.* Facilitator: Engin Koncagul Rapporteur: Rick Connor
12:00 - 12:30	Plenary: **Knowledge sharing** *Participants are invited to identify relevant background literature and key reference material (particularly reports, published or soon-to-be), data and indicators, available as well as data and information gaps, which could be useful for the lead agencies and the contributions*. Facilitator: Natalia Uribe-Pando Rapporteur: Laurens Thuy
12:30 - 13:00	Plenary: **Recap of Workshop outcomes, way forward and closure** Facilitator: Stefan Uhlenbrook Rapporteur: Jos Timmerman
13:00 - 14:00	**Lunch**
14:00	Shuttle departs for Fiumicino airport (Rome)

ANNEX 2 - WWDR 2020 LITERATURE REVIEW

This document provides a concise overview of a limited literature search on the state of thinking around water and climate change.

Climate is changing

The earth is warming. Since the 1950s, many slow and gradual changes have been observed; the atmosphere and oceans have warmed, the amounts of snow and ice have diminished, precipitation patterns have changed in many places, weather extremes such as drought, flooding and storm surges occur more frequent and sea level has risen (IPCC, 2014a). The changes include a decrease in cold temperature extremes, an increase in warm temperature extremes, an increase in extreme high sea levels and an increase in the number of heavy precipitation events in a number of regions (IPCC, 2014b). Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history (IPCC, 2014b). These climate changes have had widespread impacts on human and natural systems (IPCC, 2014b). In many regions, changing precipitation or melting snow and ice (including glaciers) alter hydrological systems and affect water resources in terms of quantity and quality (IPCC, 2014b; Ligtvoet et al., 2018). The increasing water temperature of rivers, lakes, seas and oceans negatively affects the quality of their ecosystems (IPCC, 2014b; Ligtvoet et al., 2018). Climate change will continue to amplify existing risks and create new risks for natural and human systems (IPCC, 2014b). Collective human action to avoid the 'hothouse pathway' is required to steer the Earth System away from a potential threshold and stabilize it in a habitable interglacial-like state (Steffan et al., 2018).

Water is the most important medium through which climate change impacts upon society

The impacts of climate change will be channeled to society primarily through changes in the global and local water system, directly afftecting water availability over time and space (Worldbank, 2016). Climate change with also affect water demand. Changes in precipitation patterns, weather extremes, water-related disasters, sea level rise, and melting sea ice affect both security risks and development opportunities (Ligtvoet et al., 2018). The risks are related to three water-related challenges: water scarcity (too little water), water pollution (dirty water) and flood risk (too much water). The consequences can be large and are uneven spread across the globe. Population growth, economic development, increased agricultural production and expanding cities will converge upon a world where the demand for water rises exponentially, while supply becomes more erratic and uncertain, not in the least as a consequence of climate change (UNU-INWEH, 2013).Sensive regions suchas small island developing states (SIDS), (high) mountainous areas, coastal zones are particularly vulnerable (Gurdak et al., 2015).

Water-related climate risks cascade through food, energy, urban, and environmental systems. Without mitigation and adaptation action, water scarcity, both in terms of surface water and groundwater resources, is expected to proliferate to regions where it currently does not exist and will greatly worsen in regions where water resources are already stressed (UN-Water, 2010). Moreover, the quality of water resources is expected to deteriorate due to interacting factors: increased temperature; increased sediment, nutrient, and pollutant loadings from heavy rainfall; increased concentration of pollutants during droughts; and disruption of treatment facilities during floods (IPCC, 2014a). All this may also influence drinking water production. And rainfall is projected to become more variable and less predictable, while warmer seas will fuel more violent floods and storm surges. Climate change will increase water-related shocks on top of already escalating trends in water demand and use (Worldbank, 2016). The severity of the effects will depend upon factors like geographic location and features, conditions of water availability and utilization, demographic changes, existing management and allocation systems, legal frameworks for water management, existing governance structures and institutions, and the resilience of ecosystems (UNU-INWEH, 2013).

Disasters hit harder, but number of casualties reduced – costs are higher

A large part of disaster risk is directly or indirectly linked to water (e.g. flood, drought, typhoons/ cyclones, flashfloods, landslides, water quality emergencies). Globally, water-related disasters already account for 90% of all natural disasters (WCDRR, 2014). Each year, water-related disasters, such as drought and flooding, affect approximately 160 million people, killing about 13,500 of them (Ligtvoet et al., 2018). Flooding affects most of these people (106 million, annually) and causes the largest economic damage (USD 31 billion, annually) (Ligtvoet et al., 2018). In 2010, around 1 billion people around the world were living in floodprone areas, potentially exposed to either river or coastal flooding. This number is projected to increase to over 1.6 billion by 2050 (Ligtvoet et al., 2018). With increasing greenhouse gas emissions the number of related disasters increase significantly through a higher frequency of intense storms, locally more intense rainfall and higher river discharge extremes. In most basins today, the timing of precipitation and runoff events is also shifting (UNECE, 2009; 2015). The number of people affected and the estimated damage from water-related disasters continue to rise. This increase can be partially explained by better reporting and the documentation of these disasters and its consequences. Fortunately, the higher number of people affected is not accompanied by a higher number of casualties, although women and children remain disproportionally vulnerable (UNISDR and UNECE, 2018). Due to improved early warning systems and increased disaster management capacity, the number of people killed by weather-related disasters has decreased, over the last decades. This suggests that disaster risk management is working in some areas. Nevertheless, droughts (as slowly developing disasters) cause substantial damage to the economy, and may lead to the collapse of social structures and to refugee crises that cause disruptions in the social structures of adjacent regions (UNISDR and UNECE, 2018). The negative impacts of disasters exacerbate inequalities and are disproportionately borne by poor and vulnerable communities (Ligtvoet et al., 2018; UNECE, 2009; 2015).

Freshwater becomes scarcer

Climate change, which brings higher average temperatures and changing precipitation patterns, is projected to significantly reduce available renewable surface water and groundwater resources in most dry subtropical regions, amplifying competition for water among agriculture, ecosystems, settlements, industry and energy production, and deteriorating already scarce water resources (Timmerman et al. 2017). Water consumption is increasing, especially that of households and industries (incl. energy sector) in developing and emerging economies (Ligtvoet et al., 2018). Agriculture will remain the largest user, while its relative share will likely continue to reduce. High levels of regional water stress may limit agricultural production (Ligtvoet et al., 2018; Worldbank, 2018). Meeting the increasing demand for freshwater and protecting ecosystems at the same time presents tradeoffs between stakeholders and between human and ecological needs (Timmerman et al. 2017). It is estimated that the world will face a global 40% shortfall between forecast demand and available supply of water by 2030 (Worldbank, 2018). Today, 70% of global water withdrawals are for agriculture (Worldbank, 2018). Feeding more than 9 billion people by 2050 will require a 60% increase in agricultural production and a 15% increase in water withdrawals (Worldbank, 2018). In some regions such as in Northern Africa and Northern India, groundwater is being depleted and contaminated at a rate faster thant it is being replenished (Worldbank, 2018). Changes in water availability and variability can induce migration and ignite civil conflict (Ligtvoet et al., 2018; UNECE 2015; Worldbank, 2018).

Adaptation is needed for sustainable development

Adaptation can reduce the risks of climate change impacts, but there are limits to its effectiveness, especially with greater magnitudes and rates of climate change (WWAP, 2015). Taking a longerterm perspective for adapting to hydrological extremes in the context of sustainable development increases the likelihood that adaptation actions will also enhance future options and preparedness (IPCC, 2014b). Subsequently, effective implementation depends on policies and cooperation at all scales and can be enhanced through integrated responses that link adaptation (and mitigation) with other societal objectives. Adaptation should therefore be embedded in planning processes and supported by both economical and institutional incentives (UNECE 2015). Adaptation options exist in all sectors and should be investigated and exploited where possible: We need to better understand what works best, where, and under which circumstances. Some adaptation responses involve co-benefits, synergies and trade-offs (UNECE, 2015). Adaptation is a combination of engineered and technological options, and social, institutional and ecosystem-based measures. All measures should emphasize flexibility and learning (IPCC, 2014a; 2014b; WWAP, 2015). Where possible, adaptation should also adopt a decision scaling approach (Gurlak et al., 2018).

