Interpreting climate information for water utilities

October 25, 2018
10:00 hrs Amsterdam local time

IWA the international water association

WEBINAR

EMANTI

CLIMATE SMART UTILITIES WEBINAR SERIES

- Why the webinar series?
  - Climate change is impacting availability and quality of water worldwide
    - Frequent rainfall leads to increased water turbidity and higher numbers of pathogens in the water;
    - Reduced rainfall leads to limited water availability and an increased concentration of contaminants in the water.
  - Demand for water supply in urban areas increasing
  - Push for urban stakeholders (cities, utilities, etc.) to better plan and manage the impacts affecting the water supply system

- 3 part webinar series
  - Integrating climate information for water utilities (25 October 2018)
  - Climate resilient water safety planning (28 November 2018)
  - From vision to action: how water utilities are building climate resilience (December 2018, *tbd*)

AGENDA

Host: *Rui Sancho (Águas do Algarve)*

- Climate Smart Utilities
  Katharine Cross
  International Water Association

- How to integrate climate data into water safety planning
  Philip de Souza
  Emanti Management Group Ltd.

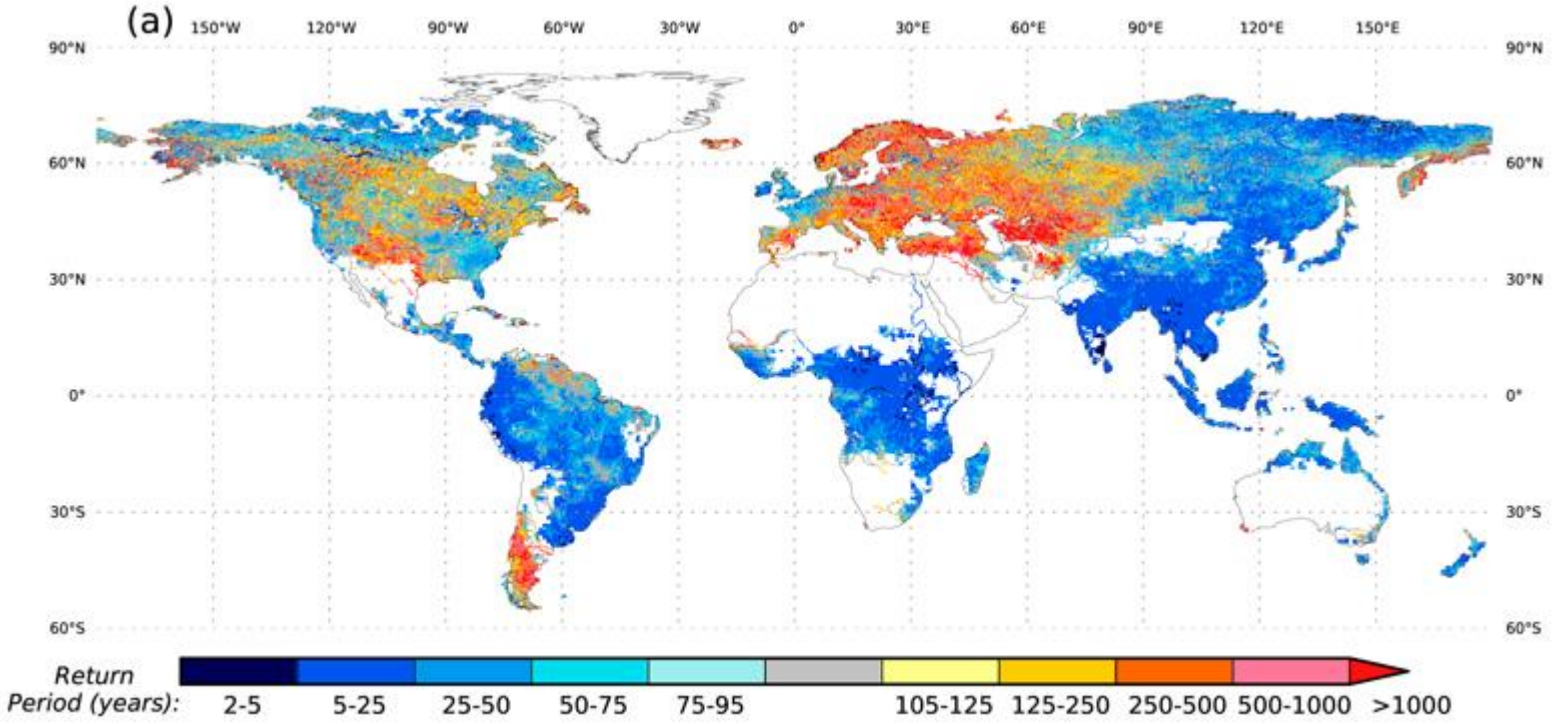
- Q/A

Climate Smart Utilities

KATHARINE CROSS

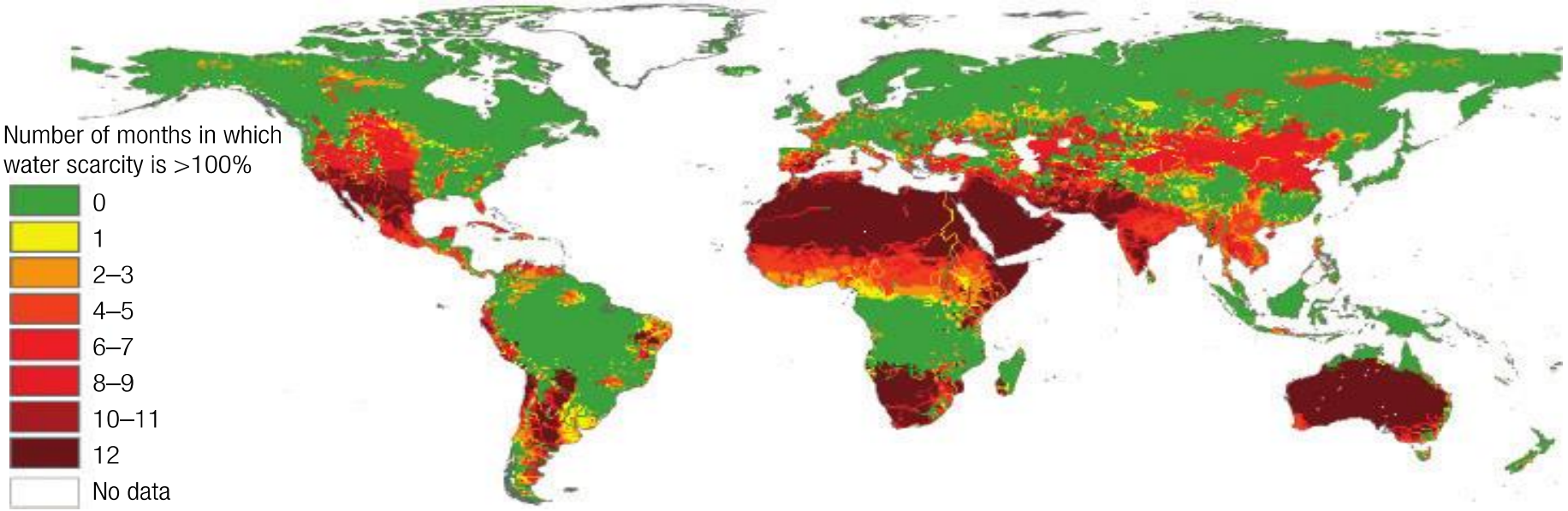
PROGRAMME MANAGER, IWA

GLOBAL CONTEXT OF FLOODS AND DROUGHTS
FUTURE FLOOD RISK



Source: Hirabayashi Laboratory, The University of Tokyo / Projected change in flood frequency

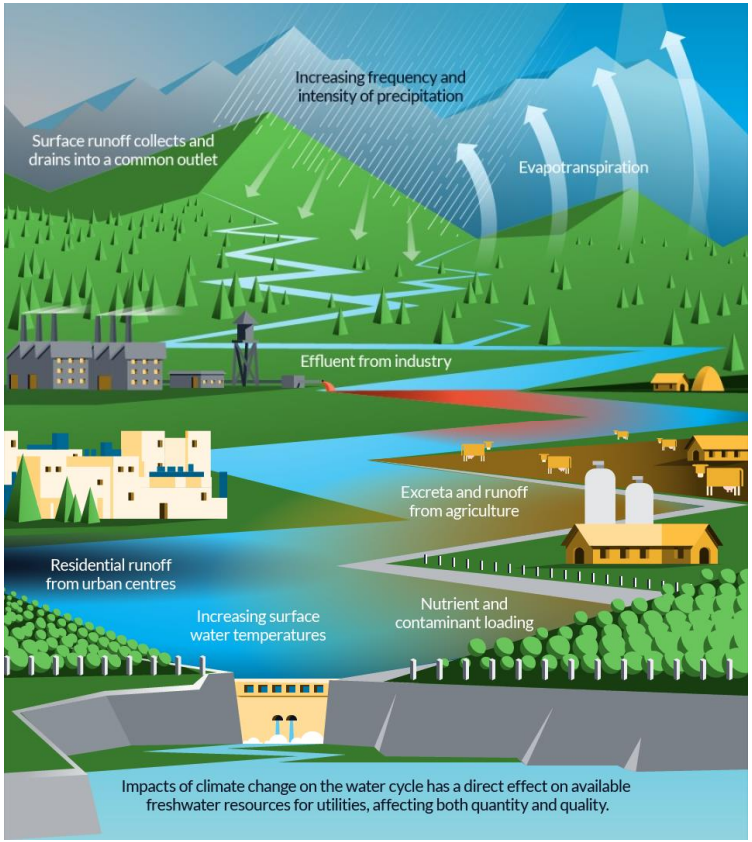
GLOBAL CONTEXT OF FLOODS AND DROUGHTS
WATER SCARCITY



Source: Mekonnen and Hoekstra 2016.

The number of months per year in which blue water scarcity exceeds 1.0 (period 1996-2005)

KEY CHALLENGES



- Increased extreme floods and droughts (exacerbated by climate change)
- Impacts water resources and consequently drinking water supply
- Poses risk to public health, economy and the environment
- Climate change an issue but not a priority to address as not able to control
- Fragmented engagement with catchment area

CLIMATE SMART WATER MANAGEMENT

- Water utilities which are better prepared for climate hazards, will be better placed to ensure a safe and secure water supply
  - Improve health;
  - Improve economic productivity;
  - Improve livelihoods.

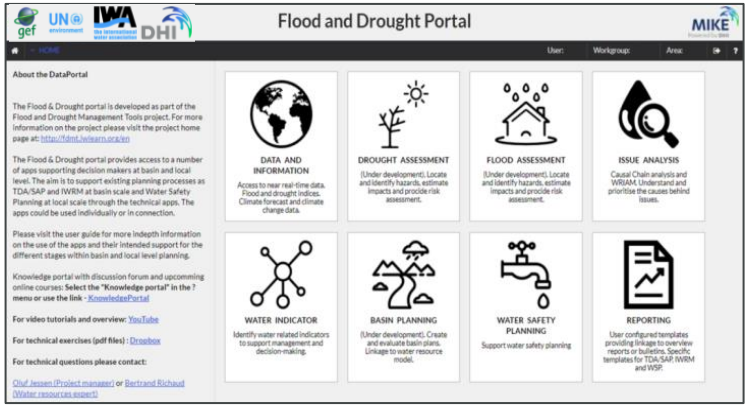
CLIMATE SMART WATER MANAGEMENT – HOW TO ACHIEVE?

- Understanding climate change information and its impacts
  - Insights into upstream & downstream in the watershed, via tools like satellite imagery
  - Cheaper and more accessible data provide valuable information in places that used to be difficult to access
- Integrating climate risk into planning

HOW IS THIS BEING ADDRESSED?

- Flood and Drought Portal
  - Access to climate data
  - Using Water Safety Planning as the entry point
- Methodology for water utilities to integrate climate data into hazard and risk assessment (presentation from Emanti)

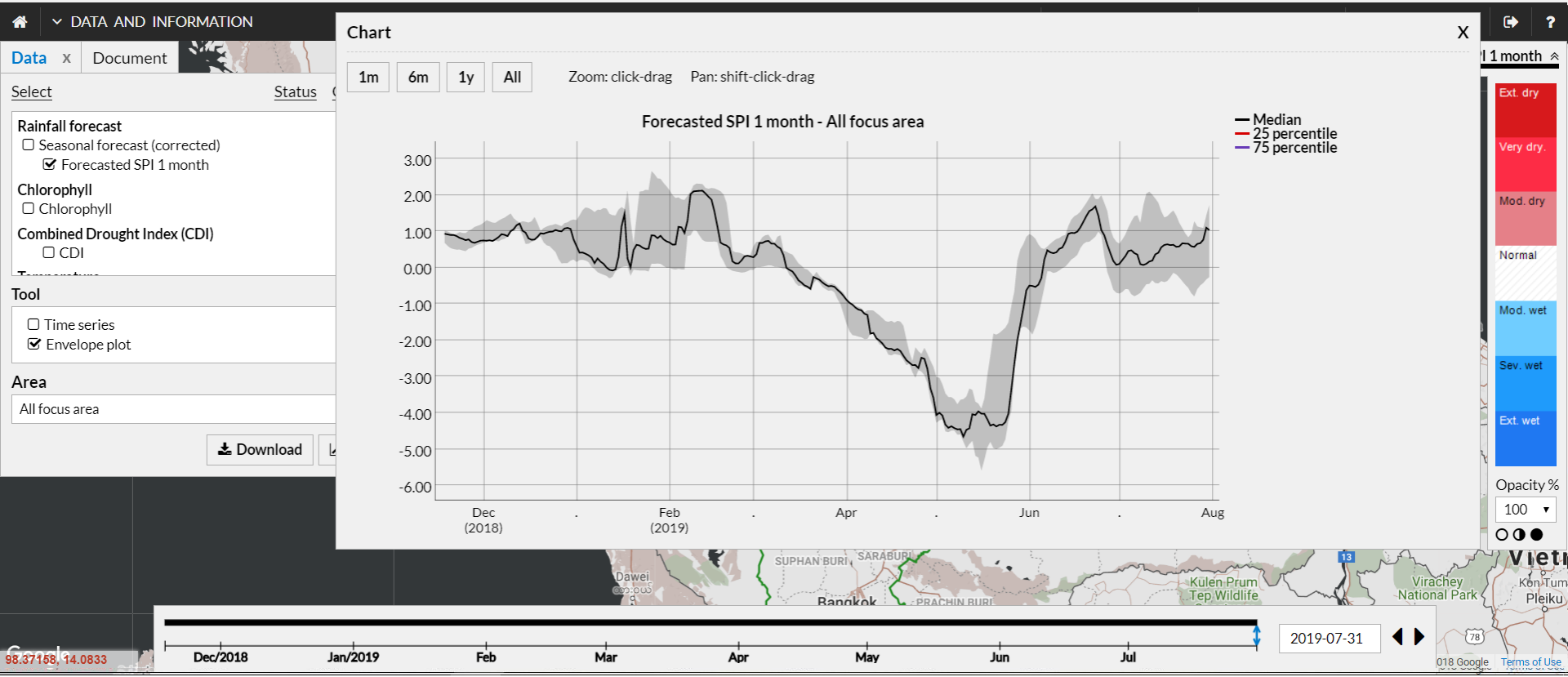
FLOOD & DROUGHT MANAGEMENT TOOLS



www.flooddroughtmonitor.com

- **Why?** A need for adaptive planning and management of water resources at basin and local level
- **How?** Developed web-based tools to support planning and decisions to address flood and drought risks from the transboundary basin to water utility level
- **Who?** The project is being implemented by UNEP; Executed by DHI and IWA from 2014-2018. End users are water resource agencies and water utilities.
- **Where?** Global applicability, portal and its applications have been developed and tested with stakeholders across 3 pilot basins

Flood and Drought Portal



www.flooddroughtmonitor.com

Flood and Drought Portal

WATER SAFETY PLANNING | User: katharinecross | Workgroup: MWAtest | Area: Chao Phraya

Open | New | Clone | Edit | Delete

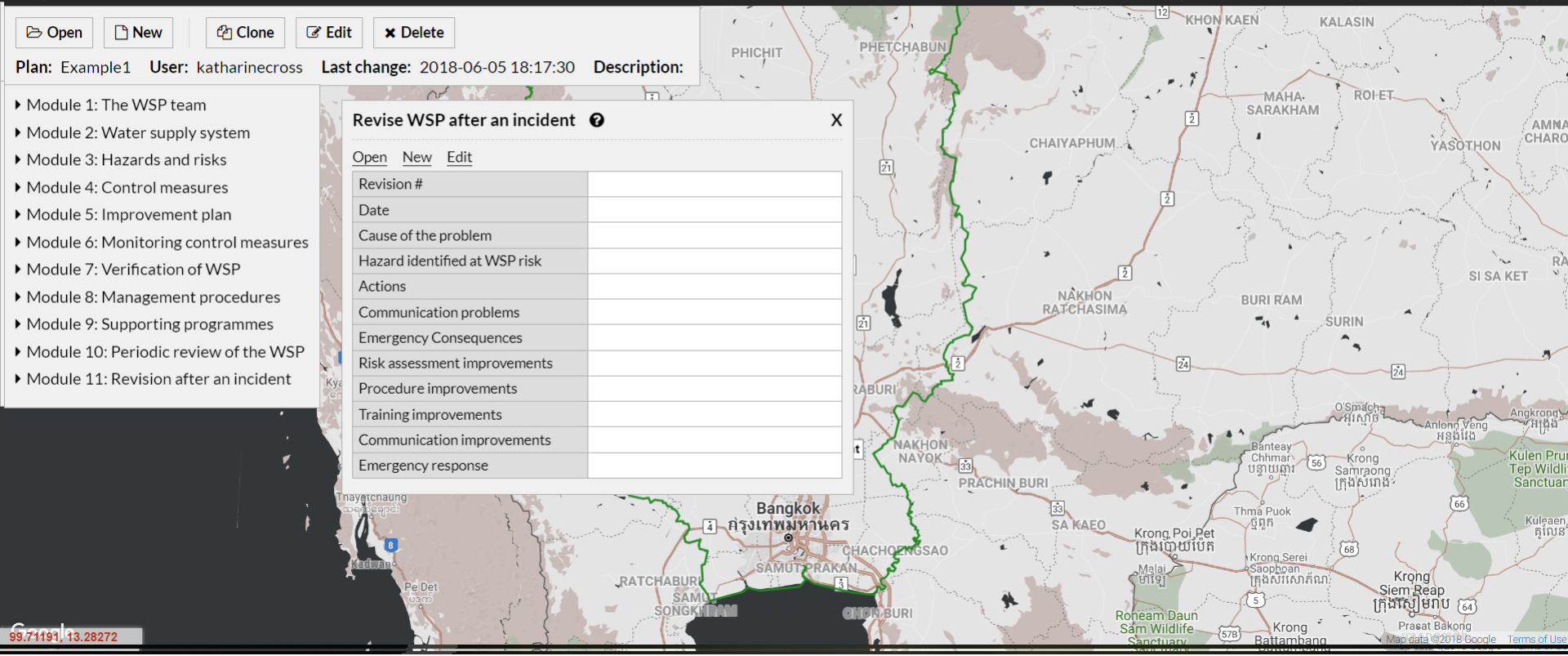
Plan: Example1 **User:** katharinecross **Last change:** 2018-06-05 18:17:30 **Description:**

