



# DAFNE

A **D**ecision-**A**nalytic **F**ramework to explore the  
water-energy-food **N**exus in complex and transboundary  
water resources systems of fast growing developing countries

## **NEGOTIATION SIMULATION LABORATORY TECHNICAL IMPLEMENTATION PLAN**

Deliverable D6.1

February 2018



*EU H2020 Project Grant No. 690268*

**Programme Call:** .....Water-5-2014/2015

**Project Number:** .....690260

**Project Title:** .....DAFNE

**Work-Package:** .....WP1

**Deliverable #:** .....D6.1

**Deliverable Type:** .....Document

**Contractual Date of Delivery:** 28 February 2018

**Actual Date of Delivery:** .....28 February 2018

**Title of Document:** .....NSL Technical Implementation Plan

**Responsible partner:** .....EIPCM

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**Availability:**.....This report is public.

<b>Document revisions</b>		
<i>Contributors to review</i>	<i>Revision content</i>	<i>Date</i>
Mark Melenhorst	Document outline ready	05-02-2018
Mark Melenhorst	Section 1Introduction ready	15-02-2018
Mathias Becker	Draft Section 6.2 Planned functionalities for collaborative document interaction area	22-02-2018
Mark Melenhorst	Draft Section 6 Implementation plan	23-02-2018
Marco Micotti	Section 4 NSL and DAFNE Geoportal integration ready	
Caroline van Bers Caroline Lumosi	Section 2 Stakeholder participation ready Section 3 First NSL Meetings in Zambezi and Omo ready	26-02-2018
Ksenia Koroleva	Section 5 Multi-perspective visual analysis tool ready	26-02-2018
Mark Melenhorst	Section 7 conclusions ready	26-02-2018
Jasminko Novak	Revision of Section 6 Implementation plan	26-02-2018
Mark Melenhorst	Final overall editing	27-02-2018
Paolo Burlando	Editing and check	27-02-2018
Caroline van Bers	Final editing, check	27-02-2018
Mark Melenhorst	Finalization, processing of feedback.	28-02-2018
Paolo Burlando	Approval and production of pdf for upload	28-02-2018

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## EXECUTIVE SUMMARY

This deliverable concerns the final version of the technical implementation plan, which is described in the DoA as follows:

*“Report describing the specific functionalities and implementation plan for the NSL including the outcome of the actor analysis, the input from the stakeholders and the results of the first NSL face-to-face meeting.”*

It reflects the outcomes of the iterative and stakeholder-driven approach in DAFNE, in which input for the Decision Analytic Framework is collected during stakeholder meetings, and in which tools to visualize its results, and to allow users to explore e.g. indicators, and solution pathways are iteratively developed and tested with stakeholders. The deliverable is structured as follows.

- **Section 1** provides the introduction, explaining the relationships with the milestones in WP6.
- **Section 2** outlines the approach for stakeholder participation in DAFNE, and its results for both the Zambezi and the Omo-Turkana case studies, starting with an explanation of the role stakeholders play in DAFNE, and the different forms of participation in the project.
- **Section 3** addresses the approach to involve stakeholders in identifying issues, indicators, solutions, and actions for each of the water, energy, and food dimensions, while motivating the stakeholders to contribute data that can be used in the DAF. Two hotspots were identified in the Zambezi basin: Luia (mainly Mozambique) and the Lunsemfwa (Zambia). For the Ethiopian/Kenyan case-study, the Omo River and Lake Turkana were identified as the focal areas.
- **Section 4** reports on the development of the Geoportal which is intended for expert users. It describes the main features of the tool in its current stage of development and reports on the feedback on the tool that was collected during the first NSL meetings in both basins.
- **Section 5** outlines the user-centred design process, the concept and the design of the easy-to-use, multi-perspective visual analysis tool for non-expert users who are not using such tools on a daily basis. This section also describes the interaction between the stakeholders
- **Section 6** addresses the implementation plan, outlining the planned features for development of the geoportal, the collaborative document annotation area, and the multi-perspective visual analysis tool, as well as its roadmap towards the final release in M42 (*MS43 Final version of NSL online platform*, and *D6.3 NSL online platform*).
- **Section 7** wraps up the deliverable, pointing out to the first release of the NSL online platform in M24 (August 2018), and of the Geoportal (M22).





# 1 INTRODUCTION

Throughout the project, the Negotiation Simulation Lab is facilitating interaction between stakeholders for the discussion of water, energy, food issues, mitigating actions, and their effects. The objective is to *simulate* negotiations in a safe environment. As such the NSL does not replace real negotiations, but provides stakeholders with the opportunity to substantiate their arguments for the real negotiations with scientific data on impact indicators along the water-energy-food nexus, as well as to better understand the arguments of other stakeholders beyond one's own sector. Through the process of data-driven interaction between stakeholders, new win-win solutions may be found, or unforeseen negative impacts on stakeholder may be prevented by identifying mitigating actions. More specifically, the NSL seeks to:

- **Compare and contrast** the impact of natural resource management practices in the river basins.
- **Visualize, explore, and understand** potential new solution pathways and multiple perspectives in the river basins
- Provide a **'safe place'** to jointly discuss potential solutions, enabling the building of trust and social learning

Furthermore, the NSL provides opportunities for stakeholder interaction through face-to-face meetings and online interaction:

- **Face-to-face stakeholder workshops:**  
*Face-to-face* stakeholder workshops are planned as NSL meetings for both case studies. Face-to-face NSL workshops ultimately serve to simulate negotiations between stakeholders by providing them with insight about solution pathways, indicators, and benchmark values for acceptable solutions. They will also present intermediate results and the use of the DAFNE tools for analysis and visualisation of pathways and their trade-offs (geo-portal and multi-perspective visual analysis tool). The introduction and usage of these DAFNE tools in the stakeholder workshops is also a form of capacity building for data-driven, analytical approaches to the analysis of W-E-F nexus issues and solution pathways. Last, but not least, the face-to-face meetings are crucial for helping to build engagement and trust between the stakeholders and the DAFNE project, as well as among the stakeholders themselves.
- **Online interaction:** Following stakeholder feedback pointing out that not all stakeholders can be present at all times, and that the infrastructure to attend live online meetings is not available or very volatile in terms of connectivity and bandwidth, asynchronous interaction is planned as the main form of online interaction, by allowing stakeholders to, for example, annotate indicators, solution pathways, or benchmark values, as well as to try out the NSL tools (geoportal, multi-perspective visual analysis tool) for their analysis of the WEF nexus modelling and simulation.

Building on the results from the actor analysis, and the collected input from the first NSL meetings in the Zambezi and the Omo-Turkana case study areas, this deliverable describes the tools stakeholders will be able to use to explore pathways, indicators, and scenarios that form the basis of the decision analytic framework: the visual analysis tool and the Geoportal.

The multi-perspective **visual analysis tool** is targeted at all stakeholders, regardless of their level of expertise, to be used both in face-to-face meetings and in online interaction. Drawing on data from the Geoportal, it affords an at-a-glance understanding of the impact of solution pathways on selected indicators from different sectoral perspectives, thereby allowing for an easy analysis of the trade-offs between water, energy, and food (and/or other related sectors). It supports an informed assessment of the impact of solution pathways for the WEF sectors and provides continuous support to safely discuss solutions among stakeholders. The **Geoportal**, as a dissemination output from WP7, stores, integrates, and shares all data collected in the DAFNE project. While different

types of users (general public, project stakeholders, project partners) can get access to the Geoportal with associated rights, the Geoportal version in WP6 is primarily targeted at expert stakeholder users who have a strong interest in performing in-depth analyses of the available content. It allows for access and in-depth analysis of, for example, scenarios, drivers, model simulation outcomes, pathways, and indicators based on available data. As described in D7.1, the Geoportal offers several analysis tools to its target groups, including a data catalogue, interactive maps, dynamic charts, and customizable dashboards. The **online stakeholder interaction** area on the DAFNE website allows for an early exchange of views regarding the key elements of the decision analytic framework between involved stakeholders, which supports the development of the Geoportal as well.

The deliverable consolidates the technical reports delivered at the following milestones:

- MS39 – Initial actor analysis complete
- MS40 – Expanded actor analysis complete
- MS37 – NSL technical implementation plan ready in preliminary form

It provides the methodology for identifying, and the list of identified and selected actors, incorporating both the MS39 and the MS40 report. It also extends the feedback on the preliminary plan and designs for the multi-perspective visual analysis tool reported at MS37 by adding the results from the Omo NSL. It describes the concept behind the Geoportal and the visualization and discussion tool, as well as the resulting designs that have been revised based on the collected feedback. Finally, this deliverable consolidates the technical implementation plan for both tools.

## 2 STAKEHOLDER PARTICIPATION IN DAFNE

### 2.1 ROLE OF STAKEHOLDERS

Stakeholders play a critical role in the DAFNE project and are particularly important for assessing the various options and pathways developed in the decision analytical framework (DAF). As such, stakeholders contribute to the DAFNE project in three ways:

- a) As the key end users of the DAF, stakeholders will support the verification of pathways and indicators. Through a participatory process, stakeholders will support the verification of the indicators developed in the DAF in order to enhance its robustness in the optimization of alternative pathways.
- b) They play a vital role by participating in real-life simulation negotiation processes that support robust transboundary planning through a comparative analysis of the alternative pathways and solutions for management of river basin. This simulation process is being carried out in the Negotiation Simulation Lab that will support future effective and robust decision making and policy development at all levels of river basin management.
- c) They provide critical information and data that supports the modelling of alternative pathways. Stakeholders play a key role in identifying the critical areas/ challenges in basin planning and management and as such are also central in providing information and data to support mapping of these challenges in order to develop and model a framework that support our understanding of the interlinkages between different sectors.

Thus, it is critical that stakeholders are identified, which can provide the needed expertise in the project. Specifically, stakeholders in the DAFNE project support the project in the following ways:

- d) Sharing their perspectives on the issues in the basins and providing clarity of these issues;
- e) Providing project feedback, enabling access to available data, and supplying knowledge for model development through bilateral consultation and participatory processes;
- f) Supporting the identification of and/or verifying indicators and alternative planning and management solutions;
- g) Validating or helping to develop pathways to sustainable resource use.

Table 1 below explains the level at which stakeholders are or will be engaged in the project and in the NSL.

Table 1 – Stakeholder level of Engagement in DAFNE

Level of engagement	Description of the process in the project	DAFNE engagement avenues
Inform <i>(One way communication- present information)</i>	Provide the stakeholders with relevant information to increase their understanding of necessary facets of the project (depending on their role in the project)	Project reports/ newsletters
Consult <i>(Seek and obtain feedback)</i>	Seek and obtain feedback on alternative planning and management solutions in the NSL Collect data and knowledge related to basin issues/concerns	Stakeholder workshops Data collection through interviews, surveys, etc.
Involve <i>(Tap into stakeholder skills and experience)</i>	Involve stakeholders in indicator development /validation phase (WP5 &6) Involve stakeholder in identification of operational pathways for the implementation of integrated water management solutions	Stakeholder Workshops NSL Online platforms for developing DAF
Collaborate and Empower <i>(Deciding and acting together with stakeholders based on shared goal)</i>	Work directly with stakeholders to: - gather relevant data for model development; - evaluate the political acceptability of different management/ development options Empower local stakeholders in problem solving and knowledge transfer through consultation and training on use of DAF	Online platforms/meetings Stakeholder Workshops NSL Training Courses MOOC

### The approach to selection of stakeholders in DAFNE

In this section we explain how stakeholders were identified in the DAFNE project. An actor analysis was conducted involving six steps as outlined by Hermans (2005). Each step is described below.

#### Step 1: Define purpose and conditions for actor analysis

The actor analysis was conducted for two purposes: (1) to identify actors to support the research in the DAFNE project, and (2) to identify actors to participate in the Negotiation Simulation Lab (NSL) sessions.

##### *Purpose 1: Support research in the DAFNE project*

The first aim of the actor analysis is to identify key stakeholders to collaborate with project partners in support of the research aspects of the project. Actors in the DAFNE project play a key role in providing critical information and data to support modelling the interlinkages between water, energy and food in the Zambezi and Omo-Turkana basins.

##### *Purpose 2: Participating in the NSL*

Secondly, the actor analysis is used to identify key actors to participate in the Negotiation Simulation Lab sessions. Therefore, this analysis is used to help DAFNE partners to form a mock 'negotiation' team of actors who are knowledgeable and can provide insights on the interlinkages between water, energy and food in the basins that they represent. The NSL also serves to equip the

actors with knowledge and skills to better understand the WEF nexus interlinkages in order to position themselves to engage in future WEF nexus river basin planning, policy and management processes in their respective basins. Therefore, the NSL lab is also seen a 'training' ground for key actors in these basins.

## Step 2: Preliminary scan of actor network and practical preparation

In order to achieve the second purpose, participating in the NSL, it was important to identify the actor networks, and the culture and context in which these actors are embedded. To support this step the local case study leaders in the basins (Zambezi and Omo-Turkana) were engaged and together with the WP 6 lead partner scanned information to identify the organisations involved in and/ or affected by water management in the two basins. This involved scanning project reports, policy documents and strategies (such as the Zambezi Basin Strategic Plan). In some cases, it involved informal talks with (potential) actors. This step provided a general understanding of the various actors by sector and organisation type in the basins and led to the development of the master list of 126 actors for the Zambezi basin and 80 actors for the Omo-Turkana basins (a full listing for both is available on the DAFNE Cloud - Polybox: <https://polybox.ethz.ch/index.php/s/iM8rAB-FKO8M3A6Q>). At this stage we were able to classify the actors according to the sectors (i.e. water, energy, food, environment, other), the type of organization (i.e., governmental, non-governmental, research, etc.) and the administrative level (national level, regional level or basin/local level).

For the Zambezi basin, the 126 actors identified are from 15 countries of which 36 are from the water sector, 30 from the energy sector, 13 from the food/agriculture sector, 22 from the conservation and environment sector, and 16 under the 'other' category. This 'Other' category includes individuals from organisations concerned with meteorology, human rights, university research and health. Some actors represented more than one sector and, thus, were incorporated in all the sectors they represented.

For the Omo-Turkana basins we identified 80 actors from 2 countries of which 11 were from the water sector, 6 were from the energy sector, 17 were from the agriculture/ food sector, 16 were from conservation/ environment sector and 29 were listed as 'other' meaning that they represent other sectors notably culture & tourism and foreign affairs.

## Step 3: Identify stakeholders' interests

In this step we were interested in preliminarily assessing the actors' understanding of WEF nexus issues in the basin, how the different sectors interact with one another, the main challenges they face in forming these interactions and their limitations. These questions formed the basis for interaction in the first NSL session.

This stage went a little further than step 2 in classifying the actors within the sectors and to understand the level of engagement of the actors. To do this we used the power/interest matrix (see Figure 1) that grouped the actors in two four categories: inform, involve, consult and collaborate. For this step we developed and relied on several questions that helped us to categorize the stakeholders in one of the four categories: high interest and low power; high interest and high power; low interest and low power; and, high power and low interest. These questions include:

- Which actors could be interested in the DAFNE project and its outcome?
- Which actors would benefit from the outcomes of the project and in which ways?
- Which actors (if any) stand to 'lose out' and may thus be resistant or present challenges during the project?
- Which actors have the data, information or knowledge to support the project objectives, goals and outcomes?
- Which actors could influence the project outcomes?
- Which stakeholders are better placed to make decisions (or influence decisions) concerning the WEF nexus integration in their countries?
- Which actors have the capacity (technical, institutional) to be involved in the project through various meeting fora (internet and face-to-face)?

- Which actors would 'lose' their independence in achieving their goals through the use of the WEF nexus approach?

Responding to the above questions for the actors identified helped us to categorise the power/ influence level and level of interest / stake. Figure 1 below provides examples.

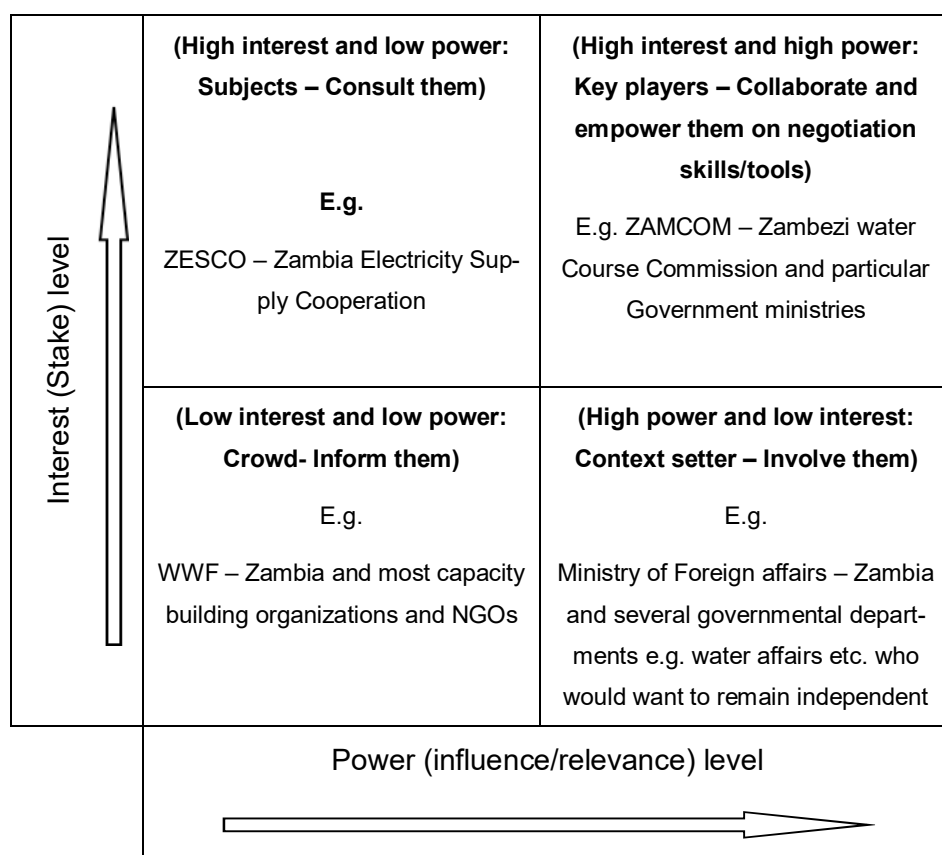


Figure 1 – Power-influence level and stake of WEF Nexus actors.

At this stage, our focus was on understanding each actor's roles, i.e. what role the organizations would play in the project as well as in the NSL lab and the role of the actors in their organizations. We assessed the extent to which actors were knowledgeable about the issues in the basin as well as the role that their organization plays in addressing these issues. We also assessed their willingness to speak freely on behalf of their organization based on the authority that the actors held in their respective organizations. The goal was to secure actors who are senior enough to represent their organizations in such meetings (such as the mock negotiation session) as well as knowledgeable enough to understand the interlinkages between the sectors and nexus issues at the basin and sub-basin level. Using a social participatory approach, local case study leaders who have been previously involved in river basin management projects compiled the stakeholder list with this information (see categories and examples in Table 2 below). This meant that we reviewed and identified the position/ seniority of the actors in each sector and the potential role they would play in the NSL as well as in the project as a whole. In addition, we identified the potential resources that the actors have that could support the project. This selection process as a whole sometimes implied that a trade-off had to be made between seniority and the proximity of the actors to local/on-the ground activities.