Adaptation can be combined with mitigation

In many respects, water is to adaptation what energy is to mitigation. Mitigation measures can influence water resources and their management, and it is important to realise this when developing and evaluating mitigation options (Wallis et al., 2014). Hydropower as a mitigation measure to reduce GHG emissions, for instance, can contribute to flow regulation, flood control, availability of water for irrigation and the protection of the environment (Bates et al., 2008). On the other hand, construction of hydropower plants may cause ecological impacts on existing river ecosystems and fisheries, and social disruption, among others (Bates et al., 2008; Worldbank, 2016). Nevertheless, adaptation activities, leading to the increased resilience of systems and improved rural incomes, may also have a mitigation value. For instance, forestry management and agroforestry techniques, agricultural 'good practices' that conserve soil and water resource, and properly scaled bio-energy projects for rural communities as adaptation measures also provide mitigation options and provide additional income to poor rural communities (Tubiello and van der Velde, 2011). Wetland restoration as adaptation option can result in improved water quality and decreased flooding, and also contribute to mitigation through CO_2 absorption and carbon capture (however, net carbon stoarge, including possible methane emissions, need be considered). Afforestation and reforestation may also have beneficial hydrological and mitigating effects (Bates et al., 2008; Tubiello and van der Velde, 2011; Wallis et al., 2014).

Climate change is a water governance issue

Climate change is, to a large extent, water change and where the water crisis is a governance crisis, climate change adaptation is made more difficult by deficiencies in governance (Timmerman et al., 2017). Unsustainable development pathways and governance failures have affected the quality and availability of water resources including groundwater, compromising their capacity to generate social and economic benefits (IPCC, 2014b; UNU-INWEH, 2013). While physical assets and infrastructure are often the focus of climate adaptation efforts and expertise, the framework for avoiding, reducing and resolving conflicts and tradeoffs between different water uses and across territorial boundaries serves as a 'soft' infrastructure (Timmerman et al., 2017). Such a framework requires well-designed and empowered institutions with supporting legislative and policy instruments and mechanisms for involving a large range of stakeholders). It also requires capacity for change, adaptive management structures, new forms of relationships, and multilayered models capable of integrating complex natural and social dimensions (Timmerman et al. 2017; UNU-INWEH, 2013). Governance structures must be adapted to local conditions and needs, and applied at various levels so that they mutually reinforce and complement one another (WWAP, 2015). Governance includes ethical dimensions, equity, value judgments, economic assessments and diverse perceptions and responses to risk and uncertainty (Timmerman et al. 2017; UNU-INWEH, 2013; WWAP, 2015).

Need for nature based solutions

Ecosystems are under stress as a result of climate change. Apart from biodiversity loss, ecosystem services such as purifying water, irrigation water, fish resources, carbon capture and storage, recreation, and natural flood protection may deteriorate. These developments particularly affect people who depend on natural resources for their lives and livelihood (Ligtvoet et al., 2018). Action is needed, also in water management, to increase the inherent capacity of ecosystems and their species to adapt to a changing climate. Realisation is growing that nature-based solutions (NBS), that are inspired and supported by nature and use, or mimic, natural processes, can contribute to the improved management of water while providing ecosystem services as well as a wide range of secondary cobenefits (IPCC, 2014a; UNEP, 2014; WWAP/UN-Water, 2018). For example, floodplains can reduce flood risk and simultaneously improve water quality, recharge groundwater, support fish and wildlife and provide recreational and tourism benefits (WWAP/UN-Water, 2018). NBS can help to respond to the impacts of climate change on water resources and contribute to people's health and quality of life through supporting sustainable food production, improving human settlements, providing access to water supply and sanitation services, and water-related disaster risk reduction (UNEP, 2014; WWAP/UN-Water, 2018).

Sectors

Many economic sectors are highly dependent on water and influence water, especially agriculture, energy and industry. Choices made in one domain have direct and indirect consequences on the other, positive or negative. Approximately 90% of global power generation is water intensive, amounting to some 15% of the world's total water withdrawals (WWAP, 2014). 69% of global water withdrawals are for agriculture (United Nations 2018). And water is a vital factor of industrial production (Worldbank, 2016). The demand for water is expected to increase. The availability of water for a range of water users is threatened in many places by a combination of increasing demand and climatic variability - longer periods of dryness and more erratic patterns of rainfall - as well as problems of pollution affecting water quality (Newborne and Dalton, 2016; Worldbank, 2016). Companies are increasingly encountering disruption of their operations due to problems of water supply and water quality, as well as floods (Newborne and Dalton, 2016). Some regions could see their GDP growth rates decline by as much as 6% by 2050 as a result of water-related losses in agriculture, health, income, and property, while on the other hand implementation of improved water policy could result in a GDP increase of up to 11% (Worldbank, 2016). Poorly designed or implemented water-management policies can exacerbate the adverse growth impacts of climate change (Worldbank, 2016). Dams, mostly built for energy production and irrigation, can disturb river flow dynamics and fish migration, have a general negative impact on river ecology, and trap sediment flows to coastal areas and deltas resulting in increased erosion of coasts, deltas and mangrove systems, and lead to displacement of people and disruption of social structures (WWAP, 2014). Few companies are beginning to take steps to change the way they manage water, but they are mostly investing in water infrastructure for their own direct interests with little consideration of other water users and stakeholders within the catchment (Newborne and Dalton, 2016).

Responses

Effective adaptation and mitigation responses will depend on policies and measures across multiple scales: international, regional, national and sub-national. Policies across all scales supporting technology development, diffusion and transfer, as well as an enabling environment (including finance, legal systems, capacity, institutions etc.) for responses to climate change, can complement and enhance the effectiveness of policies that directly promote adaptation and mitigation (Bates et al., 2008; IPCC, 2014a). Climate uncertainty is an important element to be dealt with in developing strategies and plans, and tools and methods are being developed to include climate uncertainty in the selection of adaptation pathways (UNESCO-IHP and ICIWaRM, 2018).

Responses can be found in:

1. Optimizing the use of water. Current problems and future developments require better ways of allocating (inceasingly in reallocating) scarce water resources across and within sectors. It will call for establishing credible institutions, policies and legal systems that can facilitate transfers of water in ways that maximize benefits (and minimize trade-offs) to all parties to the agreement.
2. Increasing water efficiency. The creation and adoption of new water saving technologies, incentives, education, and awareness is needed.
3. Expand water supply and availability. In the short run, investments in storage infrastructure such as dams and aquifer recharge that makes water available when it is needed; water recycling and reuse; and where viable, desalination can provide solutions. More sustainable responses can sometimes be found in nature-based approaches.
4. Reduce the impact of extremes, variability, and uncertainty. Adaptive water management techniques, including scenario planning, learning-based approaches, and flexible and low-regret responses, can help create resilience to uncertain hydrological changes and impacts due to climate change.
5. Greater support for research and development. This is particularly important with respect to the design and application of local solutions that work effectively in a given context.
6. Capacity development. There is a need for improving the understanding of what climate change implies and how this can be addressed. In all these responses there is no "one-size-fits-all" approach. Specific attention is needed for addressing slow-onset events (e.g. droughts, sea-level rise and salinisation) as well as for improving transboundary water cooperation; shared waters provide opportunities for cooperation across nations and support political dialogue on broader issues such as regional economic integration, environmental conservation, and sustainable development (ADB, 2018; IPCC, 2014a; 2014b; Leb et al., 2018; UNU-INWEH, 2013; World Bank, 2016).

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ANNEX 3 - WWDR 2020 STORYLINE

This document provides an overview of what the WWDR on water and climate change should contain. Additional background information is provided in the short overview of literature.

