ENTRO
EASTERN NILE TECHNICAL REGIONAL OFFICE

BARO-AKOBO-SOBAT MULTIPURPOSE WATER RESOURCES DEVELOPMENT STUDY PROJECT

Integrated Water Resources Development and Management Plan

V.2.1 April 2017

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Title of document	**Baro Akobo Sobat multipurpose water resources development study project**
Document Reference	**800838**
Reference No.	**Integrated Water Resources Development and Management Plan – 2nd draft report**

Date of publication	Ref. No :	Observations	Compiled by	Verified and validated by
24 November 2016	**V1**	Integrated Water Resources Development and Management Plan – 1st draft report	Jean-Michel Citeau and Steve Crerar	Sébastien Chazot
27 December 2016	**V1.1**	Integrated Water Resources Development and Management Plan – 1st draft report – revision 1	Jean-Michel Citeau and Steve Crerar	Sébastien Chazot
25 April 2016	**V2.1**	Integrated Water Resources Development and Management Plan – Final draft report – version 1	Jean-Michel Citeau and Steve Crerar	Sébastien Chazot

BARO-AKOBO-SOBAT MULTIPURPOSE WATER RESOURCES DEVELOPMENT STUDY PROJECT

Integrated Water Resources Development and Management Plan – Final draft report

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1. INTRODUCTION

1.1 OBJECTIVES OF THE IWRDM PLAN

The Baro-Akobo-Sobat River sub-basin is the least developed of the four sub-basins of the Eastern Nile. At the same time, it is recognised that the sub-basin presents a huge potential for development. Given its transboundary nature and the relatively pristine state of much of the basin, there is both a need and an opportunity for cooperative transboundary planning, development and management of the sub-basin's resources. The IWRDMPlan is therefore highly relevant for the sub-basin.

As stated in the terms of reference, the IWRDMPlan is aimed at

- establishing a shared vision of the future development of the sub-basin as well as the strategic objectives required to reach this vision;
- identifying principles of water resource management as well as water-linked ecosystem management and,
- reviewing, evaluating and recommending the institutional framework required for the implementation of the plan (roadmap).

Establishing i) and ii) at this stage is important in order to provide a framework for the SSEA because as stakeholder-driven process, the SSEA depends on a common understanding of the strategic objectives to be realised through implementation of the "programme" (IWRDMPlan). At the same time it is important to recognize that the baseline and preparatory work for the SSEA have contributed towards the fashioning of this strategic framework and necessary principles of ecosystem-based water resources management.

In addition to the above overall objectives, it is stressed that the Plan needs to go beyond the establishment of a strategic framework and principles. The terms of reference provide some more specific objectives, requiring that the plan:

- "identifies sustainable investments and provides a sound framework for long-term cooperative development and management of water resources" and
- should optimise the various types of investments (including management and protection of the natural resources) and
- should "develop a priority sequence of the multipurpose water resources development projects.

Thus while the plan is strategic in nature and rests squarely on the finding of the SSEA and associated options analysis, it also has to be concrete in terms of its presentation so that it can lead rapidly to implementation.

1.2 LINKING THE SSEA AND THE IWRDMPLAN

As already indicated above the SSEA has provided the foundation for the IWRDMPlan.

Section 4 of the report presents the strategic analysis in detail … showing how the definition of the strategic objectives have guided the choice of SSEA dimensions and how the SSEA analysis has provided strategic findings that have been used to develop the strategic actions presented later in this report

1.3 DESCRIPTION/CHARACTERISTICS OF THE PROPOSED PLAN

The Plan aims to set out the actions that are required to move towards an agreed vision of the basin. However, it is important to note that the plan has a timeframe of 25 years but that the Vision represents something a bit further into the future, perhaps 40 or 50 years. Indeed, the economic analysis of the different options has been based on a 40 year timeline. The Plan includes the following key elements:

- A **Vision and associated strategic objectives**. The vision represents the desired future state for the basin to be achieved (at least in a large part) by implementation of the Plan
- **Strategic actions**. These are the strategic level actions that will have to be carried out to realise each strategic objective. They may be direct, infrastructure-orientated actions or actions that are aimed at supporting or providing an enabling environment.
- **Specific actions**. As their name suggests, these actions are specific in nature. Direct infrastructure type specific actions will include the implementation of specific infrastructure projects such as large dams and associated multipurpose projects (hydropower, irrigation, water supply etc). Clearly the choice of which projects and when (prioritising) depends to a large extent on the SSEA and options analysis.

  However, specific actions also include the specific actions that are required to **support** the implementation of direct actions. These could include, for example, actions relating to capacity and institutional aspects.
- **Implementation strategy and plan**. The Plan includes both a strategy for implementation and a plan with a timeline. Much of the strategy relates to the findings of the SSEA.
- **Institutional framework**. The Plan requires a suitable institutional framework at all levels. For this Plan, which has a high level, transboundary focus, the high level institutional framework is of particular interest.
- **Monitoring and evaluation and adaptive management**. A key component of the Plan is its monitoring and evaluation framework. The main purpose of this framework is to ensure that implementation of the Plan is leading to the desired outcome and ultimately the future vision of the basin.

1.4 STRUCTURE OF THIS REPORT (SECTION TO BE CHECKED)

This draft report comprises this introduction and seven additional chapters. This draft final report is published following the completion of the final draft SSEA report and more recently, the selection of medium and short-term projects for taking forward to the preparation of terms of reference..

Chapter 3 is aimed at presenting the Vision and Strategic Objectives of the Plan. These are based on an analysis of the issues, challenges and opportunities in the basin as summarised briefly at the beginning of this chapter. The Vision and Strategic Objectives represent the strategic framework for the Plan. All actions will be aimed at the achievement of these strategic objectives and realisation of the Vision.

Together with Chapters 3 and 5, Chapter 4 is at the core of the report. In Chapter 4, the strategic analysis is carried out and is aimed at moving from strategizing to action. Three types of strategic actions are presented (direct, enabling and cross-cutting) in support of each strategic objective.

The aim of Chapter 5 is to move the plan closer to something that can actually be implemented. It is important that the plan is represented in concrete terms and with timeline and responsibilities identified. Chapter 5 presents specific cations under each of the strategic actions. These actions have both timelines and associated responsibilities.

Chapter 6 is aimed at providing a costing of the overall plan and a limited cost benefit analysis. This section of the report will be completed only when the preferred development pathway has been decided.

Chapter 7 provides a preliminary institutional framework with a focus on overall implementation and coordination of the plan and transboundary responsibilities. Finalisation of this section depends on the development pathway chosen as well as the choice of medium and long-term projects for prioritisation.

Chapter 8 provides the Monitoring and evaluation framework. Monitoring and evaluation will be based mainly results-orientated. This chapter includes a results-based framework. Finalisation of all details in this framework depends on agreement over the preferred option.

2. BACKGROUND AND STRATEGIC CONTEXT

2.1 OVERALL CONTEXT

2.1.1 The Nile Basin Initiative (NBI)

The **Nile Basin Initiative (NBI)** is a partnership between the riparian states of the Nile River: Burundi, Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Rwanda, South Sudan, Sudan, Tanzania and Uganda. The NBI seeks to **develop the river in a cooperative manner, share substantial socio-economic benefits, and promote regional peace and security.** The NBI started with a participatory process of dialogue among the riparian countries that resulted in an agreement on a shared vision, namely, to "achieve sustainable socioeconomic development through the equitable utilization of, and benefit from, the common Nile Basin water resources," and a Strategic Action Program to translate this vision into concrete activities and projects.

The **Eastern Nile Subsidiary Action Program** (ENSAP) of the NBI was launched by Egypt, Ethiopia and the Sudan (with South Sudan joining in 2012) to **initiate concrete joint investments and action on the ground** in the Eastern Nile sub-basin in the areas of power generation and interconnection, irrigation and drainage, flood preparedness and early warning, watershed management, development of planning models and joint multipurpose programs. ENSAP is governed by the Eastern Nile Council of Ministers (ENCOM) and implemented by the Eastern Nile Technical Regional Office (ENTRO) in Addis Ababa, Ethiopia. Funding for ENSAP accrues from Eastern Nile countries and various bilateral and multilateral development partners.

2.1.2 Integrated Development of the Eastern Nile (IDEN)

The Eastern Nile Technical Regional Office (ENTRO), established by the Eastern Nile Council of Ministers (ENCOM) of water affairs in the Eastern Nile countries, is responsible for managing the Eastern Nile Subsidiary Action Program (ENSAP), whose overall objective is the **cooperative development of the water resources of the Eastern Nile Basin**, which includes the Baro-Akobo-Sobat River Basin, **in a sustainable and equitable manner to ensure prosperity, security, and peace for all its peoples**.

In pursuit of this objective, ENTRO has formulated the **Integrated Development of the Eastern Nile (IDEN)** as a suite of integrated development projects including hydropower, irrigation and drainage, flood control, watershed management, and water resources management. Because of its regional water and land resources potentials and the role it can play in regional peace, stability and security, the Baro-Akobo-Sobat Multipurpose Water Resources Development Study Project became one of the seven (7) projects identified in the IDEN.

The objective of the IDEN Project is to initiate a regional, integrated, multipurpose development project through a first set of investments that confer tangible, win-win gains and demonstrate joint action between the Eastern Nile countries.

2.1.3 Baro-Akobo-Sobat sub-basin

The location of the Baro-Akobo-Sobat sub-basin with respect to the Eastern Nile and the whole Nile Basin is shown in Figure 2-1.

