

Flood and Drought Webinar #5

May 17th 2017

The challenges and experiences in developing multi-objective basin plans



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Senior Advisor
UNEP-DHI Partnership



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and coordination Programme Advisor
UNEP-DHI Partnership

UNEP-DHI PARTNERSHIP
Centre on Water and Environment



UNEP-DHI Water Webinar series
Flood and Drought Management Webinars

Flood and Drought Management Tools project



- Implemented by UNEP and executed by IWA and DHI
- Duration 2014 to 2018
- Development of technical tools to improve the ability to address floods and droughts in the planning process at basin and local scale.



Project web-page: <http://fdmt.iwlearn.org>

Agenda



1. Experiences in Using Decision Support System tools for the development of the multi-sectoral Shire River Basin Plan (Børge Storm, DHI)
2. Innovative application for stakeholder driven planning as part of the Flood and Drought Management Tools project (Sílvia Leirião, DHI)
3. Additional questions from the audience

Development of Strategic Plan for the Development and Management of the Shire River

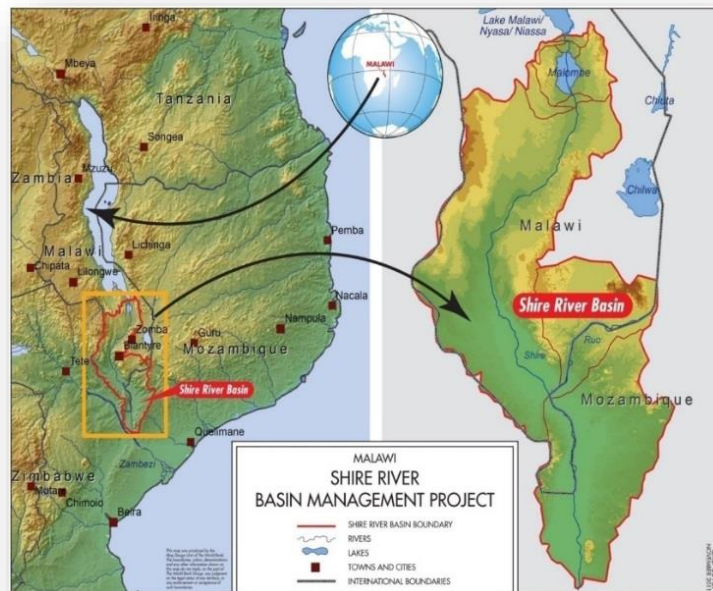
a component under the Shire River Basin Management Program, (SRBMP - Phase I)

Illustration of Use of Technical DSS Tools to Support the Basin Plan Development.



Mr. Børge Storm, DHI, Senior Advisor (presenter)

Dr Geoff Wright, NIRAS, Team Leader



Outline of Presentation

- Introduction to Shire River basin and some key issues;
- Brief introduction to Basin Planning Approach;
- Presentation of Tools of the Planning DSS and examples of use;