- Module 1: The WSP team
- Module 2: Water supply system
- Module 3: Hazards and risks
- Module 4: Control measures
- Module 5: Improvement plan
- Module 6: Monitoring control measures
- Module 7: Verification of WSP
- Module 8: Management procedures
- Module 9: Supporting programmes
- Module 10: Periodic review of the WSP
- Module 11: Revision after an incident

Revise WSP after an incident X

Open | New | Edit

Revision #	
Date	
Cause of the problem	
Hazard identified at WSP risk	
Actions	
Communication problems	
Emergency Consequences	
Risk assessment improvements	
Procedure improvements	
Training improvements	
Communication improvements	
Emergency response	



www.flooddroughtmonitor.com

How to integrate climate data into water safety planning

PHILIP DE SOUZA
DIRECTOR, EMANTI

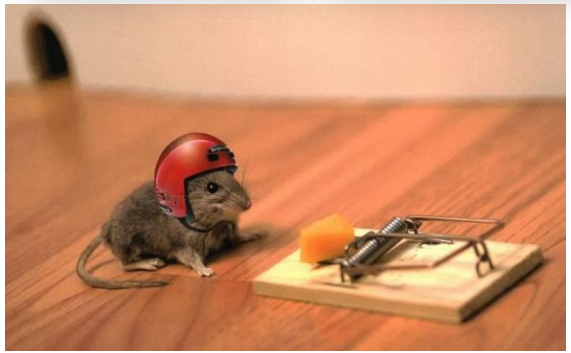
Before we start…

We are assuming you have some knowledge of WSP and climate change…

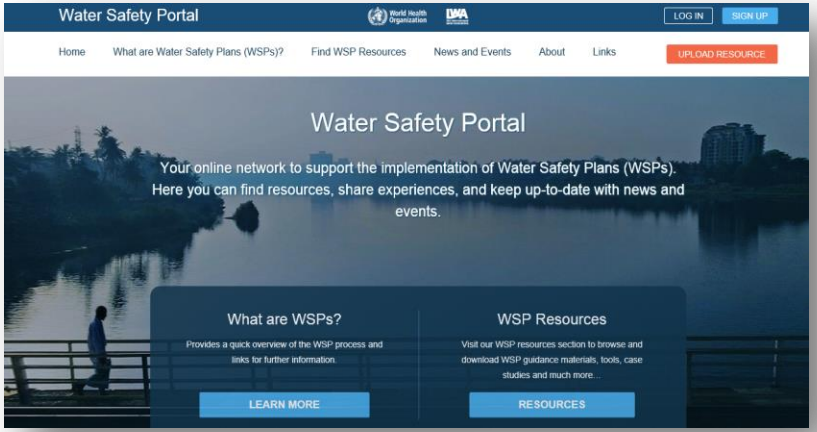
WATER SAFETY PLANNING

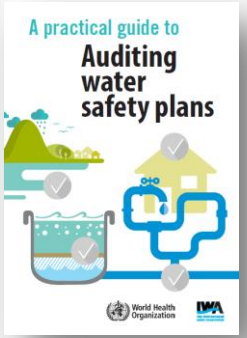
WATER SAFETY PLAN: A comprehensive risk assessment and risk management approach that includes all steps in the water supply from catchment to consumer

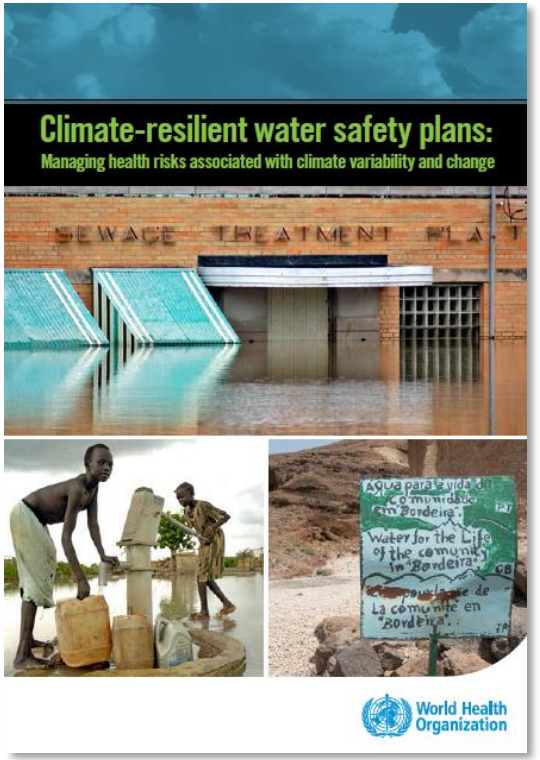
- End-product testing is not enough
  - Reactive – problem has already occurred
  - Sampling takes time – response delayed
- Preparedness and resilience