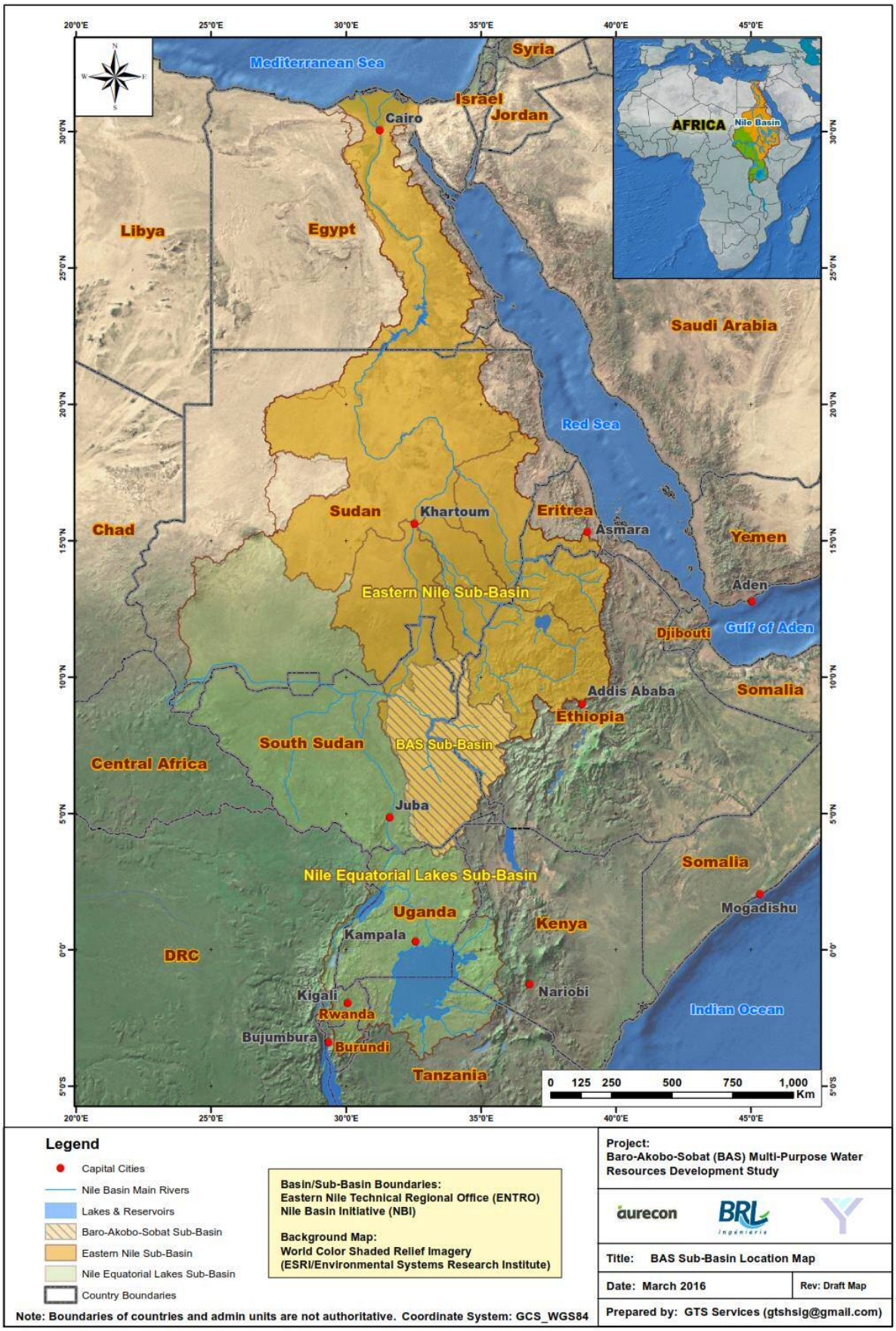


Figure 2-1: Location of the Baro-Akobo-Sobat sub-basin within the Nile Basin

The Baro-Akabo-Sobat sub-basin, with its catchment area of more than 205,000 km^2 consists of the Baro River (and its tributaries such as the Birbir) and the Akobo river (with its main tributary, the Pibor). After the confluence of the Baro and Akobo, the river is called Sobat in South Sudan. The river makes its way from an altitude of over 3000 masl in the Ethiopian highlands to about 400 masl when the Sobat crosses into South Sudan on the way to its junction with the outflow from the Sudd wetlands on the White Nile.

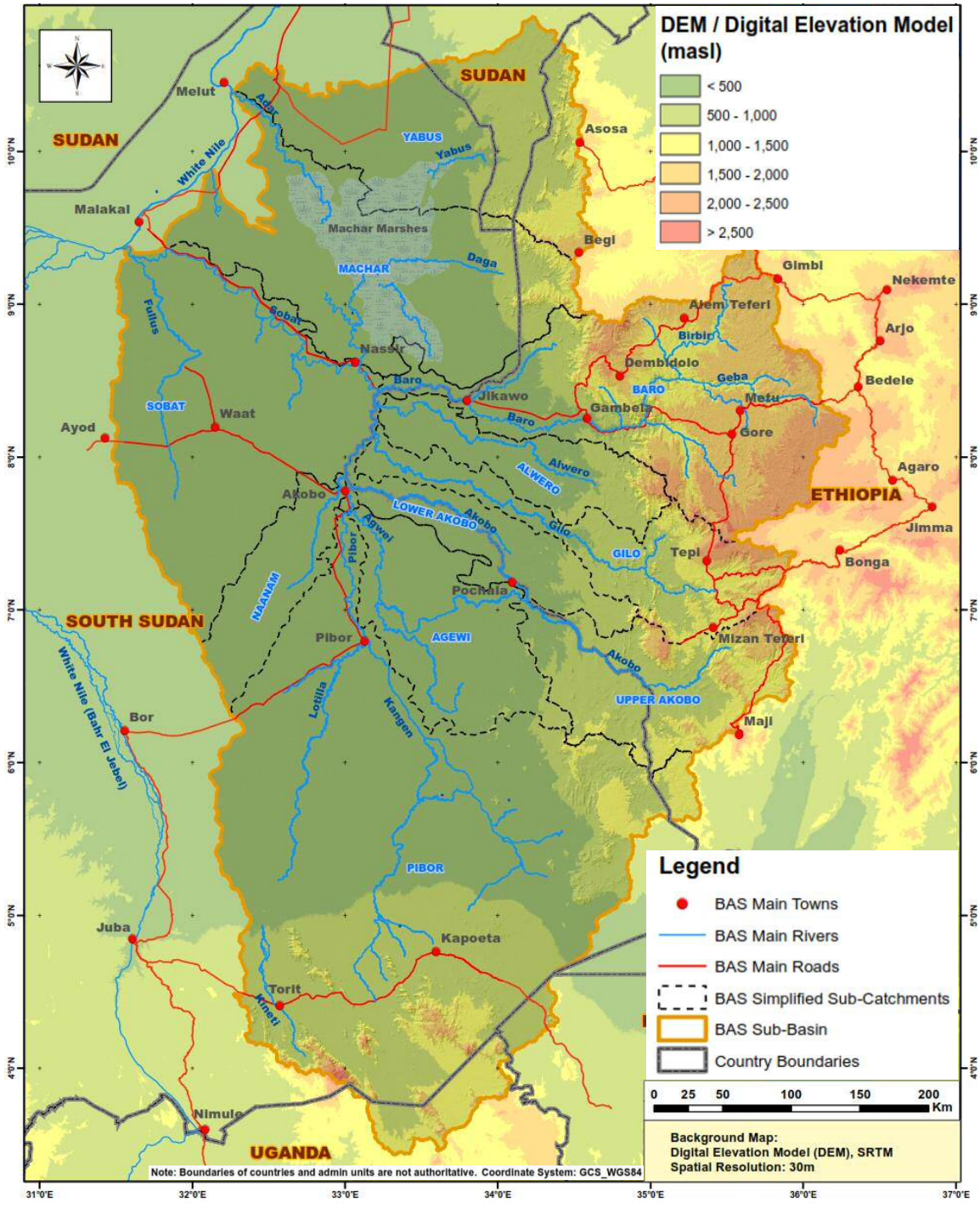


Figure 2-2: Topography and main rivers of the BAS sub-basin

The seasonal rainfall pattern and large flat areas have resulted in the formation of many wetlands that have been a defining influence on the activities of the people of the sub-basin. The Machar Marshes are located north of the Baro River upstream of its confluence with the Pibor River. This

wetland system in a depression has a hydrology primarily driven by evaporation and local rainfall. Most of the flow that goes from the Baro river system to the wetland during high flows comes back into the Baro and White Nile rivers downstream (through an extended grassy channel called Khor Adar) although flow estimates vary.

The mean annual flow of the Baro River at Gambella is around 12.4 billion m^3 (1980-2000). In its lower course, the flow spills and a large amount of spillage enters the Machar Marshes. Annual spillage is estimated to be in excess of 3 billion m^3 (1980-2000) and the mean annual flow is recorded to be 9.53 billion m^3 (1905-1955) at the mouth of the Baro River. Once contributions from the Gilo, Pibor and Akobo Rivers are taken into account the average annual inflow of the Sobat River at the Doleib hill located upstream of Malakal is estimated to be 13.687 billion m^3 (1905-1955). It should be noted that these figures come from the literature and are quoted in order to provide context. During the course of this study the hydrology will be investigated in detail which may result in some revisions to these estimates.

Rain fed crop cultivation is the principal livelihood activity in most of the basin where adequate rainfall is available. The economy, which is largely based on traditional cultivation methods, is subsistence oriented. Production is dominated by cultivating crops such as maize and sorghum for local consumption. The lowland population practise shifting cultivation, mainly for growing sorghum. In South Sudan more than 95% of households are categorized as subsistence-level rain-fed farmers cultivating small areas using simple manual agriculture implements.