Scope of the Report

As with all WWDRs, this is to be a report about water. Although scientifically fact-based, unbiased and technically sound, this report is not merely meant to be a technical report about the potential impacts of climate change on the hydrological cycle. Rather, the WWDR 2020 will seek to address the critical linkages between water and climate change in the context of the broader sustainable development agenda. The report will focus on the challenges, opportunities and potential responses to climate change – in terms of adaptation, mitigation and improved resilience – that can be addressed through enhancing water resources management and improving access to water supply and sanitation services for all. In doing so, the report will address two of the most critical crises the world will face over the next several decades: Water (in)security and climate change.

Context

The climate is changing and society is being severely affected through the hydrological changes that climate change brings about. The changes can be summarised as increasing extremes (frequency and severity) in too much water (floods), too little water (droughts) and too little water of sufficient quality (especially higher water temperature and low flows that can lead to poor water quality). These changes reach society directly through floods, droughts and water related diseases, among others, but also threaten energy and food security as well as a number of other Sustainable Development Goals (SDGs). Already, governments face severe problems in dealing with these issues, which can for a large part be attributed to insufficient, inappropriate or uncoordinated water management. Water management problems are often themselves a consequence of poor governance.

The impacts of climate change will particularly affect regions that already face serious water problems but will also extend to other regions that so far have seen relatively minor water problems. Climate change, as a result, puts higher pressure on water management and the related governance structures.

Society highly depends on water, and water is as a result critical to sustainable development in all its dimensions. Agriculture and energy are the largest water users globally, but industrial production has a substantial and rapidly increasing water demand. Next to this, drinking water requires available and accessible sources of high quality. Competition between water users exists at all levels and sometimes leads to conflicts. Climate change is expected to aggravate this competition and action is needed to deal with these situations.

Adaptation and mitigation

Adaptation in water management that accounts for changing conditions will often help to sustain and further improve socio-economic conditions. Such adaptation can support dealing with changing general conditions like air temperature, the hydrological regime and a shifting growing season, and with stronger extremes like more severe floods and droughts.

Both adaptation and mitigation measures are possible in water management, also in combination. Adaptation measures are usually designed to deal with climate change impacts without consideration of their effects on greenhouse gas emissions, whereas mitigation measures are seldom considered in light of their adaptation potential. However, it is possible to incorporate mitigation in designing and selecting adaptation measures in water management. For instance several nature based solutions for water often offer a potential for increased carbon capture and storage. Also, water efficiency measures can help mitigation by reducing energy needs for processing and transporting water and for better processing of wastes. Conversely, mitigation measures can have negative impacts on water (e.g. biofuels can increase the demand for water), underlining the need for comprehensive and coordinated policy-making and planning.

Developing strategies for adaptation and mitigation

Much attention in literature has been paid to developing adaptation strategies based on modelling, scenario building and risk- and vulnerability assessments[3], while some water-related mitigation strategies are increasingly recognised. Often, the focus of this work is on the development of the assessments and of selecting the most effective options. National level institutional frameworks and management systems (and other governance structures) play a critical role by defining and implementing effective policies and legislation that support the adaptation and mitigation strategies and designating those institutions responsible for implementation and operation. Since adaptation measures are implemented locally, they therefore also entail involvement of local stakeholders. It is nevertheless essential to consider the full set of adaptation options. And as there is uncertainty about how the climate will change, a flexible and adaptive approach is needed that looks at the long-term developments, integrates over all relevant sectors and that can adjust to hydroclimatic variability and helps prevent extreme events from becoming disasters. Strategies for climate change mitigation within the main water-related sectors (supply and sanitation, agriculture and energy production) are also dependent on both national-level governance and local stakeholder involvement.

Climate change adaptation and mitigation options

A range of climate change adaptation options has been implemented over the past decade and information has become available on how they perform under certain circumstances. The report will have its main focus on presenting adaptation options, illustrated with many case studies with the ultimate goal to increase awareness and, eventually, facilitate selection and implementation of the multitude of options among water management actors. Moreover, the examples can also show the opportunities of climate change adaptation and mitigation in improving water management in a broad sense, and vice-versa (a.o. in innovative technologies). From the examples, it should also become clear that substantial involvement of the private sector is not only possible but needed to make adaptation and mitigation work. Moreover, integration over sectors will help to ensure that actions in one sector are not counteracting actions in other sectors but can even reinforce each other. The concept of IWRM provides a solid approach for climate change adaptation and mitigation in water management. In all the options, flexibility and adaptiveness are necessary to remain relevant as the future unfolds. Finally, both adaptation and mitigation potential of the options are to be addressed. Topics to be discussed include:

- Infrastructure
- Land use management
- Nature based solutions
- Water efficiency technologies
- Energy and industry
- Agriculture
- Water purification, wastewater treatment and water reuse
- Disaster risk management
- Economic instruments
- Capacity development an awareness raising
- Monitoring
- Cooperation
- Governance

[3] For example: Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA) (https://www.unenvironment.org/resources/report/provia-guidance-assessing-vulnerability-impacts-and-adaptation-climate-change-0); Collaborative Risk Informed Decision Analysis (CRIDA) (http://agwaguide.org/about/CRIDA/), adaptation pathways (https://www.sciencedirect.com/science/article/pii/S095937801200146X).

Infrastructure

Water management is often associated with infrastructure. Dams, weirs, locks, boreholes and reservoirs are among the important water management measures. In many cases such infrastructure is inevitable, given the investments, for instance, in urban areas. It is nevertheless important to identify the negative effects of hard infrastructure, specifically the effects on the ecosystems and on human well-being. Infrastructure usually has a life-span of several decades, while the effects of climate change will also evolve over the same period (and longer). Implementing climate-proof infrastructure therefore needs to be done in view of the life-time of the infrastructure, when a new situation arises that may call for a different or modified solution.

Infrastructure is often implemented without sufficiently securing financing of its operation and maintenance. Infrastructure operation can play a significant and unique role in adaptation. Reservoirs are often designed for a specific purpose (irrigation or energy). Changes in water discharge from the reservoir can be beneficial for another purpose and balancing of the different purposes can be a way of adapting to changes in precipitation and run-off upstream of the reservoir. Similarly, badly designed and/or poorly maintained infrastructure can lead to reduced effectivity (e.g. leakages from drinking water distribution) and/or negative side-effects (e.g. leakages from waste-water collection systems). Full inclusion of maintenance requirements in the planning, design and operation of infrastructure is therefore imperative. Water management infrastructure can also play a role in GHG mitigation, mainly through improved energy efficiency measures. Wastewater treatment plants (which can require large amounts of energy) can be energy-neutral by extracting the energy content of the organics in wastewater and converting it into a useable form.

Land use management

Land use planning and management can have an important influence on improving resilience in water management. For instance afforestation can reduce run-off and improve water retention in upstream areas while reducing erosion and siltation, thus improving the efficiency and longevity of surface water storage infrastructure as well as groundwater recharge. Reserving space for water and green areas can also improve liveability of urbanised areas. Also, managed aquifer recharge (MAR) can be used to store excess renewable water supplies in aquifers during wet periods, which can be used to off-set limited surface-water supplies during dry periods. Prohibiting or limiting development in flood prone areas can help in preventing disasters. Such areas can, for instance, be designated as recreational areas in times of normal water levels. Wetland restoration, one of the main mitigation practices in agriculture (via carbon sequestration), may have positive impacts on both water conservation and water quality as well as decreased flooding.

Nature-based solutions

Nature-based solutions (NBS) can be found for many problems, whether alone or when deployed in combination to help improve the efficiency and effectiveness of grey infrastructure. The WWDR 2018 report provides a thorough discussion of the possibilities of NBS in terms of both adaptation and mitigation and a short overview can be given in the report. The limitations of NBS are also discussed as well as the need for an combined and balanced approach to achieve effective solutions.