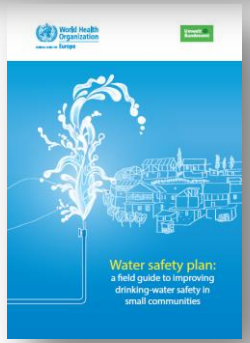


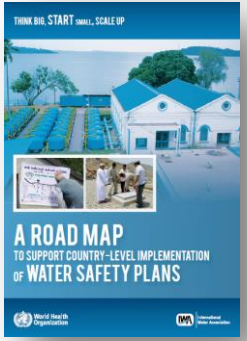
EXAMPLES: WSP TOOLS & RESOURCES

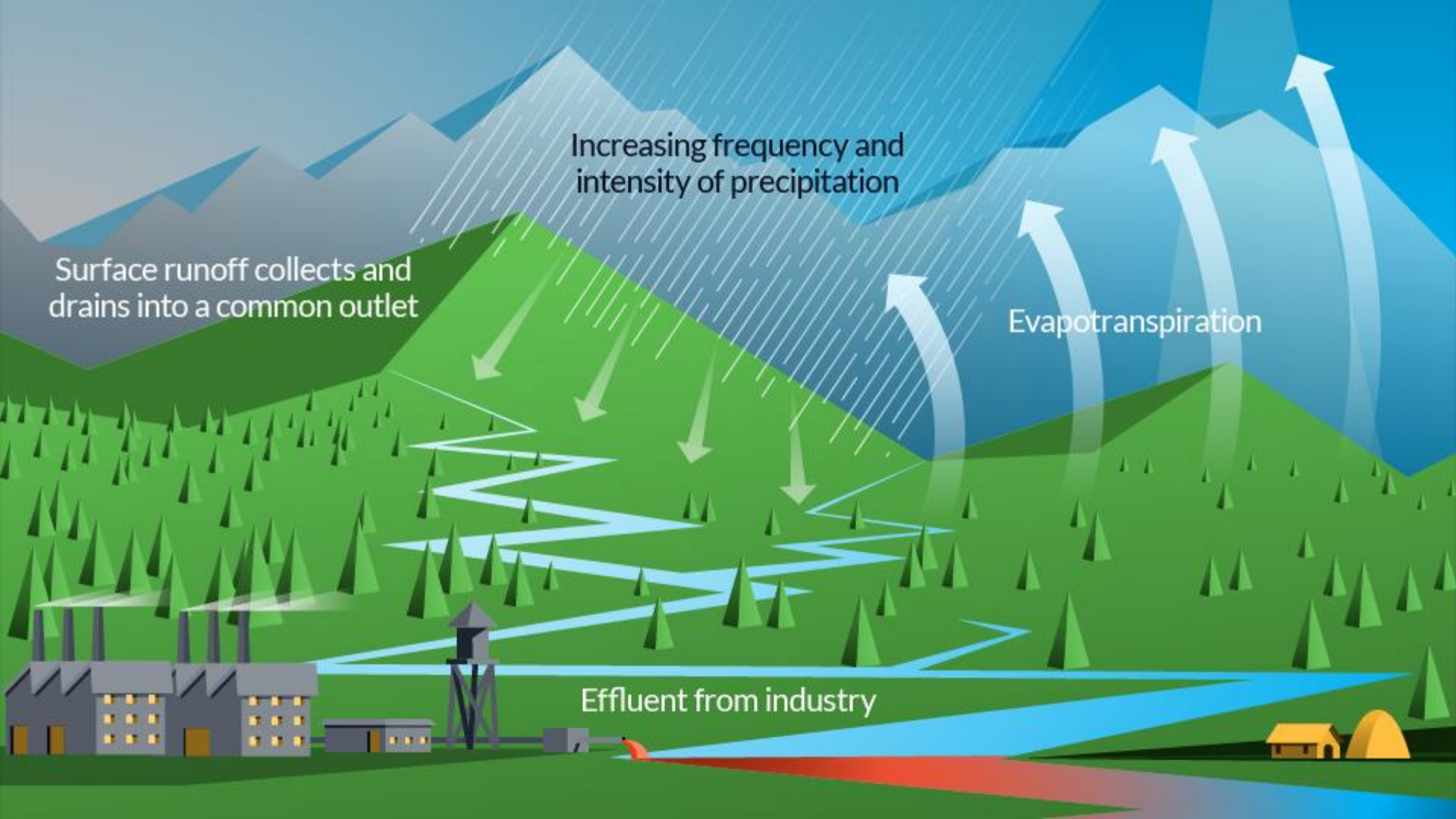


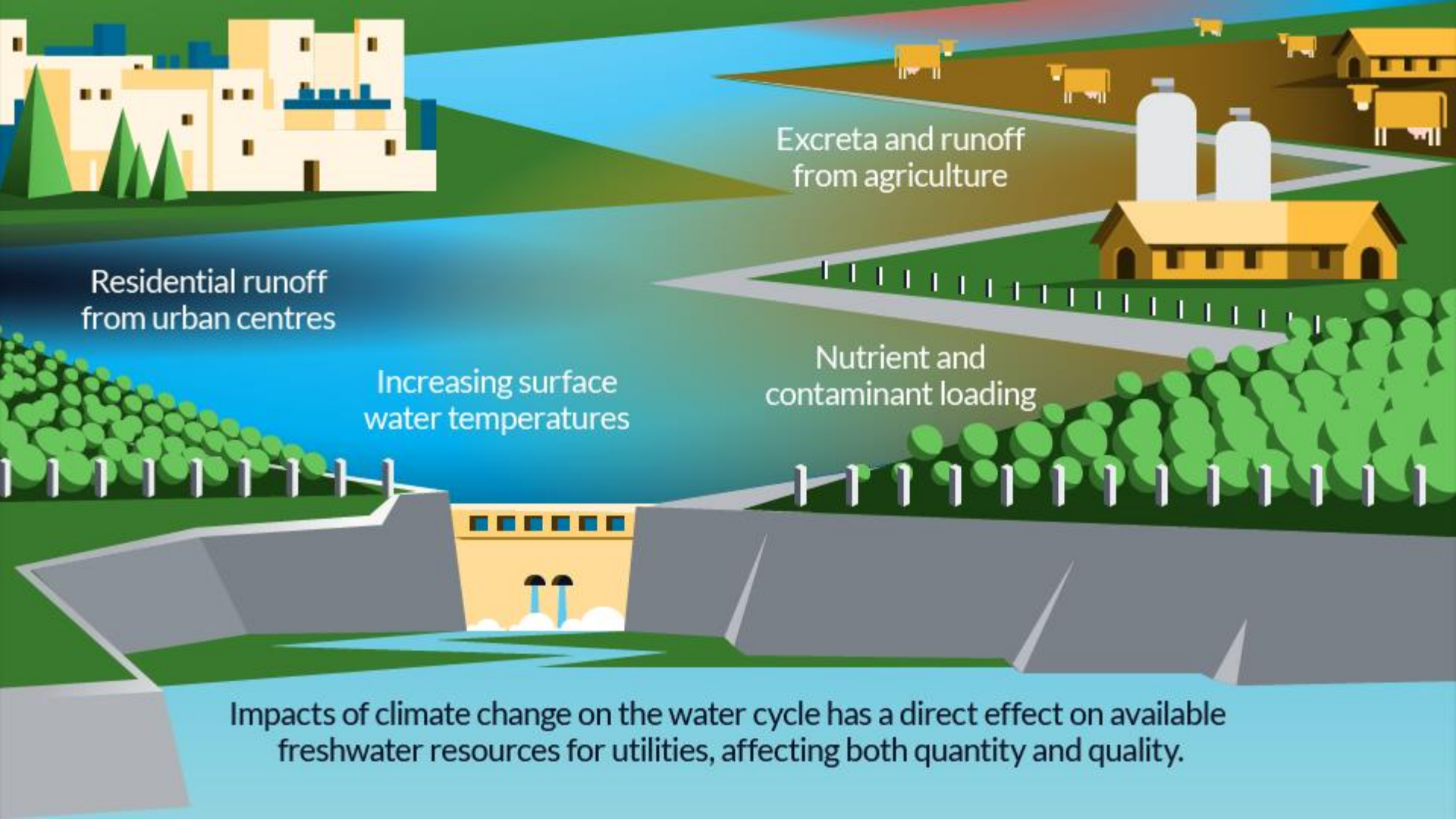




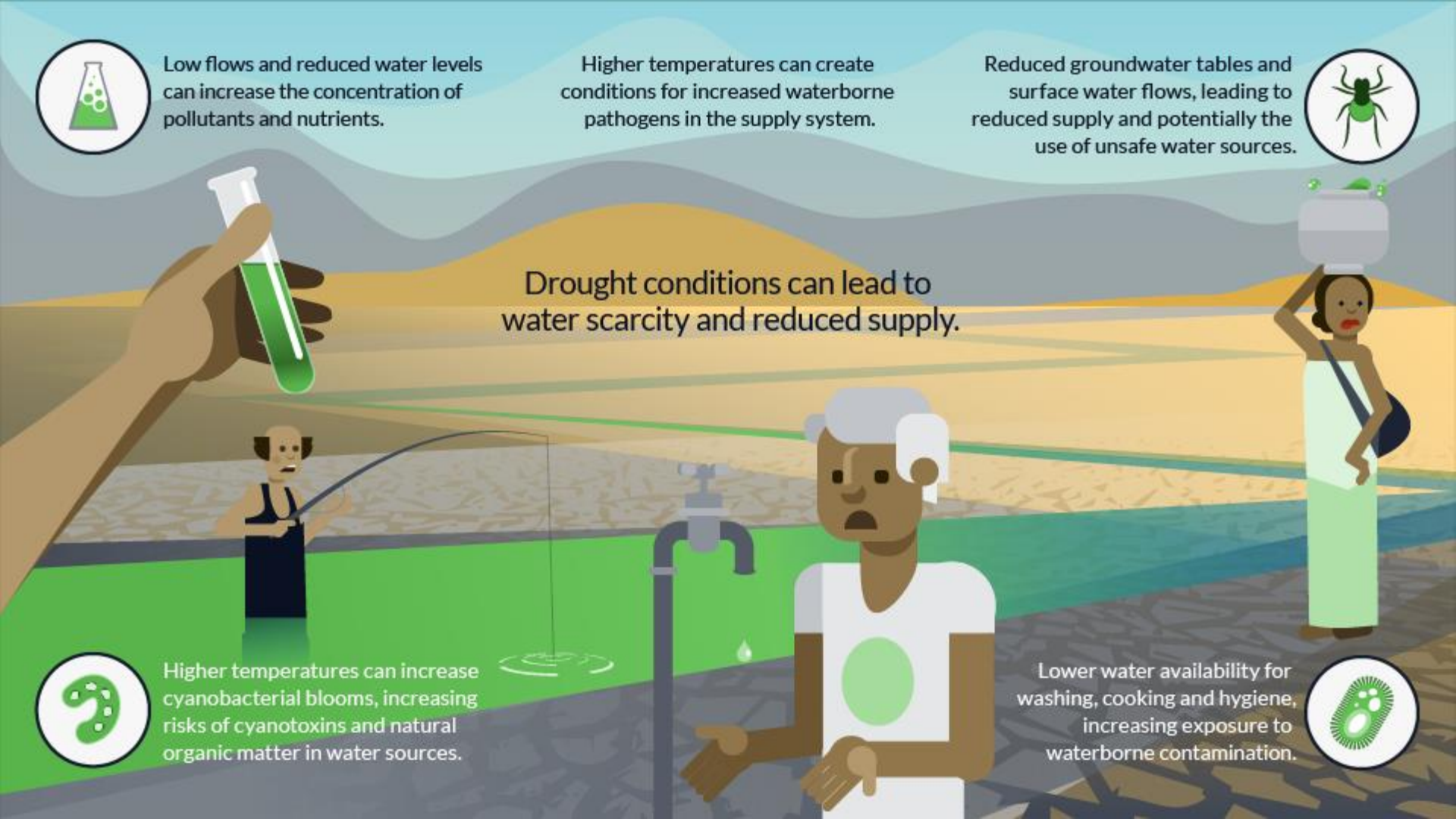


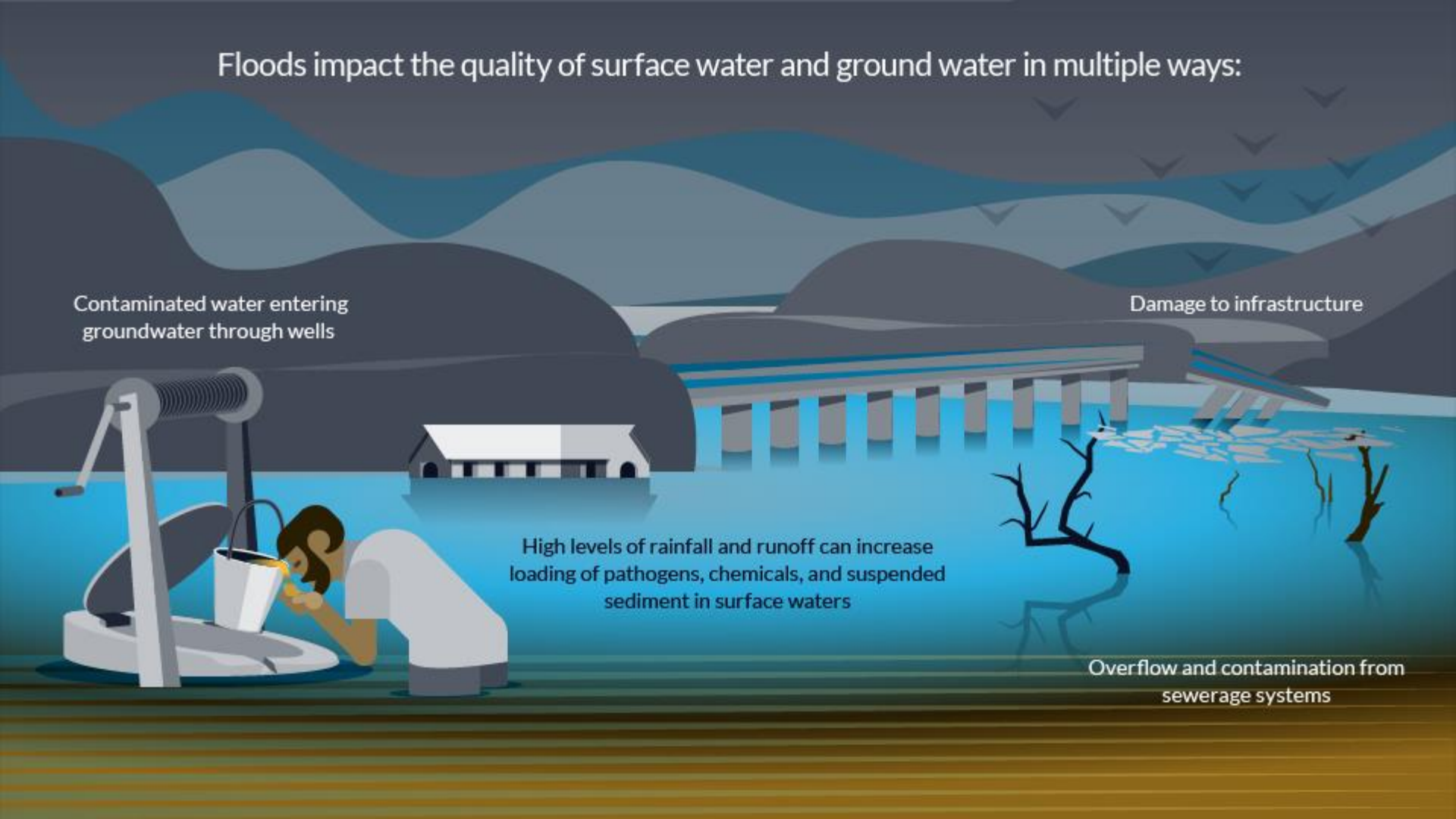



Increasing frequency and intensity of precipitation
Surface runoff collects and drains into a common outlet
Evapotranspiration
Effluent from industry

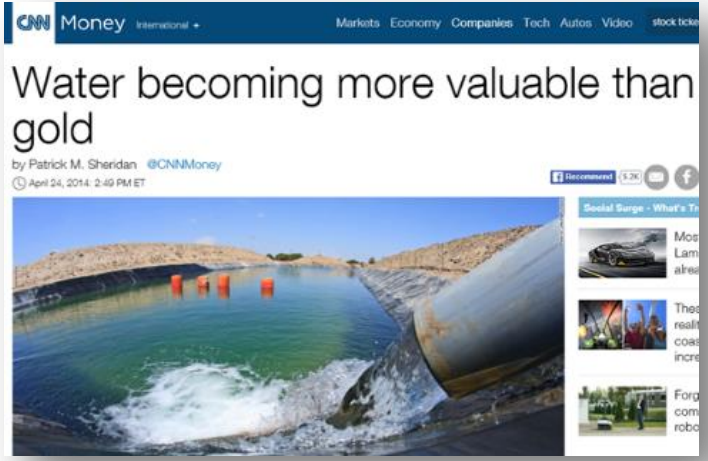


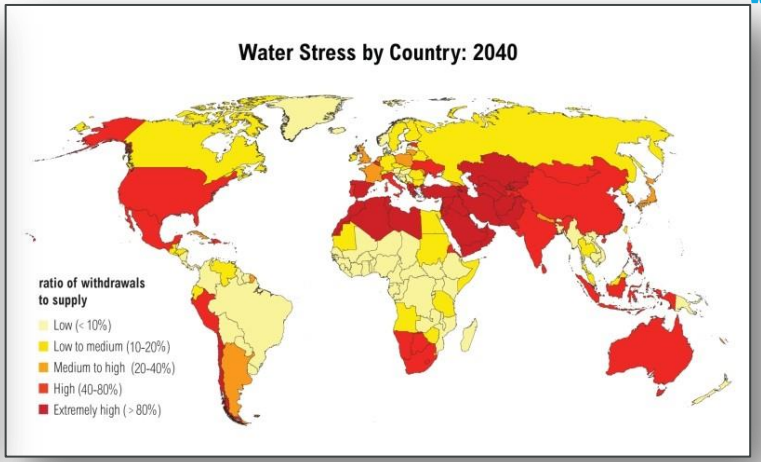
Impacts of climate change on the water cycle has a direct effect on available freshwater resources for utilities, affecting both quantity and quality.


Low flows and reduced water levels can increase the concentration of pollutants and nutrients.
Higher temperatures can create conditions for increased waterborne pathogens in the supply system.
Reduced groundwater tables and surface water flows, leading to reduced supply and potentially the use of unsafe water sources.
Drought conditions can lead to water scarcity and reduced supply.
Higher temperatures can increase cyanobacterial blooms, increasing risks of cyanotoxins and natural organic matter in water sources.
Lower water availability for washing, cooking and hygiene, increasing exposure to waterborne contamination.

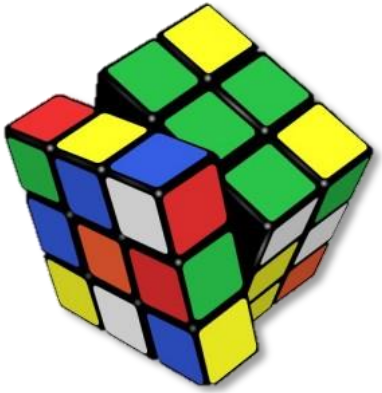

Floods impact the quality of surface water and ground water in multiple ways:
Contaminated water entering groundwater through wells
Damage to infrastructure
High levels of rainfall and runoff can increase loading of pathogens, chemicals, and suspended sediment in surface waters
Overflow and contamination from sewerage systems

WATER CRISIS?

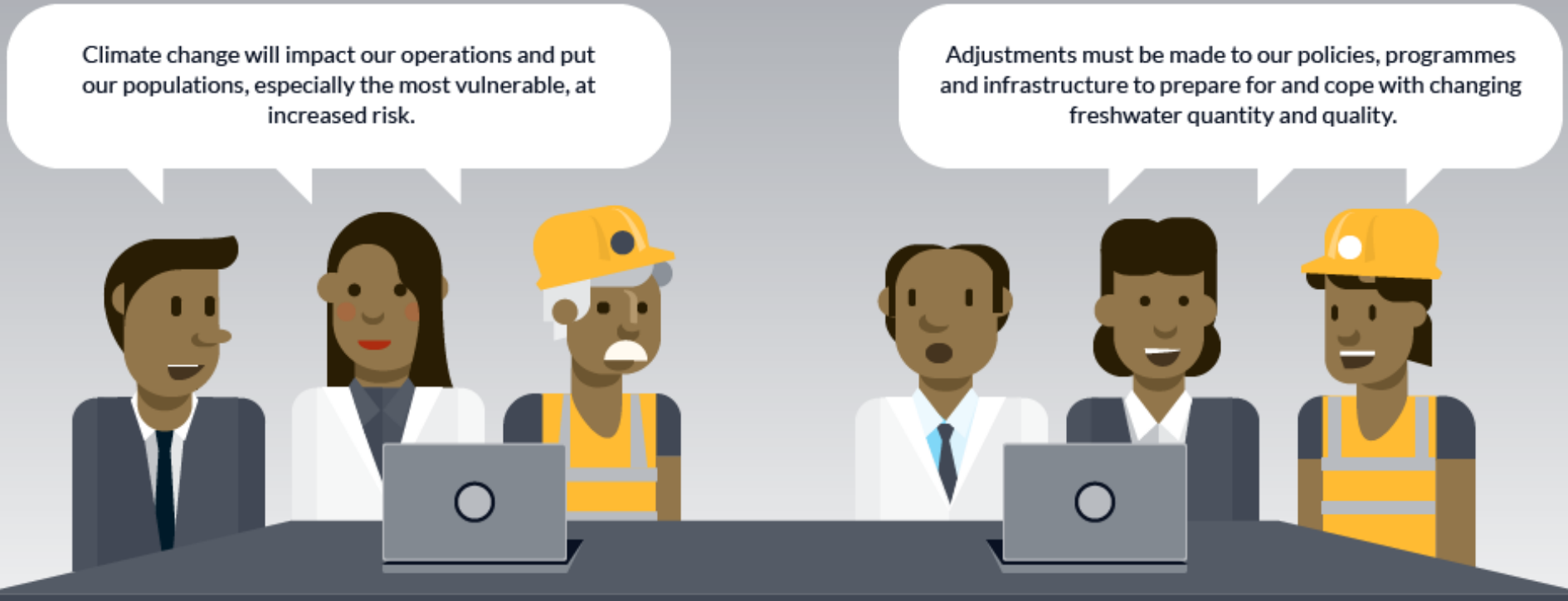




THINGS AREN'T GETTING ANY EASIER…



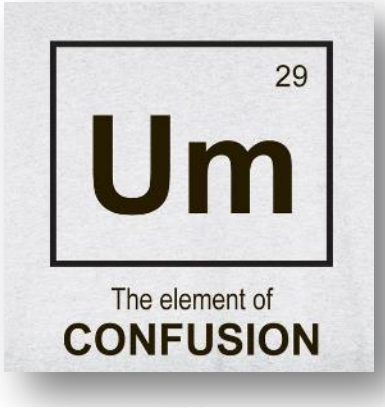
A changing climate affects the timing, predictability and intensity of precipitation.

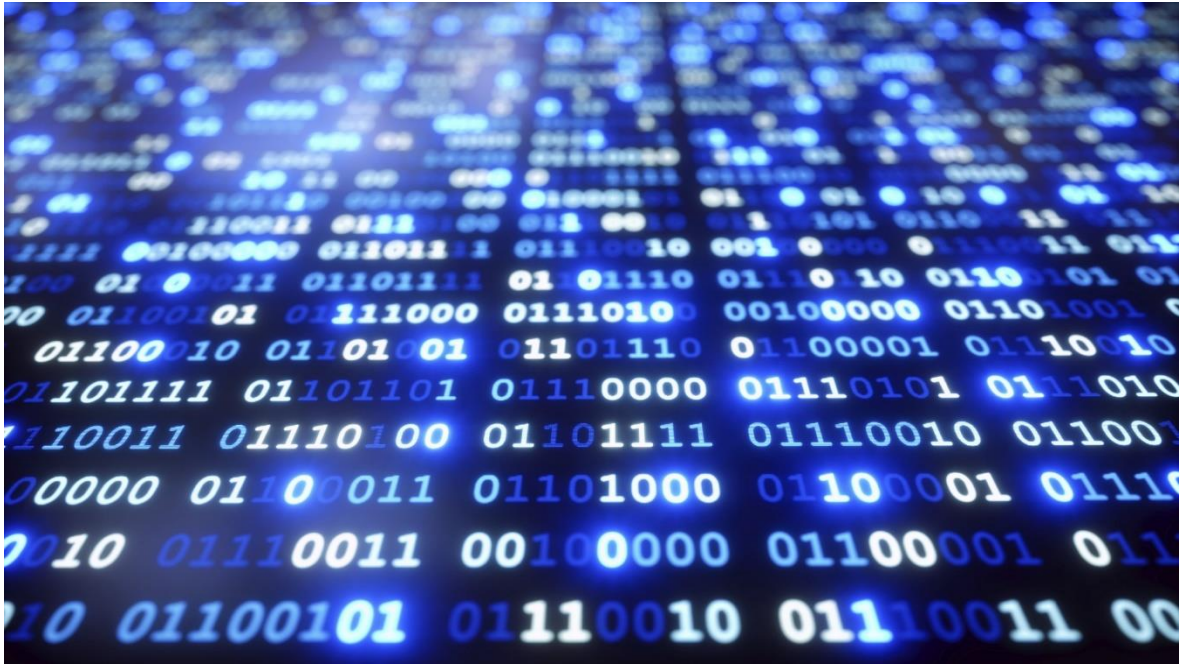


Land, water and urban area managers can better prepare for water related risks by integrating information on flood and drought events into planning and analysis processes to ensure drinking water is safe.

OBJECTIVES OF THIS SESSION

1. Where can I access climate related data?
   - Introducing the F&D Portal
2. There's too much data/information!
   - What datasets are most appropriate for me?
3. How do I use and interpret this data?
   - Accessing data, basic calculations & drawing conclusions
4. Now I know the climatic conditions…
   - How do I re-assess risk impact?
5. Now I know the dangers (risks)…
   - How do I incorporate this into my water safety planning?



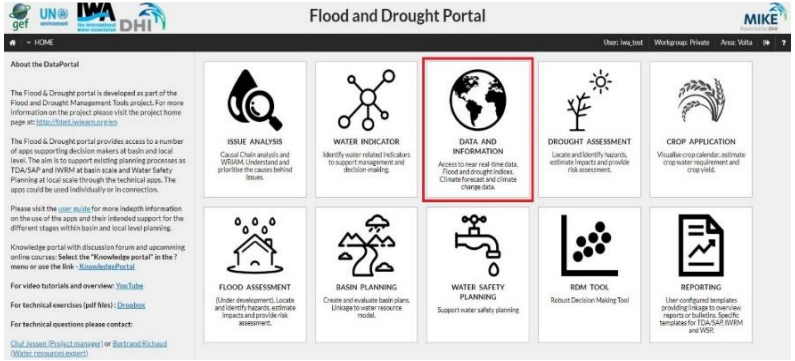


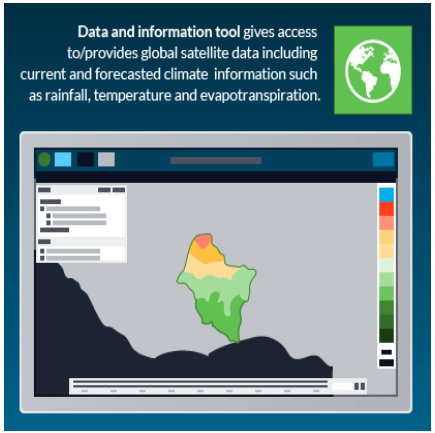
1. Where can I access climate related data?

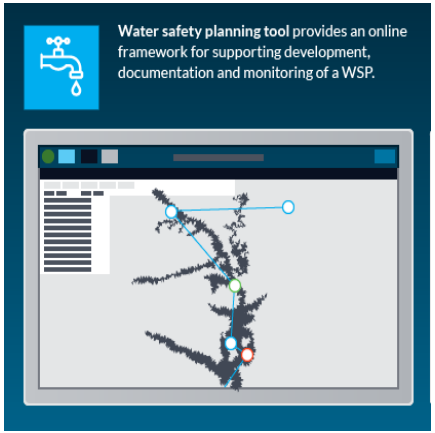
Introducing the F&D Portal

FLOOD & DROUGHT PORTAL

- Web-based system (http://www.flooddroughtmonitor.com/)
- Tools available to incorporate information about floods and droughts and likely climatic scenarios into planning
- The data and information tool provides
  - Near real-time satellite based data
  - Seasonal and medium range climate forecast
  - Climate change projections
  - Data/information relevant for basin and local planning







BENEFITS: USING FLOOD & DROUGHT DATA

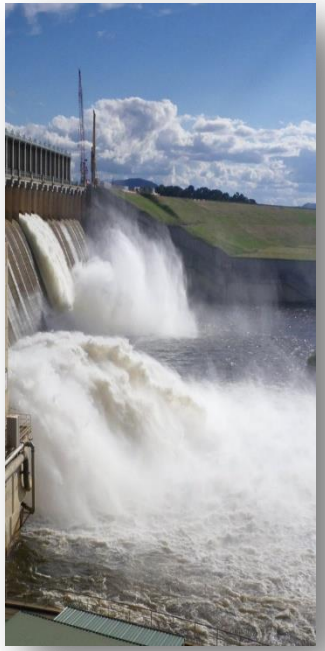
- Early detection especially in the case of droughts where the onset is not always clear
- Planning for disasters, early response time
- Protection of water infrastructure
- Improved risk management (prevention and mitigation of risks associated with floods and droughts)
- Early warning to specific areas that may be affected by a disaster

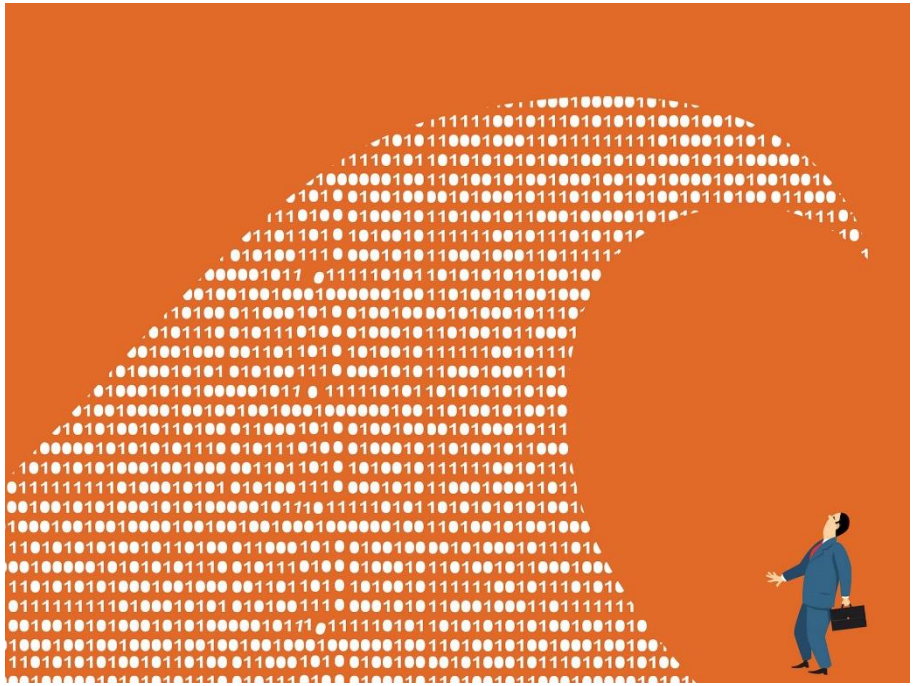
CHALLENGE

- Utilities/municipalities have trouble
  - Using and interpreting the data from the Flood & Drought Portal
  - Incorporating the findings into their water safety planning processes and operations