Physical Setting



Legend

- Cities and towns
- Rivers
- Water Resource Units
- Waterbodies

Boundaries

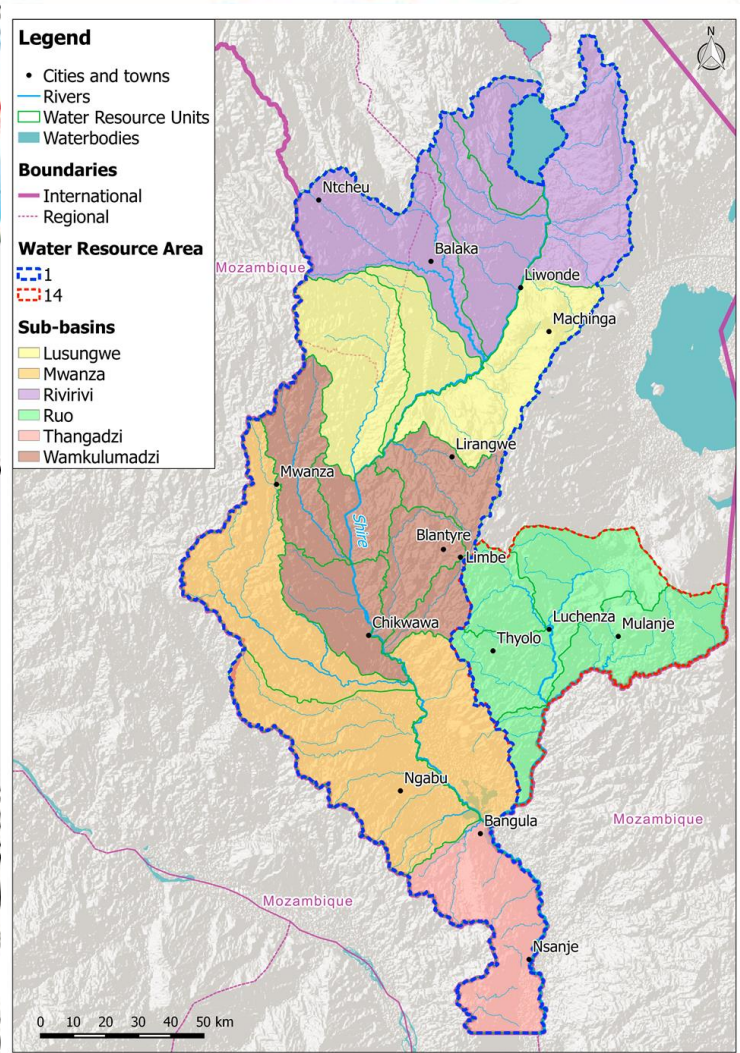
- International
- Regional

Water Resource Area

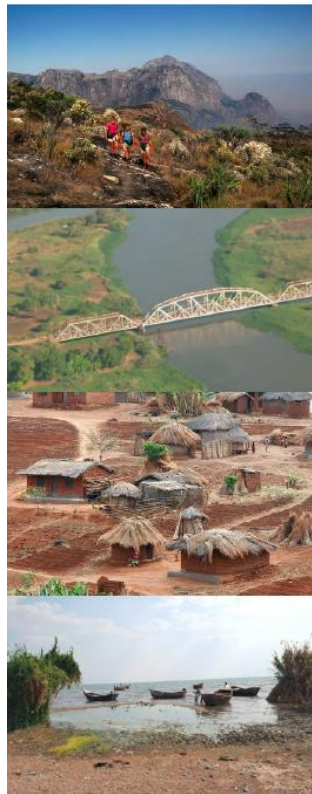
- 1
- 14

Sub-basins

- Lusungwe
- Mwanza
- Rivirivi
- Ruo
- Thangadzi
- Wamkulumadzi



Threats to Development

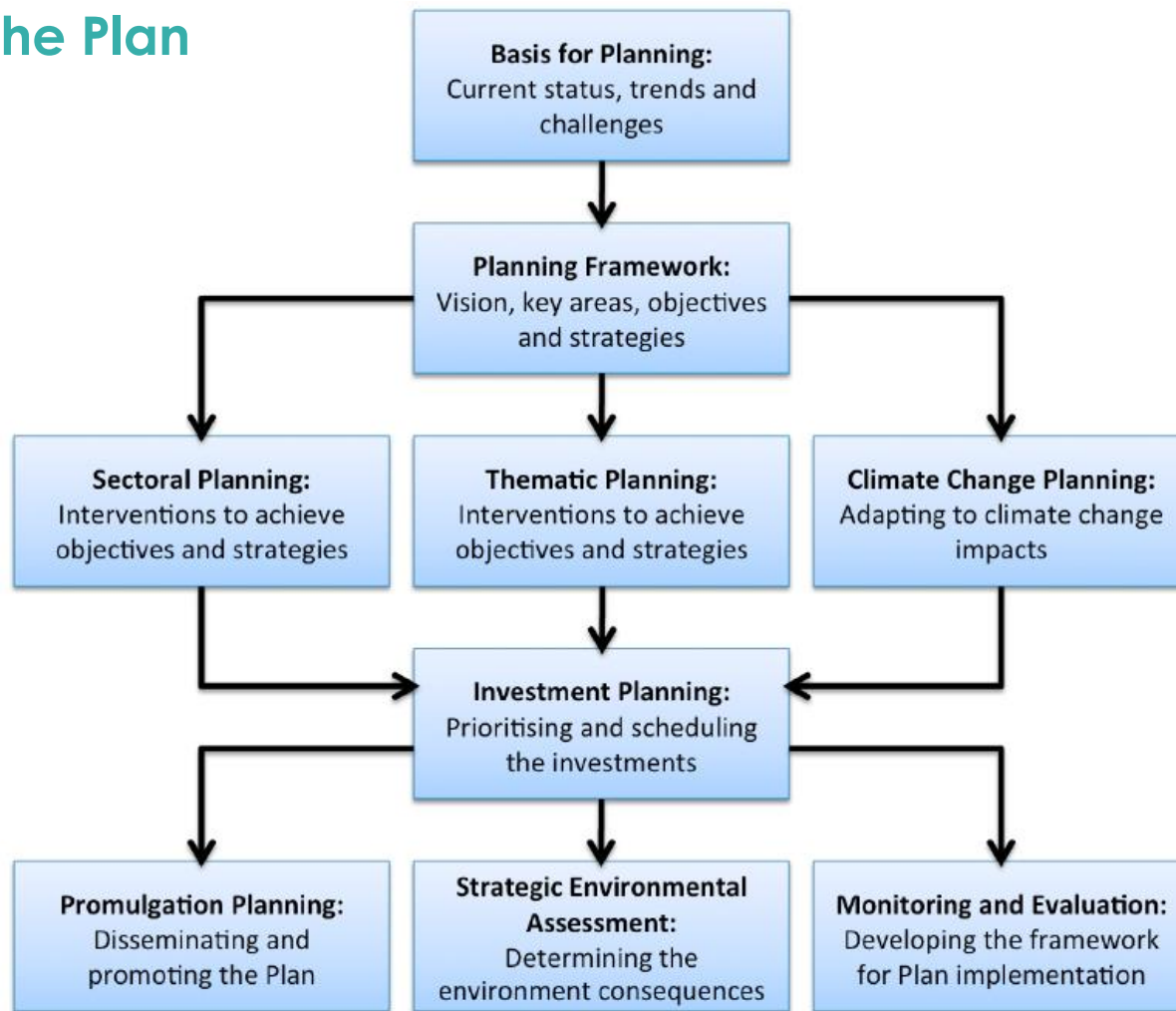


- High Population Growth
- Poor Basic Education
- Reliance on Smallholder Agriculture
- High Dependence on Biomass for Energy
- Limited Basis for Economic Growth
- Lack of Widespread Electricity Distribution to Households
- Adverse Impacts of Climate Change
- Lake Malawi Water Levels and Shire River Flows

Results of “report card” exercise

Attributes of good basin management	Rating			
	Poor	Fair	Good	Excellent
1. STABLE INSTITUTIONAL FRAMEWORK				
1.1 Strong but flexible institutional arrangements are in place, extend basin wide across international borders.	4	6	1	1
1.2 Robust and workable legal agreements are in place.	2	4	6	
1.3 There is an integrated natural resource framework in place.	3	5	4	
1.4 There are effective systems and procedures in place for community involvement at all levels.	2	7	3	
2. KNOWLEDGE				
2.1 Good river water quantity information is available across the whole basin.	7	3	2	
2.2 Good river water quality information is available across the whole basin.	7	4	1	
2.3 A comprehensive natural resource database (land, soil, fish, forest, fauna, etc is available.	4	5	3	
2.4 Natural resource data has been processed into usable information, accessible to all that need it.	3	8	1	
2.5 Additional data needs have been identified and programs are in place to satisfy them.	5	5	2	
2.6 Research is adequately funded and is targeted to meet knowledge gaps.	7	4	1	
2.7 Robust analytical models have been developed that will enable development proposals to be evaluated within a sustainable natural resource framework.	6	4	2	
3. INTEGRATION				
3.1 All agencies are working together on a “whole of resource” framework.	2	8	1	
3.2 Artificial sector boundaries have been broken down so that holistic resource management decisions are being made.	4	6	1	
3.3 Project evaluations are taking full account of the social, economic and environmental impacts.	2	4	5	
4. COMMUNITY INVOLVEMENT				
4.1 Community education and awareness programs are in place across the basin.	2	7	2	
4.2 Community input is sought and recognised at the village, catchment and basin level.	1	6	4	
4.3 Community led, and implemented resource rehabilitation programs are in place across the	2	5	4	

Structure of the Plan



Vision and Key Areas



*“By 2035, we envisage **prosperous families**, **green catchments** and **healthy waterways** in the Shire River Basin”*



Identified key areas based on the Vision:

1. Prosperous families
2. Green catchments
3. Healthy waterways
4. Robust institutions and planning
5. Reliable data and Information

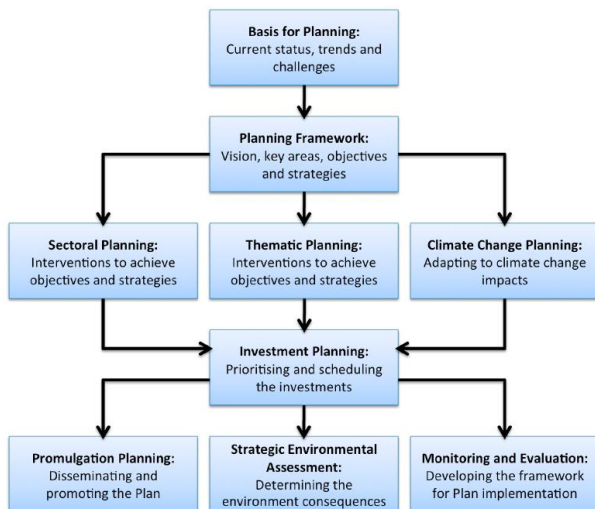
The Plan

The Shire River Basin Plan will be presented in twelve volumes:

1. Basis for Planning
2. Framework Plan
3. Sectoral Planning
4. Thematic Planning
5. Climate Change Adaptation Plan
6. Sub-basin Plans
7. Investment Plan
8. Strategic Environmental Assessment
9. Promulgation Plan
10. Monitoring, Evaluation and Reporting Plan
11. Bibliography
12. Executive Summary



Planning DSS Framework Implementation



The Implementation includes:

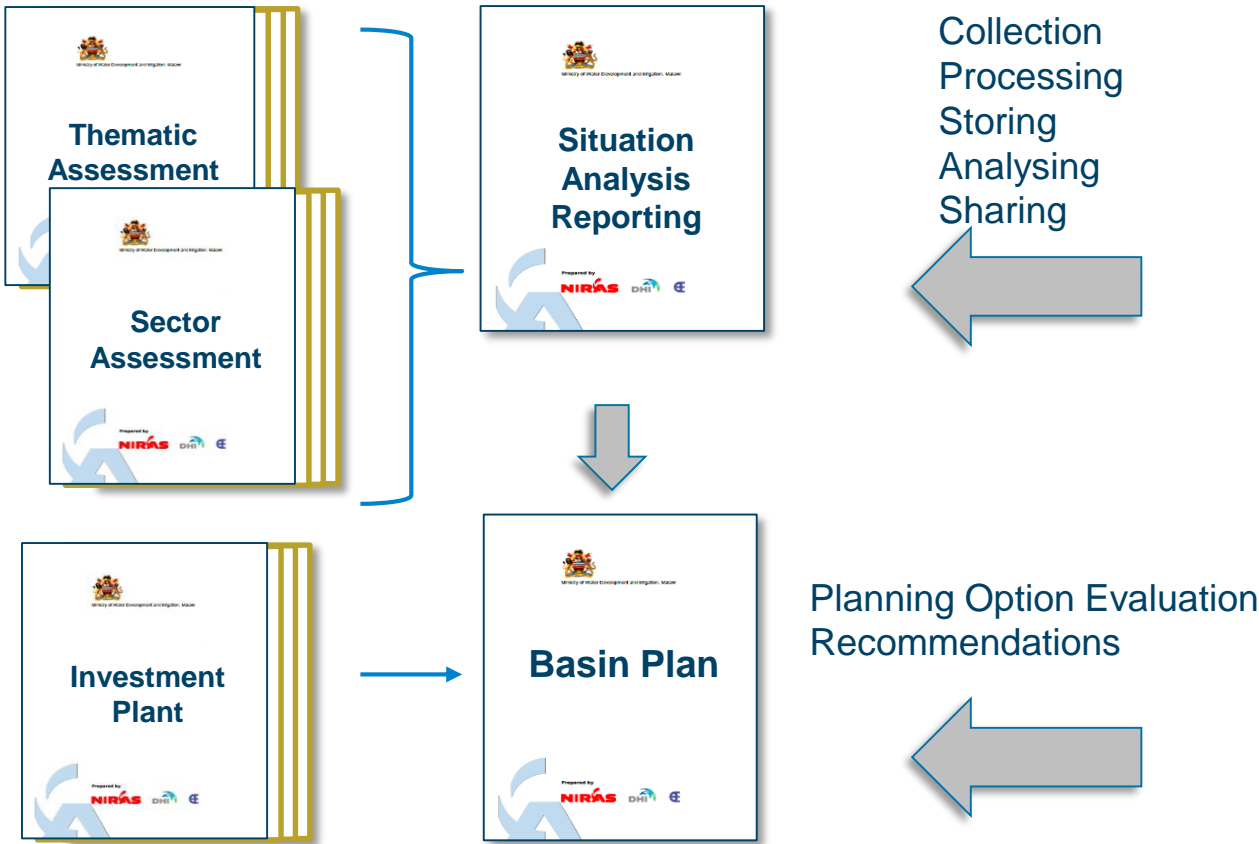
Tool development and use:

- Information and Knowledge Portal; and
- Simulation models and DSS tools/techniques.

Technology Transfer activities:

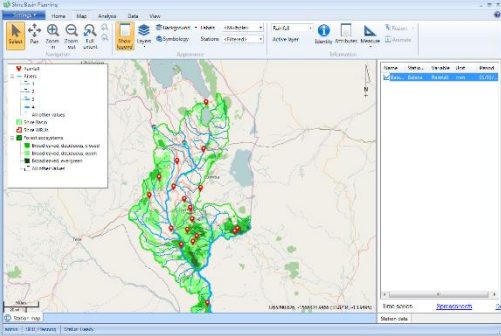
- Capacity Building / training.
- Installation

Planning DSS Framework Use Approach




Planning DSS

Information System & Knowledge Portal



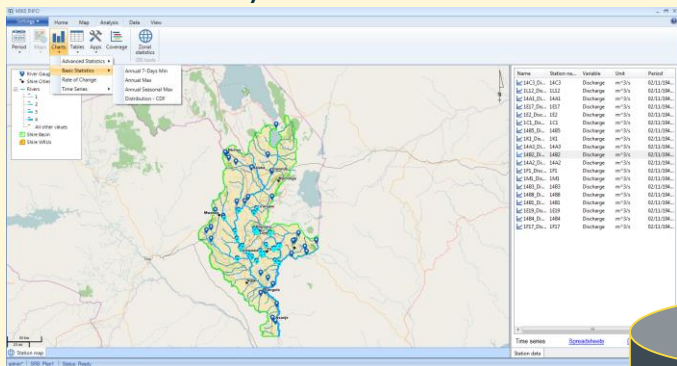
Domain & Planning Modelling/Tools



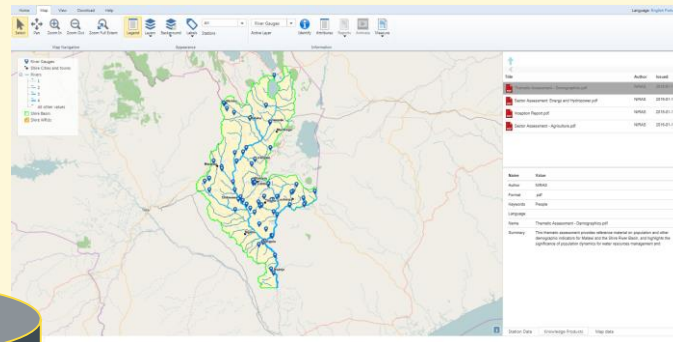
Information Knowledge System /Portal

One solution – with two types of use options

A **Office version** for analyses and management of the knowledge database by **technical staff**



A **Web Portal** for dissemination and sharing of information with a **wider audience**

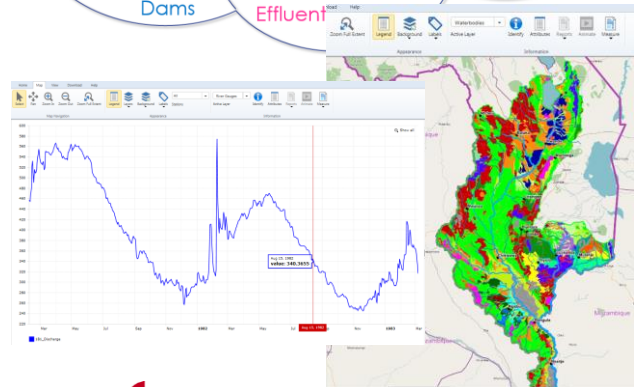
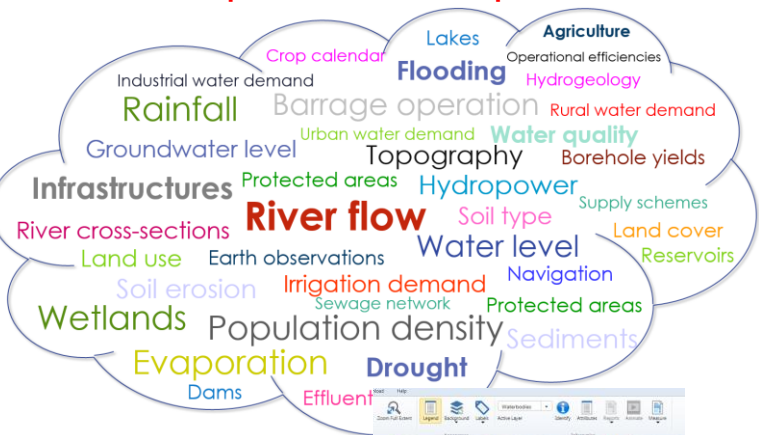