Water efficiency technologies

Increased water efficiency generally translates into lower energy use. A range of options exist towards reducing the use of water. These include managing water consumption (a.k.a. ‘demand management’), grey water reuse, water efficient industrial production, rainwater harvesting, crops that require less water, etc.. Various options could be discussed in a specific section of the report or through real-life examples provided throughout the various chapters.

Energy and industry

Energy production in general asks for large quantities of water, which are not always available. Also, several industrial sectors processes require large amounts of water. A balance is needed between the need and use for energy and process water, and the availability of water, combined with reducing the water use in energy and industrial production. Similarly, energy gains can be obtained in the treatment and distribution of water (including wastewater), thus lowering the GHG footprint of water management as a measure to mitigate against climate change. The WWDR 2014 report provides substantial background to this discussion.

Agriculture

Agriculture is the largest consumer of freshwater while food production will need to increase in order to meet growing demands from population growth and changing consumption patterns, implying an even larger demand for water. Partly, the increasing demand for food can be met through increased efficiency of food production and distribution. In many regions around the world, there is a need to shift agricultural production towards less water consuming practices including innovative irrigation techniques, crop shift and salt-resistant crops. On the other hand, flooding and waterlogging, and seasonal changes in precipitation threaten agriculture, and measures are needed to avoid this damage. Nevertheless, flooding is also beneficial for agriculture in many regions. Conservation agriculture and improving the productivity of rainfed agriculture, finally, can serve both adaptation and mitigation objectives.

Water purification, wastewater treatment and water reuse

Water purification and wastewater treatment systems will undergo increasing pressures due to impacts of climate change on the quality of water in rivers, lakes and aquifers, as well as during increasingly frequent extreme weather events such as floods and droughts. (Waste)water reuse can serve as an adaptation measure to cope with water scarcity by augmenting supplies for potable and non-potable purposes. On wastewater, the WWDR 2017 report provides substantial inputs for this issue. Discharge of untreated wastewater reduces the availability of freshwater of sufficient quality. Advances in wastewater treatment are therefore imperative to increase water resilience. Next to that, a range of applications for treated wastewater has been developed and is still under development, that can reduce the demand for freshwater, while allowing for energy gains and recovery of raw materials to be realised, thus contributing to mitigation.

Disaster risk management

Disaster risk management also calls for more adaptation to climate change. Where the focus previously has been on responding to extreme events and recovery after an event, nowadays lowering the risks through increased preparedness (ultimately preventing extreme events from becoming disasters) and for increasing the resilience of water management systems to climate changes comes to the fore. The latter is especially critical in dealing with unexpected changes, as the climate model projections are uncertain and some future trends and events may unfold in a different way than expected. Prevention pays, as it yields avoided damages, reduces loss of life and infrastructure, and the disruption of social structures. Prevention can help reduce social inequity, and it is usually advantageous for investments as it reduces the risk that these investments are negatively impacted by increased variability and disasters, consequently generating greater trust and confidence.

Early warning systems can help to increase the resilience of society. Flood and pollution early warning systems have become more and more available in many basins. Drought early warning is more complex, given its nature of developing slowly. Nevertheless, good examples of drought early warning systems already exist. Important in early warning is the institutional set-up, including regular monitoring and reporting. A missing link is often the integration of these early-warning systems into proactive (drought) risk management and policies.

Economic instruments

Economic instruments, such as water licencing, water pricing, climate risk insurance and subsidies can provide important leverages for adaptation. Such instruments can be an important means for governments, combined with regulation, to further adaptation and mitigation in the private sector and at the households level.

Capacity development and awareness raising

Many individuals, the public at large but also government officials and private sector officials, are not or only slightly aware of the impacts of climate change and if they are, they are often not aware of how they can contribute to adaptation and mitigation. The same applies to many institutions involved in water governance. Capacity limitations include 1) weak capacity in countries for investment design and preparation of measures; 2) inability to access diverse sources of financing; and 3) insufficient recognition from the climate community that sound water resources management builds systemic resilience as a result of which water is insufficiently prioritized in climate adaptation actions, including politically and financially. Capacity development is needed to improve this awareness as well as the willingness and ability to adapt.

Research, development , monitoring, analysis and reporting

In spite of a broad range of existing adaptation and mitigation strategies, knowledge gaps remain in terms of their overall performance on the ground. Improved monitoring is needed to be able to track hydroclimatic changes as they are developing in view of climatic changes, as well as to track the effectiveness and efficiency of adaptation and mitigation actions. Where monitoring used to be labour intensive and costly, current technological developments with inexpensive sensor and communication technologies enable improved monitoring at reasonable costs.

Where possible, adaptation should adopt the decision scaling approach, which has been applied to evaluate climate risks to water management systems focused on performance indicators, such as water supply reliability, flood risk estimation and cost-benefit analysis, as well as climate-sensitive hydrologic indicators.

Cooperation (basin-level and beyond)[4]

Attention for the potential of conflict over water in transboundary basins (and elsewhere) has risen with increasing recognition of the risks and potential impacts of climate change and climate variability. Especially in water scarce regions, the competition over water can lead to conflicts. It is therefore recommended to adapt to climate change at the basin level in order to maximize effectiveness of adaptation and reduce negative impacts of certain unilateral measures.
Water diplomacy or 'hydro-diplomacy' has gained attention in this respect as a means to remediate (potential) conflicts and is connected to climate change. Many countries have become increasingly aware of the multiple benefits of basin-wide adaptation, transboundary cooperation over water and the common goal of achieving this globally by 2030 (i.e. target 6.5 of the 2030 Agenda of Sustainable Development). These benefits include more effective adaptation due to exchange of data and scenarios, reduced uncertainty about cc impacts and actions of the neighbors, harmonized and not contradictory actions, enlarging the planning space to locate measures in the basin where they have the optimum effect etc.. By putting the cooperation at the political level, cooperation can be more easily be formalised and institutionalised. And it should be realised that tensions over water use not only exist between countries, but also within countries, for instance in a federal system between states, between provinces, between communities and also within communities.

Governance[5]

Improving water governance relates to improving the effectiveness and efficiency of water management, and enhancing trust and engagement. This includes ensuring that the right people and appropriate institutions can be (through regulatory frameworks) and are involved in the right way, and that individuals and institutions can participate in the process of water management, both in terms of openness and capacities. It also includes coherence between different sectors and scales, including groundwater. Next to this, data and information need to be available as well as financial resources.

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[4] Also see, e.g.: Climate Resilience in Africa : The Role of Cooperation around Transboundary Waters (https://openknowledge.worldbank.org/handle/10986/29388)

[5] OECD has developed 12 principles for good water governance: http://www.oecd.org/gov/regional-policy/OECD-Principles-on-Water-Governance-brochure.pdf

ANNEX 4 - WWDR 2020 MAIN MESSAGES

Climate change impacts upon society primarily through water. Hydrological changes imply huge risks for society, not only directly through all elements of the water cycle (including human and ecosystem demand) and overall water security (including water supply and sanitation), but also indirectly through risks for energy, food security, economic development and inequalities, among others.

Current water challenges are aggravated by governance problems. As current water problems are largely (but not only) governance problems, dealing with the impacts of climate change to achieve and ensure water security requires improved water governance.

Adaptation to climate change through water management is critical to sustainable development. Numerous examples show that adaptation through water management can lead to improving social and economic development, thus directly supporting the 2030 Agenda for Sustainable Development (including most SDGs).

Improved water management can address both adaptation and mitigation objectives. In certain cases, such as in conservation agriculture and water reuse, strategies can address both objectives in tandem.

A preventive, flexible, inclusive, integrative, long-term approach is needed. Although much uncertainty about the effects of climate change remain, especially at the basin-level, model projections provide possible development pathways on which decisions can be built. A long-term approach that accounts for climate change projections, focussing on prevention and preparedness for disasters and greater resilience to hydrological variability supports sustainable development.