→**Develop a guidance document to assist decision-making**

- Approach can be used for other data sources/datasets
  - F&D Portal current focus is on transboundary systems

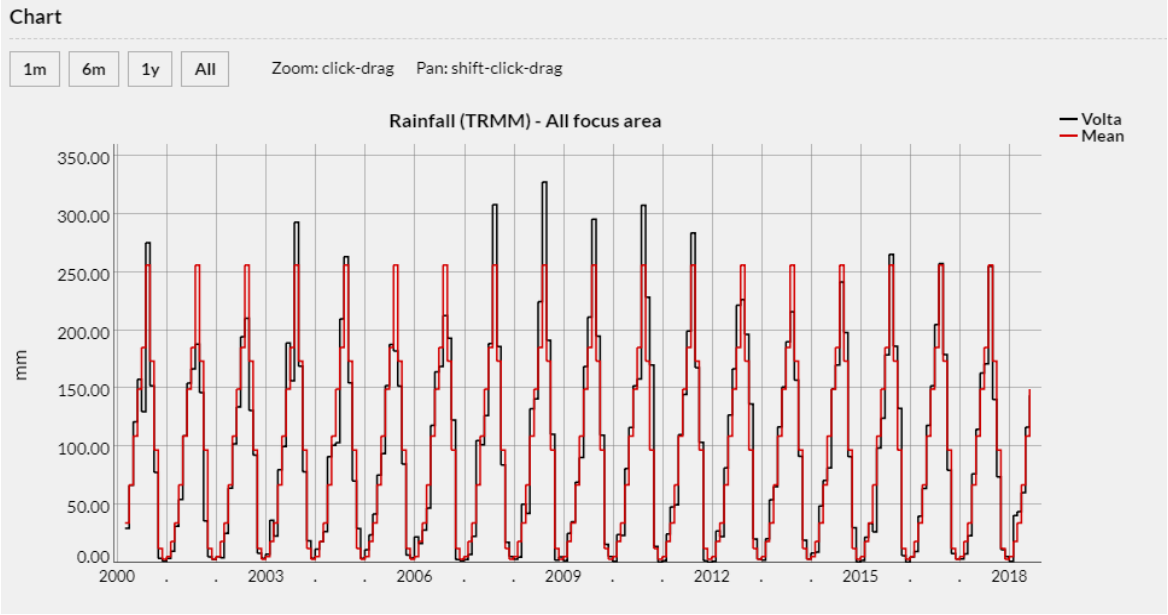




2. There’s too much data/information!

Which datasets are most appropriate for me?

WHAT DOES THIS MEAN?



DATASET EXAMPLES

Rainfall (CHIRPS)	Vegetation NDVI (5600 m)	Physical and socio-economic data
Rainfall (TRMM)	Soil water index (SWI)	Flood Index
Rainfall (GPM)	Vegetation Health Index (VHI)	Chlorophyll
Rainfall (PERSIAN)	Agricultural Stress Index (ASI)	Lakes and reservoirs
Rainfall (CRU)	Combined Drought Index (CDI)	Global Surface Water
Rainfall (GHCN)	Evapotranspiration	River discharge
Rainfall forecast	Temperature	Flash Flood
Medium Range Rainfall Forecast	Climate change	Water Bodies

…and more…

SUGGESTED DATASETS TO DETERMINE THE RISK OF WETTER OR DRIER CONDITIONS

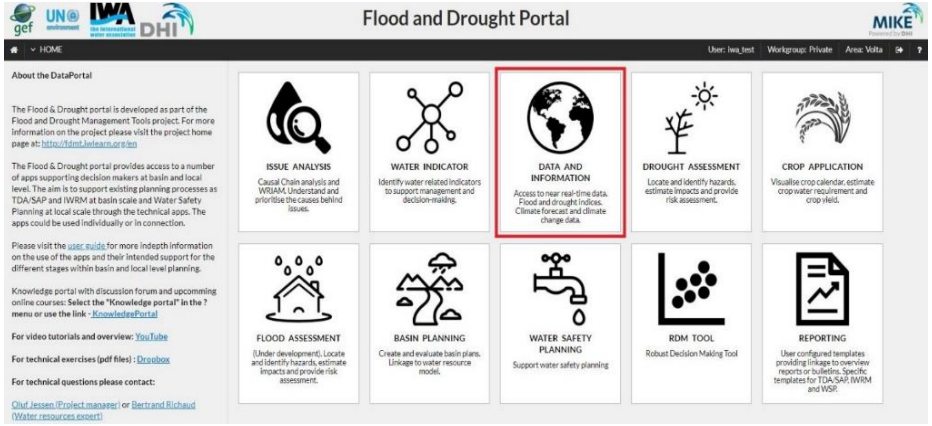
	Short-Term: Climate Analysis Datasets
1	Rainfall (TRMM)
2	Temperature (MOD11A1)

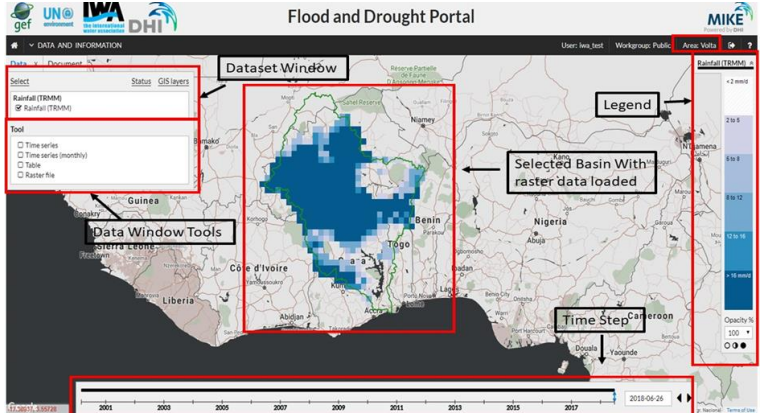
	Long Term: Climate Analysis Datasets
1	Rainfall (CRU) – Rainfall (mm/month) (CRU)
2	Precip. RCP 4.5 2016-2035
3	Temperature – CRU Temperature C
4	TEMP RCP 4.5 2016-2035

3. How do I use and interpret this data?

Accessing data, basic calculations & drawing conclusions

ACCESSING DATA





Table

Rainfall (TRMM) - All focus area - Monthly accumulated values

Time	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.	Min.	Max.
2000			29.7	66.7	121.3	157.8	129.9	275.4	152.1	77.9	3.9	1.5	101.6	1.5	275.4
2001	3.7	10.0	31.5	54.5	109.1	154.5	166.9	188.0	146.2	36.2	5.0	2.8	75.7	2.8	188.0
2002	5.3	4.5	25.3	64.1	102.4	133.9	194.4	210.2	131.0	92.6	8.2	4.0	81.3	4.0	210.2
2003	7.5	36.5	23.0	80.1	99.9	189.1	156.7	293.0	169.0	78.2	18.9	3.9	96.3	3.9	293.0
2004	11.8	18.2	26.7	91.4	101.1	103.4	209.9	263.2	154.8	70.4	29.4	3.8	90.4	3.8	263.2
2005	11.3	24.0	42.0	75.4	94.0	152.3	187.8	182.0	151.9	85.0	6.7	4.0	84.7	4.0	187.8
2006	22.3	16.7	28.2	47.1	118.1	164.2	168.8	212.5	193.1	122.8	2.9	1.7	91.5	1.7	212.5
2007	2.9	7.1	22.8	105.1	101.5	126.7	188.6	308.0	185.9	84.1	17.6	5.5	96.3	2.9	308.0
2008	3.2	4.8	50.3	42.6	132.5	141.0	224.7	327.5	191.3	110.5	2.4	5.0	103.0	2.4	327.5
2009	1.8	25.3	35.3	69.3	90.6	168.7	211.4	295.5	194.9	109.6	15.9	5.4	102.0	1.8	295.5
2010	1.3	24.4	23.5	81.1	116.5	152.1	158.0	307.4	228.5	170.0	14.0	0.8	106.5	0.8	307.4
2011	1.7	24.9	48.2	49.8	110.1	144.9	199.4	283.6	167.8	103.6	1.9	0.5	94.7	0.5	283.6
2012	1.4	27.4	22.5	81.6	127.2	166.8	221.6	226.4	196.4	136.7	20.4	3.4	102.7	1.4	226.4
2013	2.3	20.8	54.2	65.5	117.0	151.2	190.1	215.9	157.0	91.5	19.5	3.3	90.7	2.3	215.9
2014	8.5	9.1	48.9	70.8	81.5	149.6	170.0	241.4	198.0	91.3	30.3	0.8	91.7	0.8	241.4
2015	2.1	21.9	34.1	26.7	98.7	124.4	178.9	265.4	186.2	132.8	6.2	0.5	89.8	0.5	265.4
2016	5.1	9.8	40.1	63.8	118.2	152.1	205.0	257.4	179.1	79.5	7.9	3.4	93.4	3.4	257.4

1. Download suggested datasets
2. Process data (e.g. Excel)
3. Draw conclusions
4. Incorporate findings into your WSP process

SHORT-TERM CLIMATE ANALYSIS

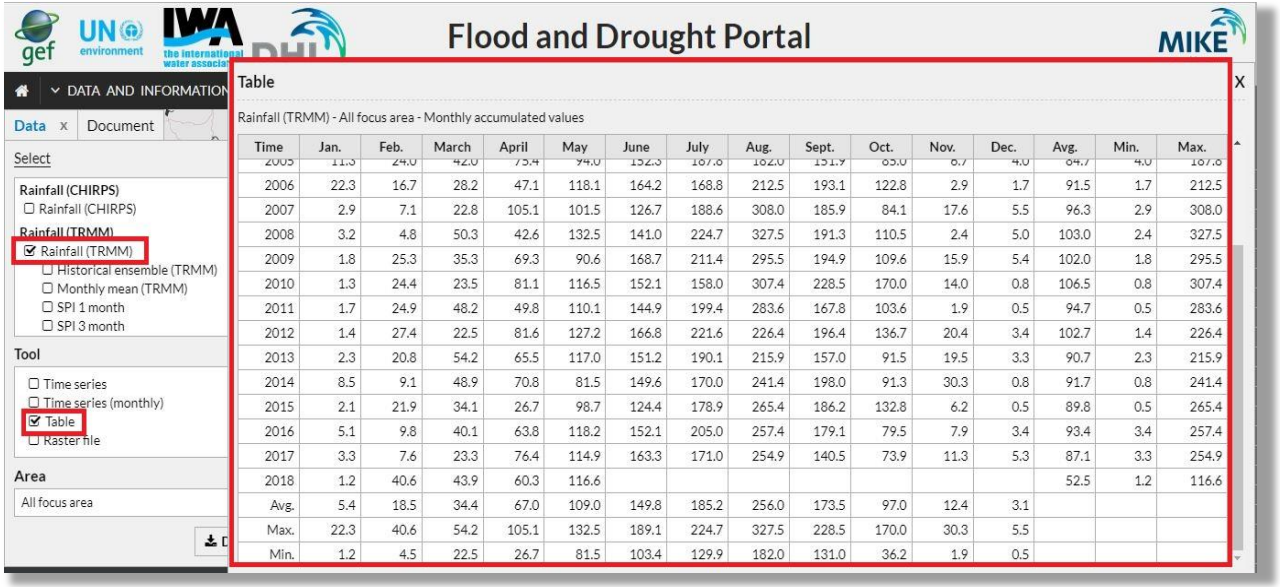
- **Are we experiencing wetter or drier conditions?**
- ✗ **NOT** intended to indicate whether the utility is experiencing floods or droughts
- ✗ **NOT** to be interpreted as a weather forecast
- **BUT** rather to:
  - Determine whether the utility is experiencing a wetting or drying trend
  - Be used to facilitate improved planning

→ Sample formulae and example spreadsheet developed to assist utilities/municipalities

	Short-Term Climate Analysis Datasets
1	Rainfall (TRMM)
2	Temperature (MOD11A1)

E.G. STEPS FOR ANALYSING SHORT-TERM RAINFALL DATA

- Select the **Rainfall (TRMM)**
- Select “table” and download the data



Time	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.	Min.	Max.
2006	22.3	16.7	28.2	47.1	118.1	164.2	168.8	212.5	193.1	122.8	2.9	1.7	91.5	1.7	212.5
2007	2.9	7.1	22.8	105.1	101.5	126.7	188.6	308.0	185.9	84.1	17.6	5.5	96.3	2.9	308.0
2008	3.2	4.8	50.3	42.6	132.5	141.0	224.7	327.5	191.3	110.5	2.4	5.0	103.0	2.4	327.5
2009	1.8	25.3	35.3	69.3	90.6	168.7	211.4	295.5	194.9	109.6	15.9	5.4	102.0	1.8	295.5
2010	1.3	24.4	23.5	81.1	116.5	152.1	158.0	307.4	228.5	170.0	14.0	0.8	106.5	0.8	307.4
2011	1.7	24.9	48.2	49.8	110.1	144.9	199.4	283.6	167.8	103.6	1.9	0.5	94.7	0.5	283.6
2012	1.4	27.4	22.5	81.6	127.2	166.8	221.6	226.4	196.4	136.7	20.4	3.4	102.7	1.4	226.4
2013	2.3	20.8	54.2	65.5	117.0	151.2	190.1	215.9	157.0	91.5	19.5	3.3	90.7	2.3	215.9
2014	8.5	9.1	48.9	70.8	81.5	149.6	170.0	241.4	198.0	91.3	30.3	0.8	91.7	0.8	241.4
2015	2.1	21.9	34.1	26.7	98.7	124.4	178.9	265.4	186.2	132.8	6.2	0.5	89.8	0.5	265.4
2016	5.1	9.8	40.1	63.8	118.2	152.1	205.0	257.4	179.1	79.5	7.9	3.4	93.4	3.4	257.4
2017	3.3	7.6	23.3	76.4	114.9	163.3	171.0	254.9	140.5	73.9	11.3	5.3	87.1	3.3	254.9
2018	1.2	40.6	43.9	60.3	116.6								52.5	1.2	116.6
Avg.	5.4	18.5	34.4	67.0	109.0	149.8	185.2	256.0	173.5	97.0	12.4	3.1			
Max.	22.3	40.6	54.2	105.1	132.5	189.1	224.7	327.5	228.5	170.0	30.3	5.5			
Min.	1.2	4.5	22.5	26.7	81.5	103.4	129.9	182.0	131.0	36.2	1.9	0.5			

DATA DOWNLOAD

- “csv” format
- Data may appear in one single column (MS Office settings)
- Data → Text to Columns → Delimited → Comma

	A	B	C	D	E	F	G	H
1	description==Monthly accumulated values							
2	Time,Jan.,Feb.,March,April,May,June,July,Aug.,Sept.,Oct.,Nov.,Dec.,Avg.,Min.,Max.							
3	2000, , ,29.7,66.7,121.3,157.8,129.9,275.4,152.1,77.9,3.9,1.5,101.6,1.5,275.4							
4	2001,3.7,10.0,31.5,54.5,109.1,154.5,166.9,188.0,146.2,36.2,5.0,2.8,75.7,2.8,188.0							
5	2002,5.3,4.5,25.3,64.1,102.4,133.9,194.4,210.2,131.0,92.6,8.2,4.0,81.3,4.0,210.2							
6	2003,7.5,36.5,23.0,80.1,99.9,189.1,156.7,293.0,169.0,78.2,18.9,3.9,96.3,3.9,293.0							
7	2004,11.8,18.2,26.7,91.4,101.1,103.4,209.9,263.2,154.8,70.4,29.4,3.8,90.4,3.8,263.2							
8	2005,11.3,24.0,42.0,75.4,94.0,152.3,187.8,182.0,151.9,85.0,6.7,4.0,84.7,4.0,187.8							
9	2006,22.3,16.7,28.2,47.1,118.1,164.2,168.8,212.5,193.1,122.8,2.9,1.7,91.5,1.7,212.5							
10	2007,2.9,7.1,22.8,105.1,101.5,126.7,188.6,308.0,185.9,84.1,17.6,5.5,96.3,2.9,308.0							
11	2008,3.2,4.8,50.3,42.6,132.5,141.0,224.7,327.5,191.3,110.5,2.4,5.0,103.0,2.4,327.5							
12	2009,1.8,25.3,35.3,69.3,90.6,168.7,211.4,295.5,194.9,109.6,15.9,5.4,102.0,1.8,295.5							
13	2010,1.3,24.4,23.5,81.1,116.5,152.1,158.0,307.4,228.5,170.0,14.0,0.8,106.5,0.8,307.4							
14	2011,1.7,24.9,48.2,49.8,110.1,144.9,199.4,283.6,167.8,103.6,1.9,0.5,94.7,0.5,283.6							
15	2012,1.4,27.4,22.5,81.6,127.2,166.8,221.6,226.4,196.4,136.7,20.4,3.4,102.7,1.4,226.4							
16	2013,2.3,20.8,54.2,65.5,117.0,151.2,190.1,215.9,157.0,91.5,19.5,3.3,90.7,2.3,215.9							
17	2014,8.5,9.1,48.9,70.8,81.5,149.6,170.0,241.4,198.0,91.3,30.3,0.8,91.7,0.8,241.4							
18	2015,2.1,21.9,34.1,26.7,98.7,124.4,178.9,265.4,186.2,132.8,6.2,0.5,89.8,0.5,265.4							
19	2016,5.1,9.8,40.1,63.8,118.2,152.1,205.0,257.4,179.1,79.5,7.9,3.4,93.4,3.4,257.4							
20	2017,3.3,7.6,23.3,76.4,114.9,163.3,171.0,254.9,140.5,73.9,11.3,5.3,87.1,3.3,254.9							
21	2018,1.2,40.6,43.9,60.3,116.6,167.6,210.3, , , , , ,91.5,1.2,210.3							
22	Avg.,5.4,18.5,34.4,67.0,109.0,150.7,186.5,256.0,173.5,97.0,12.4,3.1, , ,							
23	Max.,22.3,40.6,54.2,105.1,132.5,189.1,224.7,327.5,228.5,170.0,30.3,5.5, , ,							
24	Min.,1.2,4.5,22.5,26.7,81.5,103.4,129.9,182.0,131.0,36.2,1.9,0.5, , ,							