In the semi-arid to arid areas of the sub-basin pastoral livestock becomes predominant. Livestock as a source of livelihood is more important for the South Sudan side of the basin where there is a high concentration of cattle, sheep, and goats. The main livelihood strategies in the sub-basin are therefore a combination of crop and livestock production followed by 'crop only' farming and 'livestock only' production.

Farm employment (combining crop and livestock production) constitutes the primary form of employment for the population. The communities in the sub-basin basin (both in Ethiopia and Sudan) appear to have very limited experience in accessing cash income due to the remoteness and inaccessibility of the region from regional market centres

Fishing is also an important component of the livelihood strategies of communities that live along the rivers and wetlands in the sub-basin. The Baro-Akobo sub-basin has a high potential for flood plain aquaculture, but lacks efficient aquaculture technologies.

Overall, there is a dearth of infrastructure in the sub-basin, specifically in terms of road networks, water supply and sanitation facilities, health and education services, provision of credit and extension services. Research undertaken in the western part of the basin indicates that there is a wide spread poverty and high levels of vulnerability.

The high rainfall, fertile lands, and rivers of the basin offer significant potential for agricultural growth. The potential for large-scale hydropower development has already been identified in the highland areas of the basin in Ethiopia.

2.2 STUDY OVERVIEW

2.2.1 Objectives

The objective of the consultancy services is to assist ENTRO in preparing an Integrated Water Resources Development and Management Plan (IWRDMP) based on a Strategic Social and Environmental Assessment (SSEA), and further develop investment packages for cooperative development in the Baro-Akobo-Sobat sub-basin. The Consultant has taken note of the following specific objectives:

- Preparation of a participatory strategic social and environmental assessment (SSEA) of the sub-basin to facilitate identification of investment options that take into account social, environmental, economic and institutional considerations.
- Formulation of an Integrated Water Resources Development and Management Plan (IWRDMP) informed by the SSEA to identify sustainable investments and provide a sound framework for long term development and management of water resources.
- Identification and preparation of feasibility studies, in a participatory and consultative manner with relevant basin stakeholders, short-term investment ready projects.
- Identification with participation and engagement of relevant stakeholders in the sub-basin, medium and long-term projects and initiate project preparation activities.
- Provision of an objective and effective framework for stakeholder consultation and engagement in cooperative development and management of water resources of the Baro-Akobo-Sobat sub-basin, and support to ENTRO in mobilizing funds for the implementation of the prepared projects.

It is important to stress the fact that the title of this project is Baro-Akobo-Sobat Multipurpose Water Resources Development Study. As such, it is important to keep in mind the need to emphasise the need for a multipurpose approach creating opportunities for the joint use of available water resources by different sectors and for conservation purposes and the related ecoservices that natural resources in good condition, can provide.

2.2.2 Main Steps

The study is both complex and challenging. It is complex because there is clearly a need for rapid development to support social upliftment and there are apparently the land and water resources to support this. At the same time, most of the environmentally sensitive areas are downstream of these potential developments and could be irreversibly impacted if development is not well planned and, once implemented, well monitored. It is especially challenging because there is a dearth of the critical data that is required to the necessary planning. There are a lack of historical hydrological data and an absence of operational surface water river gauging stations in the areas of the system where the hydrology is most complex. To complicate matters further, access to the parts of the basin where knowledge is particularly limited (Machar Marshes and other wetlands in South Sudan) is very limited due to the unfavourable security situation. The Consultant has tried to mitigate both this complexity and the challenges through the use of remote sensing and associated modelling techniques.

A simplified flow chart presented in Figure 2-3 provides an overview of the main steps of the study.

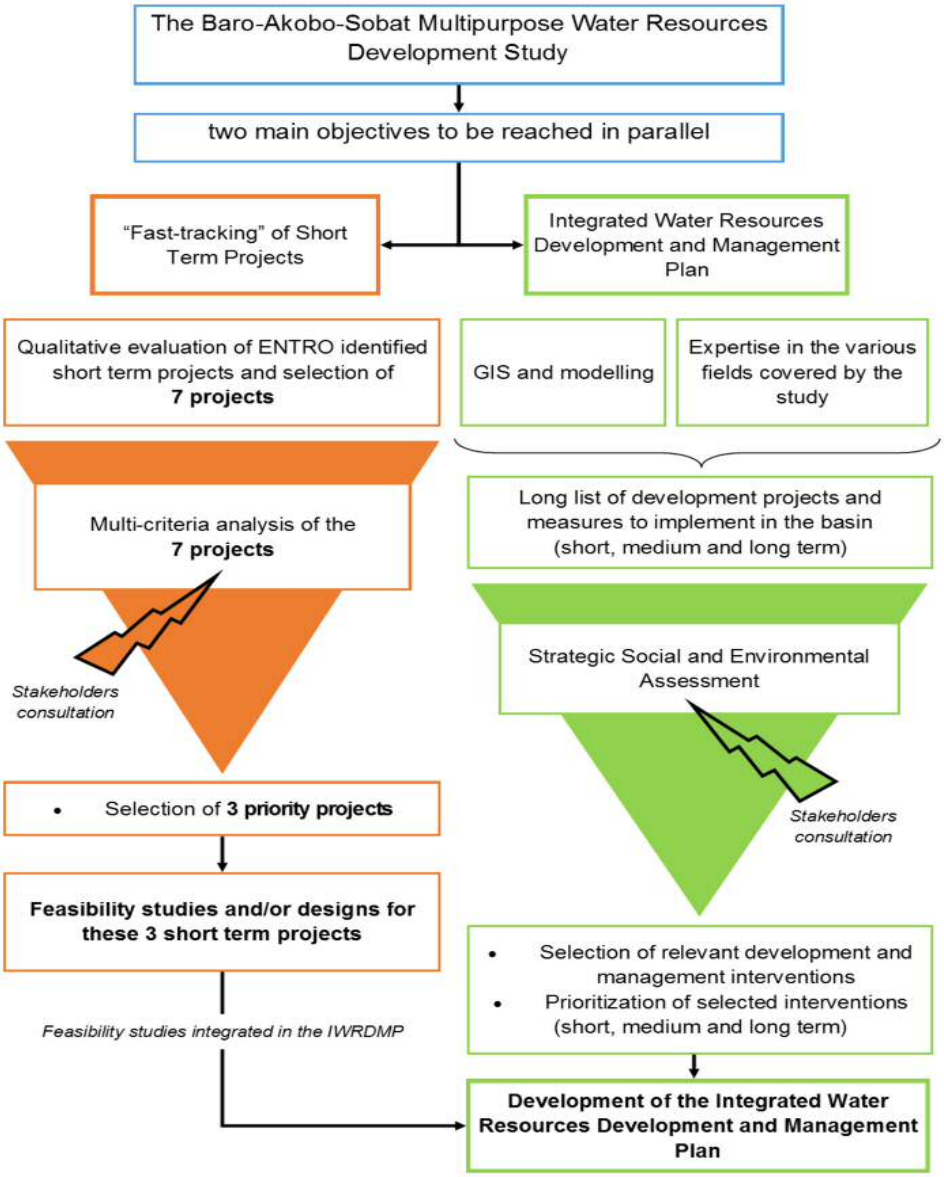


Figure 2-3: Flow chart showing key steps of the study

3. STRATEGIC FRAMEWORK; VISION AND STRATEGIC OBJECTIVES

3.1 Introduction

Development potentials and opportunities within the BAS basin were presented together with identified key issues in Baseline, key Issues and Objectives Report. A key aim of the baseline work was to understand the status of the basin from a number of perspectives, and to appreciate the related issues and challenges.

Organizing and understanding the key issues was a first step towards defining a vision for the basin in the future and for defining the strategic objectives that need to be achieved to move towards this vision. The issues were grouped into environmental, socio-economic and institutional issues.. This was discussed by stakeholders at a regional workshop and a vision and strategic objectives provisionally decided. Understanding the issues and potential development opportunities is also critical in the design of the SSEA analytical framework which should be in line with and responsive to the issues and potential development-driven changes in the basin.

The key environmental, social issues and institutional issues, as identified in the baseline work, are summarized in Sections 3.2.1, 3.2.2 and 3.2.3. For details, reference should be made to the Baseline, Key Issues and Objectives Report.

3.2 Key Environmental, Social and institutional Issues

3.2.1 Socio-economic environment of the BAS sub-basin

The key issues identified are summarized in Table 3-1.

Table 3-1: Summary of Socio-economic issues

Issues	Existing Issues	Issues related to potential change (Potential Impacts of Change)
Poverty and Food Insecurity	• Poverty in the basin is both pervasive and deep, but is also differentially distributed across the basin. Poverty can be seen as a root cause for many other social and environmental issues and challenges. Poverty levels are high despite the relative abundance of natural resources and relatively low population density in many parts of the basin.	• The alleviation of poverty must be a central objective of any future development and investment plan for the basin. • Clearly a key aim of development and associated change will be poverty reduction. Positive and negative impacts must be taken into account.
Low level of well-being	• The basin area has low levels of wellbeing. the development options will consider ways of enhancing the basin's population wellbeing	• Development options will consider ways of enhancing the basin population's wellbeing
Lack of peace and security	• The ongoing security in many parts of South Sudan is the single largest constraint to development and social upliftment in the basin. • Unpredictable conflict between tribes and ethnic groups within the region and cross-border conflict.	• Although potential developments and resultant change will assume that peace has returned to South Sudan and that both countries are stable, the issue of conflict over natural resources must be fully taken into consideration
Low level of provision of social services	• Access to services within the basin is very low. Within the Ethiopian part of the basin it is lower than elsewhere in the country. Gambella is in the process of being connected to the national grid but outside of urban centres levels of electrification are low throughout the basin.	• Important to consider how development change can impact on these aspects positively and negatively. • Development of projects can bring improved infrastructure, better

Issues	Existing Issues	Issues related to potential change (Potential Impacts of Change)
	• Poor physical and social infrastructure and communication (poor access to health and education services, poor animal husbandry and animal health services, lack of market outlet, absence of roads and information, etc. are among the constraints to basin development.	technology and improved access to services resulting in better connectivity and access to credit and markets.
Vulnerable groups	• There are many sizeable vulnerable groups in the basin including pastoral groups, women and children, conflict and war displaced people, internally-displaced persons, refugees, etc.): Much of the basin is marginalized from the mainstream economy of both countries and have experienced various forms of risks (both natural and economic),	• Major change can exacerbate position of vulnerable groups if not well planned. • Development in the basin can reduce the current levels of isolation and marginalization.