Climate change calls for action at all levels (local, regional, national, transboundary, global) **and across sectors**. The public and private sectors, as well as civil society, NGOs and international organisations need to cooperate and coordinate the planning and implementation of their mitigation and adaptation actions. The best strategies are those that deal with different potential futures through investments in no-regret measures, adaptation pathways and flexible solutions.

There is a strong need for increased capacity and better awareness of water management options. A wide range of adaptation and mitigation options in water management are available and currently being implemented. However, many actors are insufficiently aware of all costs and benefits of these options, as well as their applicability and potential trade-offs.

I**ncreased research and development, and improved monitoring, analysis and reporting are needed**. Bridging the 'observational gap' is critical to enhancing our levels of preparedness for addressing the hydrological challenges emanating from climate change and for making evidence-based decisions.

Climate change brings risks, but also opportunities. Adaptation and mitigation to climate change provides opportunities to improve existing water management approaches, stimulate innovation and promote socio-economic development.

ANNEX 5 - GROUP OUTCOMES ON MAIN MESSAGES

Group 1

Chair: Anil Mishra
Rapporteur: Amanda Loeffen

- What is the linkage between the report and SDGs – key ones SDG6 and SDG13
- What is the target audience?
- 1st Take out parts in brackets – sentences should be condensed
- 2 and 6 can be merged into mainstreaming
- 3rd need reference to Paris agreement
- 5th "under uncertainty" at the end of the message – uncertainty is a given
- 6th message is too obvious, messages need to be stronger
- 9th Split research and monitoring, they deserve separate attention
- New: "Climate change considerations should be mainstreamed into overall water management/development plan" – revisit governance structure to that goal
- New: "consider those that are left behind" – human right to water – vulnerable people are affected most
- New: "means of implementation of adaptation need to be ensured" - finance – access to 0.7% of GDP (SDG 17)

Group 2

Chair: Neil Dhot
Rapporteur: Merylyn Hedger

- Stress the urgency
- Where we are in 2020
- Pitched to help water policy makers. Tell the water community how the climate world works (no so much the other way around), to get water into the national adaptation plans. Instruct water people on how to be part of the climate movement
- Not redescribe problem, focus on solutions. Actions on water may be solutions for some challenges of climate change.
- Add an overriding message to show that the report present solutions to climate change challenges.
- Increase references to resilience and call to action on disasters, mention the economic consequences.
- How to make change on the ground, make things differently
- Work more with civil society
- A dedicated message should address industries and companies that have a role in climate change. There is an opportunity to engage private sector in the water actions for climate change, their need to increase the pace, and to go much further.
- How frameworks at national level work, with case studies and examples
- Everyone is part of the solution, and there is a shared responsibility.
- The messages could be targeted to the audience of policy makers: the entry point should be the big societal challenges (i.e.: food security, disasters). Maybe a shock message that captures the attention and then turn into a positive light

Group 3

Chair: Christophe Cudennec
Rapporteur: Rio Hada

- Need to clarify who is the target audience
- Possibility of reaching out to broader audience
- Messages to be simple, easy to understand
- More human focus upfront
- Go beyond the water sector to engage multisector, especially with climate community, so make sure we also use the climate language
- Not just highlight problems but solutions and opportunities
- Clear linkages between climate change and water. More emphasis on water resources, nature, ecosystems, biodiversity and human focus
- On risks: how to unpack cyclical, but also slow onset nature of climate change. Risks of non-action.
- Link between climate change and migrations
- Who is at risk? Link to 'leave no one behind' WWDR
- Solutions: short term what needs to be done now? Plus more wider perspective need long term actions , link to commitments under 2030 agenda , probability multisector and multidimensional dimensions of climate change
- More emphasis bottom up approach- emerging civil society movements for community level adaptation and mitigation

Group 4

Chair: Eddy Moors
Rapporteur: Marco Toscano Rivalta

- Too many messages, prioritization is needed
- To come up with the fundamental message
- Concrete specific merging recommendations (merge 3,4 & 9, 6&2, 1&3)
- Important to think to whom to address- technical or political? Strong message on geopolitical impact
- Share positive messages
- Messages to be solution oriented
- Link to oceans was found missing
- Relevant actors missing like cities
- Security nexus
- Capacity development throughout the different messages , not as a separate one
- Governance- more transparency and climate justice

ANNEX 6 - WWDR GENERIC STRUCTURE (AS DECIDED IN 2012)

Executive Summary (3 to 5 pages)

Part 1: Baseline and Context (10–15 pages)

- Presentation of the theme – links to water and development
- Notable recent developments related to water and the theme (e.g. major global crises, trends and events; evolution of key drivers/externalities)
- Theme-related highlights from previous WWDRs, other UN-Water and UN agency publications, and flagship reports by UN-Water Member and Partner Organizations
- Data availability issues (knowns and unknowns)

Part 2: Thematic Focus (30–50 pages)

- Three to five chapters covering the theme from the different perspectives of the most relevant challenge areas, including hotspots and externalities (i.e. drivers)

Part 3: Regional Aspects (10–15 pages)

- One comprehensive chapter (or regional chapters, depending on relevance of the theme to regional coverage). Highly focused cases, hotspots, externalities, examples, stories and/or unique perspectives from the five regions: what aspect of the theme makes it uniquely relevant to the region (and vice versa)?

Part 4: Response Options (15–20 pages)

- From 'in' and 'out' of the water box – these should be directly linked/applicable to the 'challenges' identified in Parts 2 and 3
- Policy implications

ANNEX 7 - PRINCIPLE PARTS OF THE REPORT

Part 1: Baseline and Background

- Prologue: State of resource (water availability, demand, quality, disasters & extremes) + overview of the potential impacts of climate change on water resources and the hydrological cycle.
- Introductory Chapter: What the report is about (scope and objective of the report), for whom it has been prepared, why it is important, and where it fits as part of the global efforts to address the issues of climate change and sustainable development.

Part 2: Challenges and opportunities for adaptation and mitigation in water management

What can be done through improved water management to better adapt to CC, to increase the efficiency and robustness of water management infrastructure (including O&M), and to contribute to CC mitigation via the main water management sectors (water resources management, water supply and sanitation services, disaster risk reduction.

Part 3: Challenges and opportunities for adaptation and mitigation for major water use sectors

Different water use sectors face different challenges with respect to water and CC. There are opportunities to improve CC adaptation and contribute to CC mitigation (i.e., 'responses').
What are the main sectors, and what are the main options/opportunities that can be pursued by each one?

Part 4: An enabling environment for change and progress

The call for adaptation to CC in water management has been happening for over 15 years. Why has progress been so slow? The mitigation opportunities of improved water management are less well known. Progress will require concerted action along several different fronts.
What needs to be done, and by whom, in terms of governance and institutional frameworks, financing, innovation and R&D, capacity development, education and awareness raising, participation and cross-sectoral coordination, etc.?

ANNEX 8 - GROUP OUTCOMES ON ANNOTATED TABLE OF CONTENTS

PART 1

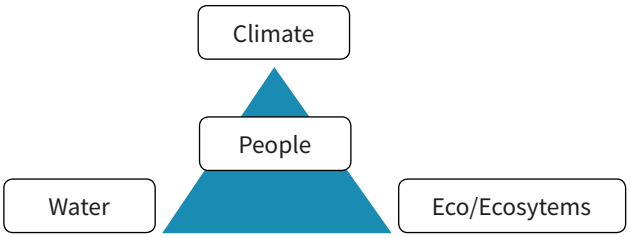
Chair: Johannes Cullmann, WMO
Rapporteur: Maggie White, SIWI
WWAP Support: Jos Timmerman

Placing report in the global context and agreements
SDG, Paris Climate Agreement, SDRR and as a rational. Go beyond Paris Agreement and NDC's
Key numbers and figures for DRR – Sendai Framework
With report coming out in 2020: from 2015 global agendas setting – where are we now? Progress and gaps, what is next, what is missing, policy based.
Illustrate how climate is impacting the overall 2030 Agenda – People are the most impacted in this – Water a strong enabling factor to reaching the overall 2030 Agenda-present in practically all the SDG's.
SDG review progress is on a yearly basis – next meeting in Stockholm. But no specific indicators for SDG13 in 2030 Agenda since it refers to the Paris Agreement – entry points to SDG13 are references to Adaptation and Mitigation and Paris Agreement.
WMO: yearly state on climate report
IPCCC report: what is the driving element between climate and water and what is the attribution of CC impacts to water and how humans are impacted or agents of change, with dimensions of security and development. Present the different scales, time, and space
What is the IPCCC highlighting and how can refer to it without repeating the elements in it. Published in October 2018.
IPCCC will probably say that will not reach 1,5 and therefore how can water issues impact that (improve or hinder) that objective. What solutions can we offer.
Global assessment report 2013 – ISDR – private sector and WEF risk assessment reports.