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Time	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.	Min.	Max.
2	2000			29.7	66.7	121.3	157.8	129.9	275.4	152.1	77.9	3.9	1.5	101.6	1.5	275.4
3	2001	3.7	10.0	31.5	54.5	109.1	154.5	166.9	188.0	146.2	36.2	5.0	2.8	75.7	2.8	188.0
4	2002	5.3	4.5	25.3	64.1	102.4	133.9	194.4	210.2	131.0	92.6	8.2	4.0	81.3	4.0	210.2
5	2003	7.5	36.5	23.0	80.1	99.9	189.1	156.7	293.0	169.0	78.2	18.9	3.9	96.3	3.9	293.0
6	2004	11.8	18.2	26.7	91.4	101.1	103.4	209.9	263.2	154.8	70.4	29.4	3.8	90.4	3.8	263.2
7	2005	11.3	24.0	42.0	75.4	94.0	152.3	187.8	182.0	151.9	85.0	6.7	4.0	84.7	4.0	187.8
8	2006	22.3	16.7	28.2	47.1	118.1	164.2	168.8	212.5	193.1	122.8	2.9	1.7	91.5	1.7	212.5
9	2007	2.9	7.1	22.8	105.1	101.5	126.7	188.6	308.0	185.9	84.1	17.6	5.5	96.3	2.9	308.0
10	2008	3.2	4.8	50.3	42.6	132.5	141.0	224.7	327.5	191.3	110.5	2.4	5.0	103.0	2.4	327.5
11	2009	1.8	25.3	35.3	69.3	90.6	168.7	211.4	295.5	194.9	109.6	15.9	5.4	102.0	1.8	295.5
12	2010	1.3	24.4	23.5	81.1	116.5	152.1	158.0	307.4	228.5	170.0	14.0	0.8	106.5	0.8	307.4
13	2011	1.7	24.9	48.2	49.8	110.1	144.9	199.4	283.6	167.8	103.6	1.9	0.5	94.7	0.5	283.6
14	2012	1.4	27.4	22.5	81.6	127.2	166.8	221.6	226.4	196.4	136.7	20.4	3.4	102.7	1.4	226.4
15	2013	2.3	20.8	54.2	65.5	117.0	151.2	190.1	215.9	157.0	91.5	19.5	3.3	90.7	2.3	215.9
16	2014	8.5	9.1	48.9	70.8	81.5	149.6	170.0	241.4	198.0	91.3	30.3	0.8	91.7	0.8	241.4
17	2015	2.1	21.9	34.1	26.7	98.7	124.4	178.9	265.4	186.2	132.8	6.2	0.5	89.8	0.5	265.4
18	2016	5.1	9.8	40.1	63.8	118.2	152.1	205.0	257.4	179.1	79.5	7.9	3.4	93.4	3.4	257.4
19	2017	3.3	7.6	23.3	76.4	114.9	163.3	171.0	254.9	140.5	73.9	11.3	5.3	87.1	3.3	254.9

ANALYSING SHORT-TERM RAINFALL DATA

- Add headings in columns
- Capture previous 12 months of data
- Calculate overall average from ALL data

	R	S	T	U
1	Month and year	Rainfall total for month	Overall average	Percent of normal (%)
2	Jun 17	163,3	92,61	
3	Jul 17	171	92,61	
4	Aug 17	254,9	92,61	
5	Sep 17	140,5	92,61	
6	Oct 17	73,9	92,61	
7	Nov 17	11,3	92,61	
8	Dec 17	5,3	92,61	
9	Jan 18	1,2	92,61	
10	Feb 18	40,6	92,61	
11	Mar 18	43,9	92,61	
12	Apr 18	60,3	92,61	
13	May 18	116,6	92,61	
14			Average Percent of Normal for previous 12 months (%)	

DETERMINING LIKELIHOOD: RAINFALL

- Determined by counting # times rainfall >, < or = “normal”
- Normal Rainfall = 100%
- Likelihood
  - 5 points > average
- Severity
  - Rainfall has decreased
  - 97,43% of average

	R	S	T	U	
1	Month and year	Rainfall total for month	Overall average	Percent of normal (%)	
2	Jun 17	163,3	92,61	176,33	>
3	Jul 17	171	92,61	184,65	>
4	Aug 17	254,9	92,61	275,24	>
5	Sep 17	140,5	92,61	151,71	>
6	Oct 17	73,9	92,61	79,80	
7	Nov 17	11,3	92,61	12,20	
8	Dec 17	5,3	92,61	5,72	
9	Jan 18	1,2	92,61	1,30	
10	Feb 18	40,6	92,61	43,84	
11	Mar 18	43,9	92,61	47,40	
12	Apr 18	60,3	92,61	65,11	
13	May 18	116,6	92,61	125,90	>
14			Average Percent of Normal for previous 12 months (%)	97,43	

5 data points > average

DETERMINING SEVERITY: RAINFALL

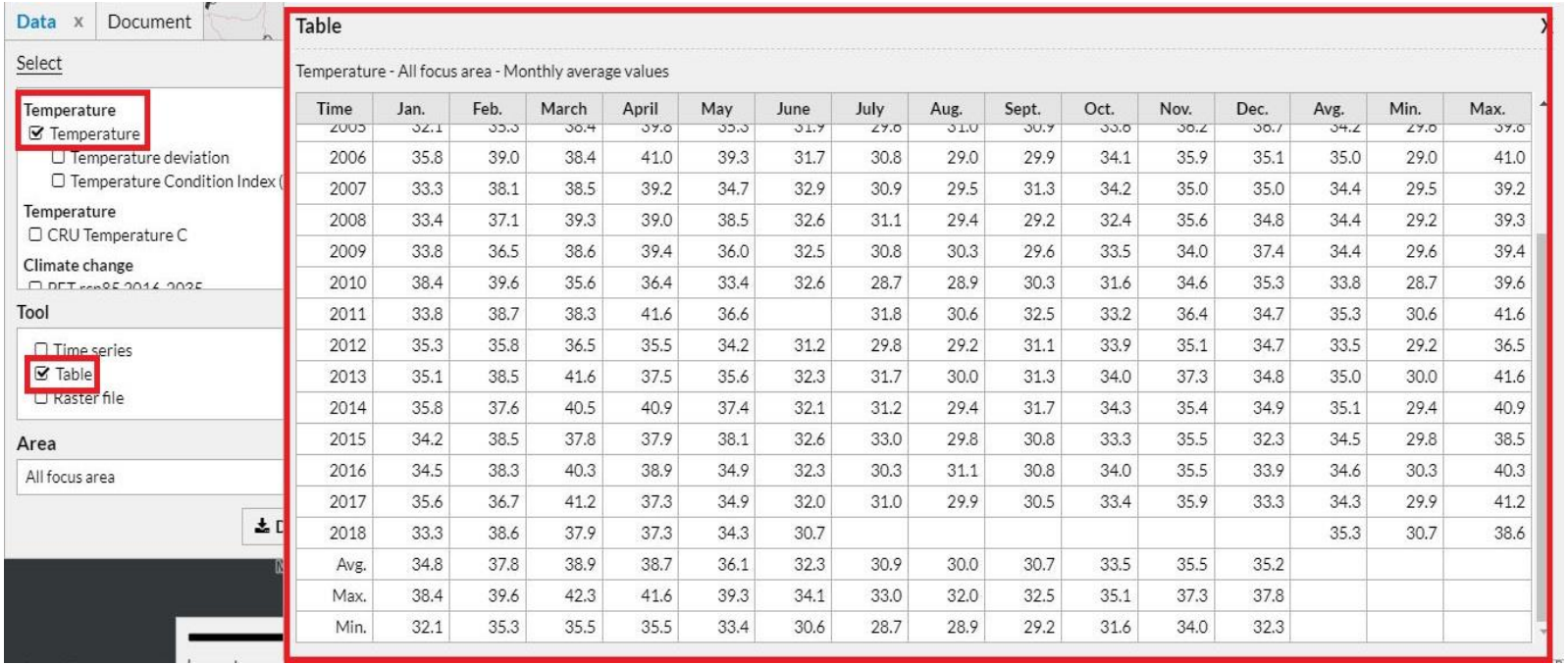
Percentage of rainfall relative to average/mean (%)	Physical conditions
>175	Extremely Wet
150 – 175	Very Wet
125 – 150	Moderately Wet
100 – 125	Mildly Wet
100	Normal
75 – 100	Mildly Dry
50 – 75	Moderately Dry
25 – 50	Very Dry
<25	Extremely Dry

MILDLY DRY

adapted from Awange et al., 2007

ANALYSING SHORT-TERM TEMPERATURE DATA

- Follow the same steps as per rainfall



Table

Temperature - All focus area - Monthly average values

Time	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.	Min.	Max.
2005	32.1	35.3	36.4	39.8	35.3	31.9	29.6	31.0	30.9	33.6	36.2	36.7	34.2	29.6	39.6
2006	35.8	39.0	38.4	41.0	39.3	31.7	30.8	29.0	29.9	34.1	35.9	35.1	35.0	29.0	41.0
2007	33.3	38.1	38.5	39.2	34.7	32.9	30.9	29.5	31.3	34.2	35.0	35.0	34.4	29.5	39.2
2008	33.4	37.1	39.3	39.0	38.5	32.6	31.1	29.4	29.2	32.4	35.6	34.8	34.4	29.2	39.3
2009	33.8	36.5	38.6	39.4	36.0	32.5	30.8	30.3	29.6	33.5	34.0	37.4	34.4	29.6	39.4
2010	38.4	39.6	35.6	36.4	33.4	32.6	28.7	28.9	30.3	31.6	34.6	35.3	33.8	28.7	39.6
2011	33.8	38.7	38.3	41.6	36.6		31.8	30.6	32.5	33.2	36.4	34.7	35.3	30.6	41.6
2012	35.3	35.8	36.5	35.5	34.2	31.2	29.8	29.2	31.1	33.9	35.1	34.7	33.5	29.2	36.5
2013	35.1	38.5	41.6	37.5	35.6	32.3	31.7	30.0	31.3	34.0	37.3	34.8	35.0	30.0	41.6
2014	35.8	37.6	40.5	40.9	37.4	32.1	31.2	29.4	31.7	34.3	35.4	34.9	35.1	29.4	40.9
2015	34.2	38.5	37.8	37.9	38.1	32.6	33.0	29.8	30.8	33.3	35.5	32.3	34.5	29.8	38.5
2016	34.5	38.3	40.3	38.9	34.9	32.3	30.3	31.1	30.8	34.0	35.5	33.9	34.6	30.3	40.3
2017	35.6	36.7	41.2	37.3	34.9	32.0	31.0	29.9	30.5	33.4	35.9	33.3	34.3	29.9	41.2
2018	33.3	38.6	37.9	37.3	34.3	30.7							35.3	30.7	38.6
Avg.	34.8	37.8	38.9	38.7	36.1	32.3	30.9	30.0	30.7	33.5	35.5	35.2			
Max.	38.4	39.6	42.3	41.6	39.3	34.1	33.0	32.0	32.5	35.1	37.3	37.8			
Min.	32.1	35.3	35.5	35.5	33.4	30.6	28.7	28.9	29.2	31.6	34.0	32.3			

ANALYSING SHORT-TERM TEMPERATURE DATA

- Calculate the overall average and associated deviation

	R	S	T	U
1	Month and year	Average Temperature for the month (°C)	Overall average (°C)	Deviation °C
2	Jun 17	32	34,55	-2,55
3	Jul 17	31	34,55	-3,55
4	Aug 17	29,9	34,55	-4,65
5	Sep 17	30,5	34,55	-4,05
6	Oct 17	33,4	34,55	-1,15
7	Nov 17	32,9	34,55	-1,65
8	Dec 17	33,3	34,55	-1,25
9	Jan 18	33,3	34,55	-1,25
10	Feb 18	38,6	34,55	4,05 >
11	Mar 18	37,9	34,55	3,35 >
12	Apr 18	37,3	34,55	2,75 >
13	May 18	34,3	34,55	-0,25
14			Overall temperature Deviation	-0,85

- During the analysis period the temperature decreased (i.e. -0.85 °C)

3 data points > average

RANGE OF TEMPERATURE DEVIATIONS

Temperature deviation (°C)	Physical conditions
3 to 5	Major increase
2 to 3	Moderate Increase
1 to 2	Minor increase
0 to 1	Near normal
0	Normal
0 to -1	Near normal
-1 to -2	Minor decrease
-2 to -3	Moderate decrease
-3 to -5	Major decrease

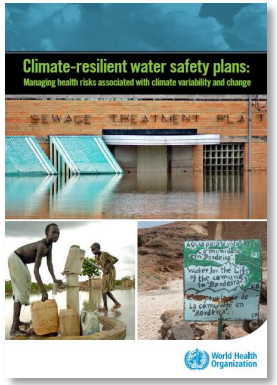
NEAR NORMAL

4. Now I know the climatic conditions…

How do I re-assess risk impact?

BEFORE YOU CONTINUE…

- Review your current WSP
- Look at your current hazards/hazardous events
  1. Will these events be affected by climatic conditions being ‘drier’ or ‘wetter’?
     - Affected by wet conditions?
     - Affected by dry conditions?
     - Affected by both wet and dry conditions?
     - Unaffected by either wet or dry conditions?
  2. Is my list of events comprehensive?
     - Literature review – e.g. WHO
  3. Does my list of events consider climate resiliency?
     - Amend/expand current list of events



EXAMPLE: HAZARDS AND HAZARDOUS EVENTS AND ASSOCIATED CATEGORIZATION

X happens (to the water supply) **because of Y**

X = What can happen to the water supply

Y = How it can happen (i.e. cause)

Examples:

- Source water becomes faecally contaminated (X) because of discharge of untreated domestic waste from households (Y)
- Water in the pipe network becomes contaminated (X) because of unsanitary pipeline repair practices (Y)
- Water is over- or under-dosed with chlorine (X) because of insufficient operator training (Y)

Hazard	Hazardous event	Physical Condition
Changes in seasonal runoff & loss of snowpack	Increases in temperature and shifting of precipitation patterns will alter seasonal runoff and storage of water as snow. Earlier peak runoff flows may strain the capacity of reservoirs to hold large earlier peak flow volumes.	Wetter
Lower lake & reservoir levels	Increases in temperature and decreases in mean annual precipitation, leads to reduced runoff and higher loss of water through evapotranspiration.	Drier
Saltwater intrusion into aquifers	Under wetter conditions - Projected sea level rise will increase inundation and salinity in coastal areas. Under drier conditions - Over abstraction of groundwater in coastal areas especially during dry periods, leads to reduced groundwater table.	Wetter or Drier
Operation restrictions chlorine building not according to legislation	The building size is not according to legislation for the chlorine content being kept in the chlorine building.	Unaffected by wetter or drier conditions
High flow events & flooding	Intense precipitation events may occur more frequently, concentrating the annual total rainfall into episodes that challenge current infrastructure for water management and flood control.	Wetter
Changes in energy sector needs	Under wet conditions - Reduced energy production due to increased flows and rises in water levels. Under dry conditions - Due to reduced water levels, energy production may not be possible.	Wetter or Drier
Open reservoir leading to increased animal activity.	Increased animal activity at open reservoirs. Increased animal activity and leads to faecal contamination due to droppings of birds and other small animals such as frogs etc.	Unaffected by wetter or drier conditions
Low flow conditions & altered water quality	Lower precipitation will lead to lower streamflow in many locations, which may lead to diminished water quality due to little flushing of pollutants taking place.	Drier

CURRENT WSP – RISK RATING FOR A PARTICULAR "DRY" HAZARDOUS EVENT

5 x 5 matrix

Likelihood						
	Almost Certain 5	5	10	15	20	25
	Likely 4	4	8	12	16	20
	Moderate 3	3	6	9	12	15
	Unlikely 2	2	4	6	8	10
	Rare 1	1	2	3	4	5
		Insignificant or no impact 1	Mild or minor 2	Moderate 3	Major 4	Catastrophic 5
				Severity		

Risk Score	<6	6-9	10-15	>15
Risk rating	Low	Medium	High	Very High

DETERMINING SHORT-TERM CLIMATE CHANGE RELATED RISKS

- **Rainfall (TRMM)**
  - Likelihood: 5 out of 12 months had rainfall that exceeded the average/mean
    - Count the number of months rainfall was > “normal” and how many times it was < “normal”
  - Severity: mildly dry
- **Temperature (MOD11A1)**
  - Likelihood: 3 out of 12 months experienced conditions that exceeded the average/mean
  - Severity: near normal

LIKELIHOOD MATRIX: CHANGE FACTOR

the international water association

Rain	6 months and 6 months	7 months and 5 months	8 months and 4 months	9 months and 3 months	10 months and 2 months	11 months and 1 month	12 months and 0 months
12 months and 0 months	+1	+1	+2	+2	+2	+2	+2
11 months and 1 month	+1	+1	+1	+1	+2	+2	+2
10 months and 2 months	1	+1	+1	+1	+1	+2	+2
9 months and 3 months	0	0	+1	+1	+1	+1	+2
8 months and 4 months	0	0	+1	+1	+1	+1	+1
7 months and 5 months	0	0	0	+1	+1	+1	+1
6 months and 6 months	0	0	0	0	0	+1	+1

Temperature

SEVERITY MATRIX: CHANGE FACTOR

Rain

Extremely Wet	>175	+2	+2	+2	+1	+1	+1	+2	+2	+2
Very Wet	150 – 175	+2	+2	+1	+1	+1	+1	+1	+2	+2
Moderately Wet	125 – 150	+1	+1	+1	0	0	0	+1	+1	+1
Mildly Wet	100 – 125	+1	+1	0	0	0	0	0	+1	+1
Normal	100	+1	+1	0	0	0	0	0	+1	+1
Mildly Dry	75 – 100	+1	+1	0	0	0	0	0	+1	+1
Moderately Dry	50 – 75	+1	+1	+1	0	0	0	+1	+1	+1
Very Dry	25 – 50	+2	+2	+1	+1	+1	+1	+1	+2	+2
Extremely Dry	<25	+2	+2	+2	+1	+1	+1	+2	+2	+2
		-3 to -5	-2 to -3	-1 to -2	0 to -1	0	0 to 1	1 to 2	2 to 3	3 to 5
		Major decrease	Moderate decrease	Minor decrease	Near normal	Normal	Near normal	Minor increase	Moderate Increase	Major increase