Table 2 – Sample of categorization of actors.

No	Name	Country	Type of organization	Scale (SH sphere of influence)	Function of organization	Role in the organization	Stake; interest in WEF in the basin	Power: influence on WEF in the basin	Category in the power/ interest matrix	Level of engagement in DAFNE	Resources to support DAFNE
1	Zambia Electricity Supply Corporation (ZESCO)	Zambia	Government	National	Hydropower Company/ Corporation	Technical Advisor	High	High	Key Player	Collaboration, Information	Datasets, Expertise
2	Lunsemfwa Hydropower	Zambia	Company	Local	Hydropower Company/ Corporation	Technical Advisor	High	High	Key Player	Collaboration, Information	Expertise, Financial resources

#### Step 4: Selection of actors for the NSL

The selection of actors to participate in the NSL session was based on a review of the complete lists of actors identified for the Zambezi basin and the Omo-Turkana basins. A total of 30 stakeholders were selected to attend an introductory stakeholder meeting for the DAFNE project in the respective basins. In the Zambezi study, a number of stakeholder participants were then selected to attend the first NSL workshop six months later. The selection was based on step 3 above and person-to-person interactions with the stakeholders. In the case of the Omo-Turkana, the introductory workshop and the NSL took place within one week due to the late joining of the Ethiopian partner, WLRC. Thus, a selection of stakeholders for the NSL had to be made by the Omo and Turkana case study leaders in advance of the events. Analysis of these actors and their relationships is further explained in step 5 and 6 below.

#### Step 5: Analysis of data

We subsequently identified the stake of the actors in WEF transboundary river basin planning and management and categorised the actors into high, medium and low stakes. For the NSL process, we selected actors who had high and medium stakes, e.g. represent by the blue and orange fields in Figure 3. This was because within these categories (high and medium) actors have both the interest and authority to be involved in river basin planning and management and thus the NSL session would equip these actors with the needed skills, tools and knowledge to support them to future engage in transboundary WEF river basin planning and policy processes in their respective basins. In Table 3 the number of actors by sector and basin for the DAFNE project as a whole and the NSL sessions specifically are shown. The full lists of actors can be found in Annex A (Zambezi) and Annex B (Omo-Turkana).

The structure and context of stakeholder interaction was based on groupings into the five sectors: water, energy, food, environment and other cross-cutting sectors such as culture and tourism. We noticed that it was not always a clear fit into one sector as some stakeholders mandates and/or expertise covered more than one sector. For example, a stakeholder from governmental agency concerned with water and irrigation could fit in both the food/agriculture and the water sectors. In this case we allowed stakeholders to contribute based on their understanding of the issues and where they feel they can best contribute.

We also assessed stakeholder interests in the basin issues through use of participatory mapping exercises in which stakeholders were to identify key issues and areas of interest, e.g. dam construction, and indicators that can be used to assess actions. This exercise allowed stakeholders to

map these on a physical map provided by the project. The exercise raised awareness among participants of the interests and knowledge of other stakeholders and how they perceive their own and other sectors.

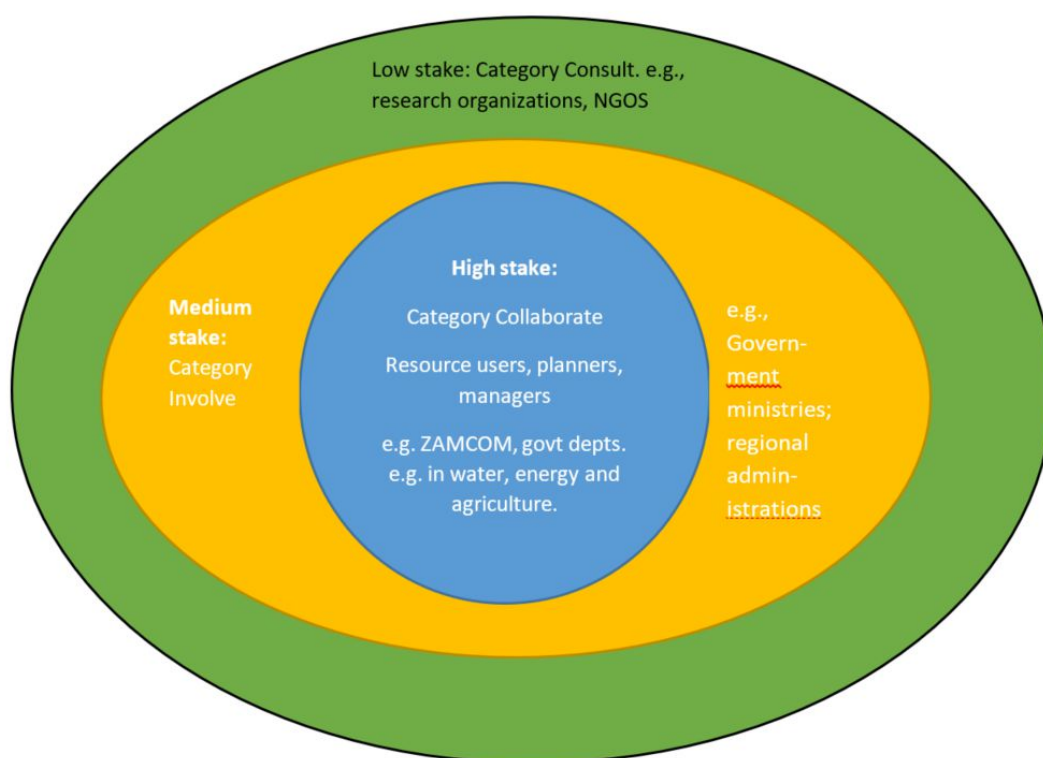


Figure 2 – Visualization of the main categories of actors for the DAFNE project and NSL.

Table 3 – Number of actors selected for project and NSL by basin and sector.

<b>Sector</b> <b>Basin</b>	<b>Water</b>	<b>Energy</b>	<b>Food</b>	<b>Environment</b>	<b>Others</b>
<b>Zambezi</b> (NSL actors are based on two sub-basins in Zambia and Mozambique)	Project: 36 NSL: 9	Project: 30 NSL: 5	Project: 13 NSL: 1	Project: 22 NSL: 2	Project: 16 NSL: 0
<b>Omo-Turkana</b> Representing two countries (Ethiopia and Kenya)	Project: 11 NSL: 4	Project: 6 NSL: 1	Project: 17 NSL: 3	Project: 16 NSL: 3	Project: 29 NSL: 7

## 2.2 FINALISATION OF THE ACTOR ANALYSIS IN THE ZAMBEZI BASIN

For the Zambezi basin, the final actor analysis for the NSL consisted of 15 stakeholders of which four represented the Luia sub-basin in Mozambique, four represented the Lunsemfwe sub-basin in Zambia and seven provided a national or whole basin perspective. All sectors (Water-Energy-Food-Environment) except 'Other' were represented. From this actor analysis, what emerged was also the need to incorporate the mining sector as a stand-alone sector as it is widely practiced in both sub-basins.

As can be seen from Table 3 above nine actors represented the water sector, five represented the energy sector, one represented the food sector, two represented the environment sector and none were listed under the category 'other'.

The key actors in the Zambezi basin are the Zambezi Water Course Commission (ZAMCOM) and SADC Water (Southern Africa Development Cooperation). They fall under the category collaborate/empower as they act as the entry points to other actors in the basin. ZAMCOM is a river basin commission that represents the interest of all the basin countries and was thus seen as a key entry point for the basin. It is therefore critical for the DAFNE project to have close collaboration and cooperation with these actors. These actors would also be relevant in hosting the DAF once completed. One way that the project is seeking to engage with them is to draft memorandum of understanding on how the project (DAFNE) can directly support the role of ZAMCOM in supporting transboundary planning and management through use of the Decision Analytical Framework.

The main challenge encountered in the actor analysis for the Zambezi basin was the issue of language especially among actors from Mozambique where Portuguese is the first language. In this case, the actors took a bit more time to become engaged in the process. To support engagement of actors, in some cases interpretation and translation was needed.

## 2.3 FINAL ACTOR ANALYSIS IN THE OMO BASIN

For the Omo-Turkana basins, the final actor analysis narrowed the list of stakeholders for the NSL to 18 stakeholders of which five represent the Turkana basin in Kenya and 13 represent the Omo side of the basin in Ethiopia. The meeting was held in Ethiopia and thus this explains the large number of actors from Ethiopia. Due to project budget constraints only a few of actors from Kenya were able to participate. In addition, confirmation of their participation was quite slow and hence this affected the number of actors that could be chosen to participate in the NSL in Ethiopia. All sectors were represented in addition to key cross-cutting sectors such as culture, population and livelihoods as well as a key government representative concerned with transboundary affairs, the Ethiopian Foreign Affairs Ministry.

As can be seen in Table 3 above, four actors represent the water sector, one is from the energy sector, three are from the food sector, three are from environment sector and seven actors represent other sectors such as culture, foreign affairs among others. The low number of actors representing the energy sector was due to late confirmation of the actors to participate in the meeting. In addition, the meeting was held at a politically sensitive time in Ethiopia and movement in some parts of the country was restricted which meant that some key basin actors could not participate in the NSL meeting.

Unlike the Zambezi basin, the Omo-Turkana basins do not have the benefit of a basin commission/authority. As such, the water sector actors were seen as the central actors with whom to collaborate. In addition, the foreign affairs actors also play an important role in this basin to ensure all matters respect political agreements between the two countries.



### 3 FIRST NSL MEETINGS IN ZAMBEZI AND OMO-TURKANA

#### 3.1 APPROACH TO FACE-TO-FACE NSL MEETINGS

In the early phases of the project, the focus of stakeholder interaction has been on collecting data and investigating the problem space with regard to water, energy and food. For the Zambezi and Omo-Turkana basins, the first two face-to-face meetings with stakeholders in each of the basins (general stakeholder meeting and NSL) have contributed to this purpose. As such, these meetings in the Zambezi in February and September 2017 and in the Omo-Turkana in February 2018 in Nairobi and Addis Ababa focused on the identification of WEF nexus issues, actions, solutions and indicators. As a secondary purpose, the meetings sought to familiarize the stakeholders with the nomenclature of the DAFNE project, and the process of simulation and visualization of issues, actions, scenarios, and pathways (see Figure 3).

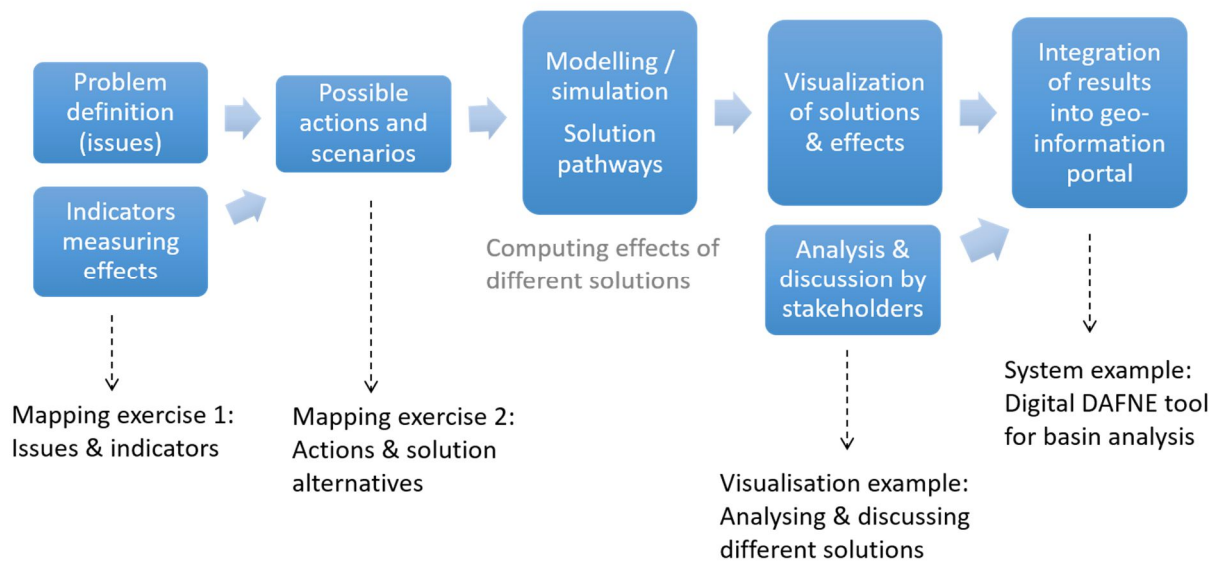


Figure 3 – Process of simulation and visualization of solution pathways.

In later phases of the project the emphasis will shift to the results of the simulation, employing the knowledge visualization tools developed as part of the NSL (see Section 4 and Section 5 respectively). The stakeholders are provided with a safe space to jointly develop and negotiate alternative solutions, based on assessment of the pathways identified and analysed in WP5. The negotiation process is aimed at comparing these alternative management solutions within a decision making framework. While it has no direct political implications, it can in the future support more effective decision making and policy development at all levels.

The approach to the first NSL is to use participatory mapping to jointly examine the current situation in the basins as a whole and in specific sub-basins and to identify actions, planned or hypothetical, that will or can contribute to sustainable resource use. A smaller group of 15 to 20 stakeholders is foreseen for these meetings as it permits more intensive discussions of issues and solutions.

The main benefits to the stakeholders of participating in the NSL is to:

- gain a better understanding of the DAFNE project in terms of process and products, and the nexus approach to integrate sectors in order to identify trade-offs and to generate more sustainable solutions to resource management issues;
- learn about/ gain insights into intersectoral aspects of resource management through the negotiation process;

- gain experience and a better understanding of the value of visualisation tools for identify trade-offs between solutions;
- have the opportunity to use the products of DAFNE including the decision analytic framework, the NSL itself, and the online Geoportal further developed and extended in WP7.

The online NSL, which will operate through meeting software such as Skype, Zoom or Adobe Connect, will bring in stakeholders who have not necessarily participated in the face-to-face meetings. There are limitations, however, in connectivity which may be overcome to some extent by timing meetings during off-peak times. The organisers of the NSL are also taking into account that some users will rely on cellular phone devices, which impose constraints on the choice of such solutions, as stakeholder should be able to contribute to the process regardless of their access to technology.

In both the Zambezi and Omo-Turkana basins the next three months will be the timeframe for establishing a functioning online forum for engagement. In addition based on discussions with the Zambezi stakeholders a new tool has been developed for online contributions by stakeholders to WEF actions and indicators, which allows for asynchronous contributions (e.g. adding comments to online documents; see Section 6.2).

There are, as expected, differences in the needs of and expertise/experience among stakeholders. Clearly participation by stakeholders is motivated by varying needs and interests which may range from learning to networking to gaining access to new tools. The full scope of this diversity is being assessed from the results of the pre- and post-NSL surveys which, for the Omo-Turkana basins were conducted two weeks ago, while the results from the Zambezi basin have been collected during the NSL in September 2017.

Furthermore, there are significant differences in the expertise and experience of the stakeholders involved both as a function of the sector and organisation they represent as well as the scale at which the organisation functions and the role of individuals selected to participate. At the same time, the interactions between and among stakeholders must be taken into account. They are confronted in the NSL with those representing potentially competing interests (e.g. water for irrigation and water for electricity). Hence, it is the responsibility of the organisers to ensure that individuals focus on identifying trade-offs and solutions in a safe and constructive environment. This means operating with integrity and transparency, exercising neutrality and employing conflict resolution when needed. Finally, the project cannot engage all stakeholders to the same extent due to limited resources in comparison to the area both basins cover.

### 3.2 THE ZAMBEZI BASIN NSL RESULTS

The first NSL for the Zambezi Basin took place in Lusaka, Zambia on September 11 and 12, 2017. Of the 17 stakeholders who were originally confirmed for the event, 14 representatives of the three WEF sectors participated. Since a target of 15 participants had been set, there was still sufficient representation.

Following the welcome address for participants and an introduction round of all participants, the purpose and agenda of the meeting were reviewed. The project coordinator, Paolo Burlando, then presented the DAFNE project in general and the water-energy-food nexus (WEFNE). He outlined the aim of the 4 year project to investigate, together with stakeholders, how water, food and hydropower (HP) are being managed in the two African basins and subsequently exploring options for sustainable and integrated management in future. The two sub-basins in the Zambezi, the Luia (mainly in Mozambique) and the Lunsemfwa (in Zambia) were subsequently presented by the respective case study leaders, Jaime Palalane (UEM) and Imasiku Nyambe (UNZA) respectively, including the criteria for choosing these catchments: the presence of water (tributaries of the Zambezi), energy production in particular hydropower generation, and food production in terms of agriculture. Emerging issues they pointed out include the expansion of irrigated agriculture, the development of new hydropower schemes and hence (potential) conflicts over resource availability vs. population growth. The purpose, scope and goals of the NSL were then presented to the participants by partners UO and EIPCM. Stakeholders were then encouraged to deliberate openly on

issues affecting them in their respective catchments and provide what they believe to be potential solutions to their concerns.

As a first step in the joint mapping exercise which followed, large catchments maps of the Zambezi basin as a whole and the Luia and Lunsemfwe basins were distributed to stakeholders representing their respective (sub)basins. They were invited in small groups to indicate issues concerning resource management issues in terms of agricultural activities and hydropower generation, as well as impacts on urban settlements the environment. The results of each of the three groups were then presented in the plenary. In a second phase of the mapping exercise the participants in their respective groups, identified in detailed way the currently implemented, planned and potential future actions that can address the issues they identified in the first stage of the exercise. The full description of the actions planned included what has to be done, who the responsible decision maker is, when the action is planned, where it is being planned for and the phase of implementation. The results were subsequently presented to the plenary<sup>1</sup>.

Some of the general issues identified that are common in the Zambezi basin in general include:

- inconsistent and inadequate or lack of access to data
- inadequate considerations of the WEF in planning
- environmental integrity and significant losses of biodiversity (not much left in the study areas)
- lack of coordination in planning hydropower
- increasing deforestation due to clearance of land for farming (related to Foreign Direct Investments)
- Access to irrigation water and resulting competition with hydropower

The Lunsemfwa subbasin deforestation is an issue primarily due to removal for farming. In the Upper Lunsemfwa there is inadequate water, a growth in competing interests and conflicts are common. The area has no water user association. In the Mulungushi area in southern part of the catchment, water is sufficient and there is an active water users association. Stakeholders are working together in this area.

The Luia Catchment is less developed than many other regions in the Zambezi basin. Agriculture takes the form of subsistence and smaller-scale commercial farming with an increasing number of farmers growing tobacco. The catchment has high hydropower potential. However, large-scale mining operations being planned may affect downstream flows. There are high levels of siltation and the area is prone to floods. In addition, institutional capacity of the basin is limited.