Go to report for water and climate rational for sustainable development
2020 – Paris Agreement goes into force – how can the report be a contribution to this? Forward looking. Not addressing only gaps and where at since 2015 but how water can enable climate issues to addressed and objectives reached –
Water issues are a main priority for countries in their NDCS, so how can water issues and management support the implementation of that – looking at adaptation, mitigation, loss and damage, HRBA-climate justice and Finance with the enabling factors: capacity dev, education, raising awareness, governance,

Facts, Numbers, causes and effect, setting the scene
Address the gaps: set the scene and projection – what should we highlight – where do we want to go?
Remind the water use per sectors: AG, energy, Industry, domestic … , yet there is also agricultural needs for the industrial sector.
Reference to existing elements: water availability, demand, quality, DRR – overview of potential impacts of CC on water resources and hydrological cycles; don't forget groundwater, glaciers, soil water and moisture, source to sea – impacts on the oceans and seas…
Need to reiterate that no certain data on extreme precipitation and flows.
Availability matrix for information, how do we share the knowledge and information and why it's important.
Availability and accessibility of data and sharing data.
Geopolitical context: population growth, migration, consumption patterns, security issues
Important to be more efficient in water use for agricultural production but also for the manufacturing and distribution.
Food loss in the chain of production, transformation and distribution. High impact on water 'footprint'
If aiming for policy makers need to have more economic inputs; equally for cities and private sector.
Water trade and virtual carbon.
Role and responsibility of the business sector. Changing models to continue making profit under the changing environment – could be self-interest. Frame it in a positive way – changes are needed to be

Multidimensional: climate – water-environment –People – Triangle is debatable – more sides to the equation



Define timeline and projections esp. in reference to adaptation and mitigation? Looking at 2015-2020 – harmonise the projections and do a comparison with the timeline of the dev goals – 2030 Agenda – how much time we have to mitigate or adapt to climate change impacts

Should we aim for a wish list of indicators – building on the existing ones – ie future demand (economic, cultural, social, environmental), water quality, - could be in the last chapter of WWDR

Don't have to cover everything – what is aimed and that will help in defining the angle- don't need to cover everything – what is the focus, the added value – mention it in the introduction.

Reporting, monitoring – scientific water area has a lot to offer to climate discussions esp when it comes to adaptation measures.
Indicators being developed to help countries in their stocktaking progress – adaptation indicators are an issue there.

How we can mitigate the impacts of CC thanks to wise water management, ecosystems, carbon capture, contributing to CO2 emissions reduction, improve carbon uptake on the land surface, how can we sustain and improve this.
State why water and climate have strong impacts on one another. Attribution.
Cause and effect chain – set the stage differently – CC pushes us to have to reorganise our thinking – water-energy-carbon
Set the stage of what we mean by climate change and how to be resilient – Need to act NOW-Urgency of the situation. Esp since behavioural change is needed and therefore need to start NOW.
Set the scene in terms of governance: esp if main messages are aimed at decision makers.
Decisions are being made under uncertainty – how can we provide substance for decisions to be made. Flexible solutions
Need to improve our scientific knowledge to have more evidence based decisions.

Part 1 is about setting the scene – define how much depth want to address and how much is covered by the different chapters.

Exposure variability vs. vulnerability
Predictions vs projections:

Financing gap: how much resources to we have or are lacking to reach the goals – Maybe should be in the enabling environment chapter.

PART 2

Chair: Mark Smith
Rapporteur: Jonathan Farr
WWAP Support: Angela Cordeiro Ortigara

- Who needs to take climate adaptation into consideration: WASH, RBM, water infrastructure agencies, funding for O&M, make utilities more financially sustainable – bringing considerations to climate change
- First chapter should identify the decision makers and lay out the range of climate change, identify ministries dealing with WASH, infrastructure, disaster risk reduction MAPPING SECTORS WITHIN WATER SECTOR, which are impacted by climate change.
- Resilient Infrastructure: climate varies and it is not constant, how can we best use the information available to improve management and deal with climate change, planning to uncertainty

Suggested mapping

	Services	Water Resources Management	DRR
Definition			
Who makes decision?			
How financed?			
How impacted climate change?			
Potential mitigation measures?			

Option 1

Water Resources Management (river, basins, ecosystems)	Sanitation	Services (water supply services)	DRR
Infrastructure: design, O&M Copying with uncertainties Short and long term	Impacting on resources Specific service challenges O&M	O&M Managing scarcity and floods Copying with uncertainties Using climate information/data	Using climate information/ data

Option 2

Challenges and opportunities FOR adaptation and mitigation IN THE WATER SECTOR

This session is about what we do.

Link between SDG 6 and 13.

Organize the chapter around the POSSIBLE SOLUTIONS for the issues faced by policy makers:

1. Resilience of supply (ecosystems, rivers, aquifers, wetlands)
2. Resilience of demand (population growth, urban/rural, agriculture and industry)
3. Resilience of water quality (pollution, sanitation, saline intrusion)
4. Resilience to extreme events (floods and droughts)

Subdivision of the above in the following (SOLUTION ORIENTED):

- Data and monitoring
- Infrastructure
- Governance
- Adaptation
- Mitigation
- Add examples of successful and not successful stories (and how countries are adapting decision making?)

Link the report to CLIMATE ADAPT WEBSITE OF THE EU

Option 2+

	IMPACT OF CLIMATE CHANGE THAT PM ARE ASKED TO TACKLE	SUBDIVISION (SOLUTION ORIENTED):
TECHNICAL APPROACHES/solutions for Water Management: Challenges and opportunities for adaptation and mitigation	Resilience of supply (ecosystems, rivers, aquifers, wetlands)	• Data and monitoring • Infrastructure available/needed • Governance • Adaptation actions • Mitigation • Financial mechanisms • Add examples of successful and not successful stories (and how countries are adapting decision making?) • Technical optimization
	Changes on demand (population growth, urban/rural, agriculture and industry)	
	Water quality (pollution, sanitation, saline intrusion)	
	Resilience to extreme events (floods and droughts)	
	Managing disaster risk (reducing existing risk and preventing the creation of new risk)	

Critique- although nicely split into 4 sections, maybe extreme events outweighs the first 3 sections.
Risks: how to tackle the existing risks and how to avoid the creation of new risks? Different kind of interventions, financial mechanisms, etc.

PART 3

Chair: Stefan Huelsmann
Rapporteur: John Payne
WWAP Support: Laurens Thuy

The following bullets within each round represent some of the main opinions expressed.