Temperature

ADDING CHANGE FACTORS TO CURRENT LIKELIHOOD AND SEVERITY

Likelihood		Severity	
Current	**Change Factor**	**Current**	**Change Factor**
2	+1	3	0
Amended Likelihood: **2 + 1 = 3 (Moderate)**		**Amended Severity:** **3 + 0 = 3 (Moderate)**	

AMENDED RISK RATING FOR A PARTICULAR HAZARDOUS EVENT

5 x 5 matrix

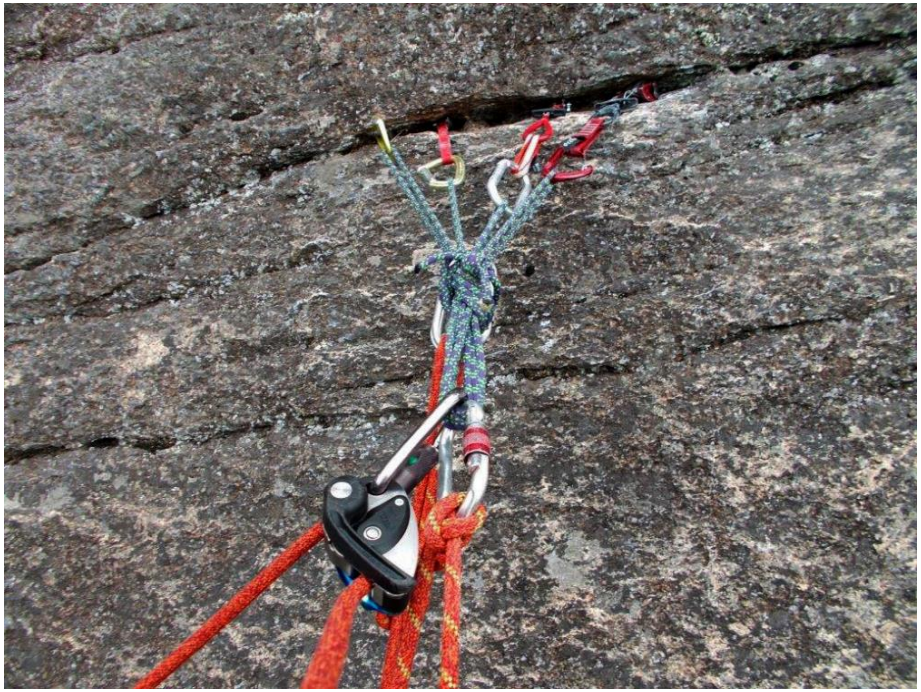
Likelihood						
	Almost Certain 5	5	10	15	20	25
	Likely 4	4	8	12	16	20
	Moderate 3	3	6	9	12	15
	Unlikely 2	2	4	6	8	10
	Rare 1	1	2	3	4	5
		Insignificant or no impact 1	Mild or minor 2	Moderate 3	Major 4	Catastrophic 5
				Severity		
Risk Score		<6	6-9	10-15	>15	
Risk rating		Low	Medium	High	Very High	

A REMINDER…

- Methodology is intentionally not too onerous
- More detailed models/analyses are possible with resources/time/skills
- Many utilities are currently doing very little/nothing

  → Start thinking about climate change impacts and incorporating this into planning

  – To support decision making
  – Prioritise risks and issues
  – Prepare for climate change impacts through implementation of control measures
  – Improve water utilities resilience to climate change



5. Now I know the dangers (risks)…

How do I incorporate findings into my WSP?

WSP MODULES REQUIRING ADDED ATTENTION

Mod 1: Assemble the WSP team

Mod 2: Describe the water supply system

Mod 3: Identify the hazards and hazardous events

Mod 4: Determine & validate control measures, assess & prioritize risk

Mod 5: Develop, implement & maintain an improvement plan

Mod 6: Define monitoring of control measures

Mod 7: Verify the effectiveness of the WSP

Mod 8: Prepare management procedures

Mod 9: Develop supporting programmes

Mod 10/11: Review and revise the WSP regularly and following an incident

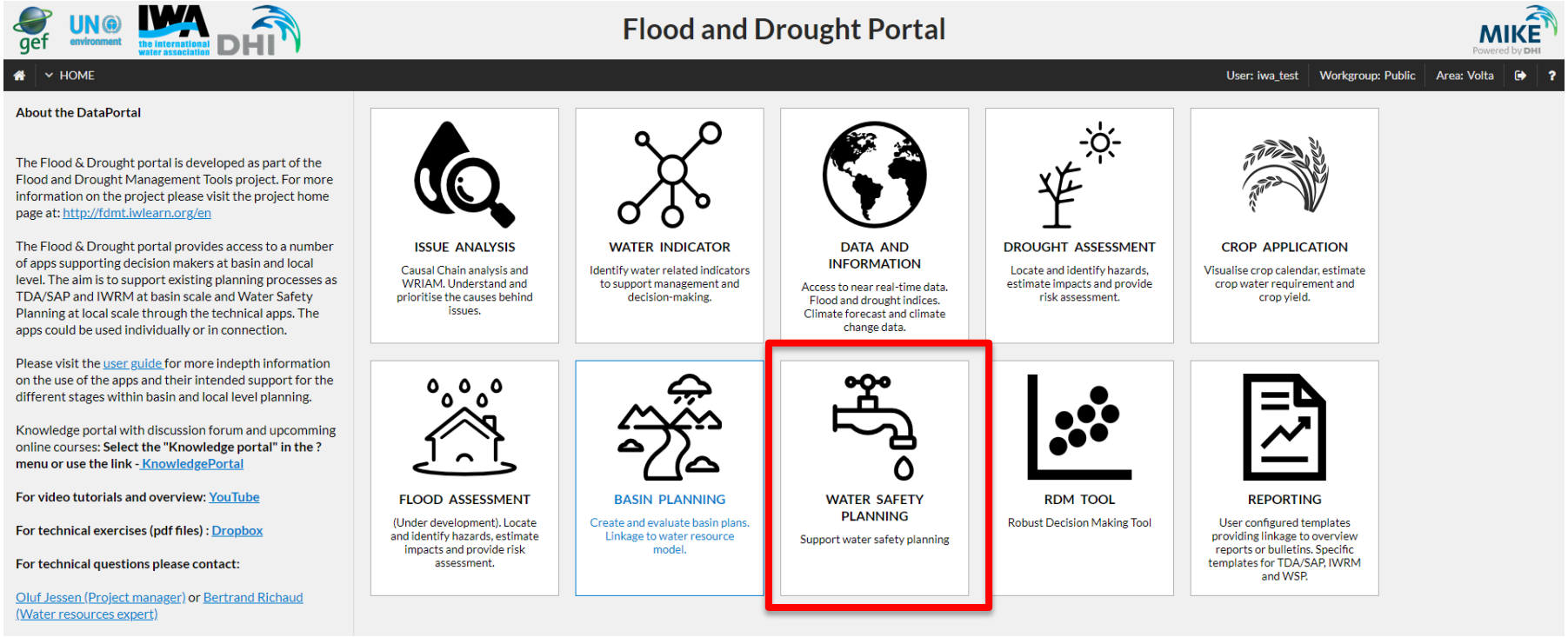
ASPECTS REQUIRING CONSIDERATION

- WSP team – should consider need for new experts
  - E.g. climatologist
- System description – should consider climate related information
  - E.g. sustainable resource yields, alternative sources, development/land use, water supply network integrity/storage capacities
- Improvement planning – should consider short, medium and long-term initiatives
  - E.g. feasibility studies, costs vs. benefits

ASPECTS REQUIRING CONSIDERATION

- Management procedures – should consider climate related emergency response planning
  - E.g. boil water advisory after a flooding event
- Support programmes – should consider climate change impact assessment studies
  - E.g. hydrology modelling, drought event planning and management, research studies of alternative water sources

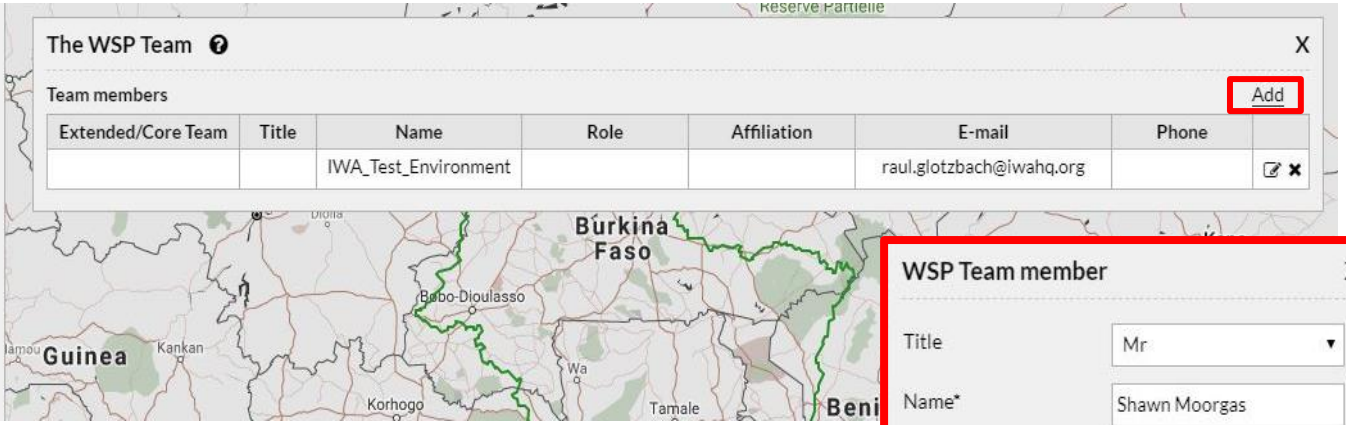
WSP LINKAGE



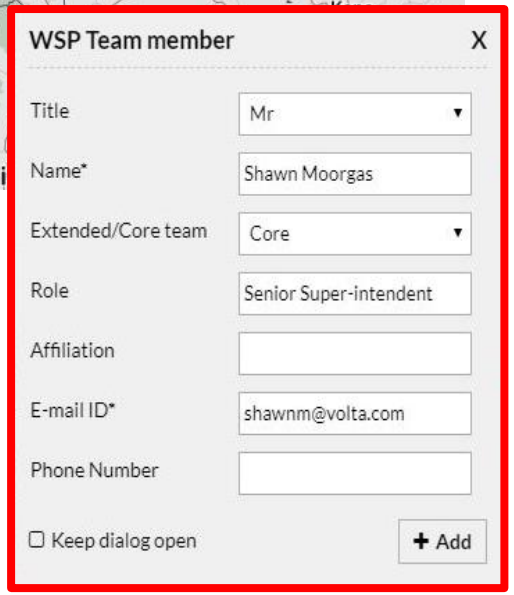
All WSP modules available on the F&D Portal

1. ASSEMBLING THE WSP TEAM

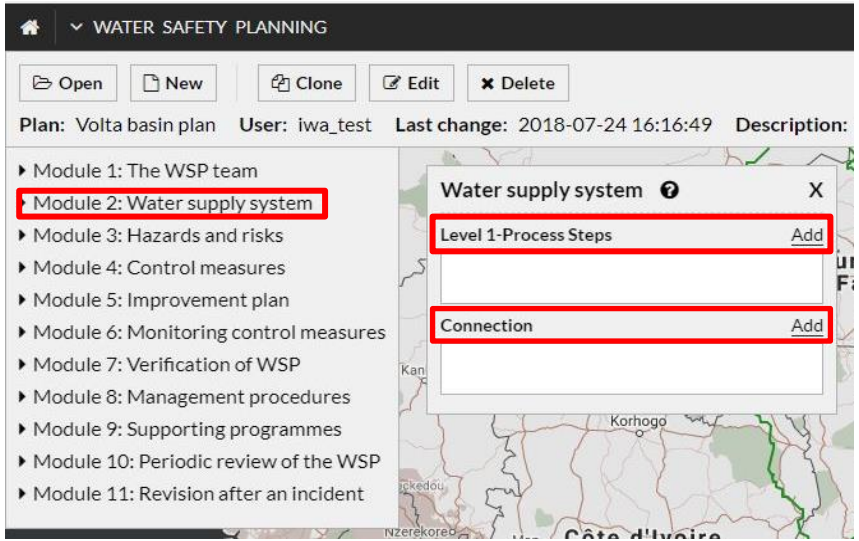
- Module 1: The WSP team
- Module 2: Water supply system
- Module 3: Hazards and risks
- Module 4: Control measures
- Module 5: Improvement plan
- Module 6: Monitoring control measures
- Module 7: Verification of WSP
- Module 8: Management procedures
- Module 9: Supporting programmes
- Module 10: Periodic review of the WSP
- Module 11: Revision after an incident



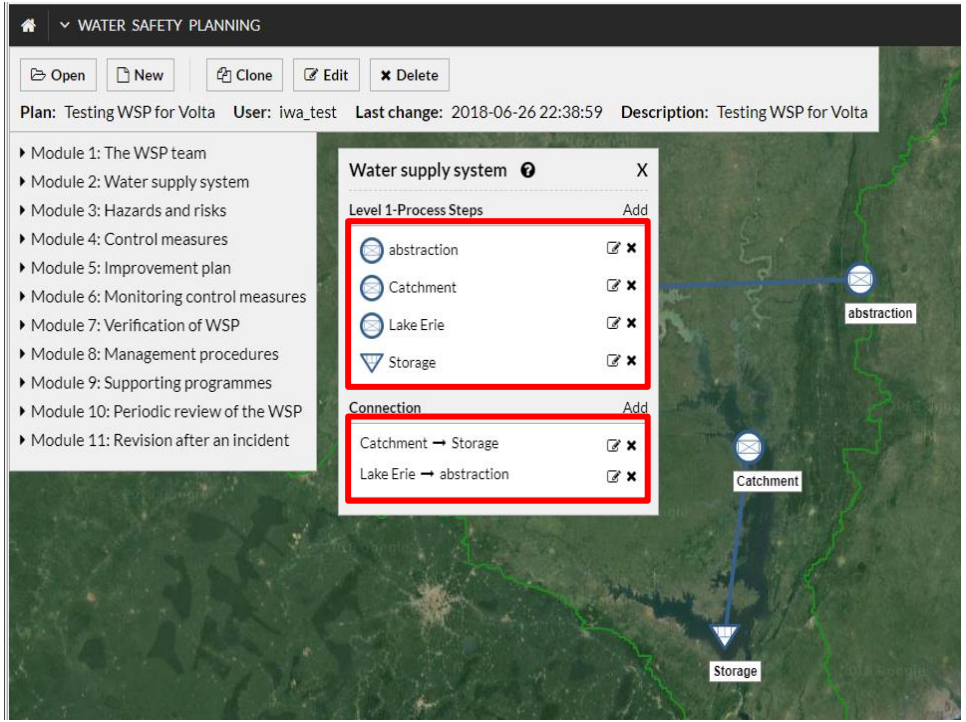
- Who is on your WSP team?
- Who will you include (internal or external) as a climate expert?
- What other team members (internal or external) do you need?



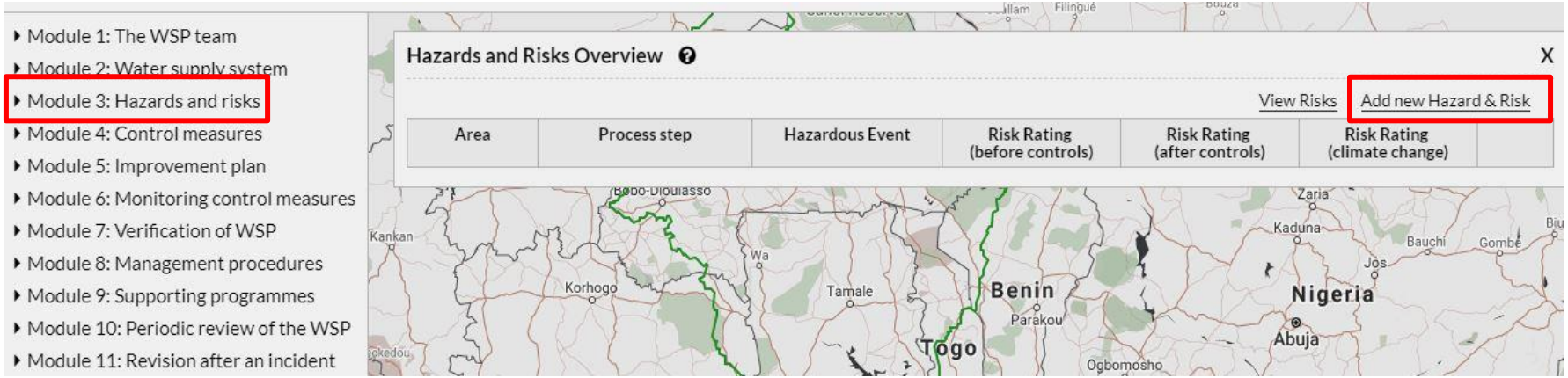
2. WATER SUPPLY SYSTEM



- What are the key components of your system?
- What components could be affected by floods/droughts?



3. HAZARDS & RISKS



GUIDANCE DOCUMENT:
LIST OF POSSIBLE HAZARDS/HAZARDOUS EVENTS

the international water association

Appendix A: List of Possible Hazards and Hazardous Events

Hazards	Physical condition	Hazardous events
Lower lake & reservoir levels	Dry	Increases in temperature and decreases in mean annual precipitation, leads to reduced runoff and higher loss of water through evapotranspiration.
Changes in seasonal runoff & loss of snowpack	Wet	Increases in temperature and shifting of precipitation patterns will alter seasonal runoff and storage of water as snow. Earlier peak runoff flows may strain the capacity of reservoirs to hold large earlier peak flow volumes.
Low flow conditions & altered water quality	Dry	Lower precipitation will lead to lower streamflow in many locations, which may lead to diminished water quality due to little flushing of pollutants taking place.
Operation restrictions chlorine building not according to legislation	Unaffected by wetter or drier conditions	The building size is not according to legislation for the chlorine content being kept in the chlorine building.
High flow events & flooding	Wet	Intense precipitation events may occur more frequently, concentrating the annual total rainfall into episodes that challenge current infrastructure for water management and flood control.
Changes in energy sector needs	Wet and dry	Under wet conditions - Reduced energy production due to increased flows and rises in water levels. Under dry conditions - Due to reduced water levels, energy production may not be possible.
Open reservoir leading to increased animal activity.	Unaffected by wetter or drier conditions	Increased animal activity at open reservoirs. Increased animal activity and leads to faecal contamination due to droppings of birds and other small animals such as frogs etc.
Saltwater intrusion into aquifers	Wet and Dry	Under wetter conditions - Projected sea level rise will increase inundation and salinity in coastal areas. Under drier conditions - Over abstraction of groundwater in coastal areas especially during dry periods, leads to reduced groundwater table.