On the second day's (September 12) the value of visualization and how it can be used in the stakeholder engagement process in the project was presented by EIPCM and discussed among the participants. Subsequently, the Geoportal Tool was also presented and discussed, in particular issues of clarity concerning the hosting, application and use of the geoportal once it is completed.

During the wrap up of the meeting, it was suggested that for ongoing participation in future meetings, small gatherings of representatives could meet with DAFNE partners once per year in face-to-face meetings which are considered to be more meaningful, resourceful and productive. Locally, meetings within catchments could be held more often, say twice per year. Overall, online meetings were encouraged as they are less costly. In addition, emphasis was put on the need to make available and collect data as that it the only sure way that the model and geoportal tools to be developed will be of value if this data can be accessed.

Finally, a presentation on *Nexus Approaches in the Southern African Development Community (SADC) Region* was given by the SADC representative, Kenneth Msibi. He provided a summary of similar nexus studies completed and currently being conducted in the SADC Region and demonstrated the linkage with DAFNE. Other studies conducted were by the World Bank and German Corporation for International Cooperation Limited (GIZ), e.g. the Maguya Dam case in the Komati

<sup>1</sup> The full results of the Zambezi workshop are available from the MS38 technical report (*Report of the first negotiation simulation lab for the Zambezi basin*).

sub-basin in Swaziland. In general, it was concluded that ZAMCOM may be the most appropriate organisation to host the completed DAFNE Geoportal.

### 3.3 THE OMO-TURKANA BASIN NSL RESULTS

The NSL in the Omo-Turkana basins held in mid-February was preceded by two general stakeholder meetings in Kenya and in Ethiopia. These meetings were held back-to-back as there was the need to catch up after the replacement of the Ethiopian partner by WLRC in the summer of 2017.

As in the Zambezi basin, the purpose of this general meeting was to introduce stakeholders to the DAFNE project and the Nexus approach to integrated river basin management. On February 12<sup>th</sup>, case study leader, Professor Eric Odada of ACCESS in Kenya and Professor Paolo Burlando of ETHZ welcomed 20 stakeholders representing organisations responsible for natural resources management in the Lake Turkana basin to the initial meeting in Nairobi. On February 14<sup>th</sup>, the Honourable Dr. Seleshi Bekele, Ethiopian Minister of Water Irrigation and Electricity, opened the stakeholder meeting on the Omo basin for Ethiopian stakeholders in Addis Ababa. Subsequently, case study leader, Dr. Gete Zeleke of the Water and Land Resource Centre and Professor Burlando subsequently welcomed the 20 stakeholders representing resource sectors concerned with river basin management in the Omo basin. The focus on managing water resources and generate a win-win outcome through cooperation and partnerships principles was stressed in both meetings.

Subsequently, on February 15<sup>th</sup> and 16<sup>th</sup> roughly 20 stakeholders from both the Turkana basin and the Omo basin met together in the NSL to explore in more detail the issues and good practices as well as the potential solutions for addressing resource management challenges in the WEF Nexus. The meeting was opened with presentations by local partners, Dr. Gete Zeleke who provided an overview of the Omo basin and Dr. Alfred Opere who presented an overview of the Turkana basin. Dr. Gete stressed that one of the most significant development challenges in the Omo is land degradation leading to erosion, sediment movement and siltation. Urban growth is an issue in the north while in the south is characterised by subsistence agro pastoralists and a growing number of large scale farms as well as archeological sites and national parks. In the Turkana, Dr. Opere pointed to the issues of population increase, deforestation, degradation, oil exploration, the increase in land being allocated for oil exploration reducing land for agriculture and pastoralist use.

As in the Zambezi NSL, basin maps were provided for locating this information. Two groups were focused on the Omo basin and a third group representing the Turkana worked on the Turkana basin map. Some of the issues identified for the Omo and the Turkana are listed below.



Figure 4 – The NSL workshop in Addis Ababa on February 15<sup>th</sup>, 2018

## Exemplary issues in Turkana

### Oil extraction

- Communities' land is being taken
- Conflicts about benefits sharing
- Ancestral pastoral land is being taken
- Land has to be fenced off, which interferes with the farmers' way of life
- Potential for hazardous materials
- Access to the lake

### Wind Hills (Wind turbines)

- Production will start end of year
- Impact on (migratory) birds → mast height was increased
- The sight has changed according to locals

## Exemplary issues for Omo

- Impact of irrigation on water quality and on pastoralists lifestyle
- Land degradation leading to siltation and affecting power generation
- Dams upstream affect downstream users
- Boundary of archaeological sites is not protected and hence land taken away from the site usage to pave way for commercial farms
- Urbanisation in the delta is increasing due to agricultural activities in the Omo basin
- Population growth due to natural birth affecting water availability
- Land degradation higher in areas of high population pressure
- Poor waste management in the urban areas - pollution and eutrophication of water resources in the area
- Controlled flooding from the dam could impact on the land for pastoral communities
- Competition for land in the basin due to population growth - competition between land for pastoralism and commercial farming and wildlife

Subsequently the three groups addressed actions and solutions and prepared to the extent possible detailed descriptions of these. An example from the Omo is provided in the table below.

Note that since the NSL has just recently taken place, the summaries of the discussions and exercises with stakeholders have not been fully processed. This will be completed in the coming weeks, after which participants will have a chance to provide their feedback on the results.

Table 4 – Example of a baseline situation, and its issues, actions, and indicators for Omo.

Baseline	Issues	Action and solution	Action description	Indicators
Agriculture is increasing, especially with large scale schemes	Economic growth	New expansion with large irrigation scheme in the Omo valley	New irrigated areas up to 100000 Ha for sugar cane	-Yearly average yield
	Food security			- Maximum water deficit wrt the water demand
	Employment/ poverty reduction	New regulation with artificial flood forced release to protect environment and recession agriculture in the Omo valley		- Yearly average flood peak
	Impacts on agriculture			- Number of consecutive days of floods

## 4 NSL AND DAFNE GEOPORTAL INTEGRATION

### 4.1 DAFNE GEOPORTAL PROTOTYPE

During the first NSL sessions, in Lusaka and Addis Ababa, initial versions of DAFNE Geoportal prototype, at an early development stage, have been presented to stakeholders, with four pages targeted to NSL support as described below.

#### WEF Nexus map

An interactive web map provides for each case study, a number of GIS dataset available on demand, with different scales addressing different stakeholders needs and interests. The map includes both aggregated information at the basin-wide scale, typically the focus of transboundary institutions, and detailed information about small sub-basins which is useful for local stakeholders (e.g., farmers associations). A customised additional layer, namely a “marker” layer, provides the possibility to highlight on the map locations connected to any kind of WEF model aspects directly considered by DAFNE, like issues, model components, indicators or hydrological variables. The access to the WEF Nexus map will be public for where free or open licensed data is concerned, while it will be restricted to stakeholders involved in the NSL for all the other types of data. The map will support both online and face-to-face NSL meetings providing a shared and structured access point to the spatial information collected in or produced by DAFNE.

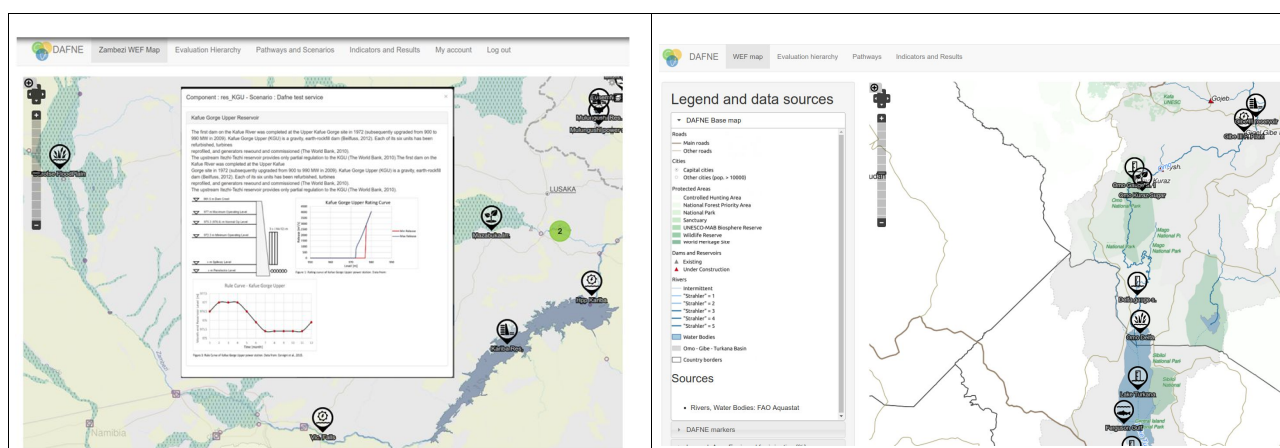


Figure 5 – Screen-shot of WEF map page from the DAFNE Geoportal prototype, Zambezi (left) and Omo-Turkana (right) case studies

#### Project Evaluation Hierarchy

In order to assess future impacts and the effects of actions and scenarios analysed in DAFNE, a number of indicators will be identified and computed building on the decision analytic framework outputs. In order to be relevant, each of these indicators should be related to an evaluation criterion used by one or more of the many involved stakeholders. The DAFNE Geoportal will provide a page targeted at representing the evaluation hierarchy of each case study, organizing criteria, sub-criteria and indicators in an interactive and dynamic tree chart. The root level of the chart will be composed of the three components of the Nexus, the intermediate levels will represent the evaluation criteria and sub-criteria, moving from the general ones to those more specific, while on all the indicators will be appended to the leaves, with a hyperlink to description pages with indicator formulation and a factsheet.

In a participatory context, indicator identification and validation are part of an interactive and iterative process that usually evolves during the lifespan of the project. For this reason, this page will be reserved for DAFNE partners and stakeholders involved in the NSL activities and it will be made



available to the general public only after the last NSL meeting when the contents and structure of the evaluation hierarchy will be stable and shared for all the case studies.

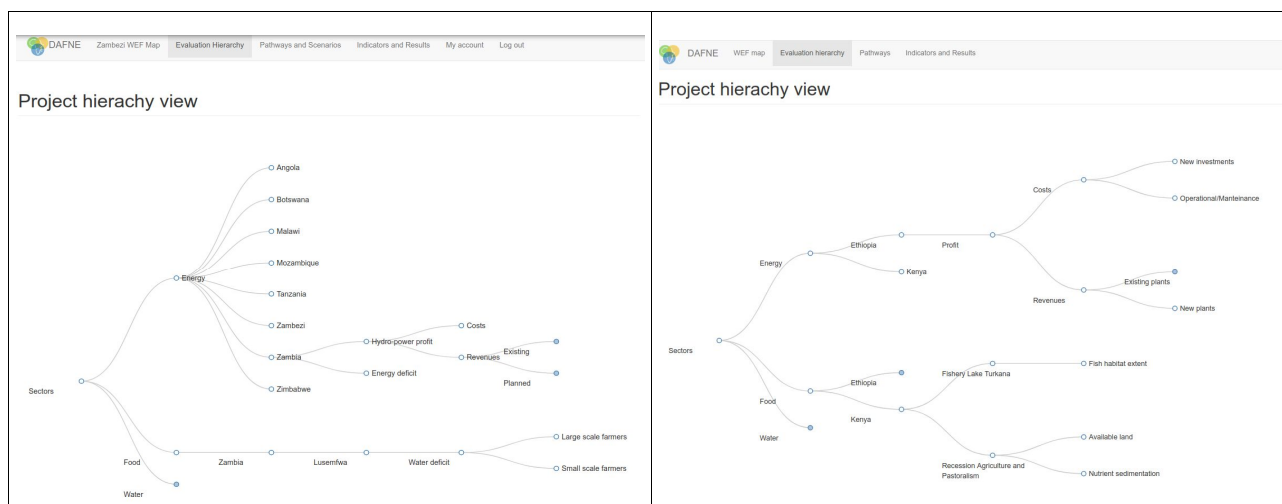


Figure 6 – Screenshot of Project hierarchy page from the DAFNE Geoportal prototype on the Zambezi (left) and Omo-Turkana (right) case studies.

## Pathways and scenarios

The Actions considered in DAFNE will be combined into pathways. Pathways are considered sets of actions to be sequentially implemented) and evaluated against a number of possible future scenarios (climatic and socio-economic). The DAFNE Geoportal will provide a page to browse and analyse the set of pathways and scenarios including both spatial and temporal dimensions. A web map will give insights to the spatial distribution of planned actions and future scenarios, while an interactive component will allow users to check their sequence and timing.

During all the project, this page will be reserved for DAFNE partners and stakeholders. After the last round of NSL meetings, interesting pathways eventually selected during the NSL could be made available for public access in a privacy-protecting way if compliant with the non-disclosure agreement or obligation of confidentiality established during the project and after the explicit consent from the stakeholders involved.

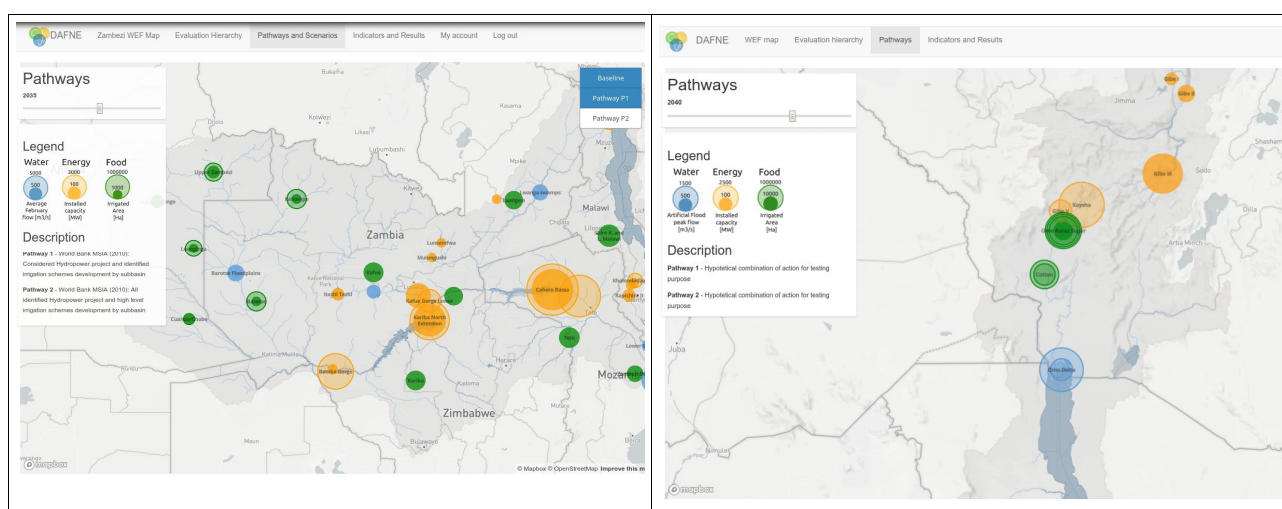


Figure 7 – Screen-shot of Pathway page from the DAFNE Geoportal proto-type on the Zambezi (left) and Omo-Turkana (right) case study.

## Indicators and results

The model variables and the indicators identified in the evaluation hierarchy will be computed for all the selected combinations of pathways and scenarios. In order to provide an effective way to navigate this large amount of data, the DAFNE Geoportal will prompt the positioning of markers on the map representing indicators or models output variables. By clicking on the markers, the user can access the associated time series. Given a combination of one or more scenarios and pathways, variables will then be rendered with line charts, while indicators with bar charts. In order to make clear the meaning of each chart, a description box will be presented with the indicators description. This page is meant to support NSL meetings and discussion, making fully transparent the discussions around effects and impacts of the considered pathways. On the other hand, to fully understand the meaning of these results, projected in the future, all the assumptions included in the modelling exercise and in the project in general should be accessible. For this reason it will be reserved for DAFNE partners and stakeholders who will have the essential background to understand them, but there are no plans for providing public access.

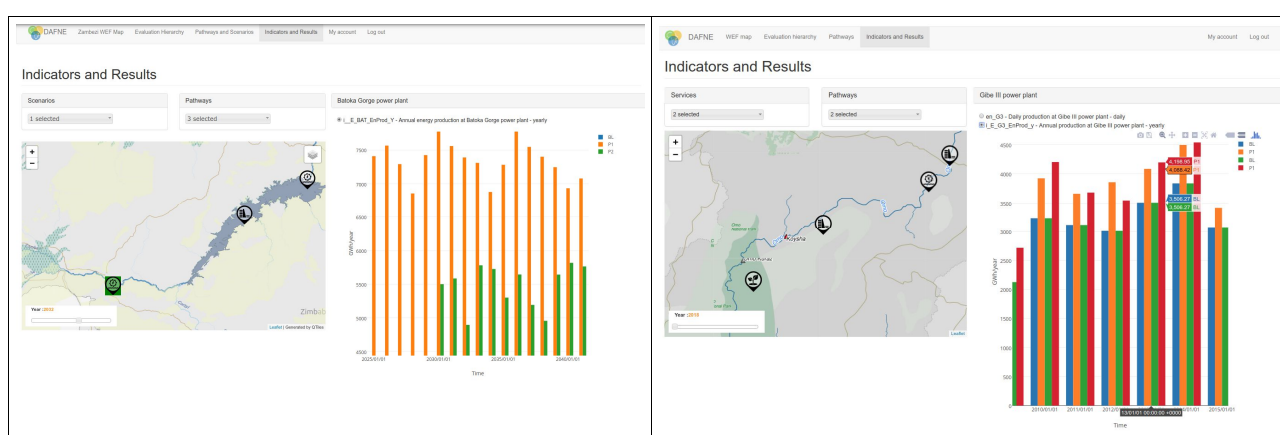


Figure 8 – Screenshot of Indicators and results page from the DAFNE Geo-portal prototype on the Zambezi (left) and Omo-Turkana (right) case studies

## 4.2 FEEDBACK FROM THE NSL SESSIONS

The features of DAFNE Geoportal described in this section have been presented to participants of the first NSL session in Lusaka. During the discussion positive comments have been made and key cross-cutting feedback has been expressed related to the possibility for stakeholders to directly contribute data and information to the framework, especially concerning emerging issues, indicators definition or planned action.

This suggestion has been seriously taken into account by the DAFNE team and two possible solutions have been identified:

1. enhancing the profile of stakeholders users of Geoportal, adding the privileges of “contributor”, with the possibility of posting comments in the reserved area related to specific content in order to propose changes and improvements. This solution could be useful mainly for technical contents, like indicators or spatial data, where the additional work of translation between stakeholders’ input and jargon or formats adopted in DAFNE would in any case be necessary.
2. enhancing the profile of stakeholders users of the Geoportal, adding the privileges of “author” with the possibility of directly adding new items through a web form and Geoportal management functionalities, or propose contents changes or corrections to existing items. This solution could be more suitable when the stakeholder is also the data holder and he/she has the best knowledge for implementing changes and updating the data itself.