Round 1:

- The structure could follow the major water use sectors, being:
  Agriculture, Industry, Energy, Infrastructure and Settlements, Tourism, Retail, Mining, Financial and Insurance; not forgetting environment/ecosystems and their services
  Such a sectoral structure had been followed in earlier WWDRs and has the advantage that readers who typically look for results presented for their particular sector will easily find the section they are most interested in. However, it was felt that there is a "sector crisis" (competition), that the definition of sectors is changing, and it has to be ensured that a more integrative view, in particular concerning the opportunities and management options is implemented in the report at some place.
- The structure could alternatively follow other categories of common relevance, related to water, such as:
  - Water productivity (biomass/ unit of water or cash/ unit of water), water use efficiency, safety measures, treatment and water quality…
  - The water-energy-food nexus, and consequently looking at the sectors from a nexus perspective.
    For example: Agriculture (sector): mainly related to food, but also water and energy.
  - A separate chapter on the NEXUS is also an option. In this chapter, the common challenges & synergies across different sectors could be identified.
    Challenges would be: water scarcities, water quality limitations, sustainability constraints (as determined by policies), risk management.
    However there is no way to manage risk if not looked upon from a cross-sectoral view. Therefore, better to not sectoralize (same for finance and risk).
- Starting with sectors could lead us more towards problems, whereas starting with a cross-sectoral approach could lead more towards opportunities, e.g, risk management is currently highly fragmented, but could benefit from integrated approaches.

Round 2:

- A possibility would be to feature a matrix with a limited number of major sectors identified versus common challenges and opportunities, such as quantity (too little/too much), quality, and accessibility.
- Part I needs to set the scene: What is available? (Governance and water) -> This drives solutions and opportunities.
- NDC (nationally determined contributions) should be included so we get: SDGs + International agreements + NDC
- Could feature boxes in chapters with solutions for rural/urbanized areas.
- Part 3 needs to address the intersectionality

Round 3:

- Should the section be structured according to the sectors? Proposed: Agriculture, Industry, Energy (which has big opportunities in terms of GHG emissions), Citizen Settlements, Tourism, Health,..? With focus on water availability (water stress too) and water quality for each sector. The environmental aspect (typically not considered a sector) requires due consideration.
- Topics that should be worth considering in terms of opportunities and options, and the pros and cons of solutions are the following:
- Better forecasting systems, Technological Innovation, Policies and Management, Green processes / reuse / recycling, and awareness raising, IWRM for CC
- Perhaps there could be 3-4 sections with sectors grouped such as: Industry & Energy; People, Cities & Health; Agriculture & Ecosystems
- Or on the other hand individual sections + a section that covers all interlinkages (The opinions are divided on this)
- It could be a great idea to open the report in a more sensational way that immediately appeals: stressing issues that immediately affect the public at large: Rising food and energy prices. -> Could get more media attention

Round 4:

- There is the need to address the relation between adaptation and mitigation.
- Examples of how challenges and opportunities for adaptation and mitigation in water management for the 'Big 3' can look like:
- Energy → GHG Reduction (green energy) + water usage reduction
- Industry: Manufacturing and Agrifood; water usage reductions, water treatment improvements, risk assessment related to not having clean water supply
- Agriculture: No monoculture, technology improvements, resistant crops + use of specific incentives, use of NBS. + Need to stress the importance of agriculture in developed as well as developing countries

Summary

The discussion evolved through three main iterative stages. Throughout an effort was made to distinguish what should be included in Part 3 as opposed to Part 2 as there are apparent overlaps. For example water supply and sanitation, cities and settlements belong in Part 2.

1. Sector silos versus cross-sectoral issues

It was recognized that there are linkages between sectors, such as the water-energy-food nexus, and common synergies and challenges. In this respect consideration was given to organizing the material in terms of water quality, quantity, availability, productivity and so on. Discussion also included the urban-rural split, though it was felt that this belonged to Part 2. A matrix showing the sectors and their challenges was also proposed.

2. Silos as a preferred approach

It was felt that potential readers would be working in conventional silo sectors and would therefore be looking for the section of their particular interest. Moreover, based on previous WWDR experience, the the material would be easier to research, organize, write and present in this way. In contrast, it was felt that cross-cutting issues would be difficult to synthesize.

Given the word limitation and that every sector could not be reasonably covered, it was thought that the "Big 3", that is agriculture, industry and energy as the principal users of water, should be prioritized. Within these a limited number of major challenges, such as water stress (quantity, scarcity), accessibility, and quality, should be described. These would be addressed by solutions, giving the pros and cons, and noting opportunities. Examples might be for energy - water intensity and renewables; for industry - value chain pressure, risks and (un)certainity, water use reductions, water footprints and consumer pressure; for agriculture – no monoculture, technology, drought resistant crops, irrigation and some focus on high as well as low-income countries.

The relationship between adaption and mitigation should be in the discussion, for example energy and GHG reduction can lead to renewables using less water.

Some review of other larger sectors, such as ecosystems, tourism, mining and transportation, should be included, possibly as boxes.

3. Nexus Section

Recognizing that there are linkages and cross-sectoral concerns, challenges, issues and solutions, a short separate section at the end was proposed to recognize and highlight these points, perhaps including some discussion of IWRM for CC in terms of sectors.

PART 4

Chair: Marianne Kjellen
Rapporteur: Dani Gaillard
WWAP Support: Natalia Uribe Pando

Role of science and evidence of linkage between climate change and water, driven us to recognize a problem before it gets worse. How to deal with the unknowns and how to fill the gap in information about how climate science can be integrated into adaptive water management and vice versa? Now on political agenda. (Success of science-policy interface) Contributes to public awareness.
Not so much technical solutions, but use illustrations of good practices from different countries, spotlights. Understand that climate change is manifested in different ways in different places, need to tailor adaptation accordingly.
Unintended consequences: Creates competition between countries to do better and learn from one another.
Two approaches:

Examples where it works -successes (e.g. DRR policies), rather than saying it hasn't worked or so slow.
identify obstacles to be overcome and how (data collection and sharing, governance national vs. transboundary, financing)

Intention is to stimulate action, and express a sense of urgency of action: how to encourage collective action (Governance), how different actors can contribute to change process, how we can encourage a feeling of shared responsibility (we are one) for action, rather than a feeling that we are combatting nature. Different alliances can contribute to that on specific areas. In part, some of that should be achieved through education and cultural understanding, which then can also contribute to the geopolitical debate.

Strong on action on different fronts – territories, how contextualized in different settings and available resources. Mechanics of getting things done and down to the national level or local, more concrete. Urbanization and city networks (CDP, 100 Resilient Cities, C40, etc.) Business as partners should be the norm, opportunity to promote sustainable business models. Attention to intersections with other sectors. Go into shoes of other sectors, what does water and climate mean for other sectors.
Change and progress is dealing with humans, but how to put that into practice? Human component somewhat missing. How to create a widespread climate consciousness. Different for different social groups – value different things.
Political will – elected leaders, alignment of public sector budgets, or other communities such as business (BAFWAC) or climate investors, recognizing that adaptation measures take a long time to implement. Concerted action – political will needs to be there – this is a priority and we want to take action on this front (declaration to take measures to take action in certain directions, and a different levels (India – defecation free and decentralized) and manifested by putting money where your mouth is. Integration among agencies for concerted action.

The Paris Agreement and NDCS have created a space to talk about adaptation, of which water is a big part. So governance and institutional frameworks need to be clearly explained and identified. What change we want to see in terms of change and how to get there: International commitments and agreements (UNFCCC, SDGs, Sendai etc), what enabling environments are required for that. Intro- relevant international frameworks – but here, are they enabling enough? Do they need to be stronger?

Finance – SDG13; 100B annually for developing countries, how is that implemented and used, how to unlock that? Cost-benefit calculations, intersectoral competition for funds; where we invest and how we allocate; valuing water some unquantifiable—not only economic value.
Broader question of financing: How investments are done and other criteria to take into account – need to further study and get a better handle on that. Need to create greater clarity for what is adaptation and what is development. Risks as a basis for investment.
Lending to companies, not just GCF.

Attribution
Governance and institutional frameworks – transboundary cooperation in a regional context. How to integrate climate piece into those mechanisms. Mainstreaming into planning.
Legal personality to rivers – new approaches

Questions as to the logic of the structuring – need to advisable responses, and how to do that. We need to provide an attempt as solutions in this section if organized in this way.
Big responsibility in this chapter – Attribution of causes (climate change takes blame for a lot of things as an excuse to not manage watersheds) Policy responses to be adapted
But don't stop there—Maybe send subject to the introduction.