CURRENT & FUTURE RISK RATING

Likelihood						
	Almost Certain 5	5	10	15	20	25
	Likely 4	4	8	12	16	20
	Moderate 3	3	6	9	12	15
	Unlikely 2	2	4	6	8	10
	Rare 1	1	2	3	4	5
		Insignificant or no impact 1	Mild or minor 2	Moderate 3	Major 4	Catastrophic 5

Risk Score	<6	6-9	10-15	>15
Risk rating	Low	Medium	High	Very High

Hazard and risks | Control measures | Improvement plan

Preliminary risk assessment with no control

	Current	Future (Climate change)
Likelihood	Unlikely	Possible
Severity	Moderate	Major
Risk rating	Medium risk	High risk

- Also capture
  - Control measures
  - Improvement plan

4. CONTROL MEASURES

- Module 1: The WSP team
- Module 2: Water supply system
- Module 3: Hazards and risks
- Module 4: Control measures
- Module 5: Improvement plan
- Module 6: Monitoring control measures
- Module 7: Verification of WSP
- Module 8: Management procedures
- Module 9: Supporting programmes
- Module 10: Periodic review of the WSP
- Module 11: Revision after an incident

Hazards and Risks Overview X

View Risks | Add new Hazard & Risk

Area	Process step	Hazardous Event	Risk Rating (before controls)	Risk Rating (after controls)	Risk Rating (climate change)

Hazard and risks | Control measures | Improvement plan

Existing control measures

Existing Control measure: Catchment\Covering and protecting springs

Effectiveness: Yes

Note:

Re-assessment of risk (with existing Control measure)

	Current	Future (Climate change)
Likelihood	Possible	Most unlikely
Severity	Minor	Moderate
Risk rating	Medium risk	Low risk

GUIDANCE DOCUMENT: LIST OF POSSIBLE CONTROL MEASURES

Appendix B: List of Possible Control Measures

a) Use the portal to monitor the weather conditions for rainfall and temperature.
b) Finance systems to recycle water this can include greywater for homes and businesses
c) Reduce agricultural and irrigation water demand by working with irrigators to install advanced equipment (e.g. drip or other micro-irrigation systems with weather-linked controls)
d) Practice demand management through communication to public on water conservation actions and implementation features such as: water metering, leak detection, water loss monitoring. Award those who has installed water conserving appliances/toilets/rainwater harvesting
e) Monitor surface water conditions, including river discharge, snowmelt, and streamflow
f) Practice fire management plans in the watershed, such as mechanical thinning, weed control, selective harvesting, controlled burns, and creating more fire breaks.
g) Manage reservoir water quality by investing in practices such as lake aeration to minimise algal blooms due to higher temperature
h) Monitor vegetation changes in watersheds
i) Monitor and inspect the integrity of existing infrastructure
j) Monitor flood events and drivers that may impact flood and water quality models (e.g. storm intensity and sea level)

- What existing control measures do you have for each hazard?
- Is the control measure sufficient?
  - Even with increased flooding?
  - Even with drought and increased water scarcity?

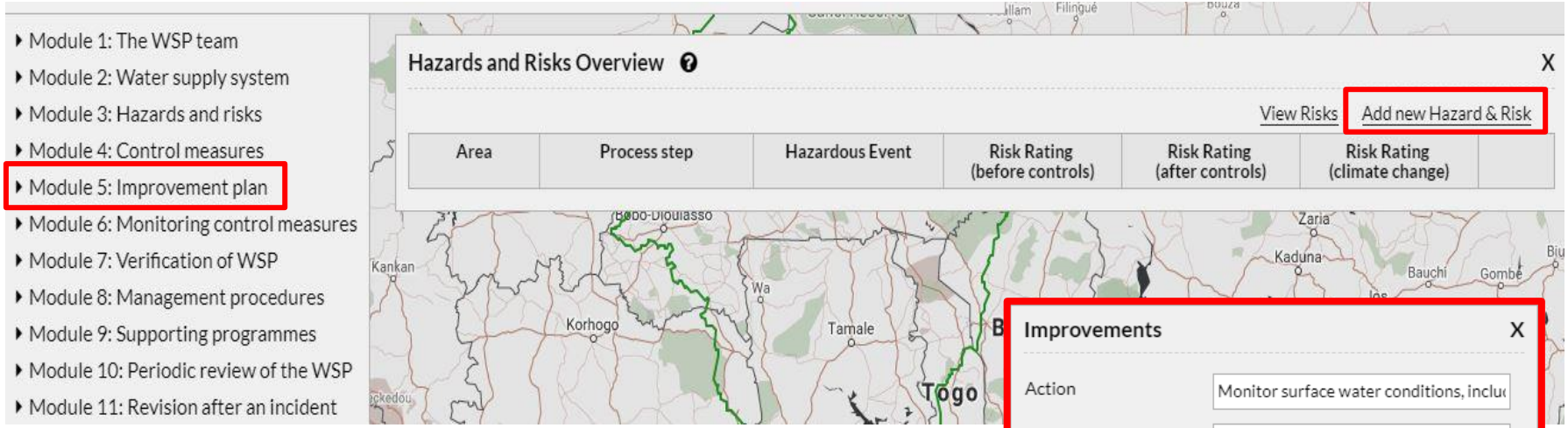
BEFORE CLIMATE CHANGE CONSIDERATIONS

	Physical Condition	Hazards	Likelihood	Severity	Risk	Possible control measures
1.	Wetter	Changes in seasonal runoff and loss of snowpack	Unlikely 2	Moderate 3	Medium 6	Monitor flood events and drivers that may impact flood and water quality models (e.g. storm intensity and sea level). Does this still meet our needs? WSP team to review and amend as required.
2.		High Flow events and Flooding	Likely 4	Moderate 3	High 12	Monitor surface water conditions, including river discharge and streamflow
3.	Drier	Low flow conditions which results in altered surface water quality	Moderate 2	Major 2	Low 4	Manage reservoir water quality by investing in practices such as lake aeration to minimise algal blooms due to higher temperature. Does this still meet our needs? WSP team to review and amend as required.
4.		Lower lake and reservoir levels	Moderate 3	Moderate 3	Medium 9	Practice conjunctive use of water. Example, storing groundwater in the wet months and using the water in the dry months
5.	Unaffected by wetter or drier	Increased animal activity in open reservoir	Unlikely 2	Moderate 2	Low 4	Cover reservoir with roof, or put measures in place to discourage animals from entering reservoir such as “eagle eye”. Does this still meet our needs? WSP team to review and amend as required.
6.		Operation restrictions as chlorine building is not according to legislation	Likely 4	Catastrophic 5	Very High 20	Redesign Chlorine building and ensure that the chlorine building is not overstocked with Chlorine

AFTER CLIMATE CHANGE CONSIDERATIONS

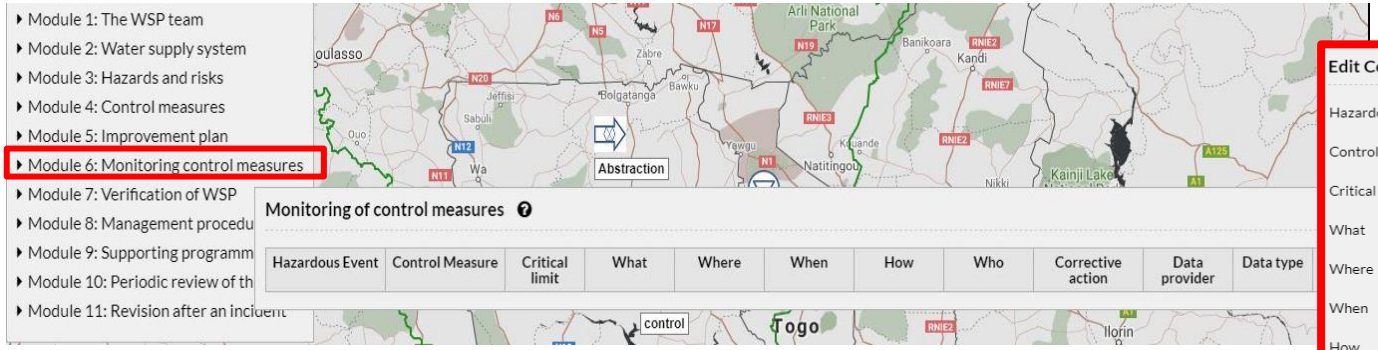
	Physical Condition	Hazards	Likelihood	Severity	Risk	Possible control measures
1.	Wetter	Changes in seasonal runoff and loss of snowpack	Moderate 2+1= 3	Major 3+1= 4	High 12	Monitor flood events and drivers that may impact flood and water quality models (e.g. storm intensity and sea level). Does this still meet our needs? WSP team to review and amend as required.
2.	Drier	Low flow conditions which results in altered surface water quality	Unlikely 2	Major 2	Medium 4	Manage reservoir water quality by investing in practices such as lake aeration to minimise algal blooms due to higher temperature. Does this still meet our needs? WSP team to review and amend as required.
3.	Unaffected by climate change	Increased animal activity in open reservoir	Unlikely 2	Moderate 2	Low 4	Cover reservoir with roof, or put measures in place to discourage animals from entering reservoir such as “eagle eye”. Does this still meet our needs? WSP team to review and amend as required.

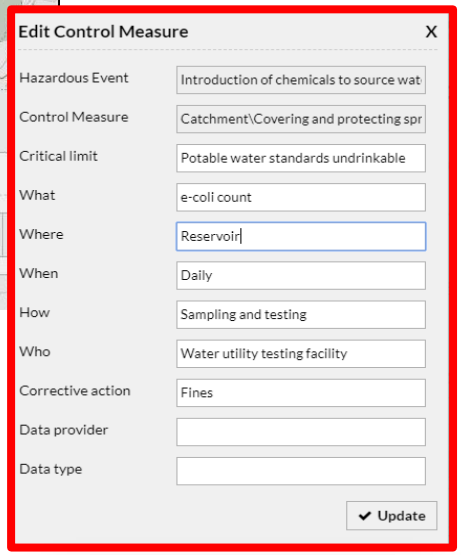
5. IMPROVEMENT PLAN



- Which control measures are not working well?
- What improvements can be put in place?
- What new control measures are required to deal with future climate hazards?

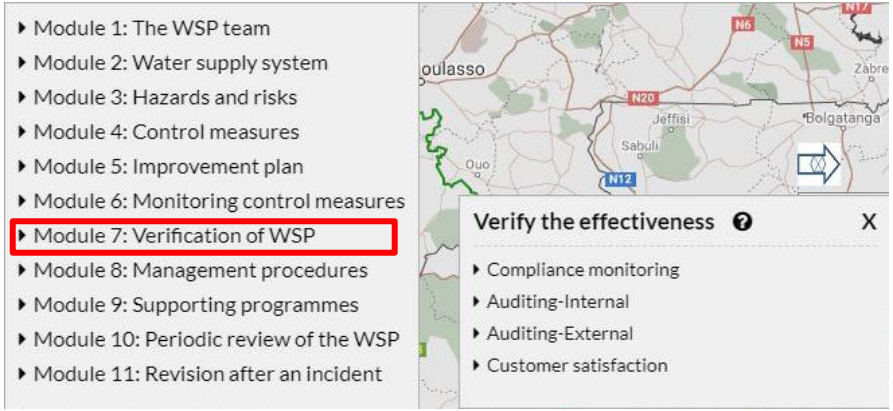
6. MONITORING OF CONTROL MEASURES





- Do you monitor the effectiveness of existing control measures?
- What indicator/s should be monitored?

7. VERIFICATION OF THE WSP

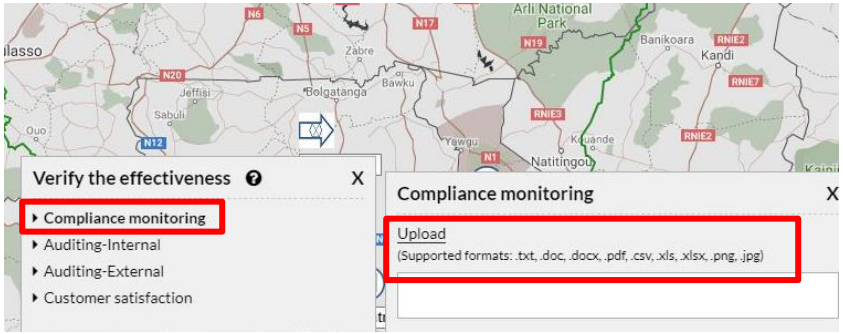


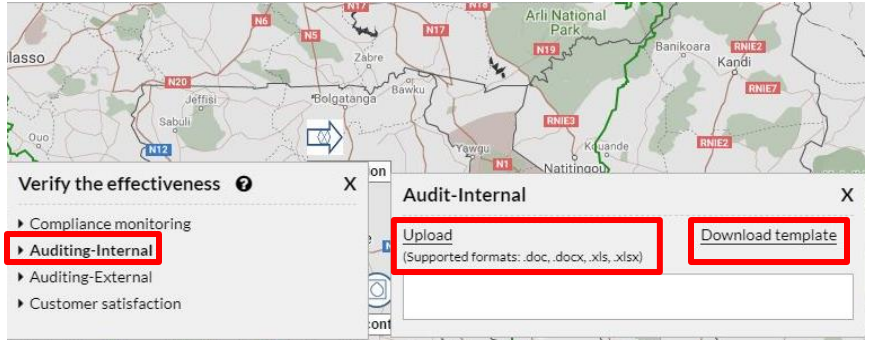
- Are you auditing your WSP?
- Internal and/or external auditing?
- Are you regularly engaging customers?

→ In the WSP Resources folder

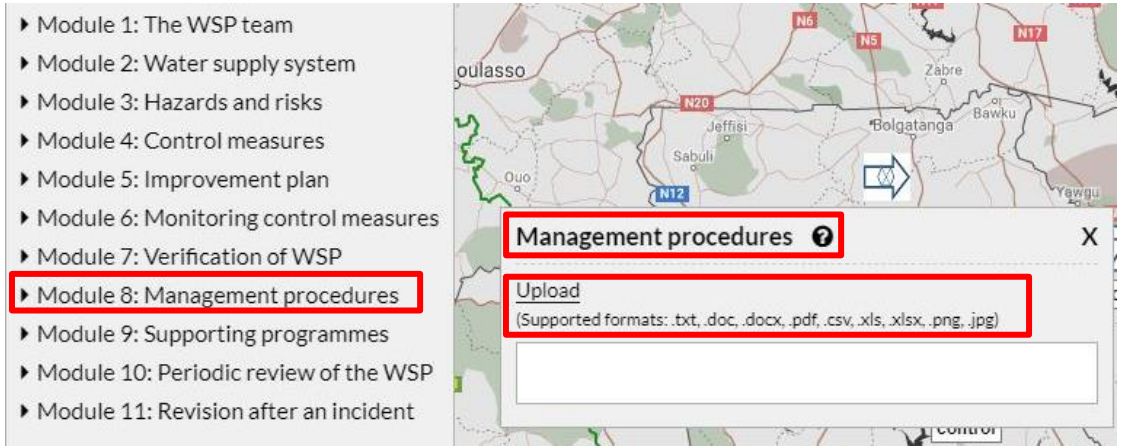
WQA

WSP_Quality Assurance Tool_User Manual

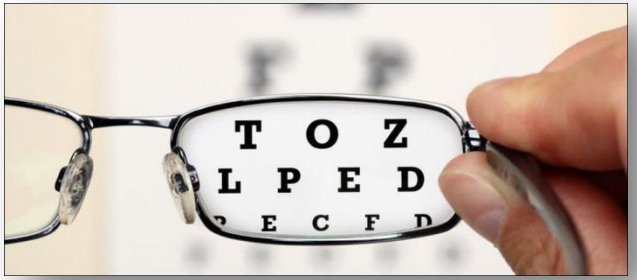




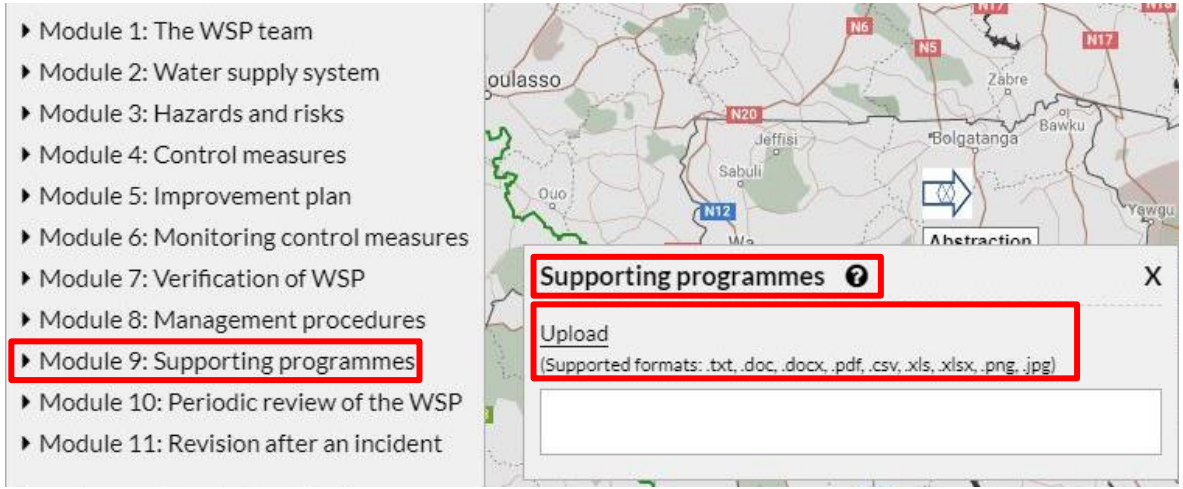
8. MANAGEMENT PROCEDURES



- What management procedures do you have for normal and incident/emergency situations?
- Do you have management procedures that consider weather specific related emergencies (flooding and droughts)?