Gender inequality	• Gender inequality is an issue at household, community and national levels, as women have low access to productive resources, education and health services. The work burden for women is also high. The level of legal disenfranchisement is high for women. In most cases they are socially limited and excluded from important economic activities and resources such as property as well as effective political representation. There are a number of common issues, despite differences between ethnic groups.
	• Important to note: area of inequality:
	  • Equality in access to education
	  • Access to employment
	  • Access to wealth,
	  • Inheritance rights
		• The change that comes with development can improve gender equality if well-managed. This should be taken into account in evaluation of development. Improved access to health services and education will help reduce gender inequality.
		• Important to consider how drivers of gender inequality may be impacted positively and negatively by potential development projects

Scattered settlements	• The settlement pattern of the communities, where many rural communities are scattered along the river banks increasing susceptibility to flooding and reducing accessibility, thus making access to social services complicated.	• Potential positive impacts related to reduced flooding and increased urbanization to be taken into account in evaluation
Poor agriculture extension and poor credit facilities	• Agricultural extension programs which are not designed to address the complex socio-cultural farming systems and agro – climatic conditions in the basin. • Lack of, or no, rural credit facilities, agricultural input supply and market facilities, inadequate linkage between research – extension farmers and cooperatives, prevalence of livestock diseases and crop pests, inadequate market infrastructure and marketing information system and traditional farming techniques are among the constraints limiting agricultural productivity in the basin.	• Important to consider how development change can impact on these aspects positively and negatively. • Development of projects can bring improved infrastructure, better technology and improved access to services resulting in better connectivity and access to credit and markets. These aspects to be taken into account in evaluation of development impacts and change

Recurrence of various forms, intensity, duration and impacts of conflicts	• Conflicts in the basin occur as interrelated and mutually reinforcing layers consisting of three main types of conflicts.
	  • Resource-based conflicts in South Sudan relate to the management, allocation and control of land and water resources. Resource allocation conflicts between national and state/regional governments and indigenous people over land allocation policies and practices. Unclear land tenure and the lack of effective conflict resolution mechanisms mean that there is high potential for conflicts.
	  • Historical pastoralist conflicts: cattle raids, communal clashes, revenge attacks. The frequency and intensity of these conflicts have increased in recent years.
	  • Political conflicts in the basin on both sides of the border.
		• New developments will change the dynamics and can offer both opportunities and new challenges in terms of conflict management
		• Transfer of large areas of lands into the hands of investors can cause conflict and unrest
		• The breakdown of customary means of conflict resolution means that governance structures on managing and allocating land and water resources need to be strengthened and applied equitably. Legal and institutional frameworks to address issues such as land tenure, water rights and conflict resolution need to be developed and

Issues	Existing Issues	Issues related to potential change (Potential Impacts of Change)
		implemented in a consultative and transparent manner at all levels
Potential for influx of people	• There has been migration across the border into Ethiopia from South Sudan by refugees. • Influx into the basin has been relatively limited since the current level of development and employment opportunities is limited.	• The various development options/alternative will result in an influx of people into the basin from other areas of the two countries.
Risks	• Risk is high in many areas. Conflicts, flooding, disease outbreaks, economic shocks, insecurity etc. are common in the area.	• Many of the risk areas can be impacted by changes resulting from development, many in a positive way.
Flood and drought	• Flooding is a real challenge for many communities living in many areas around Gambella and elsewhere. It is also a challenge for the development of agriculture in flood-prone areas. Drought is also a risk and affects food security.	• Regulation can have a major, generally positive, impact on issues associated with flood and drought
Land security/land tenure issues	• There are significant land security and tenure issues with respect to the rights of indigenous people. These rights and land tenure issues are relevant when designating land for any type of development.	• Development will require that land security and tenure issues are properly addressed.
Climate change	• Effects of climate change are uncertain but are likely to lead to an increased occurrence of extreme events such as floods and droughts. Without adaptation of natural resources management practices, many social issues will be exacerbated.	• New developments can provide opportunities for climate change adaptation and this should be taken into account when evaluating development options.
Weak institutions, poor coordination and cooperation among existing institutions	• There are varying levels of capacities and resources in the basin countries and the BAS sub-basin. In many areas capacity is very limited.	• Properly planned and managed development can bring increased capacity and institutional strengthening. • Multipurpose projects can help build coordination and cooperation between institutions

3.2.2 Bio-physical environment of the BAS sub-basin

Table 3-2: Summary of environmental issues

Issues	Existing Issues	Issues related to potential change (Potential Impacts of Change)
Stress on Wetlands	• Loss of wetlands in upper sub-basin due to wetland drainage, over cultivation, over exploitation. This is the result of both misguided policy/strategy and poor management. These wetlands are home to *cyperus latifolius* (epiphytic flatsedge), which is used for thatching.	• A reduction in the inflow (through abstraction or regulation) of river water into the downstream wetlands (Gambella, Machar Marshes etc) will resultant change in wetland functions. Without due care, this could have an impact on wildlife, livestock and fish through reduction of dry season grazing, spawning areas etc
Loss of biodiversity	• Despite a historic attention paid to conservation in Ethiopia, the countries protected areas are increasingly degraded. Land is being converted for subsistence and commercial agriculture, timber use, fuel wood and construction, protected grasslands used for livestock grazing. The loss of forests and other protected land is underpinned by a growing population, unsustainable natural resource management, poor enforcement of existing legislation, uncertain land tenure and very low public awareness of the impact of climate change and the importance of biodiversity and ecosystems.	• In South Sudan, the situation is much better with many areas in a relatively pristine condition. The potential for rapid development and the risks that go with it if not properly managed are there. These risks have already showed themselves with pollution issues around oil exploitation • Provision of alternative energy sources (eg electricity) can have a

Issues	Existing Issues	Issues related to potential change (Potential Impacts of Change)
		positive impact, reducing and reversing deforestation rates. • Changes to downstream wetland functioning can impact biodiversity.
Unsustainable hunting of wildlife	• The civil war and the proliferation of arms allows hunters to kill more wildlife with less effort. In the context of insecure tenure, wildlife has become an open access resource and well-armed hunters are rapidly depleting wildlife populations. This is exacerbated by a lack of livelihood options for internally displaced people (IDP) and returning refugees. • Livestock grazing pressure, access to water and the transmission of wildlife-livestock diseases are important factors affecting local wildlife, livestock and human communities as well as natural resource management (USAID, 2010c).	• With project assumes peacetime conditions which should resolve some of the problems.

Loss of natural forest	• The dominant environmental change in the Baro-Akobo sub-basin is the loss of forest cover, most marked in the southern and eastern part of the upper sub-basin. Estimated annual loss of forests and other wooded land in South Sudan is 277,630 hectares. In the high forest areas of Ethiopia (Dima, Godere, Gog, Akobo and Gambella woredas) deforestation estimated at 2.23% caused by expanding population. Annual destruction of the woody biomass from the high forest areas for agricultural expansion in BAS basin of Ethiopian side is high.
	• Important to note drivers of deforestation:
	  • Clearing for cultivation: The most important factor
	  • Clearing for roads and settlements:
	  • Charcoal burning: The main fuel used in urban centres
	  • Brick making in South Sudan:
	  • Construction and fire wood;
	  • Unsustainable levels of livestock grazing
	  • Fires (by farmers, pastoralists and hunters, natural)
	  • Population growth and resettlement
	  • Allocation of forest land to state farms and investors
		• Provision of alternative energy sources (eg electricity) can have a positive impact, reducing and reversing deforestation rates
		• Projects may require clearing of forest
		• Important to consider how drivers of deforestation may be impacted positively and negatively by potential development projects

Soil erosion	• Soil erosion is a serious problem particularly on sloping areas with coarse soil texture and poor vegetation cover. Erosion is more prominent in the highlands of the BAS basin due to higher human pressure, steeply sloping land and/ or generally coarser soil types
	• Important to note drivers of deforestation:
	  • Cultivation, in particular using poor farming practices. Lack of soil conservation measures and cultivation close to stream edges
	  • Deforestation (see previous issue which includes many specific drivers)
	  • Over-grazing
		• Livelihood-based Watershed management programmes can contribute positively.
		• Development of reservoir storage can catalyze soil erosion reduction/ prevention measures
		• Important to consider how drivers of deforestation may be impacted positively and negatively by potential development projects