Both of these two solutions are technically feasible and could also be developed in a complementary way: some related tests have been scheduled in the Geoportal development process in order to understand how to fully meet the requests of stakeholders.



During the NSL session in Addis Ababa other positive feedback has been provided and a request for more direct involvement has also been expressed, specifically in the development and population of the platform with a comprehensive set of data.

## 5 MULTI-PERSPECTIVE VISUAL ANALYSIS TOOLS

### 5.1 CONCEPT AND DESIGN

There is a substantial difference between the stakeholders in terms of their affinity with technology, their professional background, and their experience with respect to using data-driven visualization tools that allow them to assess the merits of solutions for WEF issues. To account for these differences, a user-centred design approach is needed that considers the needs of different stakeholders, matches these against technological constraints and opportunities, and subsequently develops a visual analysis tool in an iterative way, alternating between development and stakeholder consultation. The user-centred design process that is adopted in DAFNE is depicted in Figure 9.

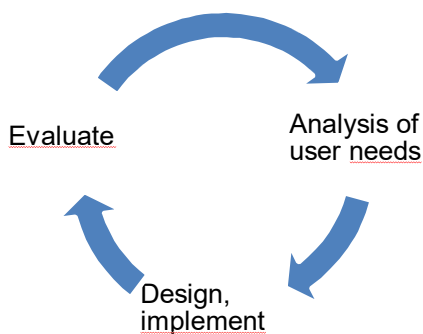


Figure 9 – User-centred design process.

In the first step, the analysis of user needs, the output of the stakeholder and actor analysis, as well as the results of the kick-off meetings have yielded insights into the needs of stakeholders with respect to the negotiation simulation lab. Future stakeholder consultations will continue to refine the project's understanding of these needs, which feed into the design and development process.

In the second phase, the design and implementation phase, two processes converge: user pull and technology push. While user pull reflects the specific needs and requirements of the stakeholders with respect to possibilities of a visual analysis tool and their usefulness for their decision making in practice, technology push reflects the technological opportunities DAFNE wants to employ, extend, and apply to the two case studies in the Zambezi and Omo river basins (e.g. the decision analytic framework and the underlying modelling approach for the water-energy-food nexus). In the first iteration, the result of these two processes is a conceptual design, a set of visuals resembling screenshots that reflect what the tools could look like (mock-ups), which features it will contain, and how users could interact with it. In later iterations, the outcome of this phase will be the subsequent versions of the tool that is then implemented as working software.

In the third phase, the output of the second phase is evaluated with stakeholders. The evaluation starts a new loop as the feedback received provides additional information about the stakeholder's needs, as well as input for the design and development of the visualization tools.

The results of the stakeholder analysis distinguish between two types of users:

- Experts from the water, energy, or food domain who seek to obtain an in-depth understanding of solutions, pathways, and indicators as well as gain insights into trade-offs. Such users sometimes use analytical visualization tools for their daily work
- Non-expert users who have a stake at the decisions that are made along the WEF nexus, but who are typically not using such visualization tools for their daily work.

The first types of users within both river basins are more likely to benefit from using the Geoportal, as it is adapted to the needs of this user group. The second type of users would mainly need a different type of a visual analysis tool, that is suitable to be used both in group discussions and for individual analyses. The conceptual design for this tool is addressed in this section, while the Geoportal is addressed in Section 4.

Whereas visualization tools for complex geospatial and time series data often require background knowledge to grasp the conveyed information, in this case an easy-to-use, easy-to-understand solution is required that allows users to:

- visually explore the interrelationship between water, energy and food perspectives and related sectors, based on selected indicators and underlying data
- familiarize users with the concepts from the decision analytic framework
- support users in gaining a better understanding of the impact of certain solution pathways on different sectors and associated indicators

The conceptual design that explains the foreseen functionalities of a visual analysis tool to be used as part of the NSL is presented below. It allows for the interactive exploration of solution pathways and indicators from different perspectives in an easily understandable way, while promoting the understanding of the impact of the different solution pathways beyond one's own sector. The mock-ups provided below include specific examples for the Omo-Turkana basins (similar mock-ups have been used for the Zambezi basin<sup>2</sup>). Based on these examples the envisaged functionality of the tool is explained.

First, as presented in Figure 10, users see the status quo pathway reflecting its impact on the 4 indicators (columns) when no further action is taken over a given time period. In the depicted example, the selected status quo pathway highlights the problem that while the impact on the yearly average flood peak would be positive (green marker, highlights the indicator most positively affected), this would come at the cost of lower yearly average yield in Ethiopia (red marker, highlights the indicator most negatively affected). Note that no units of measurement are represented on the Y-axis. This approach is intended to offer an at-a-glance understanding of the impact of a pathway on the indicators, offering first high-level information, while a more detailed assessment can be done by expanding an indicator. Also, the underlying scale is normalized from 0 to 100, where the higher value corresponds to the better performance on the depicted indicator.

At the top of the screen, users can select a scenario for changes in exogeneous conditions, such as climate conditions or socio-economic conditions. The impact of the solution pathways on the indicators is then adapted based on the selected scenario (pre-calculated to allow for offline exploration).

While by default the current status quo is selected, users can manually select different solution pathways to explore their impact on the selected indicators (see Figure 11).

In Figure 11, the manually selected solution pathway 1 can be compared to the status quo pathway, which are now both selected. It is now visible to the user that in this example, solution pathway 1 (high energy development in Ethiopia, minimum agricultural expansion, no fishery protection measures) would have a more positive impact on the yearly average yield in Ethiopia, but a more negative effect on the yearly average lake water level in Kenya.

<sup>2</sup> The mockups for the Zambezi case can be found in the M37 report (*NSL technical implementation plan ready in preliminary form*)

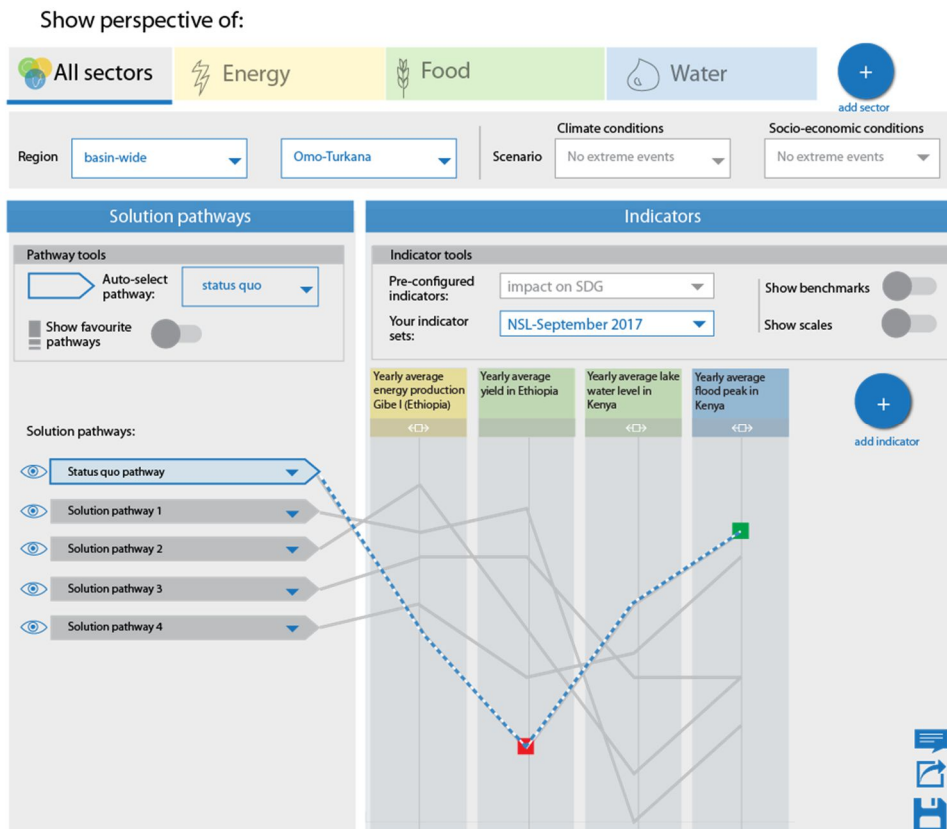


Figure 10 – The DAFNE visualization tool: Visualizing the impact of different solution pathways on sector-related indicator. By default, the Status Quo pathway is highlighted.

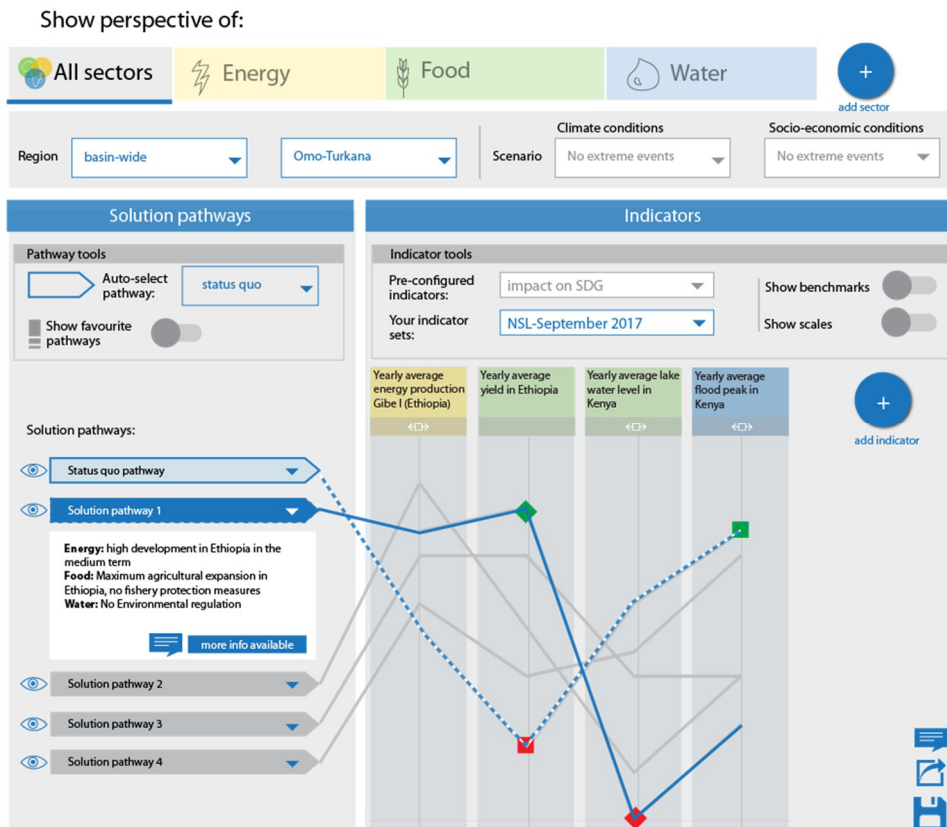


Figure 11 - Effect of solution pathway 1, compared to the status quo.

Upon a selection of a solution pathway, users can choose to inspect it in more detail (see Figure 11). First, a textual summary of the actions that are undertaken in the selected pathway is provided at the top. In addition, users can explore the pathway using a slider to show the actions linked to the solution pathway over time projected on a map, with different colours representing water, energy, and food developments. Larger circles represent e.g. higher capacity of a hydro-power plant (yellow), or size of irrigation area (green circles). The full functionality would be available in the Geoportal, which this view links to, but it is important that already in this view a pathway can be analyzed to some extent.

Users are also supported in gaining a better understanding of the meaning of an indicator as depicted in Figure 13. When users ‘expand’ such an indicator, they get more information about the indicator, including the scale the indicator is scored on (e.g. the Y-axis), a textual explanation of the importance of the indicator, and links to the Geoportal where a more in-depth location-based exploration of the impact can be done.

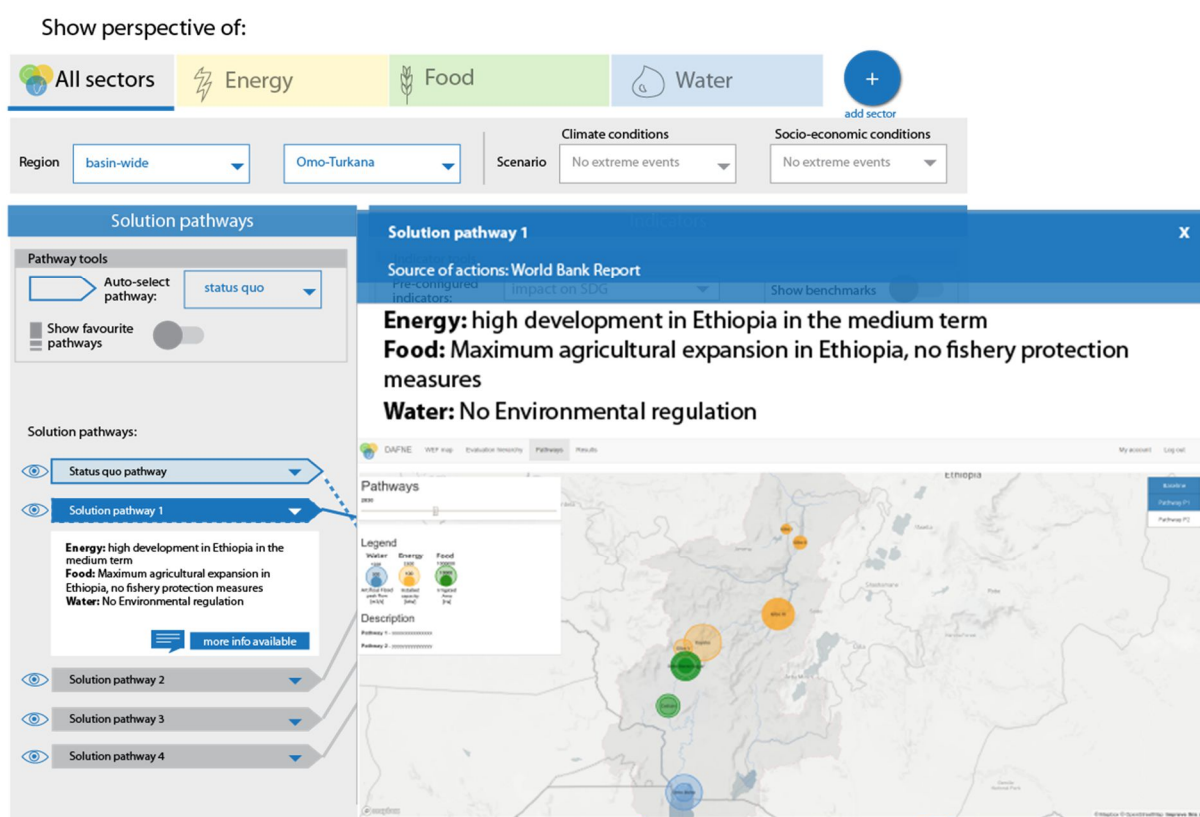


Figure 12 – Map-based and time-based analysis of solution pathways.

Even though default indicators are selected in the beginning, e.g. based on the main discussion topic, users can manage the indicators that are displayed in the graph (see Figure 14). This allows to adapt the view over the course of a discussion, and get a better understanding of the whole solution space and its impact.

As the NSL serves to support finding solutions that best manage the trade-offs for the involved stakeholders from the three nexus dimensions, comparing alternative solution pathways in terms of the indicators is an important part of the visualization. For this purpose, users can select one or more indicators, for which subsequently the estimated best pathway is highlighted in green (see Figure 15).

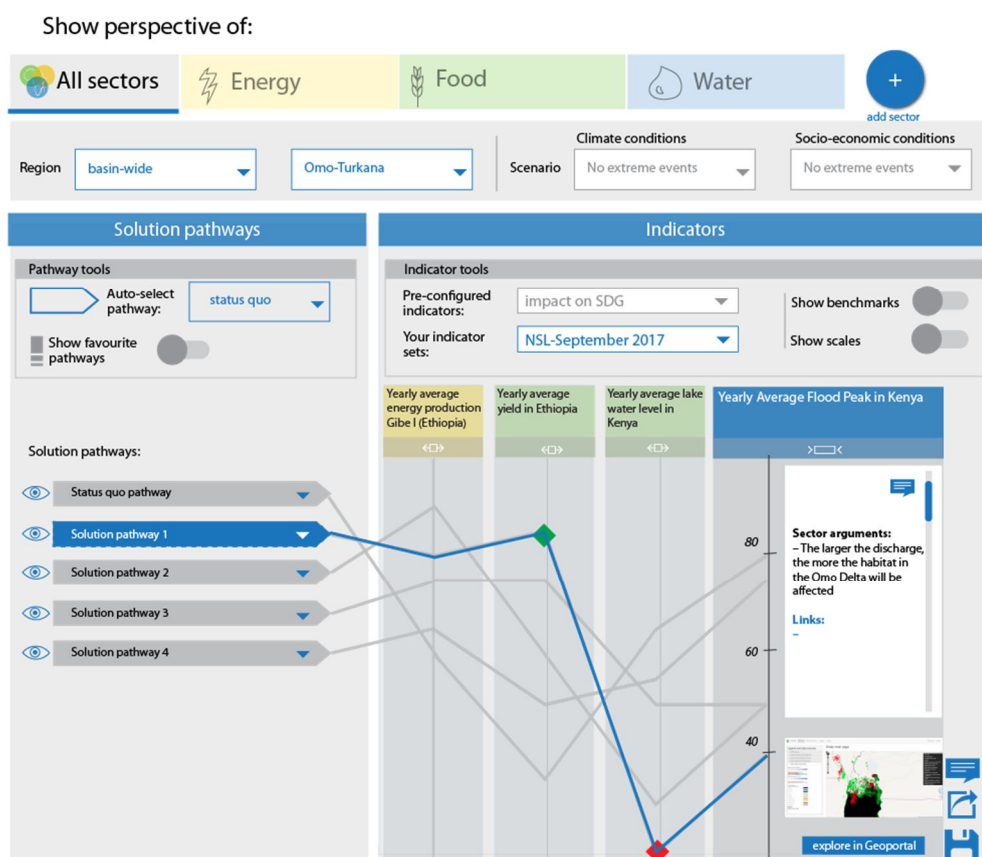


Figure 13 – Support for the user's understanding of indicator by expansion.

Manage indicators		
show	sector	
<input checked="" type="checkbox"/>	E	Yearly average energy production Gibe I
<input checked="" type="checkbox"/>	F	Yearly average yield in Ethiopia
<input checked="" type="checkbox"/>	F	Yearly average lake water level in Kenya
<input checked="" type="checkbox"/>	W	Yearly average flood peak in Kenya
<input checked="" type="checkbox"/>		Indicator 5
<input checked="" type="checkbox"/>		Indicator 6
<input checked="" type="checkbox"/>		Indicator 7
<input checked="" type="checkbox"/>		Indicator 8
<input checked="" type="checkbox"/>		Indicator 9
<input checked="" type="checkbox"/>		Indicator 10
<input checked="" type="checkbox"/>		Indicator 11
<input checked="" type="checkbox"/>		Indicator 12
<input checked="" type="checkbox"/>		Indicator 13
<input checked="" type="checkbox"/>		Indicator 14
<input checked="" type="checkbox"/>		Indicator 15
<input checked="" type="checkbox"/>		Indicator 16
<input checked="" type="checkbox"/>		Indicator 17
<input checked="" type="checkbox"/>		Indicator 18
<input checked="" type="checkbox"/>		Indicator 19
<input checked="" type="checkbox"/>		Indicator 20

Figure 14 – Managing indicators.