Knowledge
Database

Shared
Information

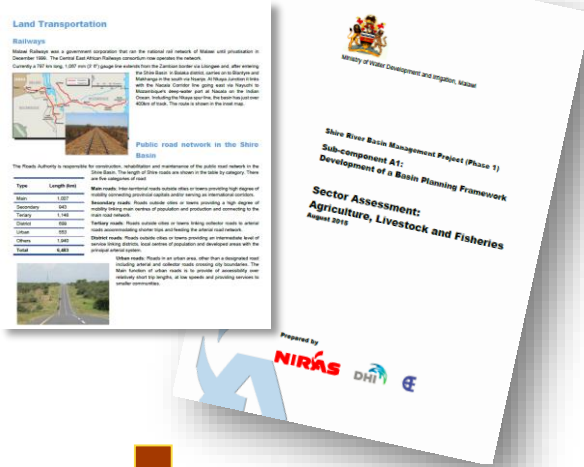
Information & Knowledge Portal

Spatial and temporal data



NIRAS

Publications



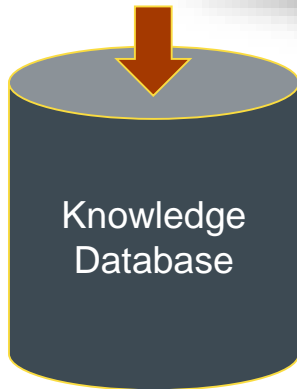
Analytical Tools

Basin
Planning
Tool

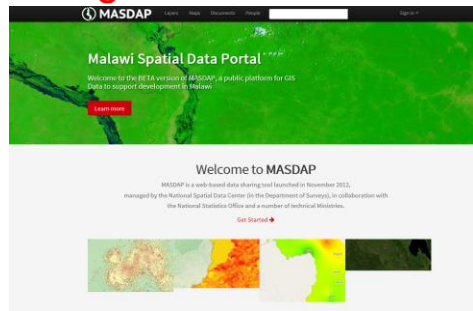
Hydrolo
gical
Models

Soil
Erosion

GIS



Links to existing databases or
websites



The Planning Web Portal (<http://shirebasinplanning.wris.info/>)

The screenshot displays the Planning Web Portal interface. The top navigation bar includes links for Home, Map, View, Download, and Help. Below this is a toolbar with icons for Select, Pan, Zoom In, Zoom Out, Zoom Full Extent, Legend, Layers, Background, Labels, Stations, and Information. The main map area shows a geographical view of the Shire Basin with river discharge data overlaid. A legend on the left side of the map identifies various features: RiverWL, River Discharge, Rivers (1, 2, 3, 4), All other values, Shire Basin, Waterbodies, Boundaries (International, Regional, All other values), and Station map. On the right side, a sidebar lists available reports for download, including 'Exec Summary.pdf', 'Volume 5 - Climate Change Adaptation Plan.pdf', 'Volume 2 - Framework Plan.pdf', 'Volume 3 - Sectoral Planning.pdf' (highlighted), and 'Volume 4 - Thematic Planning.pdf'. A 'Download' button is visible next to the highlighted report. Below the list, a summary section provides details about the selected report, including Author (NIRAS), Format (.pdf), Keywords, Language (English), Name (Volume 3 - Sectoral Planning.pdf), and a detailed Summary. At the bottom, a status bar shows 'Station Data', 'Knowledge Products', and 'Map data'. A yellow dialog box at the bottom center asks: 'Do you want to open or save Volume 3 - Sectoral Planning.pdf (5.74 MB) from shirebasinplanning.wris.info?' with buttons for 'Open', 'Save', and 'Cancel'.

Home Map View Download Help

Select Pan Zoom In Zoom Out Zoom Full Extent Legend Layers Background Labels Stations Multiple RiverWL Active Layer Identify Attributes Reports Animate Measure

Map Navigation Appearance Information

RiverWL
River Discharge
Rivers
1
2
3
4
All other values
Shire Basin
Waterbodies
Boundaries
International
Regional
All other values

Station map

Folder: /Shire Basin Plan Reports

- Exec Summary.pdf NIRAS
- Volume 5 - Climate Change Adaptation Plan.pdf NIRAS
- Volume 2 - Framework Plan.pdf NIRAS
- Volume 3 - Sectoral Planning.pdf NIRAS
- Volume 4 - Thematic Planning.pdf NIRAS

Download

Author: NIRAS
Format: .pdf
Keywords:
Language: English
Name: Volume 3 - Sectoral Planning.pdf
Summary: Principal content: Separate plans focusing on main sectors: Agriculture; Livestock; Fisheries; Forestry; Energy; Mining; Industry; Water Supply and Sanitation; Navigation and Other Transport; Tourism. Each plan covering: Identification and analysis of the spatial characteristics of existing and potential future activity in each sector: Specific objectives for the sector: Analysis of water

Station Data Knowledge Products Map data

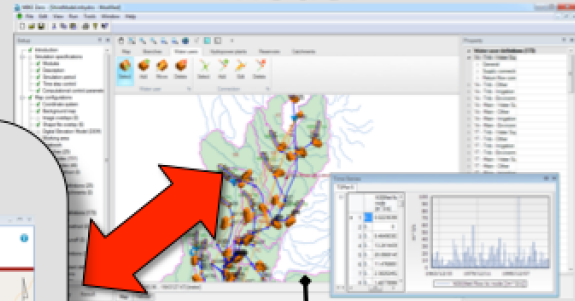
Do you want to open or save Volume 3 - Sectoral Planning.pdf (5.74 MB) from shirebasinplanning.wris.info? Open Save Cancel

100%

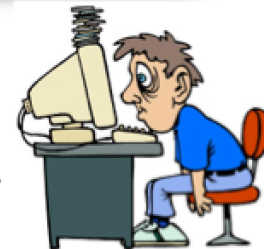
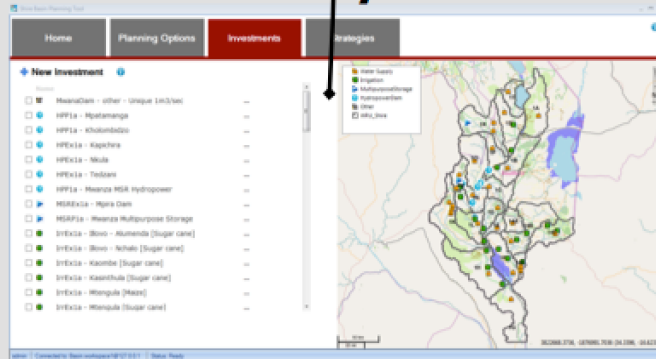
The Concept of the Shire Basin Planning Tool



Complex Water Balance Model



User Friendly Interface



The Design of the Shire Basin Planning Tool


Shire Basin Planning Tool

Home

Planning Options

Investments

Strategies



The Shire River Basin Planning Tool

The Shire River Basin Planning Tool has been developed to assist the Government of Malawi together with stakeholders to develop an integrated multi-sectoral Shire River Basin Plan.

The tool helps to quantify impacts of typical water resources planning issues such as:

- Will there be enough water to meet growing population in the Shire River Basin?
- How much water is available for irrigation development?
- Should more storage dams be constructed?
- What is the impact of implementing environmental flows?
- What impact will climate change have on water availability?
- And others!

These questions are answered by testing different planning options of water resource development interventions. The planning options can be compared against one another to find the option which best meets the objectives of all stakeholders in the basin.

The tool has been developed as part of the Shire River Basin

admin | Connected to: Basin.workspace1@127.0.0.1 | Status: Ready

The Design of the Shire Basin Planning Tool

Shire Basin Planning Tool

Home Planning Options Investments Strategies

Summary Details Basin Score

New Planning Option

Name

☒ NIRAS Priority Example - ES A
☐ NIRAS Priority Example - ES B
☐ NIRAS Priority Example - ES C
☐ NIRAS Priority Example - ES D

Planning Option details

Name
New Planning Option

Description

External Scenario

Population growth: Zero (0%)
Climate change: No Climate Change
Environmental flow: Q90 Flow
Upstream development: Unchanged

Select Investments

<input checked="" type="checkbox"/>	HPEX1a - Nkula
<input checked="" type="checkbox"/>	HPEX1a - Tedzani
<input checked="" type="checkbox"/>	HPP1a - Mwanza MSR H...
<input checked="" type="checkbox"/>	MSREX1a - Mpira Dam
<input type="checkbox"/>	MSRP1a - Mwanza Multip...
<input type="checkbox"/>	IrEX1a - Illovo - Alumenda...
<input checked="" type="checkbox"/>	IrEX1a - Illovo - Nchalo (S...