Scattered settlements	• Many rural communities are scattered along the river banks increasing susceptibility to flooding and reducing accessibility, thus making dissemination of best management practices and technology more difficult.	• Regulation of flows and pull towards urban poles can have significant positive impact
Poor agriculture extension and poor credit facilities	• Agricultural extension programs which are not designed to address the complex socio cultural farming systems and agro – climatic conditions of the basin. • Lack of rural credit facilities, agricultural input supply and market facilities, inadequate linkage between research – extension farmers and cooperatives, Prevalence of livestock diseases and crop pests,	• Important to consider how development change can impact on these aspects positively and negatively. • Development of projects can bring improved infrastructure, better technology and improved access to

Issues	Existing Issues	Issues related to potential change (Potential Impacts of Change)
	inadequate market infrastructure and traditional farming techniques (hand tillage) are among the constraints limiting agricultural productivity in the basin.	services resulting in better connectivity and access to credit and markets.
Flood and drought	• While flood and drought are parts of the natural cycle, the social impacts often results in exacerbation of environmental issues. This is the case sometimes in the Gambella Plains	• Regulation and to a lesser extent will have impacts on flood peaks and low flows and their durations. Environmental impacts will require careful evaluation
Lack of peace and security	• Unpredictable conflict between tribes and ethnic groups within the region and cross border conflicts. Cattle raiding and conflicts over resources..	• New developments will change the dynamics and can offer both opportunities and new challenges in terms of conflict management
Poor physical and social infrastructure	• Much of the basin is characterized by poor physical and social infrastructure and communication (poor access to health and education services, poor animal husbandry and animal health services, poor market outlet, absence of roads and information). In many areas, some services are (almost) totally absent. Absence of infrastructure and alternative livelihood opportunities can be a problem with increased population and pressure on natural resources.	• New developments will bring major improvements in infrastructure and access to services. Issues and challenges relate to good planning and change management. • Environmental impacts associated with new infrastructure and associated urbanization must be managed
Climate change	• Effects of climate change are still uncertain but are likely to lead to an increased occurrence of extreme events such as flood and drought (see flood and drought above). Without adaptation of natural resources management practices, climate change can result in environmental degradation	• New developments can provide opportunities for climate change adaptation, but they can also have impacts on natural resources which can be exacerbated by climate change.
Lack of knowledge	• Lack of knowledge constrains management of the environment is the lack of knowledge with respect to water and natural resources around the basin. This is especially true for South Sudan where the conflict situation and a lack of resources has meant that few hydrological and environmental data have been collected for decades. The biggest knowledge gap in the basin concerns the Machar Marshes	• There are significant risks associated with development based on inadequate data. • Investments in development can be used as leverage to invest in an improved knowledge base

3.2.3 Institutional Context of the BAS sub-basin

The key issues identified are summarized in Table 3-3.

Table 3-3: Summary of institutional issues

Issues	Existing Issues	Issues related to potential change (Potential Impacts of Change)
Transboundary Cooperative framework	• The Cooperative Framework Agreement has not yet been put into force.	• This is certainly a gap in itself and beyond this situation, it appears that very little institutional organization has been developed since 2010. This situation is not counterbalanced by other mechanisms such as possible bilateral agreement relating to development based on water resources, nor future management and operation of activities having transboundary effects

Issues	Existing Issues	Issues related to potential change (Potential Impacts of Change)
Security and instability	• The ongoing security situation in many parts of South Sudan is the single largest constraint to institutional development at all levels, but especially at the local level. • Within the Ethiopian portion of the basin there are also security issues, especially in Gambella Region, but also in part of Oromia. These also have an impact on the effectiveness of regional and local level institutions • The security situation has a knock-on effect on other institutional aspects indicated further in this table.	• Project implementation will require a stable situation free from political conflict. • This has been assumed in formulation of the Plan so should no- be considered as an issue related to potential change. Indeed, it is assumed that this improved situation will support institutional change
Lack of capacity/ experience in (MPP) project implementation	• The planning, development, implementation and management of multipurpose projects are relatively new concepts. ENTRO has experience in planning of projects, including the multipurpose concept (MSIOA, watershed management etc) • National and local level experience in the development and implementation of projects is minimal and existing arrangements tend to support unilateral sectoral development. Capacity and experience at the national levels is limited, largely because implementation tends to take place along sectoral lines..	• There is a gap with respect to multipurpose project implementation and especially operation and maintenance, bearing in mind that there will be a high level of sectoral inter-dependence in terms of shared infrastructure, water resources management etc. • Absence of the cooperative framework of similar transboundary tool will be a challenge
Capacity of local government institutions and Water Users	• The capacity of local government institutions within both countries is weak. This represents one of the major issues when it comes to implementation	• This represents one of the major issues when it comes to implementation
Lack of inter-sector coordination and cooperation	• Sectoral developments including the required associated water resources development are currently being conceived and planned almost independently.	• The lack of inter-sector coordination, necessary right at the beginning of the project cycle will be an unacceptable hindrance to the most efficient use of water resources and the early identification and planning of multipurpose projects which could build on cross-sectoral planning and capitalise on shared spending from the earliest possible time
Planning based on limited consultation	• Due, amongst others, to the security challenges in South Sudan in recent years, there is little preparedness for large developments based on water in general. Despite progress in drawing up master plans at national scale (agriculture, irrigation…), it is doubtful that adequate grass roots level consultation of stakeholders was possible.	• The project situation assumes peace and stability so this problem should be resolved
Inadequate water resources data/monitoring	• One major weakness is relating to data, for water resources and many other items.Much data are old or missing and the literature references often cross quote each other. This is both a technical issue and an organizational issue when considering that developing a much more extensive and reliable monitoring network should be put at the top of the list of priorities (hydro-meteorology especially). As an example, the Machar marshes are almost not known at al and yet their consideration will be central to any water resources modelling exercise..	• This can only be envisaged in the frame of a close cooperation between the two countries, through: exchange of data, water information system, global ESIA (not case by case) etc. This is an institutional and policy matter
Land security/land tenure issues	• There are significant land security and tenure issues with respect to the rights of indigenous people.	• These rights and land tenure issues are relevant when designating land for any type of development (commercial farm; large scale irrigation, hydropower, national parks, protected areas).

3.2.4 Conclusions

These are, in summary form, the issues and challenges that have been taken into account when formulating a vision for the basin.

3.3 A Vision for the BAS sub-basin

The Vison is a future state and in the case of the IWRDMPlan it is how we envisage the future state of the BAS basin after implementation of the IWRDMPlan. It should be stressed that the Vision statement does **not aim to state how or what has to be done** for the envisioned future state to be achieved.

Ultimately it is the vision that guides the design of the plan and building the plan therefore requires the building of a **chain of logic** that allows us to understand why each action that is defined in the plan plays a role towards achieving the vision.

The vision comprises the following elements:

- A vision statement for the future state of the basin. This is the figurehead of the visioning process, but not in itself the critical element.
- Associated timeline. The vision of the future state of the basin should be related to a timeline. In this case the timeline is assumed to be 25 years
- Justification and explanation of the vision.
- A comparison between the current and targeted situation. This is important so that progress that may result from implementation of the plan can be measured. There should be a clear understanding of the current and targeted status of each of the key elements of the vision.
- Monitoring indicators. These will be used in the overall monitoring and evaluation system for the plan to see whether the desired changes are being achieved.

During the baseline workshop held in Adama, Ethiopia on April 16th, 17th and 18th 2016, some time was put over to the workshopping of a potential vision for the basin in 2042 and associated strategic objectives. Three groups, each with representation from Ethiopia, Sudan, South Sudan and ENTRO worked on the tasks of drawing up a vision and associated strategic objectives.

Although the wording of the visions were different, there was general consensus on the key elements of the vision. The key elements of the future status of the basin and its inhabitants, as identified by the groups, can be summarised as follows:

- Sustainable development and management
- Security (in terms of peace, certainty);
- Prosperous (wellbeing);
- Connectivity (integration);
- Co-existence.

The following vision of the basin in 2042 is provisionally proposed:

"A sustainably managed and developed BAS river sub-basin with prosperous, connected, peacefully and mutually co-existing societies."

3.4 Strategic Objectives

3.4.1 Introduction

While the vision is a statement of where we want multipurpose water resources management and development to take us by 2042, the strategic objectives provide clear direction on **how to get there**. These objectives are closely related to the key water related issues and challenges (see section 3.2) and have been carefully developed with the proposed vision in mind.

3.4.2 Sustainable Development Goals

As with the vision, the formulation of the strategic objectives takes into account how the development and management of water resources should contribute to the attainment of the Sustainable Development Goals (SDGs) in and around the Baro Akobo Sobat sub-basin. There are 17 SDGs (see Annex 1), all of which can be considered in the context of a sustainable development programme such as the BAS IWRDMPlan. However, there are

- Goal 1. End poverty in all its forms everywhere
- Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
- Goal 6. Ensure availability and sustainable management of water and sanitation for all
- Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all
- Goal 13. Take urgent action to combat climate change and its impacts

Other SDGs which may be less directly related to the development and management of water resources, but which are absolutely critical for the sustainable development of the basin's water resources, include:

- Goal 3. Ensure healthy lives and promote well-being for all at all ages
- Goal 5. Achieve gender equality and empower all women and girls
- Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
- Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
- Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

3.4.3 Strategic Objectives in the SSEA and for the IWRDMPlan

As part of the visioning exercise already introduced in section 3.3, there was a stakeholder-driven effort to derive the draft strategic objectives that would be required to lead towards realisation of the vision. Three groups worked independently to come up with their suggestions for the strategic objectives and then these were discussed in a plenary session. The Groupwork outputs are summarised in Annex 2.

The following draft strategic objectives were developed based on the stakeholder discussions and the need to develop a coherent and logical set of objectives, the realisation of which will ensure that the vision becomes a reality.