Selecting one of the nexus dimensions at the top of the tool allows for sector-based exploration of the impact. Benchmark values for the user's sector can be entered to filter out solution pathways that are unacceptable from the currently selected sector's point of view and identify those that are (see Figure 16). In this example, the Food sector is selected, and the user can drag the benchmark indicator to the appropriate value. One can also identify benchmark ranges, the highest and the lowest acceptable value for each of the indicators.

Finally, a best possible compromise can be displayed, given the benchmarks that are set for each of the individual sectors (see Figure 17). We see that in this case, average indicator values turn out to be mainly satisfying all of the set benchmark sectors.

Show perspective of:

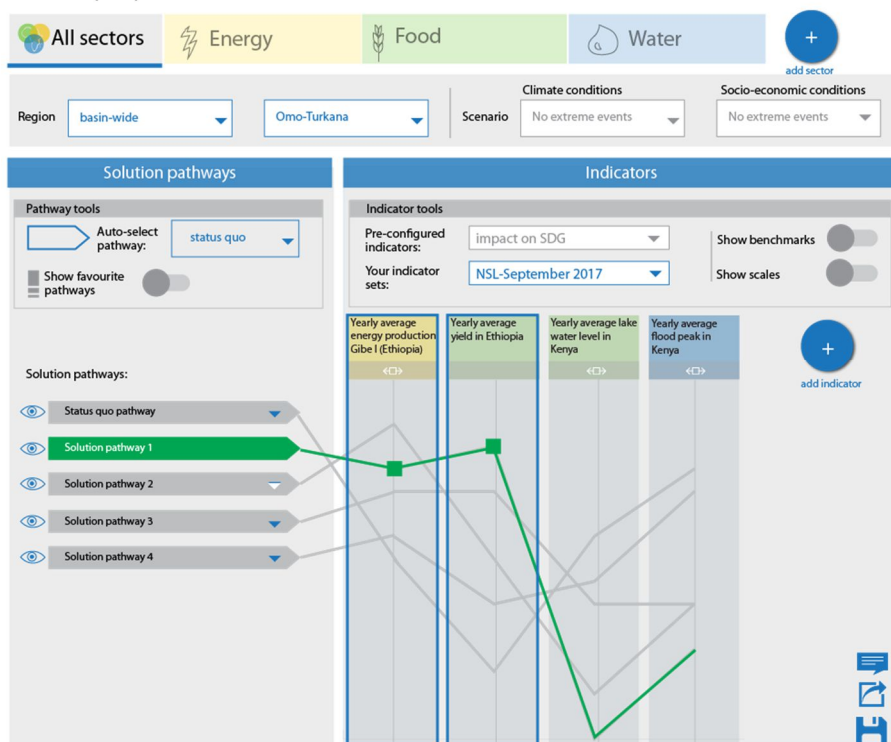


Figure 15 – Select multiple indicators to identify the best pathway for these indicators.

Show perspective of:

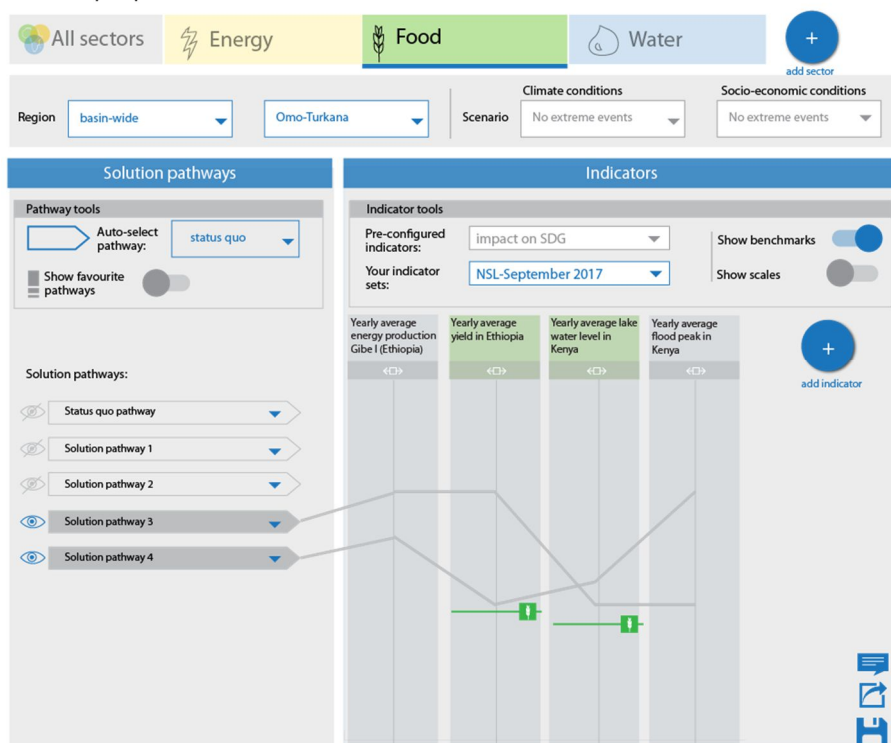


Figure 16 – Sector perspective on indicators, with benchmarks to identify acceptable solutions.



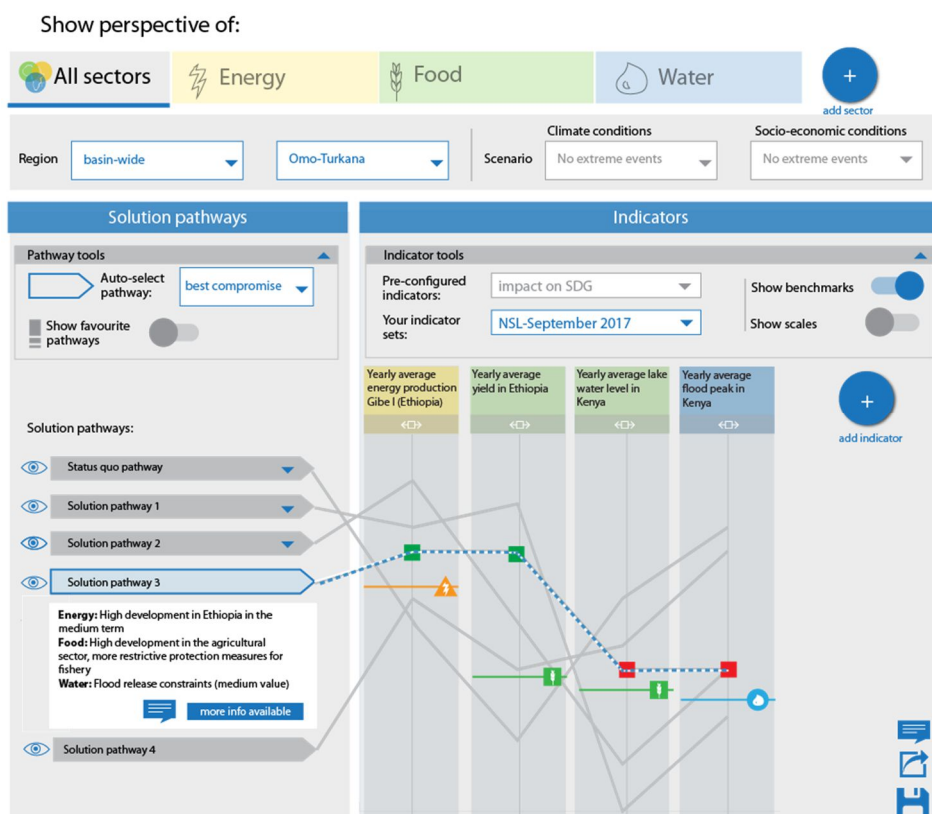


Figure 17 – Best possible solution, given benchmark values defined by different sectors.

## 5.2 FEEDBACK FROM THE NSL SESSIONS

### Feedback from the Zambezi NSL

During the first NSL meeting in Lusaka the mock-ups were presented to the participating stakeholders with the purpose of collecting feedback on the underlying concept (rather than on the specific user interface and interaction design). The mock-ups depicted and explained in the previous section were shown, alternated with questions to collect feedback.

The participants positively evaluated the visualization concept that was presented. Their contributions to the discussion reflected an understanding of the underlying concepts (e.g. solution pathways, indicators, benchmarks), as well as the types of analyses that can be done using the visualization tool. Participants also reflected on the use of the NSL beyond the lifetime of DAFNE, making a plea for integration with existing solutions (as addressed in *Task 7.5 – Communication and dissemination in local communities and at cross-African level (M1-M48)*).

Furthermore, participants appreciated the contribution the NSL can give to negotiation processes, providing the participants with data-driven insights into the position of stakeholders. In that case, particularly the display of the optimal solution pathway was considered useful, as from the participants' experience alternative procedures for accomplishing this purpose often lead to unbalanced results. Nevertheless, one consideration was mentioned that should be taken into account: when an optimal solution is pointed out, the attention of participants can shift from understanding and visualizing trade-offs between the WEF dimensions to this optimal solution pathway only.

Stakeholders also expressed that they would like to see the impact of solution pathways for different geographic levels (local, regional, basin-wide). They argued that the impact of a solution pathway may not occur at the same location as the solution is implemented. This is currently not yet represented in the concept. This particularly affects environmental indicators.

On a more detailed level, some questions were asked, concerning the flexibility of the decision analytic framework, and required simulations in adding, or updating indicators and data, as well as questions that were triggered by the particular examples that were shown in the conceptual design:

- Representation of proxy indicators in the design.
- The opportunity to add additional information (e.g. documents) as arguments in favor of or against certain solutions.
- Comparability of the indicators. To avoid complicating the visualization of pathways, the Y-axes and units of measurement were intentionally left out. However, participants asked for the approach with which the indicators can be made comparable.
- Inclusion of socio-economic and environmental indicators. While planned to be included in the modelling, sociodemographic and environmental indicators were not part of the examples that were shown in the conceptual design.
- Prioritization of indicators. Participants wanted to express the relative importance they attribute to certain indicators and solutions above others. While this can be done by setting thresholds, participants requested to consider different ways of expressing this importance, for example by annotating certain indicators or solutions.
- Given the different languages used in the Zambezi basin, translation to other languages was perceived important. Portuguese was considered the most important addition, since Portuguese is spoken in Mozambique, where the Luia sub case is located.

### Feedback from the Omo-Turkana NSL

Again, similarly to the Zambezi NSL, the participants of the Omo-Turkana NSL positively evaluated the visualization concept that was presented. Their contributions to the discussion reflected an understanding of the underlying concepts (e.g. solution pathways, indicators, benchmarks), as well as the types of analyses that can be done using the visualization tool. They especially liked the functionality to set specific benchmarks, to view the optimal pathway for selected indicators, the temporal dimensions of the indicators, as well as the ability to reach a cross-sectional perspective of the solutions that are optimal for a wide range of stakeholders. This consistently positive feedback is supported by the project processing the feedback that was received during the first NSL session in the Zambezi basin. It demonstrates that almost all of the identified issues in Lusaka have been resolved, save from the request from stakeholders in both basins to see the impact of solution pathways for different geographic levels (local, regional, basin-wide). Nevertheless the discussions also pointed out a number of reflections on the WEF modelling and the modelling of pathways, and indicators. For reasons of completeness, they are listed below.

Some clarification issues needed to be solved to ensure full understandability of the concept. First, in line with the DAFNE stakeholder involvement approach, it was pointed out that the indicators should be provided by the stakeholders, by stating which ones are important to them and to which extent. After the meeting, the stakeholders will be provided with the list of indicators that were discussed and they should provide their opinions about the importance of each of them and/or include the missing ones. Based on their input, the hierarchy of the indicators and the utility functions that describe them will be set. Second, the stakeholders will not be able to change the parameters of the final model, but they will be able to explore the solution space which reflects the needs of their sectors and agree on the compromise solution. It was stressed that the tool will give support and negotiation power to the sectors, but the agreement about the final integrated solution should be achieved by the sectors themselves. Other more detailed reflections include:

- Stakeholders desired to know how the indicators are measured. They were especially concerned about the indicators which cannot be directly measured with an objective value, such as the impact on the societal benefits which is quite complex that can only be estimated in the long term. This is foreseen in the model by using functional representations and historical data. In the tool, the stakeholders will have the possibility to explore each indicator in detail and see how it is measured by checking the detailed view similar to the one presented in Figure 13. We can consider adding more information to this detailed view to cater for this need.
- Stakeholders were expressing a wish to view the hierarchy of the indicators, i.e. how individual indicators map into the aggregate ones which were selected for optimization in the model.



This functionality can be considered to be added either in the Geoportal or the visualization tool.

- Some stakeholders desired to have separate models for separate parts of the basin, e.g. one upstream and one downstream. In the tool, the local perspective is provided by separating the exploration of the indicators by country, basin, region. However, there is just one underlying model that takes into account the impact on all the indicators. We can, however, consider to expand the local perspective by enabling viewing the indicators only relating to specific parts of the basin.
- The stakeholders were worried whether the tool can take into account the changing environment so that it can be useful in the future. The temporal dimension is inherent in the model: one considers the impact on the indicators in the span of 15-20 years. Also, the tool can show the solution pathways under different scenarios, also under any extreme conditions that can be foreseen by the model. Additionally, we can consider including more information about the development of the indicators over time in the detailed view of the indicator in question (either in the Geoportal or the visualization tool).
- The stakeholders were wishing that the tool could show the integrated cross-sectoral integrated perspective. However, it is not the aim of the tool to provide the single solution to a specific problem, but to expose the stakeholders to a range of solutions which they can use to negotiate on the final solution depending on their needs. We can consider to model integrated indicators but these indicators have to be communicated by the stakeholders.
- Finally, the stakeholders were wishing to see robust indicators, which will be there no matter which pathway is selected. The stakeholders can always keep the indicators in the tool that interest them, and then identify the pathway which is robust to the selected indicators similar to the example presented in Figure 17.

Similar to the NSL workshop in Zambezi, both the positive feedback and the type of issues that were raised during the NSL meeting in Addis Ababa demonstrated that participants grasped the concepts behind the visualization and the underlying decision analytic framework, and were able to articulate their wishes, in terms of indicators that should be taken into account, types of analyses they wished to do, and the added value they could derive from the NSL for *real* negotiation situations.

## 6 IMPLEMENTATION PLAN

The previous sections have introduced the two main NSL tools, encompassing the DAFNE Geoportal, targeted at technical experts, which also integrates and stores all available datasets, and a knowledge visualization tool for all (less technically savvy) stakeholders. In addition to the mock-ups (multi-perspective visual analysis tool) and early prototypes (geo-portal) presented in Sections 5 and 6, this section defines the planned functionalities and the roadmap for the development and evaluation of these tools in the DAFNE NSL, and situates them in the planned stakeholder interaction process.

### 6.1 PLANNED ONLINE STAKEHOLDER INTERACTION

The support for the continuous stakeholder involvement in the DAFNE development process will be bundled in an online stakeholder interaction on the DAFNE website. This area shall provide a “one-stop shop” access point for the DAFNE stakeholders. It will include both the access to the reports of the DAFNE NSL workshops in the basins as well as access to the DAFNE tools for the stakeholders (geo-portal, visualization and discussion tool).

The basis for the implementation of the stakeholder online interaction platform and the related DAFNE tools is the defined lightweight process for stakeholder involvement connecting face-to-face meetings and online interaction. This process follows the participatory integrated planning methodology underlying the DAFNE project and aligns its implementation with the practical constraints identified in the field. The two main practical constraints are: the limited and unreliable

bandwidth of Internet connectivity in both the Zambezi and Omo-Turkana cases, and the difficulty in ensuring the continuity of stakeholder representation in the NSL workshops. The former is a concern because due to Internet connectivity limitations the original idea of online meetings had to be discarded at the request of the stakeholders, pointing to a need for an asynchronous online interaction process. The latter is a concern, because as is often the case in multi-stakeholder processes that occur over large spans of time, while the participating actors may be committed to be continuously represented in the process, this may not always involve the same persons (e.g. due to different levels of delegation and representation for different occasions, or simply constraints in availability of specific persons on specific dates).

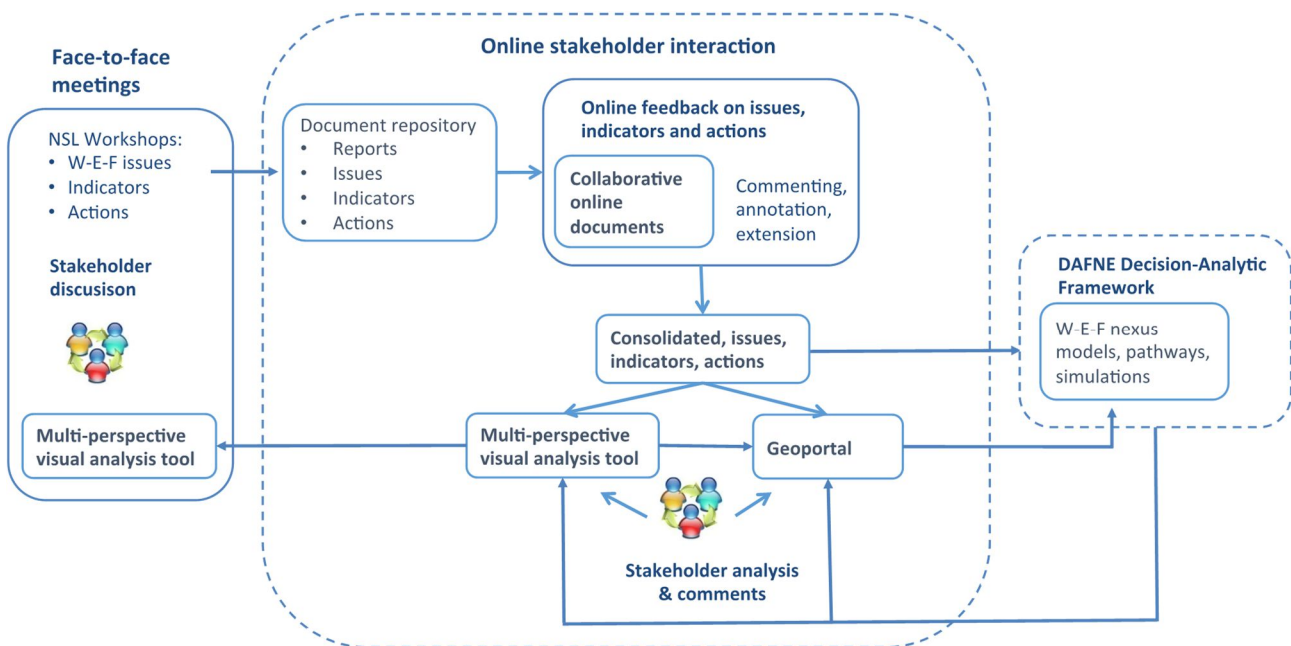


Figure 18 – Planned stakeholder interaction through face-to-face NSL workshops and online stakeholder interaction platform

Accordingly, the interaction process has been designed in such a way to support continuous stakeholder involvement in an interplay of face-to-face meetings (NSL workshops) and asynchronous online involvement between them. The overall structure is depicted in Fig. X. Starting from face-to-face meetings in the NSL workshops the results of the stakeholder discussion and the identified W-E-F issues, indicators and actions (for a given basin) are provided in form of reports and structured documents in the online stakeholder interaction area (document repository). These can then be inspected by the stakeholders, verified, corrected, extended and/or commented upon. The results of this online stakeholder feedback are then consolidated and the resulting consolidated issues, indicators and actions are input into the DAFNE decision analytic framework. They are also input into the Geo-portal where they are also made accessible to the stakeholders in a geo-based visualization.