Capacity in resources and in knowledge
Right data that will give meaningful results at the local level. CC is part of the problem and what people can do can make a difference. Community based coupled with scientific approach. Leadership.
Public participation (Eaux de Paris) – participatory approaches
Governance – root cause of many problems, enables people to move towards resilience
Long-term sustainability. Be quantitative, comprehensive business model to demonstrate long term advantages and co-benefits of improved water management for climate resilience
Knowledge transfer
Socio economic; end user, bottom up
This section should be written after the others
Public and awareness raising, responsible consumption.

Local examples, community based approaches
Governance, cognoscence of that. Things that help people work together through collective action.
Financing – still not there, need to study more. Politically conscious investors.
Empowerment.

ANNEX 9 - GROUPS FOR BREAKOUT SESSIONS

Breakout Session #1 – Main Messages

GROUP MM1
Anil Mishra (Chair)
Amanda Loeffen (Rapporteur)
Jos Timmerman (WWAP support)
Orlaith Delargy
Maria Rivera
Lucio Ubertini
Claudio Caponi
Peter Burek
Marianne Kjellen

GROUP MM2
Neil Dhot (Chair)
Merylyn Hedger (Rapporteur)
Angela Cordeiro Ortigara (WWAP Support)
Marylyn Hedger
Frank Rutabingwa
Duminda Perera
Fernando Nardi
Yo Nishimura
John Payne
Dani Gaillard

GROUP MM3
Christophe Cudennec (Chair)
Rio Hada (Rapporteur)
Laurens Thuy (WWAP Support)
Marco Petitta
Simone Grego
Klas Moldeus
Lesley Pories
Mark Smith
Stefan Huelsmann

GROUP MM4
Eddy Moors (Chair)
Marco Toscano Rivalta (Rapporteur)
Natalia Uribe Pando (WWAP Support)
Yoshiyuki Imamura
Tales Carvalho Resende
Rupa Kumar Kolli
Lindsey Aldaco-Manner
Maggie White
Johannes Cullmann
Jonathan Farr

Breakout Session #2a – ToC (14:15-14:45)

PART 1
Johannes Cullmann (Chair)
Maggie White (Rapporteur)
Jos Timmerman (WWAP Support)
Neil Dhot
Christophe Cudennec
Maria Rivera
Tales Carvalho Resende
Klas Moldeus
Amanda Loeffen
Yo Nishimura

PART 2
Mark Smith (Chair)
Jonathan Farr (Rapporteur)
Angela Cordeiro Ortigara (WWAP Support)
Orlaith Delargy
Yoshiyuki Imamura
Frank Rutabingwa
Lucio Ubertini
Rupa Kumar Kolli
Lesley Pories

PART 3
Stefan Huelsmann (Chair)
John Payne (Rapporteur)
Laurens Thuy (WWAP Support)
Marylyn Hedger
Eddy Moors
Anil Mishra
Marco Toscano Rivalta
Claudio Caponi
Lindsey Aldaco-Manner

PART 4
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Dani Gaillard (Rapporteur)
Natalia Uribe Pando (WWAP Support)
Marco Petitta
Rio Hada
Simone Grego
Duminda Perera
Fernando Nardi
Peter Burek

Breakout Session #2b – ToC (14:45-15:15)

PART 1
Johannes Cullmann (Chair)
Maggie White (Rapporteur)
Jos Timmerman (WWAP Support)
Yoshiyuki Imamura
Lucio Ubertini
Marylyn Hedger
Claudio Caponi
Lindsey Aldaco-Manner
Simone Grego

PART 2
Mark Smith (Chair)
Jonathan Farr (Rapporteur)
Angela Cordeiro Ortigara (WWAP Support)
Neil Dhot
Amanda Loeffen
Anil Mishra
Rio Hada
Duminda Perera
Fernando Nardi

PART 3
Stefan Huelsmann (Chair)
John Payne (Rapporteur)
Laurens Thuy (WWAP Support)
Christophe Cudennec
Tales Carvalho Resende
Yo Nishimura
Frank Rutabingwa
Lesley Pories
Marco Petitta
Peter Burek

PART 4
Marianne Kjellen (Chair)
Dani Gaillard (Rapporteur)
Natalia Uribe Pando (WWAP Support)
Maria Rivera
Klas Moldeus
Orlaith Delargy
Rupa Kumar Kolli
Eddy Moors
Marco Toscano Rivalta

Breakout Session #2c – ToC (15:15-15:45)

PART 1
Johannes Cullmann (Chair)
Maggie White (Rapporteur)
Jos Timmerman (WWAP Support)
Rio Hada
Fernando Nardi
Frank Rutabingwa
Peter Burek
Orlaith Delargy
Marco Toscano Rivalta

PART 2
Mark Smith (Chair)
Jonathan Farr (Rapporteur)
Angela Cordeiro Ortigara (WWAP Support)
Lindsey Aldaco-Manner
Simone Grego
Tales Carvalho Resende
Yo Nishimura
Marco Petitta
Klas Moldeus
Eddy Moors

PART 3
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John Payne (Rapporteur)
Laurens Thuy (WWAP Support)
Yoshiyuki Imamura
Neil Dhot
Amanda Loeffen
Duminda Perera
Maria Rivera
Rupa Kumar Kolli

PART 4
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Dani Gaillard (Rapporteur)
Natalia Uribe Pando (WWAP Support)
Lucio Ubertini
Marylyn Hedger
Claudio Caponi
Anil Mishra
Christophe Cudennec
Lesley Pories

Breakout Session #2d – ToC (15:45-16:15)

PART 1
Johannes Cullmann (Chair)
Maggie White (Rapporteur)
Jos Timmerman (WWAP Support)
Marco Petitta
Eddy Moors
Duminda Perera
Rupa Kumar Kolli
Anil Mishra
Lesley Pories

PART 2
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Angela Cordeiro Ortigara (WWAP Support)
Peter Burek
Marco Toscano Rivalta
Maria Rivera
Marylyn Hedger
Claudio Caponi
Christophe Cudennec

PART 3
Stefan Huelsmann (Chair)
John Payne (Rapporteur)
Laurens Thuy (WWAP Support)
Rio Hada
Fernando Nardi
Orlaith Delargy
Simone Grego
Klas Moldeus
Lucio Ubertini

PART 4
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Dani Gaillard (Rapporteur)
Natalia Uribe Pando (WWAP Support)
Frank Rutabingwa
Lindsey Aldaco-Manner
Tales Carvalho Resende
Yo Nishimura
Yoshiyuki Imamura
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ANNEX 11 - ORGANIZATION ACRONYMS

AquaFed	International Federation of Private Water Operators
BAFWAC	Business Alliance for Water and Climate
CDP	Carbon Disclosure Project
FAO	Food and Agriculture Organization (FAO)
GWP	Global Water Partnership
IAH	International Association Hydrogeologists
IAHS-AISH	International Association of Hydrological Sciences
ICHARM	The International Centre for Water Hazard
IHE	UNESCO Institute for Water Education
IIASA	International Institute for Applied System Analysis
IWMI	International Water Management Institute
OHCHR	Office of the United Nations High Commissioner for Human Rights
RAMSAR	Ramsar Convention on Wetlands
SIWI	Stockholm International Water Institute
UNDP	United Nations Development Programme
IHP	International Hydrological Programme, UNESCO
WWAP	World Water Assessment Programme, UNESCO
UNIDO	United Nations Industrial Development Organization
UNISDR	United Nations Office for Disaster Risk Reduction
UNU-Flores	United Nations University Institute for Integrated Management of Material Fluxes and of Resources
UNU-INWHE	United Nations University Institute for Water, Environment and Health
UN Water	United Nations Water
UN WMO	World Meteorological Organization
WARREDOC	Water Resources Research and Documentation Center
WYPW	World Youth Parliament for Water
WWC	World Water Council