Map

Investment Details

Name	HPP1a - Mwanza MSR Hyd...
location	1M
type	Dam Hydropower Station
source	Major River
capital cost	0
operating cost	0
tspath	Mwanza
uniqueint	True
potential benefits	0

OK Cancel

Summary

sec	Reliability (%)	View
12.63	90.0%	
6.33	92.0%	
18.96	90.0%	

Result	View
Neutral	
94.0%	
92.0%	
91.0%	

US \$ per year)

View	
\$ 74 128 303	

Irrigation annual net benefits

admin | Connected to: Basin.workspace1@127.0.0.1 | Status: Ready

External Scenario approach

Climate Change:

Three global development storylines / scenarios were selected for inclusion into the tool, being A1B, A2 and B1

Population Growth:

Low (1.5%) - Medium (2.5%) - High (3.5%)

Upstream Development:

Unchanged – (no change to inflows)

Low – 50 m³/s decrease of inflow (based on current hydrology)

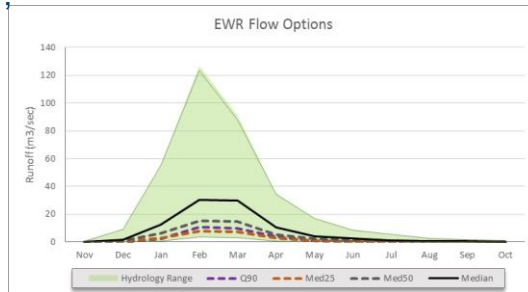
Medium – 100 m³/s decrease, **High** – 150 m³/s decrease

Environmental flows:

50% of the median natural flow;

25% of the median natural flow;

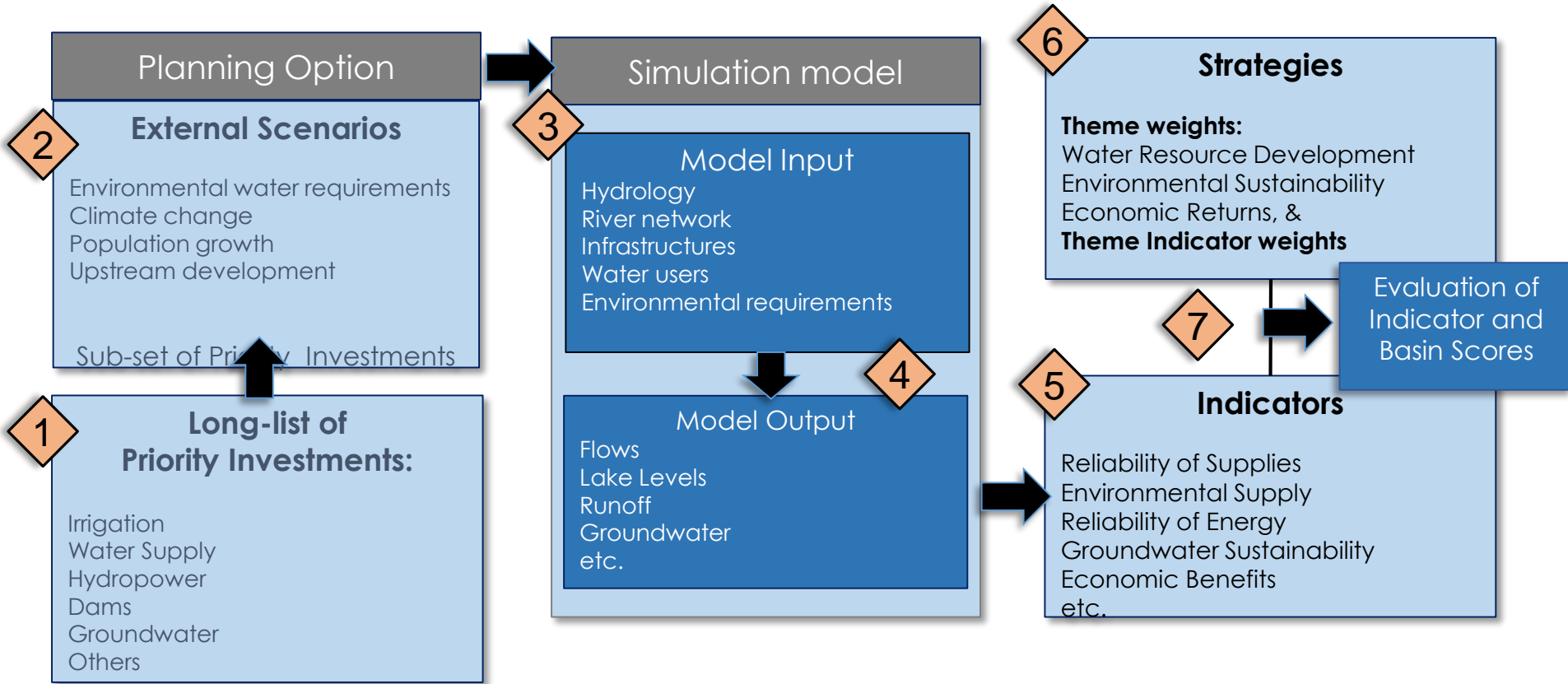
90th Percentile of natural flow.



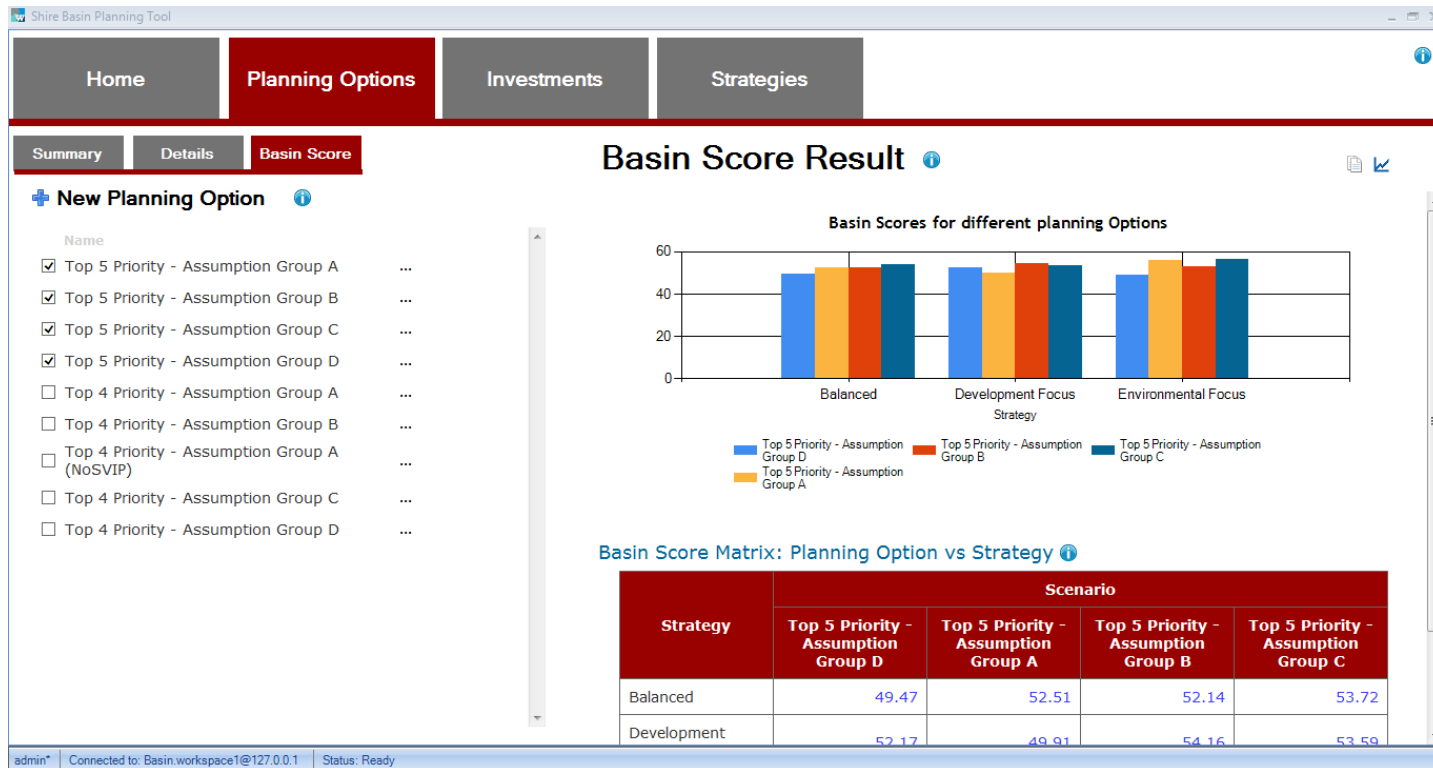
The screenshot shows the 'Create planning option' window. It includes a 'Planning Option Details' section with fields for 'Name' and 'Description'. A map of a river network is visible on the right. Below the map, there are two sections: 'External Scenarios' and 'Select Investments'. The 'External Scenarios' section is highlighted with a blue box and contains the following settings:

External Scenarios	Value
Population growth	Zero (0%)
Climate change	No Climate Change
Environmental flow	Q90 Flow
Upstream development	Unchanged

The Analytical Workflow of the Planning Tool



The Design of the Shire Basin Planning Tool



No.	Planning Option		External Scenarios			Selected Key Indicators					
	Interventions	EWR	CC	PG	US	Irrigation reliability	WS reliability	Energy (GWh/year)	EWR reliability	Net benefit (\$m/year)	Liwonde Q (m³/s)
1	Current level of development	L	None	None	None	99%	92%	2,765	86%	232	243
2	Current level of development	L	None	None	M	99%	92%	2,329	86%	196	207
3	Current development + SVIP with second priority after hydropower	M	M	M	None	67%	84%	2,640	69%	239	248
4	Current development + SVIP with second priority after hydropower	M	M	M	L	55%	84%	2,442	69%	219	229
5	Current development + SVIP with second priority after hydropower	M	M	M	M	46%	84%	2,178	69%	195	201
6	Current development + SVIP with first priority over hydropower	M	M	M	None	100%	84%	2,599	69%	243	248
7	Current development + SVIP with first priority over hydropower + top priority in each sector	M	M	M	None	90%	88%	5,219	68%	478	249
8	Current + SVIP with first priority over hydropower + all priorities in each sector (but excluding new hydropower)	M	M	M	None	83%	89%	5,219	66%	482	249
9	Current + SVIP with first priority over hydropower + all priorities in each sector (including new hydropower)	M	M	M	None	83%	89%	6,373	66%	579	256
10	Current + SVIP with first priority over hydropower + all priorities in each sector (including new hydropower)	H	H	H	None	83%	88%	6,374	59%	579	256
11	Current + SVIP with first priority over hydropower + all priorities in each sector (including new hydropower)	H	H	H	M	83%	88%	5,878	59%	537	200

Note: See Annex 3 for comprehensive results for each planning option simulation.

EWR =	environmental flow requirement	Q =	average release from Kamuzu Barrage (Liwonde)
CC =	climate change	L =	Low
PG =	population growth	M =	Medium
US =	future upstream development	H =	High

Sector/Domain	Rank	Name of the intervention
Agriculture/Irrigation	A1	Shire Valley Irrigation Project
	A2	Chilengo Irrigation Scheme
	A3	Ruo Diversion Irrigation Scheme
	A4	Mkulumadzi New Irrigation Scheme
	A5	Nthirananja New Irrigation Scheme
Environment	Env1	Reforestation at the watershed level
	Env2	Environment Water Requirements of Rivirivi sub-basin
	Env3	Environment Water Requirements of Lusungwe sub-basin
	Env4	Environment Water Requirements of Mwanza sub-basin
	Env5	Improvement of Mwanza catchments to all others
Energy/Hydropower	Eng1	Kamwamba Coal Fired Plant
	Eng2	Development of a Multi-Purpose dam near Mwanza
	Eng3	Development of a Multi-Purpose dam of Chiradzulu
	Eng4	Mpatamanga Hydropower Plant
	Eng5	Kholombidzo Low head Power Plant
Water supply/Sanitation	WSS1	Expansion of the water production at Walkers Ferry
	WSS2	Rehabilitation of Mpira-Balaka Rural Water Supply Scheme
	WSS3	Deepening and rehabilitation of boreholes
	WSS4	Development of Multi-Purpose dam Mwanza
	WSS5	Feasibility Study for rehabilitation of selected Gravity Fed Schemes for urban water supply



Discussing of priority intervention/investments by key stakeholders

Ranking of Investments

Rank	Investment	Score*	Comment
1	Shire Valley Irrigation Project	35.1	Feasibility studies being undertaken under the Green Belt Initiative
2	Expansion of the water production at Walkers Ferry	41.8	Feasibility study and detailed design completed
3	Kamwamba Coal Fired Power Plant	44.9	Being funded by the Export & Import Bank of the People's Republic of China
4	Mpira-Balaka Rural Water Supply Rehabilitation	44.9	
5	Multi-purpose dam near Mwanza	44.9	Feasibility study completed
6	Mpatamanga Hydropower Plant	45.4	Technical investigations already in progress funded by World Bank
7	Ruo Diversion (Irrigation) Scheme	45.6	
8	Mkulumadzi New Irrigation Scheme	45.5	
9	Kholombidzo Low head Power Plant	46.4	
10	Nthirananja New Irrigation Scheme	46.4	

Summary

- A Comprehensive Basin Plan for the Shire River Basin is in its final stages of preparation;
- A Planning DSS Framework comprising Information and Knowledge System/Portal and Planning Models/tools has been developed and used to support the Strategic Planning process;
- Training of counterpart staff has been undertaken.

Basin planning – new application for stakeholder driven basin and catchment planning

Sílvia Leirião – DHI

WR Engineer

sls@dhigroup.com



Agenda

- Project background
- Objectives
- Planning application
- Status and next steps

Project background

- Facilitating a scientific approach to decision-making (TDA/SAP, WSP etc.)
- Support decision processes at basin and local level
- Technical tools supporting the inclusion of flood and drought issues into existing planning processes

Implemented by UNEP

Executed by IWA and DHI

2014 to 2018



Project background

Operational planning







Short-term and seasonal management
Climate variability and water management
National, basin or catchment planning

Strategic planning




Long-term investments
Climate change and population growth
TDA/SAP, IWRM

Project background






Flood and Drought Portal


Powered by DHI

HOME

User: admin | Workgroup: Private | Area: Volta



About the DataPortal


The Flood & Drought portal is developed as part of the Flood and Drought Management Tools project. For more information on the project please visit the project home page at: <http://fdmt.iwlearn.org/en>

The Flood & Drought portal provides access to a number of apps supporting decision makers at basin and local level. The aim is to support existing planning processes as TDA/SAP and IWRM at basin scale and Water Safety Planning at local scale through the technical apps. The apps could be used individually or in connection.

Please visit the user guide for more indepth information on the use of the apps and their intended support for the different stages within basin and local level planning.


For technical questions please contact:

[Oluf Jessen \(Project manager\)](#) or [Bertrand Richaud \(Water resources expert\)](#)




DATA AND INFORMATION

Access to near real-time data.
Flood and drought indices.
Climate forecast and climate change data.