The developed W-E-F nexus models and pathways are updated and refined accordingly and the simulations of the pathway effects performed. Such stakeholder involvement in discussing the constituents of the underlying issues, indicators, solutions, and pathways is important, because the quality and correctness of these elements defines the appropriateness of the modelling and simulation algorithms and their subsequent visualizations. Also such stakeholder involvement ensures that the identified issues, indicators and solutions are relevant and important to them (and the different perspectives on the nexus), and thus can facilitate their acceptance of the results, the tools and the process itself. Therefore, an iterative feedback process is needed in which all stakeholders can revise all interim results relevant to them, i.e. to not only test and evaluate the tools over the course of their iterative development, but also to provide feedback on issues, pathways, indicators

and their underlying data sources in order to maximise the effectiveness of the NSL and to improve and fine-tune the implementation process according to their needs.

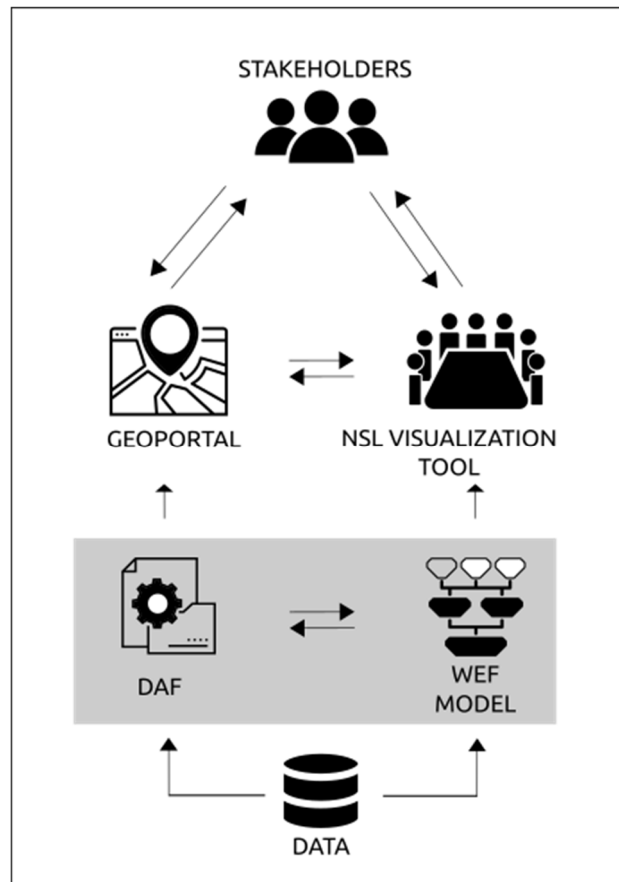


Figure 19 – Relationship between the Geo-portal, multi-perspective visual analysis tool and the decision-analytic framework.

The results of the new models and simulations are provided in the Geo-portal and the visual analysis tool and through them made available to the stakeholders in the online interaction area. The stakeholders can now use the visual analysis tool online to analyse the effects of main pathways on the different indicators and identify possible trade-offs and or candidates for compromise solutions in an easy-to-use way. They can also use the geo-portal for more detailed technical analysis of the different elements of the pathways and indicators. In this way, they can obtain insights relevant for their work and prepare for the next NSL workshop discussions. The insights and observations that they obtain in the process, can be remarked as comments in the different views of the visual analysis tool. At the next face-to-face meeting in the NSL workshops the tool is then used to discuss the results of the DAFNE simulations with respect to the different pathways and their impact on different sectors and indicators in a multi-stakeholder discussion. The results of the discussion are again reported in the stakeholder interaction area, and the described process is repeated once more, leading to the final DAFNE NSL workshop where consolidated results and findings are presented and discussed with the stakeholders.

## 6.2 PLANNED FUNCTIONALITIES FOR COLLABORATIVE DOCUMENT INTERACTION AREA

The goal of the collaborative document interaction area is to provide lightweight possibilities for stakeholders to easily access and give their feedback and extensions to the results of the NSL face-to-face workshops. They should be able to easily access the NSL workshop reports and identified issues, indicators and actions, to verify, correct and extend them, and/or comment and provide feedback on their relative importance from their perspective. While provided individually, this

input should be visible to all stakeholders, so that they can inspect and comment upon them. This should be possible without complex authentication processes, while still ensuring protected access to participants of the DAFNE stakeholder group involved in the process, as well as a simple means of identifying (or marking) individual contributions. The planned functionalities are summarized in Table 5.

Table 5 – Planned functionalities for Collaborative Document Interaction Area.

Functionality	Description
Access to NSL output	Easy access to NSL workshop reports Restricted access to DAFNE stakeholder groups without complex authentication processes.
Feedback	Easy access to identified issues, indicators, actions Opportunity to verify, correct, and extend outcomes Opportunity to indicate relative importance Visibility of feedback to stakeholders, with possibility to remain anonymous

This part of development has already been anticipated ahead of plan in order to support online stakeholder involvement as early as possible. A collaborative document interaction area addressing these planned functionalities has already been implemented and integrated into the DAFNE Website for easy access (one-stop shop) for the Zambezi case study. This is a restricted website area that can be accessed only with a password provided to stakeholders participating in the Zambezi Negotiation Simulation Lab. The area provides a simple to use repository listing the documents containing the results produced in the 1<sup>st</sup> Zambezi NSL workshop, structured into overall report and the documents corresponding to issues, actions and indicators (Figure 18).

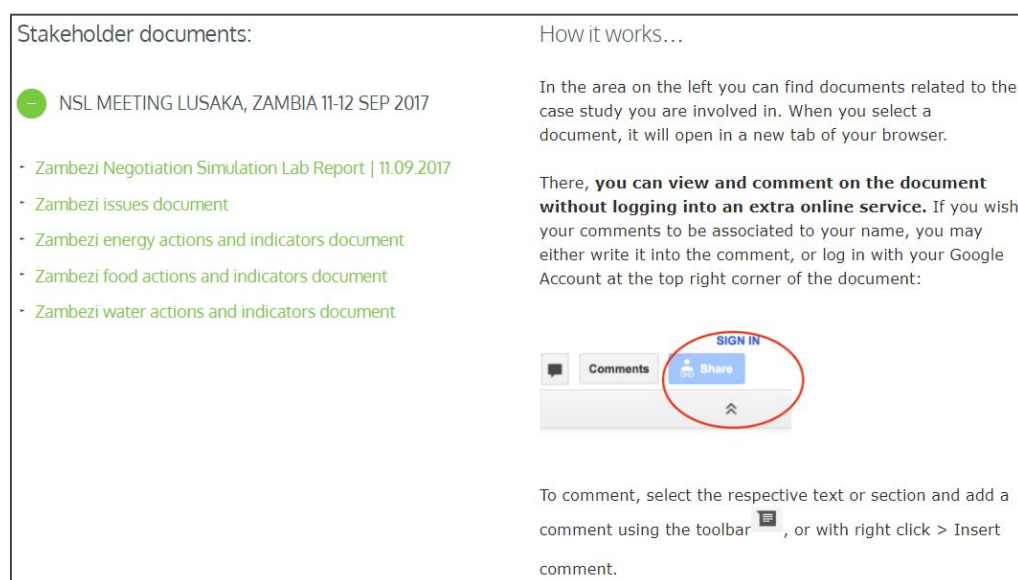


Figure 20 – Snapshot of the current status of the Zambesi stakeholder interaction area

The documents can be both accessed for reading by simply clicking on them, or they can be commented and extended by the stakeholders through different collaborative document editing functionalities. This has been achieved by integrating the Google docs and Google sheets API in a way that allows the stakeholders to directly provide comments to the individual elements in the document without having to log into an extra online service (e.g. without logging in with a Google Email address). To associate their input with a personal identity the stakeholders can simply manually

prefix their comments by their name (or initials). If they want to have more sophisticated control of the document editing and have their inputs automatically associated to their names, they can log in with their Google Account. Either way, the documents can be reviewed and feedback or extended input provided. In this way, all stakeholders can easily perform a collaborative review the project's working documents on their respective W-E-F-Nexus issues and the identified actions and indicators, and provide their feedback and additional input.

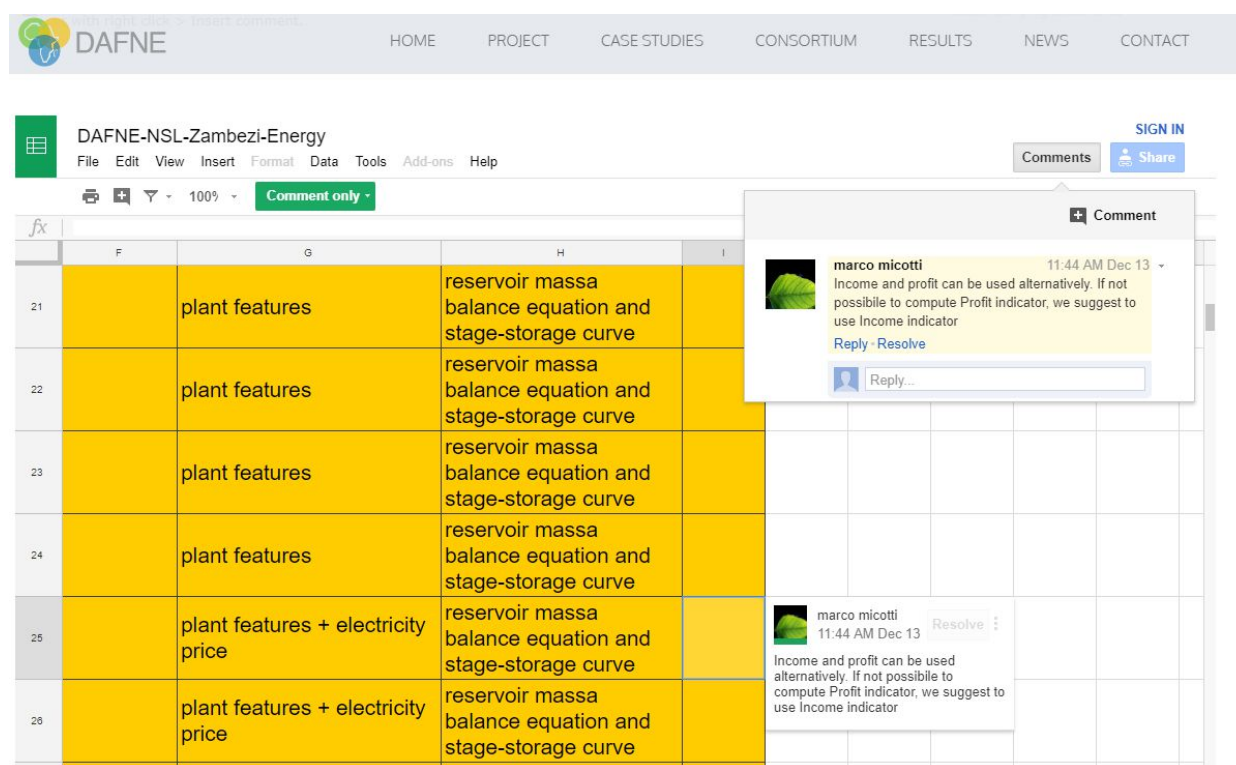


Figure 21 – Example snapshot of a collaborative document on actions and indicators in the energy sector in the Zambezi basin'

### 6.3 PLANNED FUNCTIONALITIES FOR MULTI-PERSPECTIVE VISUAL ANALYSIS TOOL AND DAFNE GEOPORTAL

For both tools a list of planned functionalities has been composed, informed by stakeholder needs, early concept ideas, pre-existing solutions, and the feedback that has been collected during the first NSL meetings in the Zambezi and in the Omo-Turkana basins on both the multi-perspective visual analysis tool and the Geoportal. In this sub section we list the planned functionalities. Table 6 outlines the main planned functionalities for the multi-perspective visual analysis tool.

The implementation of these functionalities is guided by the need for ease-of-use as to ensure that all stakeholders can get involved in discussions about solution pathways and trade-offs between WEF sectors and associated indicators.

Whereas for the multi-perspective visual analysis tool the need for ease-of-use is key, the Geoportal should enable an in-depth analyses and access to the datasets, models, and simulations that are developed in the project, providing expert users with a powerful tool for detailed technical analyses of scenarios, solution pathways, indicators, and trade-offs between sectors. Starting from discussion and feedback got during the first NSL session, DAFNE Geoportal will provide a number of functionalities to interact with the underlying data and knowledge base, which are listed in Table 7.

Table 6 – Planned functionalities for the multi-perspective visual analysis tool.

Functionality	Description
Visual display of a set of best candidate pathways provided from the decision-analytic framework	<ul style="list-style-type: none"> <li>Visual display of solution pathways and their impact on indicators, based on selected climatic and socio-economic scenarios from the decision-analytic framework.</li> </ul>
Selection of the unit of analysis	<ul style="list-style-type: none"> <li>Selecting a unit of analysis between basin level and national level to preselect the indicator sets associated to these perspectives</li> </ul>
Define a sector perspective	<ul style="list-style-type: none"> <li>Selecting indicators to associate with a perspective of a specific stakeholder sector</li> </ul>
Select and display a sector perspective	<ul style="list-style-type: none"> <li>Selecting a perspective of a specific sector will select a set of indicators associated with that perspective and display the impact of the pathways on these indicators</li> </ul>
Manual selection of indicators	<ul style="list-style-type: none"> <li>Manually determining a set of indicators against which to inspect the impact and trade-offs between pathways by adding and removing indicators from display.</li> </ul>
Select integrated (multi-sectoral) perspective	<ul style="list-style-type: none"> <li>Selecting the integrated (multi-sectoral) perspective will display the aggregated indicators for each sector and the impact of pathways on them</li> </ul>
Comparison of pathways	<ul style="list-style-type: none"> <li>Selecting pathways for comparing one solution option to another</li> <li>Comparison of alternative pathways to status quo pathway</li> </ul>
Threshold setting	<ul style="list-style-type: none"> <li>Setting threshold values for indicators for assessing acceptable solution pathways and using them to identify acceptable pathways for a given set of indicators.</li> </ul>
Filtering pathways	<ul style="list-style-type: none"> <li>Filtering pathways based on selected indicators and thresholds</li> </ul>
Indication of favorite pathways	<ul style="list-style-type: none"> <li>Indicating the user's favourite solution pathway, to identify the pathways most stakeholders agree on.</li> </ul>
Annotation	<ul style="list-style-type: none"> <li>Annotation and commenting of solution pathways and indicators.</li> <li>Annotating indicators to express relative importance.</li> </ul>
Import	<ul style="list-style-type: none"> <li>Import of a best-candidate set of solution pathways and indicators from the geo-portal, reflecting the decision-analytic framework W-E-F model, and the simulation and optimization results</li> </ul>
Saving a given view and results of analysis	<ul style="list-style-type: none"> <li>Saving a given view of the visualisation created by the user (selected indicators, pathways and comments)</li> </ul>

Both tools support stakeholder feedback, depending on the different level of technical expertise and technology affinity. As the outcomes stakeholder discussions have shown that the technical infrastructure for online meetings is not available (bandwidth, connectivity) both tools support asynchronous contributions to the discussions, allowing for all stakeholders to participate, regardless of their technical infrastructure or level of experience.

#### 6.4 TECHNICAL IMPLEMENTATION ROADMAP FOR THE NSL

The development process for the NSL tools is strongly related to the consultation of stakeholders, following the user-centred design approach presented at the beginning of this section. The roadmap for the technical implementation of the NSL and the stakeholder involvement is provided in Figure 20.



Table 7 – Planned Geoportal functionalities.

Functionality name	Description
Import	Interface for bulk import of action and indicators
WebGIS	Dynamic and customisable map, able to view and contrast geographic data from different sources and resolution;
Evaluation hierarchy chart	A customizable view of the evaluation hierarchy, where criteria, sub criteria and indicators could be proposed or commented by stakeholders;
Spatio-temporal maps	Interactive browsing and in-depth analysis of pathways and scenarios, covering both spatial and temporal dimensions.
Time series dynamic viewer	Interactive time series analysis of indicators and models outputs, with the possibility to dynamically change the time-scale, add or remove on the fly different scenarios and pathways, export the generated chart in an image format to be used outside Geoportal.
User management	Refinement of authoring privileges to include 'contributor' (for technical content, such as indicators or spatial data) and 'author' (e.g. proposals for adding / changing content).
Commenting	Possibilities for authorized users (participating stakeholders) to add comments to content (e.g. to indicators and actions)
Export	Interface for selective export of variables, indicators and information for the NSL multi-perspective visual analysis tool.

As it can be seen from Figure 20, the planned stakeholder consultations are intertwined with milestones on the technical implementation roadmap, feeding stakeholder feedback into the development process of the NSL tools at every stage of the design process. Figure 18 also shows that initial introduction meetings are organized through a stakeholder workshop, with the purpose of establishing a foundation for collaboration with stakeholders. For the Zambezi, this took place in the Zambezi in February 2017 and was followed by the first NSL in September 2017. For the Omo-Turkana basins it took place in February 2018. A final face-to-face NSL will take place in year 4 of the project when the final and most important NSL takes place in order to validate solutions and define pathways as a result of outputs from WP5. Intermediate NSL workshops will take place in between, with a plan to hold one more NSL workshop in each case study in 2019. Though not originally planned, these meetings were identified as highly desired by participants and have thus been added to the roadmap.

In addition, as described in Section 6.1, the NSL online interaction area supports asynchronous online interaction for stakeholder involvement in-between the face-to-face NSL workshops. After each workshop and after the main technical implementation milestones, the obtained results are provided online to the stakeholders for their analysis and feedback. This includes both the issues, indicators, actions and the pathways resulting from the simulations as well as the geo-portal and multi-perspective visual analysis tool developed for the NSL which they can use to analyse the DAFNE results so far (see Section 6.1 for details). In this way a continuity in the engagement of the stakeholders in the project is ensured, in order to further develop indicators, validate interim results and refine solutions and pathways.