- To contribute to food security, livelihood enhancement, poverty reduction and the protection and conservation of biological resources through stakeholder-driven management of wetlands, watersheds and other important natural resources;

- Taking into account the comparative advantages of the different parts of the sub-basin to sustainably develop water resources for hydropower, irrigation, water supply and sanitation and other sectors with the dual aims of reducing poverty within the sub-basin and generating revenue;
- To ensure transboundary and inter/intra sectoral cooperation and benefit sharing with a view to minimizing resource-based conflicts through optimized management and use of water and associated resources;
- To manage water resources so that disasters associated with flood and drought can be prevented and/or mitigated;

These represent the strategic objectives which would lead to concrete improvements on the ground. However, stakeholders were unanimous on the importance of capacity building and institutional strengthening at all levels and an additional draft strategic objective reflecting this aim, was also initially tabled:

- To enhance human and institutional capacities for sustainable management of the water, land, ecosystems and related resources.

During the initial development of this plan it was found that this objective cannot be considered **as an objective in its own end. In other words, the building** of capacity is not done for capacity's sake, but rather to support the realisation of other objectives. It cannot therefore be considered as a strategic objective of the plan. Action associated with capacity building and institutional strengthening must be considered as **enabling** in nature

The strategic objectives were included in the first draft SSEA Report and presented to stakeholders in August 2016.

The importance of the strategic objectives cannot be overstated. In view of the fact that SSEA is a stakeholder-driven process, the agreed strategic objectives provide consensus on key issue areas and challenges. For example, it is clear that accelerated development is a prerequisite but that this development should be sustainable. It should also make provision for both large-scale water resources development and for the conservation of natural resources and support to the livelihoods that depend on these resources. Transboundary cooperation and conflict resolution are also critical concerns that should be fully taken into account in the SSEA analytical framework.

4. STRATEGIC ANALYSIS

4.1 INTRODUCTION

The SSEA has provided the key findings that will guide the definition of strategic actions within the already agreed framework of the Vision and strategic objectives.

4.2 STRATEGIC SOCIAL AND ENVIRONMENTAL ASSESSMENT

4.2.1 Introduction

The approach adopted follows the recommendations of the two most recent guidelines of the funding partner (African Development Bank) :

- AfDB. (2014). Integrated Safeguards System Guidance Materials - Volume 1: General Guidance on Implementation of OS 1. Tunis: AfDB.
- AfDB. (2015). Environmental and social Assessment Procedures (ESAP). Abidjan: AfDB.

As stated in these guidelines, “SESA (SSEA) should be undertaken in a more flexible and adaptive manner than traditional project ESIAs, depending on the nature of the Program-Based Operations (PBO), and especially the likely relationship between the PBOs and downstream decisions, activities and investments “.

4.2.2 An iterative process

At the core of the SSEA is the assessment of the potential environmental and social implications of the existing development options and the selection of the preferred development option or development pathway. Since there is a wide range and even a continuum of development possibilities, the main purpose of the SSEA is to inform the IWRMP about the sustainable envelope within which development options can be defined. This requires understanding how the system reacts to various development intensities and defining environmental and social thresholds which reflect the limits of sustainability. As the SSEA has been developed in synergy with the design of the IWRDMP, a stepwise and iterative process was followed. The baseline report defined the current situation in the basin, the various development potentials and the existing and potential environmental, social and institutional issues. This provides the starting point for the SSEA.

- In Step 1 the Vision and associated strategic objectives for the IWRDM Plan were decided. These are highly strategic in nature but are aimed at providing a consensual framework for the SSEA;
- In Step 2 the aim was to define the water resources related “development space” of the BAS, through the investigation of effects associated with different levels of hypothetical and highly contrasting water resources development intensities. This approach was used to investigate and understand the environmental and social implications and associated opportunities/possibilities of different water resources development and management options. It is important to stress three key aspects of this step:
  - The different options have been particularly designed to understand the respective effects of irrigation development, irrigation storage, hydropower and irrigation and hydropower combined together. An important part of the effects investigated relates to the positive and negative impacts on economic activities dependent on the ecological services provided by potentially impacted natural resources. This is a central part of the analysis.

- The different levels of development intensity are represented by levels of water resources development, in particular the development of large irrigation and hydropower schemes. The design of each level of development intensity to be investigated has been done with the aim of understanding the different environmental and social impacts at the basinwide level through the use of water resources modelling and application of other tools. The investigation of different development intensities should not be confused with the assessment of water resources management and levels of development intensity which will come at a later stage and which will compare realistic and specific development options.
- The so-called development space is multidimensional in nature. There is not a single "hinge point" beyond which resources development becomes unsustainable. The approach adopted considers a number of key environmental and social dimensions each with their own thresholds. Figure 1 below illustrates the idea of the multi-dimensional analysis.

The tool used to carry out this multidimensional analysis is referred to as the *SSEA Analytical Framework.* At the core of this framework is the water resources model. Water resources modelling is critical in the investigation of these levels of development intensity since it makes it possible to look in detail at a wide range of water resources related effects for a large number of points and areas all around the basin.

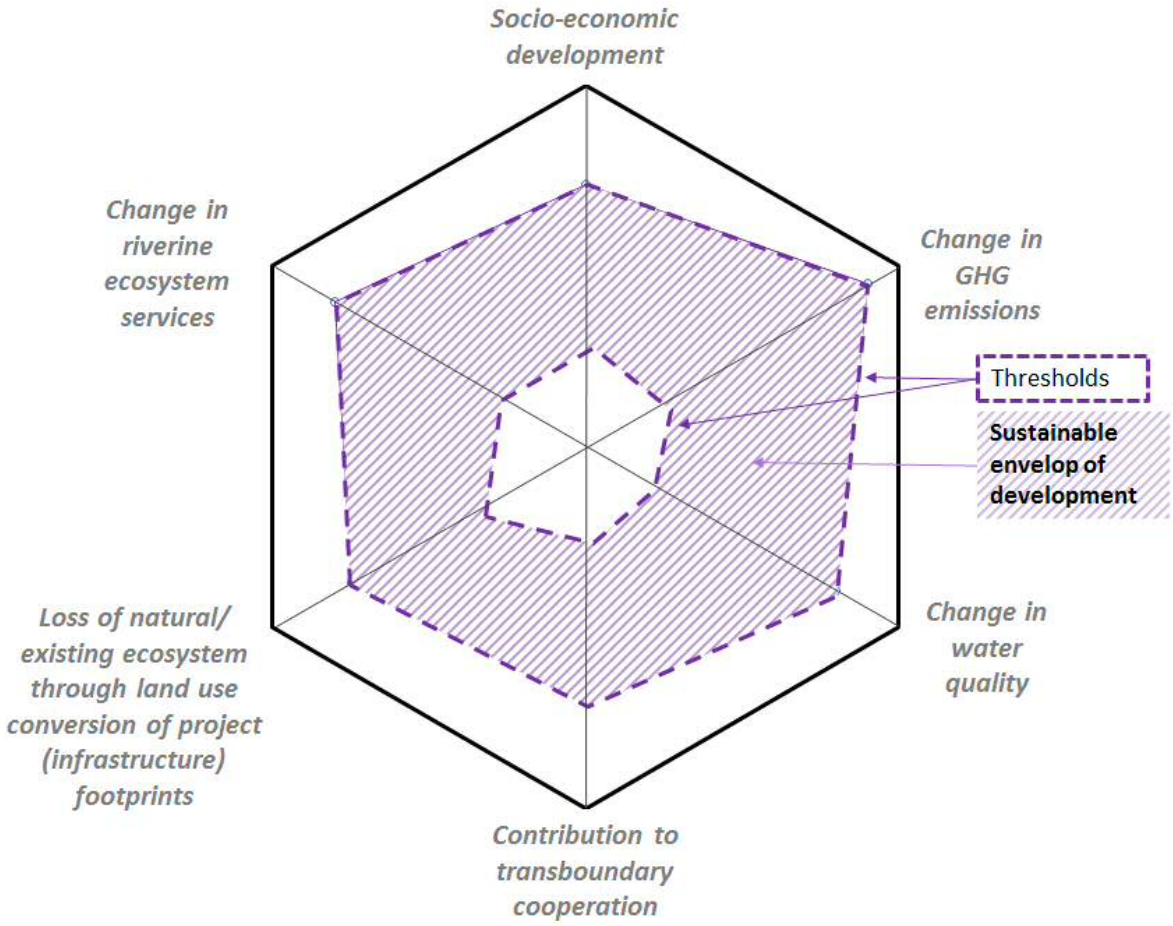
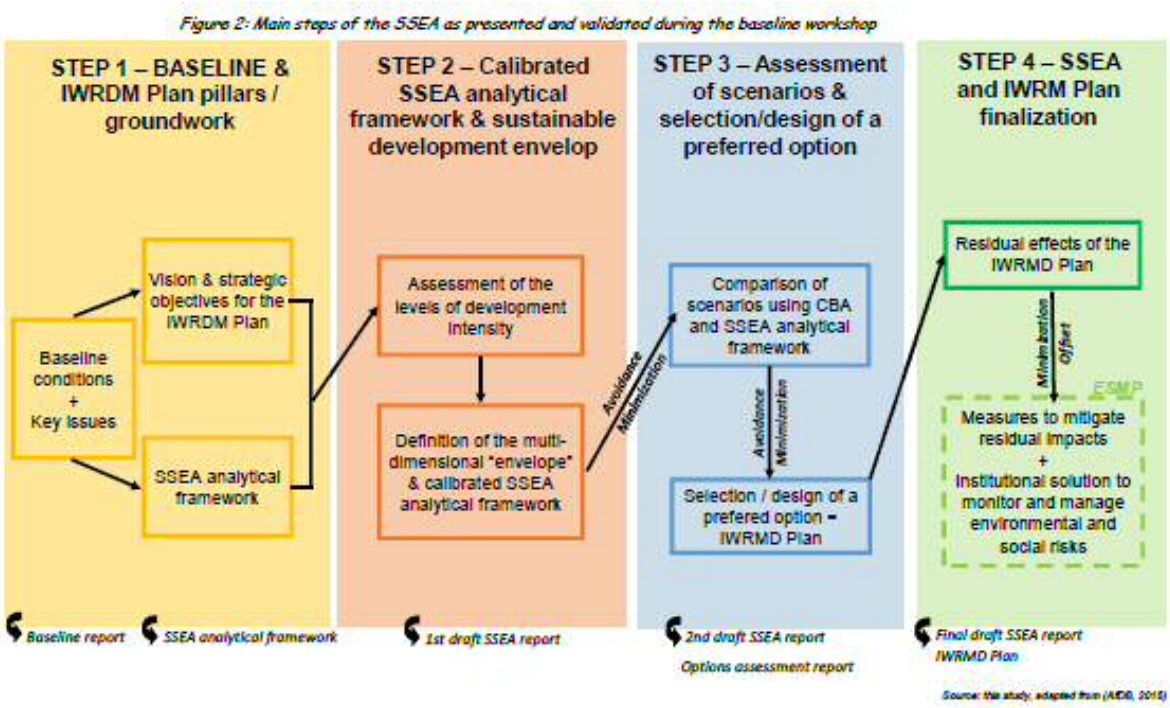