DROUGHT ASSESSMENT

(Under development). Locate and identify hazards, estimate impacts and provide risk assessment.




FLOOD ASSESSMENT

(Under development). Locate and identify hazards, estimate impacts and provide risk assessment.




ISSUE ANALYSIS

(Under development). Causal Chain analysis and WRIAM. Understand and prioritise the causes behind issues.




INDICATOR BUILDER

Explore and create indicator frameworks to support management and decision-making.




BASIN PLANNING

(Under development). Create and evaluate basin plans. Linkage to water resource model.



WATER SAFETY PLANNING

Set up water safety plans and identify hazards



REPORTING

(Under development). User configured templates providing linkage to TDA/SAP, IWRM and WSP.

Baseline
assessment

Risk
assessment

Planning

Dissemination
and warning

Monitoring

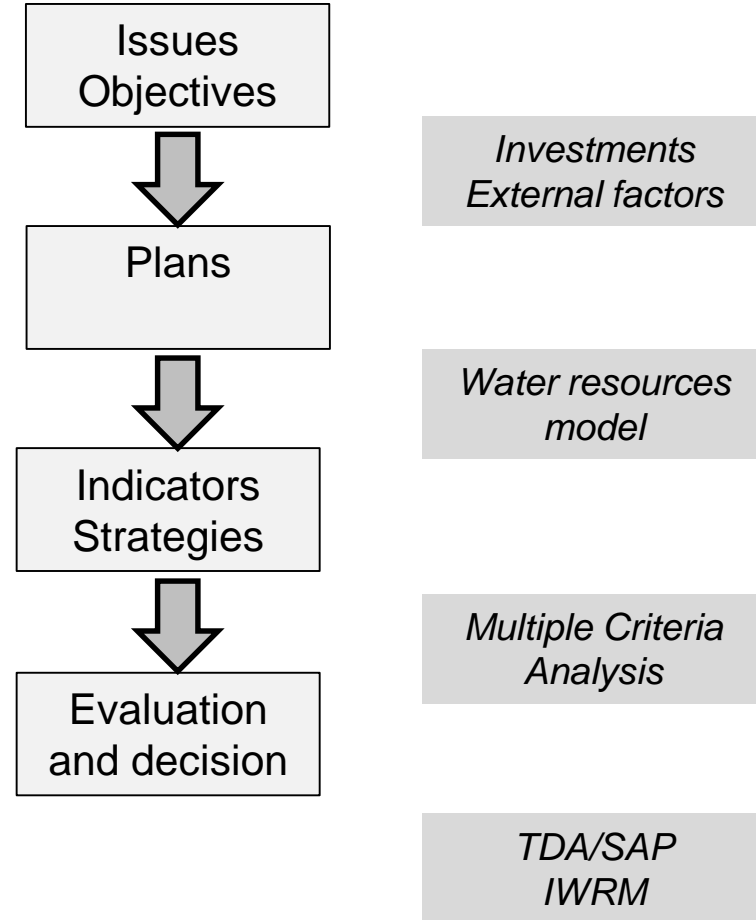
Basin Planning

Objective:

- Evaluate existing plans
- Create new plans and evaluate

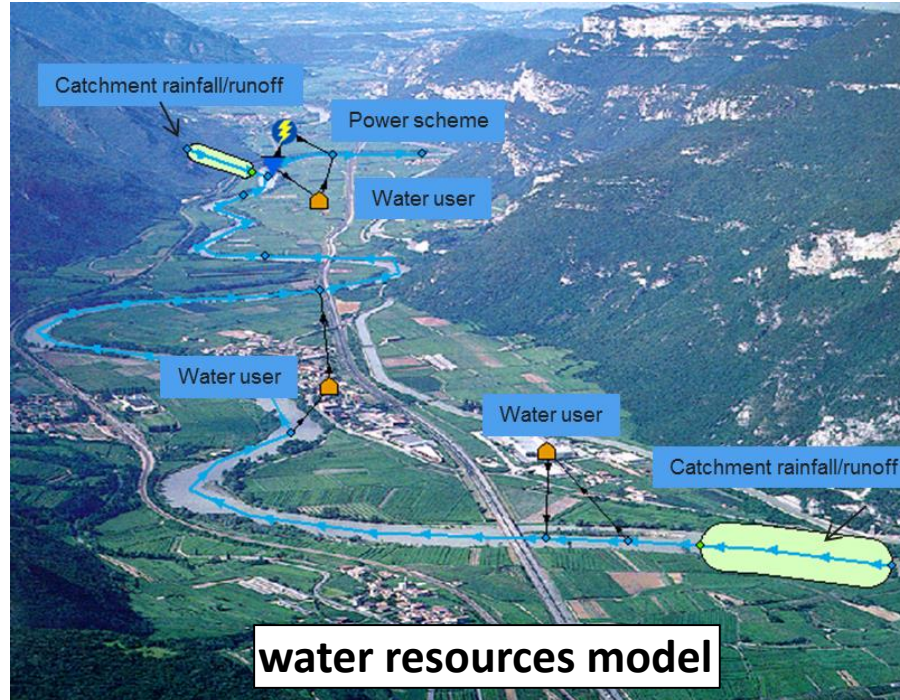
What is a plan?

- A plan is a combination of investments and factors
- A plan is implemented in the tool through features and information added to an existing water resources model
- A plan is evaluated by executing the water resources model and calculating indicators
- Evaluation of the indicators and strategies within a MCA framework