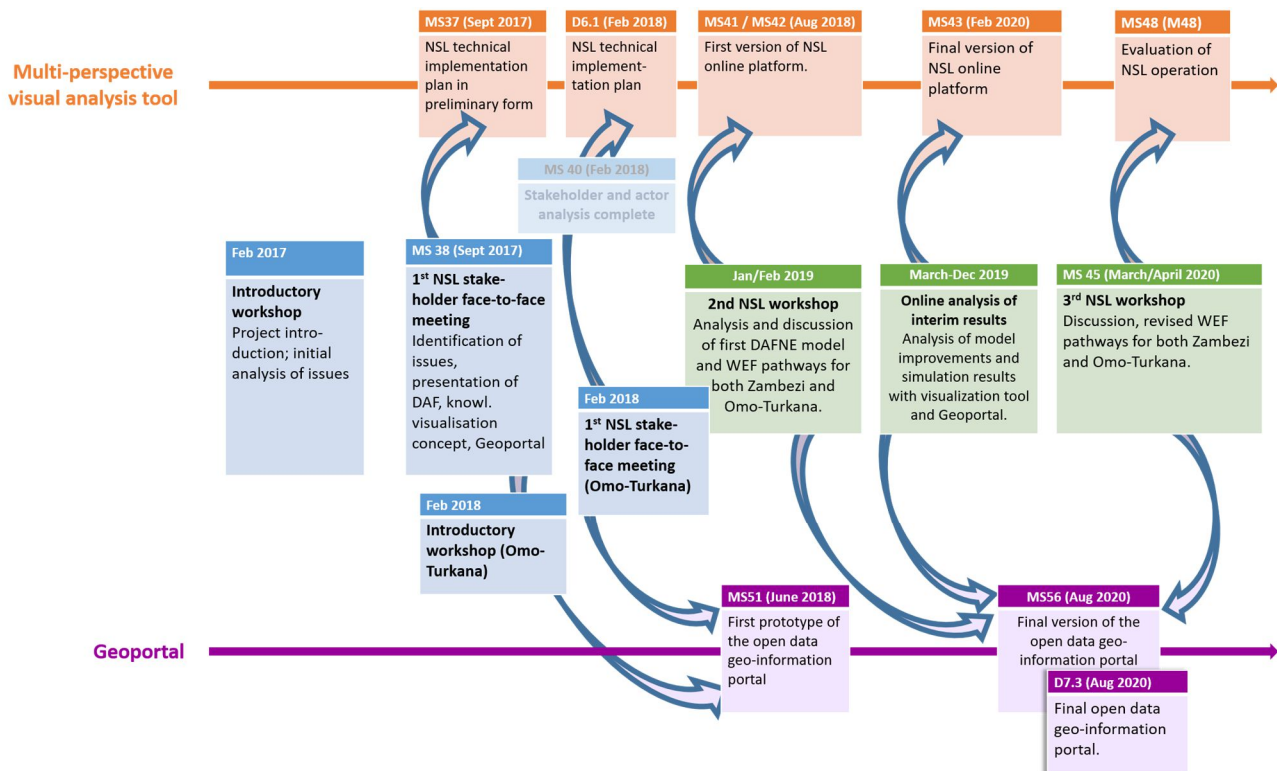


Figure 22 – Roadmap for the technical implementation and stakeholder consultation

## 7 CONCLUSIONS

This deliverable has described how a stakeholder analysis has been performed in DAFNE and the approach to continuous stakeholder involvement in the project. It includes the results of the first NSL workshops conducted in the two case studies (Zambezi, Omo-Turkana) resulting in the first iteration of the identification of issues, indicators, and solution pathways to support the development of the water-energy-food models and the Decision Analytic Framework.

We have also provided the plans for the development of the two main tools supporting stakeholder involvement in analysis of the identified W-E-F issues and trade-offs between different solution pathways: the DAFNE Geoportal and the DAFNE multi-perspective visual analysis tool. The early designs of the two tools have been discussed in the NSL stakeholder workshops. They demonstrated that the concepts developed for tools that visualize the outcomes of the modelling efforts were well-aligned to the needs of these stakeholders, as became clear from the positive end-user feedback on both the Geoportal for expert users and the multi-perspective visual analysis tool for non-expert stakeholders.

The implementation plan for both tools and the associated roadmap present the next steps in the implementation of the DAFNE Geoportal and the DAFNE multi-perspective visual analysis tool. The plan also demonstrates their application in supporting stakeholder interaction both in the NSL workshops and in the DAFNE online stakeholder interaction area.



## ANNEX A: OVERVIEW OF ACTORS IN THE ZAMBEZI CASE-STUDY

Table 8 – Zambezi basin stakeholders master list.

#	Country	Organization/ Institute	Sector	Type	Level	Level of envisioned engagement
1	Zambia	Zambia Electricity Supply Corporation (ZESCO)	Hydropower Company/ Corporation	Government	National	Consult
2	Zimbabwe	Zimbabwe Electricity Supply Authority	Hydropower Company/ Corporation	Government	National	Consult
3	Mozambique	Cahora Bassa Hydropower	Hydropower Company/ Corporation	Government	National	Consult
4	Zimbabwe	ZAMCOM	River Basin Authority	Inter-governmental	Regional	Collaborate/Empower
5	Botswana	SADC Water	River Basin Authority	Inter-governmental	Regional	Involve
6	Zambia/Zimbabwe	Zambezi River Authority (ZRA)	River Basin Authority	Inter-governmental	Regional	Collaborate/Empower
7	Zimbabwe	Southern African Power	Hydropower Company/ Corporation	Inter-governmental	Regional	Inform
8	Zimbabwe	WaterNET	Capacity building	Inter-governmental	National	Involve
9	Zambia	Department of Civil Engineering (UNZA)	University	Government	National	Inform
10	Zambia	Ministry of Mines, Energy and Water development	Energy, Water, Mines	Government	National	Inform
11	Zambia	Permanent Secretary - Ministry of water	Water	Government	National	Inform
12	Zambia	Water Resources Management Authority (WARMA)	Water	Parastatal	National	Inform
13	Zambia	Department of Water Resources Development	Water	Government	National	Inform
14	Zambia	Zambia Environmental Management Agency	Conservation	Government	National	Inform
15	Zambia	Lunsemfya Hydropower	Hydropower Company/ Corporation	Government	Sub-national	Inform
16	Zambia	Forest Department	Public	Government	National	Inform

17	Zambia	Department of Fisheries	Environment Sector	Government	National	Inform
18	Zambia	Department of National Parks and Wildlife	Conservation	Government	National	Inform
19	Zambia	Department of Agriculture - Ministry of Agriculture	Agriculture	Government	National	Inform
20	Zambia	National Heritage Conservation Commission.	Conservation	Government	National	Inform
21	Angola	Instituto Nacional De Recursos Hidricos	Public	Government	National	Inform
22	Mozambique	Agencia de Desenvolvimento do Vale do Zambeze / Zambeze Vale Development Agency	Water	Government	National	Inform
23	Mozambique	Direcção Nacional de Gestão de Recursos Hídricos / National Water Resources Management	Water	Government	National	Inform
24	Mozambique	Administração Regional de Aguas do Zambeze (ARA Zambeze) / Zambeze Regional Water Resources Administration	Water	Parastatal	National	Involve
25	Mozambique	Direcção Nacional de Gestão de Recursos Hídricos / National Water Resources Management	Water	Government	National	Inform
26	Mozambique	Hidroelétrica de Cabora Bassa	Hydropower Company/ Corporation	Government	National	Consult/ Involve
27	Mozambique	Instituto Nacional de Irrigação / National Irrigation Institute	Agricultural, Water	Government	National	Inform
28	Mozambique	Direcção Nacional de Energia / National Directorate of Energy	Energy	Government	National	Inform
29	Zambia	Chamber of Mines / Association of Zambian Mineral Exploration Companies	Mining, Large scale users	Government	National	Inform
30	Zambia	Lusaka water and sewerage company	Water, Large scale users	Publi-Private		Inform
31	Zambia	WWF	Non-governmental	Non-Governmental	National	Inform
32	Zambia	Nature Conservancy	Conservation	Non-Governmental	National	Inform
33	Zambia	Green enviro	Conservation	Non-Governmental	National	Inform
34	Mozambique	WWF Mozambique	Conservation	Non-Governmental	National	Inform
35	Zambia	Zambia Sugar Company	Agricultural company	Private sector	National	Inform
36	Zambia	Director - Crops	Agricultural	Government	National	Inform
37	Zambia	Director - Food Reserve Agency	Agricultural	Government	National	Inform
38	Zambia	Director - Livestock	Agricultural	Government	National	Inform

39	Zambia	ZAMBEEF-Someone from Mpongwe farm	Agricultural	Private sector	National	Inform
40	Zambia	Zambia Farmers Union	Agricultural	Local	National	Inform
41	Botswana	Mwamabula Power Station	Thermal Power station	Government	National	Inform
42	Botswana	Morupule A Power Station	Thermal Power station	Government	National	Inform
43	Botswana	Morupule B Power Station	Thermal Power station	Government	National	Inform
44	Angola	Lauca Dam	Hydropower Company/ Corporation	Government	National	Inform
45	Angola	Cambambe Hydro Power Station	Power stations	Government	National	Inform
46	Angola	Capanda Dam	Power stations	Government	National	Inform
47	Angola	Matala Power Station	Power stations	Government	National	Inform
48	Malawi	Kapichira Power Station	Power stations	Government	National	Inform
49	Malawi	Nkhula A Power Station	Power stations	Government	National	Inform
50	Malawi	Nkhula B Power Station	Power stations	Government	National	Inform
51	Malawi	Tedzani I Power Station	Power stations	Government	National	Inform
52	Malawi	Tedzani II Power Station	Power stations	Government	National	Inform
53	Malawi	Tedzani III Power Station	Power stations	Government	National	Inform
54	Malawi	Wovwe Power Station	Power stations	Government	National	Inform
55	Zambia	Itezhi-tezhi Dam	Power stations	Government	National	Inform
56	Zambia	Kariba North Bank Power Station	Power stations	Government	National	Inform
57	Zambia	Victoria Falls Power Station	Power stations	Government	National	Inform
58	Zimbabwe	Kariba South Bank	Power stations	Government	National	Inform
59	Zimbabwe	Kariba South Bank Extension	Power stations	Government	National	Inform
60	Zimbabwe	Tokwe Mokorse Dam	Power stations	Government	National	Inform
61	Angola	Instituto Nacional de Recursos Hídricos	Water affairs	Government	Regional - SADC	Inform
62	Botswana	Department of Water Affairs	Water affairs	Government	Regional - SADC	Inform
63	DRC	10e Neveau, Immeuble,	?		Regional - SADC	Inform
64	Lesotho	Department of Water Affairs	Water affairs	Government	Regional - SADC	Inform
65	Malawi	Department of Water Affairs	Water affairs	Government	Regional - SADC	Inform

66	Madagascar	Ministere des Affaires Etrangeres Rue Andriam-fidy	?		Regional - SADC	Inform
67	Mauritius	Ministry of Foreign Affairs	Foregin affairs	Government	Regional - SADC	Inform
68	Mozambique	DNA	DNA?			Inform
69	Namibia	Ministry of Agriculture, Water & Forestry	Water, Foresstry and Agriculture	Government	Regional - SADC	Inform
70	Seychelles	Ministry of Foreign Affairs,	Water affairs	Government	Regional - SADC	Inform
71	South Africa	Department of Water Affairs	Water affairs	Government	Regional - SADC	Inform
72	Swaziland	Department of Water Affairs	Water affairs	Government	Regional - SADC	Inform
73	Tanzania	Ministry of Water Development	Water affairs	Government	Regional - SADC	Inform
74	Zambia	Departement of Water Affairs	Water affairs	Government	Regional - SADC	Inform
75	Zimbabwe	Water Resources Planning and Management	Water affairs	Government	Regional - SADC	Inform
76	Angola	Instituto Nacional de Meteorologia e Geofisica-INAMET	Meteorology	Government	National	Inform
77	Botswana	Botswana Meteorological Services	Meteorology	Government	National	Inform
78	DRC	METTELSAT, Chausse M'ze Kabila			National	Inform
79	Lesotho	Lesotho Meteorological Services	Meteorology	Government	National	Inform
80	Madagascar	Madagascar NMHS	Meteorology	Government	National	Inform
81	Malawi	Meteorological Services	Meteorology	Government	National	Inform
82	Mauritius	Meteorological Services	Meteorology	Government	National	Inform
83	Mozambique	Institutio Nacional de Meteorologia	Meteorology	Government	National	Inform
84	Namibia	Meteorological Services	Meteorology	Government	National	Inform
85	Seychelles	National Meteorological Services	Meteorology	Government	National	Inform
86	South Africa	South African Weather Services	Meteorology	Government	National	Inform
87	Swaziland	Swaziland Meteorological Services	Meteorology	Government	National	Inform
88	Tanzania	Tanzania Meteorological Agency	Meteorology	Government	National	Inform
89	Zambia	Meteorological Department	Meteorology	Government	National	Inform
90	Zimbabwe	Meteorological Department	Meteorology	Government	National	Inform
91	Malawi	Malawi Red Cross Society	Human rights	Non-Governmental	National	Inform

92	Mozambique	Mozambique Red Cross Society	Human rights	Non-Governmental	National	Inform
93	South Africa	The South African Red Cross Society	Human rights	Non-Governmental	National	Inform
94	Angola	Ministry of Agriculture & Rural	Agricultural	Government	National	Inform
95	Swaziland	Ministry of Agriculture & Cooperatives	Agricultural	Government	National	Inform
96	Tanzania	Ministry of Agriculture Food Security and Cooperatives	Agricultural	Government	National	Inform
97	Botswana	Ministry of Environment	Conservation	Government	National	Inform
98	South Africa	Department of Environmental Affairs	Conservation	Government	National	Inform
99	Zimbabwe	Ministry of Environment, Water & climate	Conservation, Water	Government	National	Inform
100	Malawi	Ministry of Health	Health	Government	National	Inform
101	Namibia	Ministry of Health and Social Services	Health	Government	National	Inform
102	Tanzania	Ministry of Health and Social Welfare	Health	Government	National	Inform
103	Lesotho	Catholic Commission for Justice and Peace (CCJP)	Civil Society	Non-Governmental	National	Inform
104	Namibia	Desert Research Foundation of Namibia	Conservation	Non-Governmental	National	Inform
105	Zambia	Ministry of Mines, Energy and Water	Mines, Energy, water	Government	National	Inform
106		Limpopo Watercourse Commission	Water	Inter-governmental	Regional	Inform
107		Okavango River Basin Water Commission	Water	Inter-governmental	Regional	Inform
108		Orange-Senqu River Commission	Water	Inter-governmental	Regional	Inform
109		Zambezi Watercourse Commission	Water	Inter-governmental	Regional	Collaborate/Empower
110		Lesotho Highlands development Authority (LHDA)		Government	National	Inform
111		Komati Basin Water Authority (KOBWA)	Water	Government	Regional	Inform
112		Institute for Groundwater Studies	Water	Inter-governmental	Regional	Inform
113	South Africa	Global Water Partnership Africa	Water affairs	Non-Governmental	Inter-governmental	Consult
114		IUCN (International Union for Conservation of Nature)	Conservation	Non-Governmental	Regional	Inform
115		IWMI Southern Africa Regional Office (IWMISA)	Conservation	Non-Governmental	Regional	Consult

116		WWF - Joint Zambezi River Basin Environmental Flows Programme	Conservation	Non-Governmental	Regional	Consult
117		GIZ - Transboundary Water Management in SADC	Conservation	Non-Governmental	Regional	Consult
118		IWMI	Conservation	Non-Governmental	Regional	Consult
119	Angola	Water Resources National Institute	Water affairs	Government	National	Inform
120	Botswana	Department of Water Affairs	Water affairs	Government	National	Inform
121	Germany	BoyWa AG Smart Farming and Internationalization Agri-services	Agricultural services	Private sector	National	Inform
122	Zambia	Zambia Community Based Natural Resource Management Forum	NRM	Non-Governmental	National	Inform
123	Zambia	Africa Wildlife foundation	Wildlife and NRM	Non-Governmental	National	Inform
124	Zambia	Joint Zambezi River Basin Environmental Flows Programme	River Basin	Non-Governmental	National	Involve/ Consult
125	Zimbabwe	Community Based natural Resource Management	NRM	Non-Governmental	Sub-national	Inform
126	Zimbabwe	SAPP Coordination Centre	Energy	Inter-governmental	Regional	Inform

Table 9 – Proposed actors for the Zambezi basin NSL.

#	Organisation / Institution	Name Contact	Country	Remarks
	<b>Hydropower Operators / Energy Sector</b>			
1	Zambia Electricity Supply Corporation (ZESCO)	Elenestina Mwelwa/George Sikasote	Zambia	
2	Kariba North Bank Power Station (Extension)	Mr. Wesley Lwiindi	Zambia	
3	Itezhi-tezhi Dam	Mr. Kelvin Kamwale	Zambia	
4	Kariba North Bank Power Station	Mr. Edward Simbaya	Zambia	
5	Victoria Falls Power Station	Mr. Abraham M. Sashi	Zambia	
6	Zimbabwe Electricity Supply Authority		Zimbabwe	
7	Kariba South Bank		Zimbabwe	
8	Kariba South Bank Extension		Zimbabwe	
9	Tokwe Mokorse Dam		Zimbabwe	
10	Electricity Supply Commission of Malawi		Malawi	Not on Zambezi
11	Kapichira Power Station		Malawi	
12	Nkhula A Power Station		Malawi	
13	Nkhula B Power Station		Malawi	
14	Tedzani I Power Station		Malawi	
15	Tedzani II Power Station		Malawi	
16	Tedzani III Power Station		Malawi	
17	Wovwe Power Station		Malawi	
18	Empresa Nacional de Angola Electricity			Not on Zambezi
19	Instituto Nacional De Recursos Hidricos	Manuel Quintino	Angola	
20	Lauca Dam		Angola	
21	Cambambe Hydro Power Station		Angola	
22	Capanda Dam		Angola	
23	Matala Power Station		Angola	
24	Mwamabula Power Station		Botswana	

25	Morupule A Power Station		Botswana	
26	Morupule B Power Station		Botswana	
27	Cahora Bassa Hydropower		Mozambique	
28	Zambezi Regional Administration			
29	Agencia de Desenvolvimento do Vale do Zambeze		Mozambique	
30	Direcção Nacional de Gestão de Recursos Hídricos		Mozambique	
31	Hidroelétrica de Cabora Bassa		Mozambique	
32	Direcção Nacional de Energia / National Directorate of Energy		Mozambique	
	<b>Regional and River Basin Organisations/ Authorities</b>			
1	ZAMCOM	Prof. Zebediah Phiri	Zimbabwe	Provided supporting letter
2	SADC Water -		Botswana	Provided supporting letter
3	Zambezi River Authority (ZRA)		Zambia/Zimbabwe	
4	Southern African Power Pool		Zimbabwe	Provided supporting letter
5	Administração Regional de Aguas do Zambeze (ARA Zambeze) / Zambeze Regional Water Resources Administration		Mozambique	
6	Direcção Nacional de Gestão de Recursos Hídricos / National Water Resources Management		Mozambique	
	<b>Capacity Building Organisation/University</b>			
1	WaterNET provided Supporting letter	Dr. Jean Marie Kileshye	Zimbabwe	
2	Department of Civil Engineering (UNZA)	Dr Edwin Nyirenda	Zambia	
	<b>Public Sector</b>			
1	Permanent Secretary - Ministry of water			
2	WARMA	Paul Kapotwe or Lemmy Namayanga	Zambia	Provided supporting letter



3	Department of Water Resources Development	Dr. Howard Mpamba -dir DWA	Zambia	
4	Zambia Environmental Management Agency	Charity Lwenya / Rodwell Chandipo	Zambia	
5	Lunsemfwa Hydropower	Chanda Chisha	Zambia	<i>Outside Lusaka</i>
6	Forest Department;	Sibajene Ethel Mudenda	Zambia	
7	Department of Fisheries	Dr. Harris Phiri	Zambia	
8	Department of National Parks and Wildlife	DG	Zambia	
9	Department of Agriculture - Ministry of Agriculture			
10	National Heritage Conservation Commission.	Muyumbwa Ndiyai	Zambia	
<b>Other Institutions</b>				
1	WWF	Loreen Katiyo or Dr. Nyambe	Zambia	
2	Nature Conservancy	Mundia Matongo	Zambia	
3	Green enviro	Abel Musumali	Zambia	
<b>Large scale users of groundwater and surface water:</b>				
1	Chamber of Mines / Association of Zambian Mineral Exploration Companies		Zambia	
2	Lusaka water and sewerage company	Eng. Elijah Musonda	Zambia	
3	Agencia de Desenvolvimento do Vale do Zambeze / Zambeze Vale Development Agency		Mozambique	
<b>Agricultural Sector</b>				
1	Zambia Sugar Company		Zambia	
2	Director - Crops		Zambia	
3	Director - Food Reserve Agency		Zambia	
4	Director - Livestock		Zambia	
5	ZAMBEEF-		Zambia	
6	Zambia Farmers Union		Zambia	

7	Instituto Nacional de Irrigação / National Irrigation Institute		Mozambique	
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Table 10 – Stakeholders who participated in the Zambezi NSL, Sept 2017.