Figure 4-1: The multi-dimensional concept

A key part of the strategic analysis was to firstly define a sustainable development space from the social and environmental perspective, aimed at ensuring that the **detailed analysis of water resources development and management options would be focussed on a set of realistic and socially and environmental acceptable scenarios**. This is shown as Step 2 in

Figure 4-2.

Figure 4-2: Main steps of the SSEA and interrelation with the IWRDMPlan



In a second step (Step 3 in

Figure 4-2), the realistic options were investigated in detail (Options Analysis), making use of both the water resources and an economic model in order to move towards a preferred development option (or at least the key recommendations that would define the first steps of a development pathway. This would accept the fact that such a development pathway **would still include a number of alternatives and questions to be answered as part of implementation of the IWRDMPlan itself. The options analysis is presented in more detail in Section 4.2.3.**

Associated with the agreed development principles and priority actions, the SSEA then presented an Environmental and Social Management Plan which includes the definition of actions related to dealing with the residual effects of development, SSEA monitoring and evaluation and SSEA-related environmental considerations. The SSEA process, including showing how it relates to the IWRDMPlan, is summarised in

Figure 4-2.

4.2.3 Options Analysis

4.2.3.1 Introduction

In the third step of the SSEA and one which contributes directly to the formulation of the IWRMDPlan, the aim is to propose development options that fit within the development space. These options (scenarios) are more detailed than the "*levels of development intensity*" and looked at different combinations of specific projects and/or management approaches as defined in a number of scenarios or options that have been investigated in detail. The principal objective was that the water resources development and management scenarios fall within the multi-dimensional envelope of development space, that is to say, are within the social and environmental thresholds, "ensuring" the sustainability of the proposed development. However, there were a number of different options which fell within the development space. For this reason, the comparison of the scenarios/options also made use of an economic and financial analysis carried out on each of the options. The results of this analysis are presented in Annex 3 of the SSEA, *"Assessment of options; Cost-benefit Analysis").*

The Assessment of Options is therefore aimed at identifying a preferred water resources development and management scenario or development pathway which:

- is environmentally and socially sustainable (SSEA);
- is cost-effective (cost-benefit analysis as part of the economic and financial analyses), taking into account preliminary estimates of cost of mitigation measures recommended by the SSEA;
- Will lead to satisfaction of the agreed strategic objectives and therefore ultimately the vision for the basin (IWRDMPlan).

The scenarios analyzed as part of the SSEA consist of various combinations of the identified projects. These projects are mapped in Figure 4-3.

The scenarios can be summarized as follows:

- **Scenario 0 or Baseline scenario:** it is the status quo, which provides a benchmark for the SSEA. The Baseline case includes current domestic and livestock water use, current small-scale irrigation, 10 400 ha irrigation from Abobo Dam and 5 MW Sor Hydropower Dam.
- **Scenario 1:** This is a Precautionary Principle case, using reduced irrigation areas (small-scale and large-scale) with no encroachment into environmentally sensitive areas. Irrigation dam storage volumes were also reduced where possible to account for the reduction in irrigation water requirements when this was the case. All potential hydropower dams were included with the notable exceptions of **Tams Dam and Birbir Dam**. These two large dams were excluded in order to limit the potential downstream effects of over-regulation.
- **Scenario 2:** This is an extension of the Precautionary Principle case, similar to Scenario 1, except that Tams Dam and Birbir Dam are included.
- **Scenario 4a:** This is a "full-development" case, with Tams Dam **operated to maximise hydropower production.** All future small-scale and all identified potential large-scale irrigation schemes are included. All identified potential hydropower schemes are also included.
- **Scenario 4b:** This is a "full-development case, with Tams Dam operated to **optimise irrigation and flood control.** All future small-scale and all identified potential large-scale irrigation schemes are included. All identified potential hydropower schemes are also included.
- **Scenario 3a:** This is a Compromise case, similar to Scenario 2, but with environmental water releases imposed on all dams in order to conserve natural flow patterns.
- **Scenario 3b:** This is a Compromise case, similar to Scenario 4a, but with environmental water releases imposed on all dams in order to conserve natural flow patterns.

All scenarios (except the baseline scenario) also include livestock development, fisheries development in reservoirs and fish farming development in irrigation schemes. They also include water supply requirements related to the projected population increase in 2041.

Additional investigation scenarios were also performed to look at the implications of imporved irrigation efficiency (hence reduced irrigation application) and climate change.

Table 4-1: Alternatives considered - Inputs parameters in the water model

	Baseline	Precautionary principle options		Compromise options		Full development options	
	Scenario 0	**Scenario 1**	**Scenario 2**	**Scenario 3a**	**Scenario 3b**	**Scenario 4a**	**Scenario 4b**
Irrigation demand							
Irrigation -general principles	Existing irrigation	Irrigation avoiding sensitive areas	Irrigation avoiding sensitive areas	Irrigation avoiding sensitive areas	All irrigation	All irrigation	All irrigation
Irrigation - small-scale	Existing diffuse (117 692 ha)	Existing diffuse (117 692 ha) + 76% identified potential (63 555) = 181 247 ha	Existing diffuse (117 692 ha) + 76% identified potential (63 555) = 181 247 ha	Existing diffuse (117 692 ha) + 76% identified potential (63 555) = 181 247 ha	Existing diffuse (117 692 ha) + 100% identified potential (83 616) = 201 307 ha	Existing diffuse (117 692 ha) + 100% identified potential (83 616) = 201 307 ha	Existing diffuse (117 692 ha) + 100% identified potential (83 616) = 201 307 ha
Irrigation - large-scale	Almost existing 10 400 ha (Alwero scheme)	Alwero scheme + 67% identified potential (363 219 ha) = 373 623 ha	Alwero scheme + 67% identified potential (363 219 ha) = 373 623 ha	Alwero scheme + 67% identified potential (363 219 ha) = 373 623 ha	Alwero scheme + 100% identified potential (544 365 ha) = 554 769 ha	Alwero scheme + 100% identified potential (544 365 ha) = 554 769 ha	Alwero scheme + 100% identified potential (544 365 ha) = 554 769 ha
Irrigation dams	Existing Abobo dam	Only as required to support irrigation (reduction of Full Supply Level of Gilo 1 and Gilo 2)	Only as required to support irrigation (reduction of Full Supply Level of Gilo 1 and Gilo 2)	Only as required to support irrigation (reduction of Full Supply Level of Gilo 1 and Gilo 2)	No Baro storage (without Gambella and Itang dams)	No Baro storage (without Gambella and Itang dams)	No Baro storage (without Gambella and Itang dams)
Irrigation - total demand (ha)	128 092	554 870	554 870	554 870	756 076	756 076	onl 756 076
Irrigation - total annual demand (BCM)	0.176	6.44	6.258	6.619	9.46	9.098	9.001
Hydropower capacity							
Hydropower - general principles	Existing Sor dam	All hydropower dams except TamsandBirbir	All hydropower dams	All hydropower dams with conservation of some natural flow patterns	All hydropower dams with conservation of some natural flow patterns	All hydropower dams with operation aimed at maximising hydropower production	All hydropower dams with operation aimed at maximising irrigation and flood reduction
Hydropower - total installed capacity (MW)	10	1 243	2 710	2 710	2 710	2 710	2 710
Storage capacity							
Combined theoretical storage capacity of hydropower, irrigation and multipurpose dams (BCM)	0.1	8.2	20.9	20.9	20.9	20.9	20.9
Water supply							
Water supply requirements (BCM/year)	0.11	0.24	0.24	0.24	0.24	0.24	0.24
Livestock watering							
Water requirements (BCM/year)	0.05	0.08	0.08	0.08	0.08	0.08	0.08
Livestock sector development	Current	Deemed to be developped as an indirect consequence of the water development in the Basin					
Aquaculture and fish farming							
Sector development	Current	Fish farming : 1% of irrigated areas Rizipisciculture : 1 % of rice irrigated areas					

NB: In the table above, the scenarios are described as inputs of the water resources modelling. It is important to note that input paramaters are only one part of describing scenarios. It is important to consider the outputs very carefully as well). For example, the **targeted irrigation surface area leads to the calculation of the irrigation demand** (how much water is required to irrigate the targeted surface area) is an input of the water model. **As an output, the model gives information about how much water is available which is then converted into an irrigable surface area** (the surface area which can be effectively irrigated when the water deficits are taken into account). For hydropower, the input is expressed in terms of **installed capacity (MW)** of the sum of dams included in the scenarios. Once the model has been run, it gives, as **an output, the energy that can be produced (GWh/year) according to the water available for each scenario.** This is the important number to take into consideration.