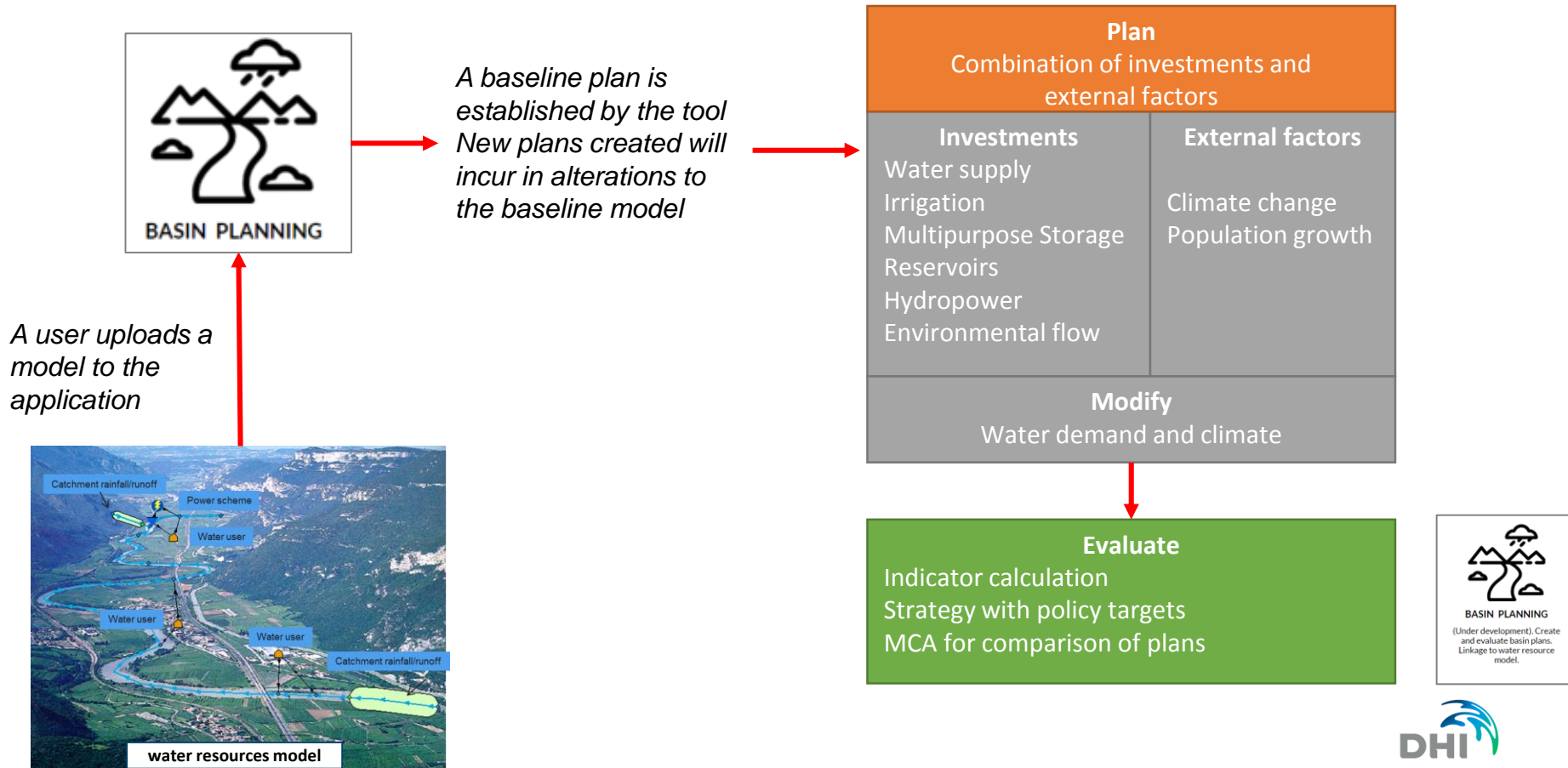
Basin Planning - concept

A water resources model takes part in the evaluation of a plan by providing a measure of its impacts.

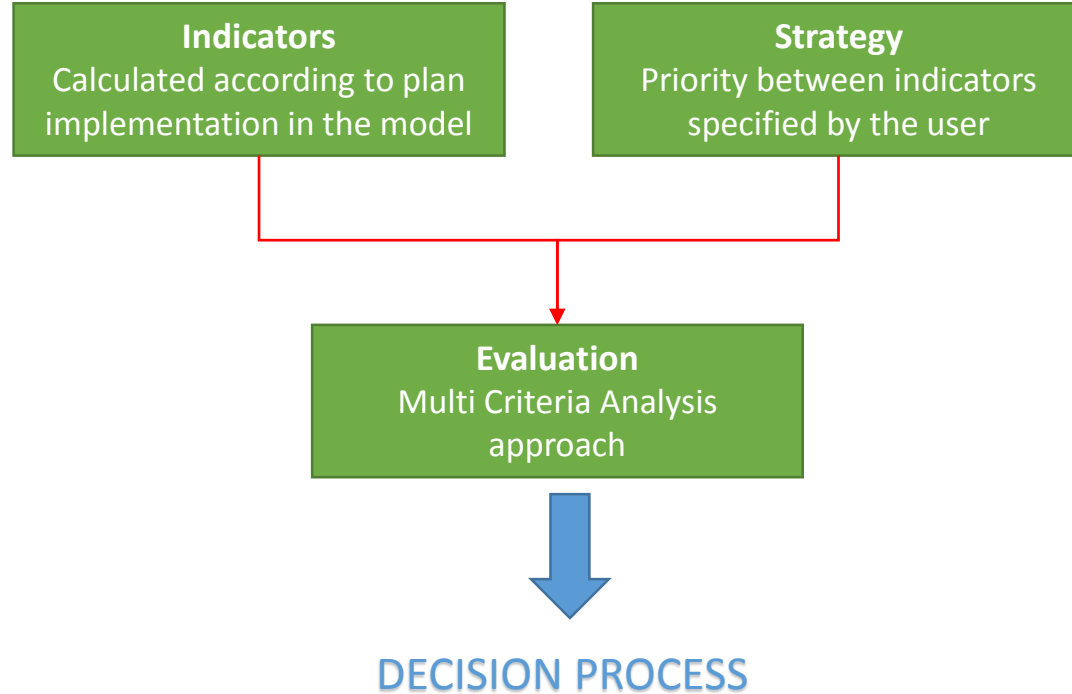


Schematic representation / Simplified process description

Basin Planning - concept



Basin Planning - concept



Baseline
assessment

Risk
assessment

Planning

Dissemination
and warning

Monitoring

Basin planning - web

WEB interface for
basin planning under
development

A Web Page

http://

Results Planning Reporting

PLANNING TOOL

Settings Working group Logout Info

Plans Summary Details Regions

Select plans to evaluate

- ☐ Plan A
- ☒ Plan B
- ☐ Plan C
- ☐ Plan D
- ☒ Plan D

List of all available plans -> models executed

Retrieve results

Plan information

User: ozj
Created on: 2017-02-21
Baseline model: Baseline 2010

Description: ljoiljlopj pikpojæ jæo j joo jo æojæo joæ

Display the info of the selected plan

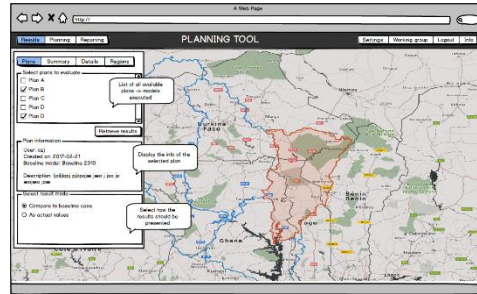
Select result mode

- ☒ Compare to baseline case
- ☐ As actual values

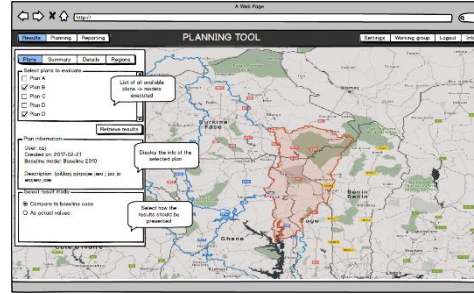
Select how the results should be presented

Basin planning - web

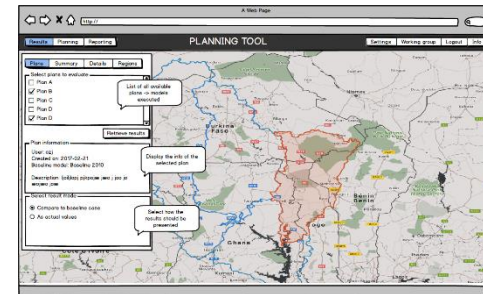
Web interface



User 1



User 2



User ...



- Evaluate plans
- Create plans
- Disseminate planning results

Baseline
assessment

Risk
assessment

Planning

Dissemination
and warning

Monitoring

Status and next steps

- Web application released by September, 2017

Further work required on:

- Indicator selection for different use cases
- Training and testing with stakeholders
 - Lake Victoria, Volta and Chao Phraya
- Extension for WEAP support



THANK YOU

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Audience questions

Flood and Drought Webinars

- #1: Use of satellite data for drought and flood management (Technical presentation)
- #2: Drought management today - cases from Asia (January 12, 2017)
- #3: Drought early warning and assessment, experiences from Ghana (February 28, 2017)
- #4: Water Safety Plans –link water utilities with basin planning processes (March 15, 2017)
- #5: Basin planning – the climate change challenge (April 25, 2017)

Recordings on
<http://www.unepdhi.org/fd-webinars>

New Source to Sea Management webinar series: www.unepdhi.org/webinars/s2s-webinars

- Short feedback survey in follow-up email – please take 2 minutes to fill in
 - we value your opinion!

Future flood and drought webinars

- Feedback and suggestions for future topics welcome!

Thank you for joining!