#	Name	Organisation	Basin representation
1	Francisco João Macaringue	Administracao Regional de Aguas do Zambeze	Luia sub-basin, Mozambique
2	Sílvia Eduardo Francisco	DIPREME – Tete Provisional Directorates of Mineral Resources and Energy	Luia sub-basin, Mozambique
3	Gustavo Cornelius Jessen	HCB - Cabora Bassa Hydropower	Luia sub-basin, Mozambique
4	Reinaldo Gonçalves Júnior	Água de Chiúta (Waters of Chiúta)	Luia sub-basin, Mozambique
5	Chanda Chisha	Lunsemfwa Hydropower	Lunsemfwa sub-basin, Zambia
6	Don Burton	Mafundzalo Farms	Lunsemfwa sub-basin, Zambia
7	Yoram Sinyangwe	Lukanga Water and Sewerage Organization (LWS)	Lunsemfwa sub-basin, Zambia
8	Oscar Silembo	Water Resources Management Authority (WARMA)	Lunsemfwa sub-basin, Zambia
9	Loreen Katiyo	World Wide Fund for Nature – Zambia (WWF)	Regional – Zambezi River Basin
10	Mkhuzo Chngo	Zambia Department of Water Resources Development	Regional – Zambezi River Basin
11	Romas Kamanga	Zambia Electricity Supply Corporation (ZESCO)	Regional – Zambezi River Basin
12	Kenneth Msibi	Southern African Development Community - SADC Water	Regional – Zambezi River Basin
13	Chipso Zimbawah	Zambezi Watercourse Commission (ZAMCOM)	Regional – Zambezi River Basin
14	Christopher Chisense	Zambezi River Authority (ZRA)	Regional – Zambezi River Basin
15	Frank Nyoni	Water Resources Management Authority (WARMA)	Regional – Zambezi River Basin

## ANNEX B: OVERVIEW OF ACTORS IN THE OMO-TURKANA CASE-STUDY

Table 11 – Omo-Turkana master list.

#	Organization/ Institute/ Directorate	Sector	Type	Level	Country
1	Irrigation and drainage Directorate	Water	Governmental	National	Ethiopia
2	Basin administration Directorate	Water	Governmental	National	Ethiopia
3	Hydrology and water qualities Directorate	Water	Governmental	National	Ethiopia
4	Hydropower study and dam administration Directorate	Water	Governmental	National	Ethiopia
5	Boundary and transboundary river affairs Directorate	Water	Governmental	National	Ethiopia
6	Natural resources development conservation and utility Directorate	Agriculture	Governmental	National	Ethiopia
7	Rural land administration and utility Directorate	Agriculture	Governmental	National	Ethiopia
8	Small scale irrigation development and expansion Directorate	Agriculture	Governmental	National	Ethiopia
9	Environmental and social impact assessment and Environmental licensing Directorate	Environment	Governmental	National	Ethiopia
10	Natural Forest Protection and Conservation	Environment	Governmental	National	Ethiopia
11	Cultural heritages study and protection authority	Others	Governmental	National	Ethiopia
12	Equitable development directorate and	Others	Governmental	National	Ethiopia
13	Conflict prevention and resolution directorate	Others	Governmental	National	Ethiopia
14	Ministry of Finance and Cooperation	Others	Governmental	National	Ethiopia
15	Fishery resource development directorate	Agriculture - Fisheries	Governmental	National	Ethiopia
16	Livestock production and Marketing Sector	Agriculture - Fisheries, Livestock	Governmental	National	Ethiopia
17	National planning commission of Ethiopia	Others	Governmental	National	Ethiopia
18	Ethiopian Electric Power	Energy	Governmental	National	Ethiopia
19	Gibe I dam	Energy	Governmental	National	Ethiopia
20	Gibe III dam	Energy	Governmental	National	Ethiopia
21	Ethiopian Wildlife Conservation Authority	Environment	Governmental	National	Ethiopia
22	Omo National Park	Environment	Governmental	National	Ethiopia

23	Mago National Park	Environment	Governmental	National	Ethiopia
24	Ethiopian Sugar corporation	Agriculture - Food	Governmental	National	Ethiopia
25	Kuraz Sugar Development Program	Agriculture - Food	Governmental	National	Ethiopia
26	Ethiopian Investment Commission	Other	Governmental	National	Ethiopia
27	Ethiopian Energy Authority	Energy	Governmental	National	Ethiopia
28	Ethiopian Metrological Agency	Other	Governmental	National	Ethiopia
29	Bureaus of agriculture - Oromia region	Agriculture	Governmental	Regional	Ethiopia
30	Bureaus of agriculture - South nation and nationality people (SNNP) region	Agriculture	Governmental	Regional	Ethiopia
31	Bureaus of water, mining, and Irrigation - Oromia region	Water	Governmental	Regional	Ethiopia
32	Bureaus of water, mining, and Irrigation - SNNP region	Water	Governmental	Regional	Ethiopia
33	Jimma zone	Other	Governmental	Zonal	Ethiopia
34	Wolayita zone	Other	Governmental	Zonal	Ethiopia
35	Dawro zone	Other	Governmental	Zonal	Ethiopia
36	South Omo zone	Other	Governmental	Zonal	Ethiopia
37	Forum for Environment	Environment	Non-governmental	National	Ethiopia
38	PHE-Ethiopia	Environment	Non-governmental	National	Ethiopia
39	World Vision Ethiopia	Food	Non-governmental	National	Ethiopia
40	Ethiopian Wildlife & Natural History Society (EWNHS)	Environment	Non-governmental	National	Ethiopia
41	Ethiopian Pastoralist Research & Development Association	Livelihoods	Non-governmental	National	Ethiopia
42	World Bank	Other	Non-governmental	National	Ethiopia
43	African Development Bank	Other	Non-governmental	National	Ethiopia
44	European Union	Other	Non-governmental	National	Ethiopia
45	USAID	Other	Non-governmental	National	Ethiopia
46	Water and land resource center (WLRC)	Other	Non-governmental	National	Ethiopia
47	Addis Ababa University	Other	Governmental	National	Ethiopia
48	Jimma University	Other	Governmental	National	Ethiopia
49	Arba Minch University	Other	Governmental	National	Ethiopia

50	Ethiopian Agricultural Research Institute	Other	Governmental	National	Ethiopia
51	Fri-el Ethiopia farming and processing PLC	Agriculture	Private sector	National	Ethiopia
52	Sisay Tesfaye agricultural development enterprise	Agriculture	Private sector	National	Ethiopia
53	Friends of Lake Turkana Trust	Conservation	Non-governmental	Local	Kenya
54	Kenya Marine and Fisheries Insitutute (KMFRI)- Lake Turkana Research Station	Fisheries Research	Parastatal	National	Kenya
55	Lake Turkana Wind Power Ltd (LTWP)	Energy	Private	Local	Kenya
56	Turkana County Government	Other	Governmental	National	Kenya
57	Marsabit County Government	Other	Governmental	National	Kenya
58	Beach Management Units from Turkana and Marsabit Counties	Community fisheries governance	Private	Local	Kenya
59	National Environment Management Authority (NEMA)	Environmental Management	Parastatal	National	Kenya
60	State Department of Fisheries	Fisheries Research	Governmental	National	Kenya
61	Kenya Wildlife Services	Wetlands Management	Governmental	National	Kenya
62	Wetlands International	Wetlands Management	Non-governmental	International	Kenya
63	Nature Kenya	Conservation	Others	local	Kenya
64	The Nature Conservancy	Conservation	Non-governmental	local	Kenya
65	National Museums of Kenya	Heritage	Parastatal	National	Kenya
66	Kenya Electricity Transmission Company Ltd (Kentraco)	Energy	Parastatal	National	Kenya
67	Water Resources Authority	Water	Parastatal	National	Kenya
68	Pastoralist Development Network of Kenya	Pastrolist	Non-governmental	National	Kenya
69	Kenya Meteorological Department	Meteorology	Parastatal	National	Kenya
70	IGAD- Climate Prediction and Adaptation Centre (ICPAK)	Climate	Parastatal	National	Kenya
71	Institute for Climate Change and Adapataion	Climate	Non-governmental	Regional	Kenya
72	Research on Environment and Development Planning	Environmental Management	Non-governmental	Regional	Kenya
73	State Department of Water	Water	Governmental	National	Kenya
74	State Department of Irrigation	Irrigation	Governmental	National	Kenya
75	State Department of Livestock	Livestock	Governmental	National	Kenya

76	State Department of Environmnet	Environment	Governmental	National	Kenya
77	State Department of Agriculture	Agriculture	Governmental	National	Kenya
78	IUCN - ESARO	Environment	Non-governmental	International	Kenya
79	African Studies Centre Oxford	environment	Non-governmental	Local	Kenya

Table 12 – Shortlisted stakeholders for the stakeholder meetings – Ethiopia.

#	Ministry	Organization/ Institute/ Directorate	Sector	Type	Level	Level of envisioned engagement (Inform, Consult, Involve, Collaborate/ Empower)
1	Ministry of Water, Irrigation & Electricity	Irrigation and drainage Directorate	Water	Governmental	National	Collaborate and Empower
2	Ministry of Water, Irrigation & Electricity	Hydropower study and dam administration Directorate	Water	Governmental	National	Collaborate and Empower
3	Ministry of Water, Irrigation & Electricity	Boundary and transboundary river affairs Directorate	Water	Governmental	National	Collaborate and Empower
4	Ministry of Agriculture & Natural Resources	Sustainable land management programe	Agriculture	Governmental	National	Collaborate and Empower
5	Ministry of Environment, Forest & Climate change	Environmental and social impact assessment and Environmental licensing Directorate	Environment	Governmental	National	Collaborate and Empower
6	Minister for Foreign Affairs	Transboundary river affairs Directorate	Others	Governmental	National	Consult
7	Ministry of culture and tourism	Cultural heritages study and protection authority	Others	Governmental	National	Consult
8	Ministry of fishery and livestock	Livestock production and Marketing Sector	Agriculture - Fisheries, Livestock	Governmental	National	Collaborate and Empower
9	National planning commission of Ethiopia	National planning commission of Ethiopia	Others	Governmental	National	Consult
10	Federal government - Energy	Ethiopian Electric Power	Energy	Governmental	National	Collaborate and Empower
11	Federal government - Environment	Ethiopian Wildlife Conservation Authority	Environment	Governmental	National	Collaborate and Empower
12	Federal government - Agriculture	Ethiopian Sugar corporation	Agriculture - Food	Governmental	National	Collaborate and Empower
13	Federal government - Agriculture	Kuraz Sugar Development Program	Agriculture - Food	Governmental	National	Collaborate and Empower
14	Federal government	Ethiopian Investment Commission	Other	Governmental	National	Consult



15	Water, Mineral, and Energy Bureau	Bureaus of Water, Mineral, and Energy: Oromia Regional	Water	Governmental	Regional	Collaborate and Empower
16	SNNPRS Water Resources Bureau	Bureaus of water resource: South nation and nationality people (SNNP) region	Water	Governmental	Regional	Collaborate and Empower
17	Zonal administrations	Jimma zone	Other	Governmental	Zonal	Involve
18	Zonal administrations	South Omo zone	Other	Governmental	Zonal	Collaborate and Empower
19	Non-Governmental	PHE-Ethiopia	Environment	Non-governmental	National	Collaborate and Empower
20	Non-Governmental	Ethiopian Pastoralist Research & Development Association	Livelihoods	Non-governmental	National	Collaborate and Empower
21	Higher Learning and Research Institutes	Water and land resource center (WLRC)	Other	Non-governmental	National	Collaborate and Empower
22	Higher Learning and Research Institutes	Jimma University	Other	Governmental	National	Collaborate and Empower
23	Higher Learning and Research Institutes	Ethiopian Agricultural Research Institute	Other	Governmental	National	Involve
24	Private sector	Fri-el Ethiopia farming and processing PLC	Agriculture	Private sector	National	Involve
25	Private sector	Sisay Tesfaye agricultural development enterprise	Agriculture	Private sector	National	Involve

Table 13 – Shortlisted stakeholders for the stakeholder meetings – Kenya.

#	Organization/ Institute/ Directorate	Sector	Type	Level	Level of envisioned engagement (Inform, Consult, Involve, Collaborate/ Empower)
1	Friends of Lake Turkana Trust	Conservation	Non-governmental	Local	Collaborate
2	Kenya Marine and Fisheries Insitutute (KMFRI)- Lake Turkana Research Station	Fisheries Research	Parastatal	National	Collaborate
3	Lake Turkana Wind Power Ltd (LTWP)	Energy	Private	Local	Collaborate
4	Turkana County Government	Other	Governmental	National	Collaborate and involve
5	Marsabit County Government	Other	Governmental	National	Collaborate and involve
6	Beach Management Units from Turkana and Marsabit Counties	Community fisheries governance	Private	Local	Collaborate and involve
7	National Environment Management Authority (NEMA)	Environmental Management	Parastatal	National	Collaborate and involve
8	State Department of Fisheries	Fisheries Research	Governmental	National	Consult
9	Kenya Wildlife Services	Wetlands Management	Governmental	National	Consult
10	Wetlands International	Wetlands Management	Non-governmental	International	Involve
11	Nature Kenya	Conservation	Others	local	Involve
12	The Nature Conservancy	Conservation	Non-governmental	local	Involve
13	National Museums of Kenya	Heritage	Parastatal	National	Consult
14	Kenya Electricity Transmission Company Ltd (Kentraco)	Energy	Parastatal	National	Consult
15	Water Resources Authority	Water	Parastatal	National	Collaborate and involve
16	Pastoralist Development Network of Kenya	Pastoralist	Non-governmental	National	Collaborate and involve
17	Kenya Meteorological Department	Meteorology	Parastatal	National	Consult

18	IGAD- Climate Prediction and Adaptation Centre (ICPAK)	Climate	Parastatal	National	Consult
19	Institute for Climate Change and Adaptation	Climate	Non-governmental	Regional	Consult and Involve
20	Research on Environment and Development Planning	Environmental Management	Non-governmental	Regional	Collaborate and inform
21	State Department of Water	Water	Governmental	National	Consult
22	State Department of Irrigation	Irrigation	Governmental	National	Consult
23	State Department of Livestock	Livestock	Governmental	National	Consult
24	State Department of Environment	Environment	Governmental	National	Consult
25	State Department of Agriculture	Agriculture	Governmental	National	Consult
26	IUCN - ESARO	Environment	Non-governmental	International	Inform
27	African Studies Centre Oxford	environment	Non-governmental	Local	Consult

Table 14 – Stakeholders participating in the NSL meeting for the Omo-Turkana basins.

#	Name of stakeholder	Organisation	Country representation
1	Zerihun Abebe	Ministry of Foreign Affairs - Transboundary Resource Affairs Directorate	Ethiopia
2	Bethlehem Ayalew	Ministry of Foreign Affairs	Ethiopia
3	Teshome Atnafe	Ministry of Water, Irrigation & Electricity - Boundary and Transboundary Rivers Affairs Directorate	Ethiopia
4	Fiker Kidane	Ethiopian Electric Power - Portfolio Projects Management Office	Ethiopia
5	Sultan Sulemon	Jimma University Jimma - Research and Community Services Office	Ethiopia
6	Fekadu Lebesa	Oromia Water, Mineral and Energy Bureau	Ethiopia
7	Girma Timer	Ethiopian Wildlife Conservation Authority	Ethiopia
8	Awgichew Mengesha	Fri-EI Ethiopia Farming And Processing PLC	Ethiopia
9	Tafesse Mesfin	Ethiopian Pastoralist Research & Development Association	Ethiopia
10	Negash Teklu	PHE-Ethiopia	Ethiopia
11	Desta Lorenzo	Ministry of Culture and Tourism - Sector Development Research and Study Directorate	Ethiopia
12	Habib Dlrsebo	Ethiopia Sugar Corporation - Investment and Development DCEO	Ethiopia
13	Negash Wagesho	SNNPRS Water Resources Bureau	Ethiopia
14	Shiferaw Negash	Ministry of Environment, Forest & Climate Change - Environmental and Social Impact Assessment and Environmental Licensing Directorate	Ethiopia
15	Habtamu Hailu	Ministry of Agriculture & Natural Resource - Sustainable Land Management Program	Ethiopia
16	Anne Omambia	National Environment Management Authority	Kenya
17	Eugen Mwandoe	National Water Resources Ministry of Water and Irrigation	Kenya
18	John Malala	Kenya Marine and Fisheries Institute Lake Turkana	Kenya
19	Monica Yator	Pastoralist Development Network of Kenya	Kenya
20	Mohamed Moulid Shurie	Water Resources Authority	Kenya