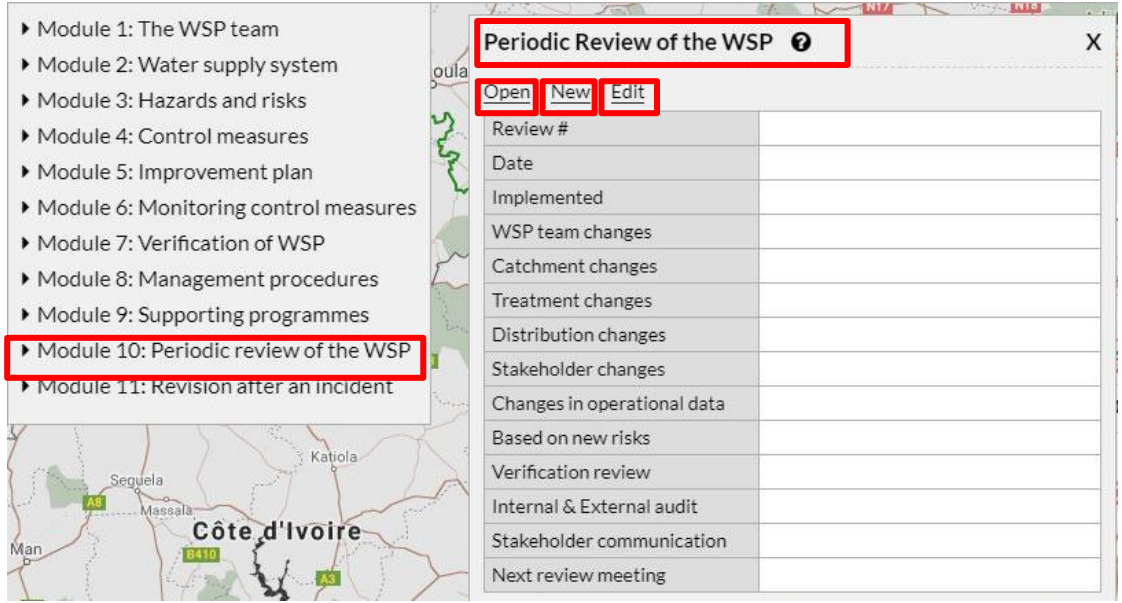


9. SUPPORTING PROGRAMMES



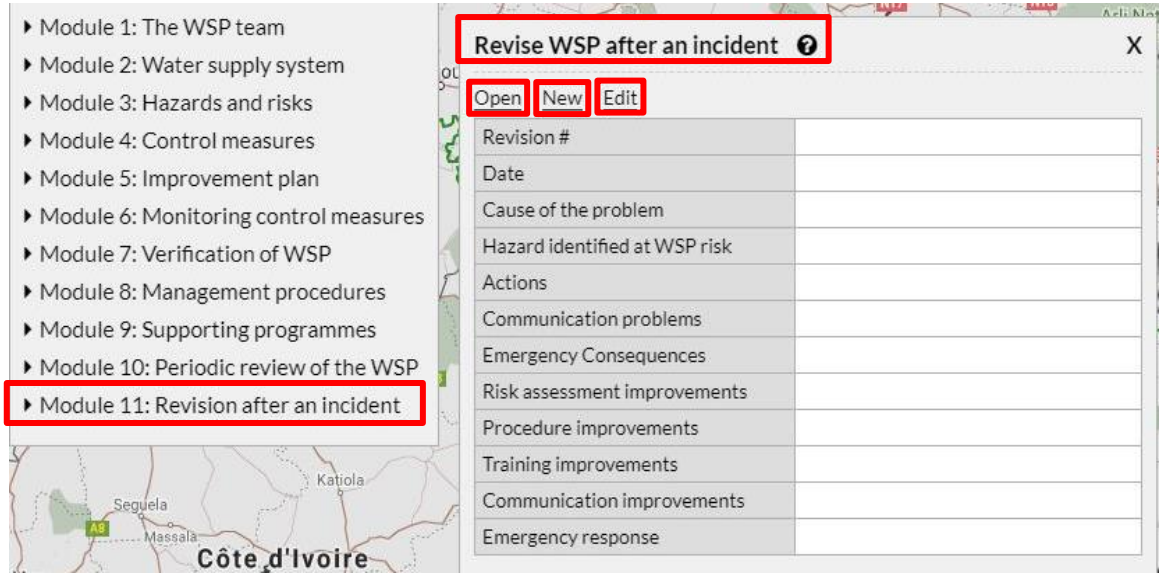
- What supporting programmes do you have to develop people's skills with understanding climate risks and implementing appropriate WSP?
- What are you doing to improve linkages between Technical, Finance and HR staff?

10. PERIODIC REVIEW OF WSP



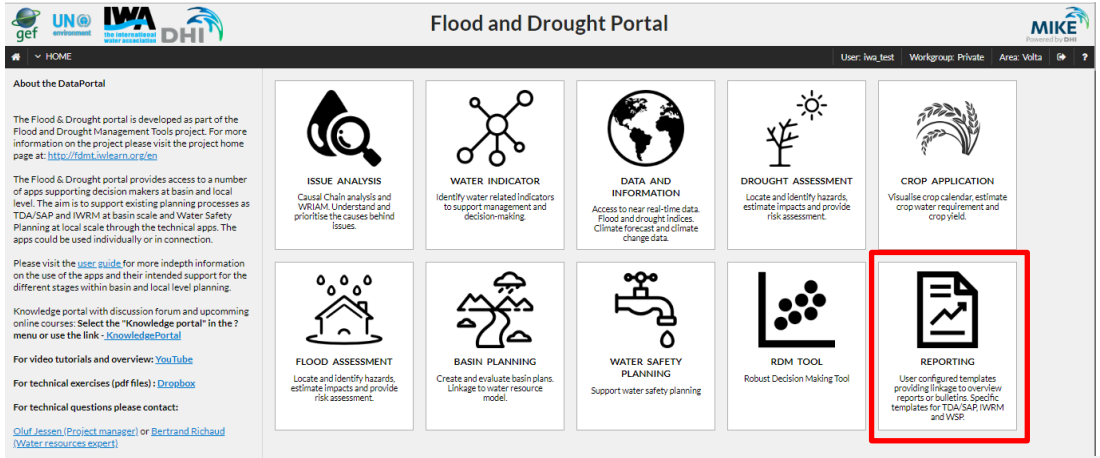
- How often do you review the WSP?
- What is the process followed?
- Must your WSP be amended to consider climate change impacts?

11. REVISION AFTER AN INCIDENT



- Do you review your the WSP after an incident?
- What weather related incidents do you anticipate for your utility?
- What would be the impact on your water supply system?

WSP REPORT



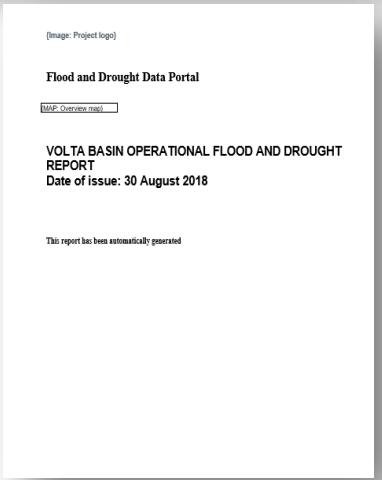
Report | Upload

Open | New | Clone

Report: * Drought report example **User:** admin **Last change:** 2017-06-12 13:21:36 **Description:**

Template: Drought report.docx
Update frequency (weeks):
Alert email:

Tag	Source	Type	Item	Setting
Image: Project logo	Data	Image	General\Project logo	imageWidth: imageHeight:
MAP: Overview map	Data	Image	General\Overview	imageWidth: 500 imageHeight:
Chart: Historical rainfall as ensemble	Data	Chart	Rainfall Climate\Envelope TRMM	analysisArea: allArea chartWidth: chartHeight: 250 chartFormat: envelope chartColour: #396AB1
Table: rainfall historical data	Data	Table	Rainfall\TRMM	analysisArea: allArea tableFontSize: 8
Map: Spatial distribution of last month	Data	Image	Rainfall\TRMM\Rainfall Deviation	imageWidth: 600 imageHeight:



(Image: Project logo)

Flood and Drought Data Portal

(MAP: Overview map)

VOLTA BASIN OPERATIONAL FLOOD AND DROUGHT REPORT
Date of issue: 30 August 2018

This report has been automatically generated

GUIDANCE DOCUMENT

Flood and Drought Management Tools Project

Guideline for Interpreting Climate Information for Application in Water Safety Planning

R	S	T	U
Month and year	Rainfall total for month	Overall average	Percent of normal (%)
Jun 17	169.1	92.61	176.10
Jul 17	171	92.61	184.65
Aug 17	254.9	92.61	275.24
Sep 17	140.5	92.61	151.71
Oct 17	73.9	92.61	79.80
Nov 17	11.3	92.61	12.20
Dec 17	5.3	92.61	5.72
Jan 18	1.2	92.61	1.30
Feb 18	40.6	92.61	43.84
Mar 18	43.9	92.61	47.40
Apr 18	80.3	92.61	86.71
May 18	118.6	92.61	128.06
		Average Percent of Normal for previous 12 months (%)	97.43

Figure 16: Final table with all calculations for rainfall

The "Percent of normal (%)" calculates the percentage increase or decrease observed in rainfall relative to the average/mean. In the case of the above example, rainfall has decreased (i.e. 97.43% of average/mean).

Table 4: Range of dry and wet spells expressed as a percentage (%) (Table adapted from [redacted] et al., 2007).

Percentage of rainfall relative to average/mean (%)	Physical conditions
>175	Extremely Wet
150 – 175	Very Wet
125 – 150	Moderately Wet
100 – 125	Mildly Wet
100	Normal
75 – 100	Mildly Dry
50 – 75	Moderately Dry
25 – 50	Very Dry
<25	Extremely Dry

MILDLY DRY

Considering the above table, we can see that the utility in the example experienced a "Percentage of average/mean" rainfall between 75-100, indicating "mildly dry" physical conditions.

Katharine Cross
Katharine.Cross@iwahq.org

Philip de Souza
philipds@emanti.co.za

Q/A WITH...

- *Philip de Souza*
  Emanti Management Group Ltd.

- *Katharine Cross*
  International Water Association

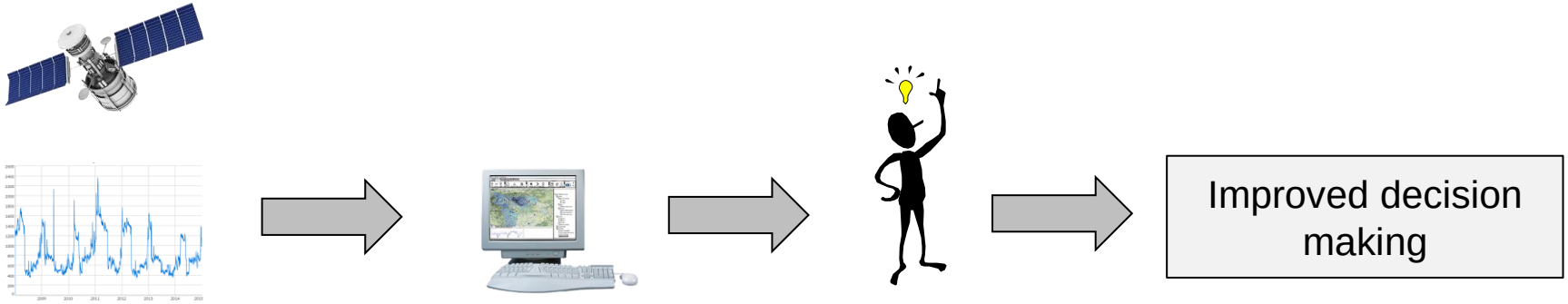
Join us for next webinar of the series:
Climate Resilient Water Safety Planning

Find out more at
http://www.iwa-network.org/iwa-learn/

DATA AVAILABILITY

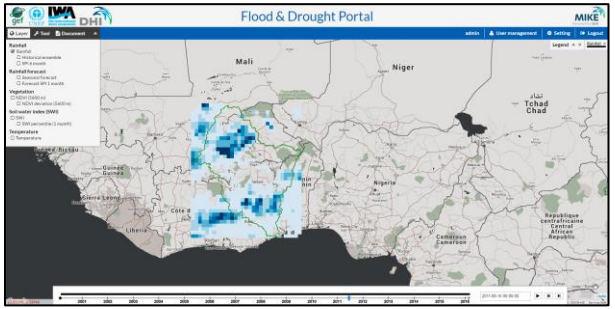
Data availability is a key issue in water resources management

- Data availability is a key concern in many countries and basins
- Availability of a “basic” set of data for water resources management is critical



DATA AVAILABILITY

Daily update
Download
QA



Daily update

Download on global scale
Reproject and convert to netcdf
QA of data quality

Number cruncher

Subset to basin scale
Calculate indices
Calculate weighted time series
QA and monitor process
Push to web-server

WEB server

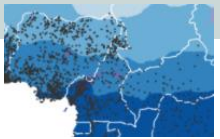
Data available as GIS layers and time series
User configuration and control

DATA AVAILABILITY

Types of data

Climate	Vegetation	Soil moisture	Socio economic	Indicators
Key input for environmental assessment • Historic • Near real time • Forecast • Projection	**Impact on agricultural sector** Crop distribution and crop growth • Historic • Near real time	**Water availability** Drought assessment Flood risk • Historic • Near real time	**Socio economic impact** Static data • Historic • Future	**State of any environmental issue** Statistical measure providing a clear indication of a state



ABOUT THE DATA AND INFORMATION APPLICATION

Supports transboundary planning globally

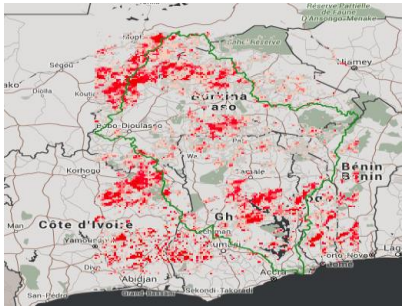
- Data made available for any transboundary basin
- Data updated in near real time

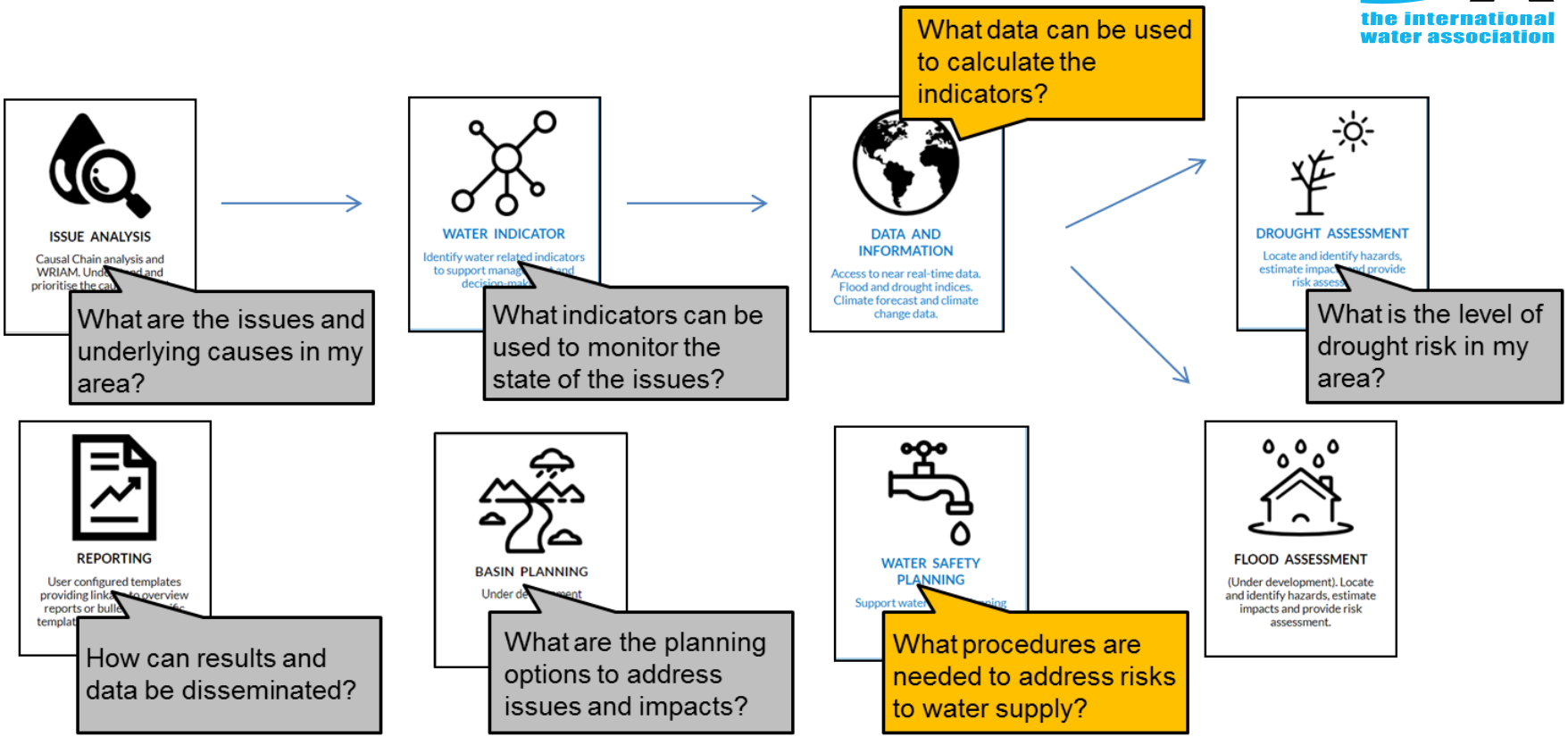
Based on freely available data sources

- All data are processed to netcdf and csv formats

Provides a basic dataset for catchment planning

- Climate data (rainfall, PET, temperature)
- Climate forecast (NOAA) and change (CORDEX)
- Drought and flood indices
- Physical and socioeconomic data




ISSUE ANALYSIS
What are the issues and underlying causes in my area?
WATER INDICATOR
What indicators can be used to monitor the state of the issues?
DATA AND INFORMATION
Access to near real-time data. Flood and drought indices. Climate forecast and climate change data.
What data can be used to calculate the indicators?
DROUGHT ASSESSMENT
What is the level of drought risk in my area?
REPORTING
How can results and data be disseminated?
BASIN PLANNING
What are the planning options to address issues and impacts?
WATER SAFETY PLANNING
What procedures are needed to address risks to water supply?
FLOOD ASSESSMENT
(Under development). Locate and identify hazards, estimate impacts and provide risk assessment.