Important qualitative parameters, such as indirect benefits associated with water resources development are not detailed here but are taken into account in the assessment of the alternatives and in the economic and financial analysis. In particular, positive externalities of scenarios are described and included in the economic and financial anaysis. For example, as navigation is not a consumptive water use, it is not part of the input parameters of the water model. However, the navigation sector is included in the analysis through the asssement of the navigable period (which depends on the river flows modifications specific to each scenario). Another example is that the development of infrastructure such as roads, schools, hospitals, ect. associated with the development of irrigation schemes is also taken into account in both the SSEA and the economic and financial analyses.

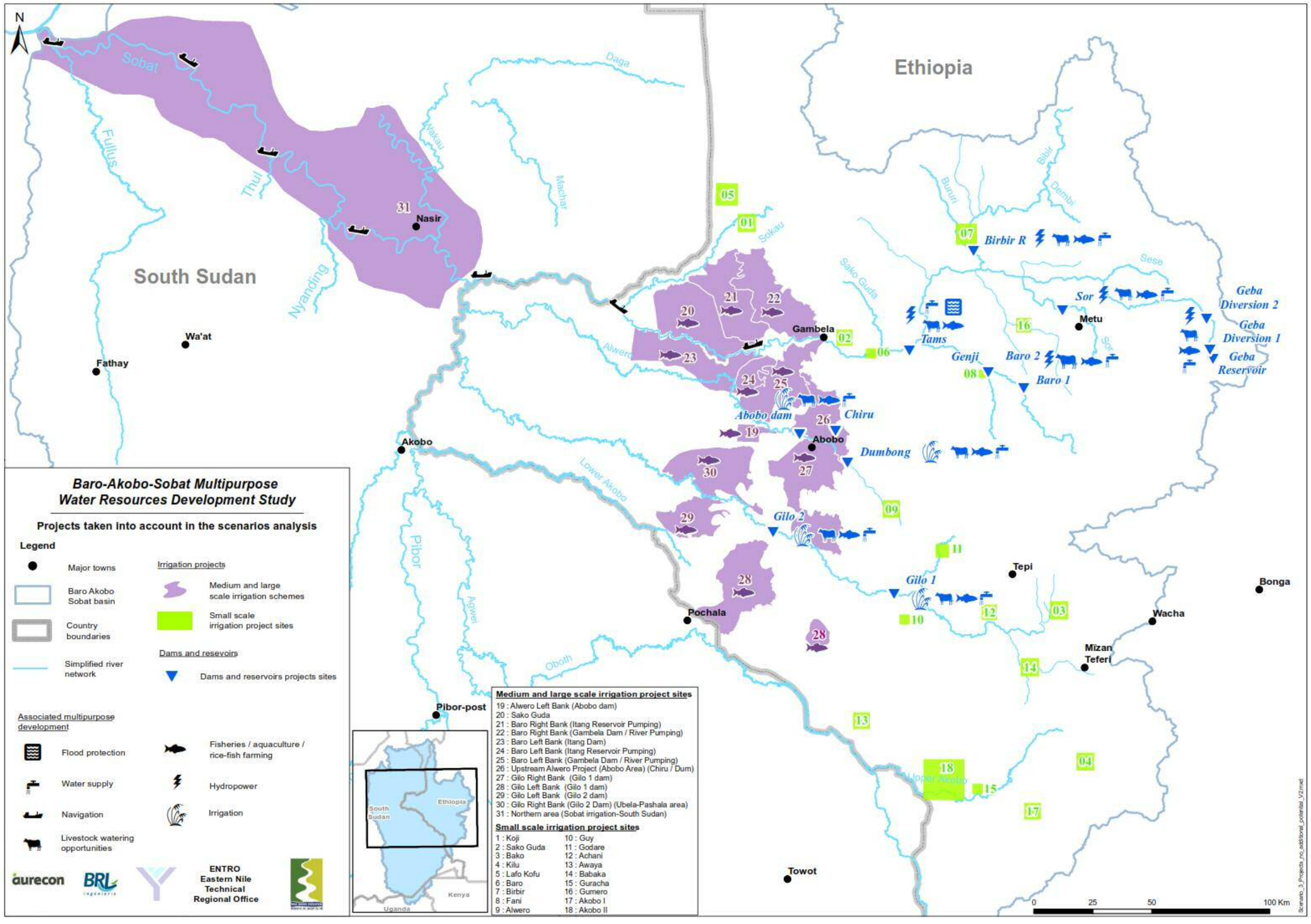


Figure 4-3: Location of irrigation, hydropower, water supply, livestock watering and fisheries developments included in the options analyses

4.2.3.2 Findings from analysis of options

INTRODUCTION

Detailed analysis is presented in Chapter 7 of the final draft SSEA report (including its analysis of options). For each of the SSEA analytical framework sub-dimensions, the results of the following analysis have been discussed in detail under the following headings:

- **Impact overview**: This refers to the nature of the impact (potential benefits and / or risks) and how it relates to potential changes generated by water resources development.
- **Scenario comparison**: this section assesses the significance of the impact according to each scenario.
- **Need for further acquisition on uncertain factors**: this section highlights the uncertainties and the need for further investigations before the implementation of some potential projects. It also highlights the need to include further investigations as actual actions within the IWRDMPlan;
- **Enhancement and mitigation opportunities**: this section focuses on avoidance and minimization options. The possibility of implementing offset options is not considered critical at this stage since they should only be considered once all preferred, or “low regret” development projects have been exhausted.
- **Residual significance**: Even if implementation of the IWRDMPLan takes place in full cognizance of recommendations of the SSEA, including enhancement and mitigation measures, there will be some residual significance which has to be identified and planned for.

The findings and preliminary conclusions of the SSEA are based on these discussions. In this report only some limited context and the main findings are summarised under the headings of:

- Outputs from the water resources modelling
- Application of the SSEA Analytical Framework
- Economic and financial analysis

OUTPUTS FROM THE WATER RESOURCES MODELLING

The analysis of the potential environmental and social impacts is based on the technical results generated by the BAS water model. Each scenario was simulated and the technical results are summarised in Table 4-2.

Table 4-2: Technical results for each scenario – outputs of the water model

	Baseline	Precautionary principle options		Compromise options		Full development options	
	Scenario 0	Scenario 1	Scenario 2	Scenario 3a	Scenario 3b	Scenario 4a	Scenario 4b
Irrigation demand							
Irrigation -general principles	Existing irrigation	Irrigation avoiding sensitive areas	Irrigation avoiding sensitive areas	Irrigation avoiding sensitive areas	All irrigation	All irrigation	All irrigation
Irrigation - total demand (ha)	128 092	554 870	554 870	554 870	756 076	756 076	onl 756 076
Irrigation - total annual demand (BCM)	0.176	6.44	6.258	6.619	9.46	9.098	9.001
Irrigation demand which can be satisfied on average							
Irrigation demand which can be satisfied most of the time (BCM/year)	0.133	4.456	6.102	2.85	4.475	7.75	8.595
% of the irrigation demand which can be satisfied	76%	69%	98%	43%	47%	85%	95%
Hydropower capacity							
Hydropower - general principles	Existing Sor dam	All hydropower dams except TamsandBirbir	All hydropower dams	All hydropower dams with conservation of some natural flow patterns	All hydropower dams with conservation of some natural flow patterns	All hydropower dams with operation aimed at maximising hydropower production	All hydropower dams with operation aimed at maximising irrigation and flood reduction
Hydropower - total installed capacity (MW)	10	1 243	2 710	2 710	2 710	2 710	2 710
Hydropower - Energy produced							
Hydropower - Energy produced (GWh/year)	42	3 946	12 274	11 246	11 246	12 303	11 428
Storage capacity							
Combined theoretical storage capacity of hydropower, irrigation and multipurpose dams (BCM)	0.1	8.2	20.9	20.9	20.9	20.9	20.9
Water supply							
Water supply requirements (BCM/year)	0.11	0.24	0.24	0.24	0.24	0.24	0.24
Livestock watering							
Water requirements (BCM/year)	0.05	0.08	0.08	0.08	0.08	0.08	0.08
Livestock sector development	Current	Deemed to be developped as an indirect consequence of the water development in the Basin					
Aquaculture and fish farming							
Sector development	Current	Fish farming : 1% of irrigated areas Rizipisciculture : 1 % of rice irrigated areas					

APPLICATION OF THE SSEA ANALYTICAL FRAMEWORK

Table 4-3 summarizes the main outcomes as generated by the application of the SSEA analytical framework. This is presented in detail in Chapter 7 “Evaluation of the environmental and social impacts of each alternative” of the SSEA Report. In this analysis the environmental and social impacts are investigated under 6 main dimensions and their sub-dimensions. The multi-dimensional analysis is illustrated in Figure 4-4. The colour-coding showed in this diagram has been carried through to Table 4-3. The results presented in Table 4-3 show, through the main sub-dimensions of the SSEA analytical framework, how scenarios are suited to achieve the vision and strategic objectives of the BAS. In this table, colours refer to the impact magnitude and/or significance. The impact is expected to be very significant when the calculated value of the indicator goes beyond the threshold as defined by the sustainable envelop of development.

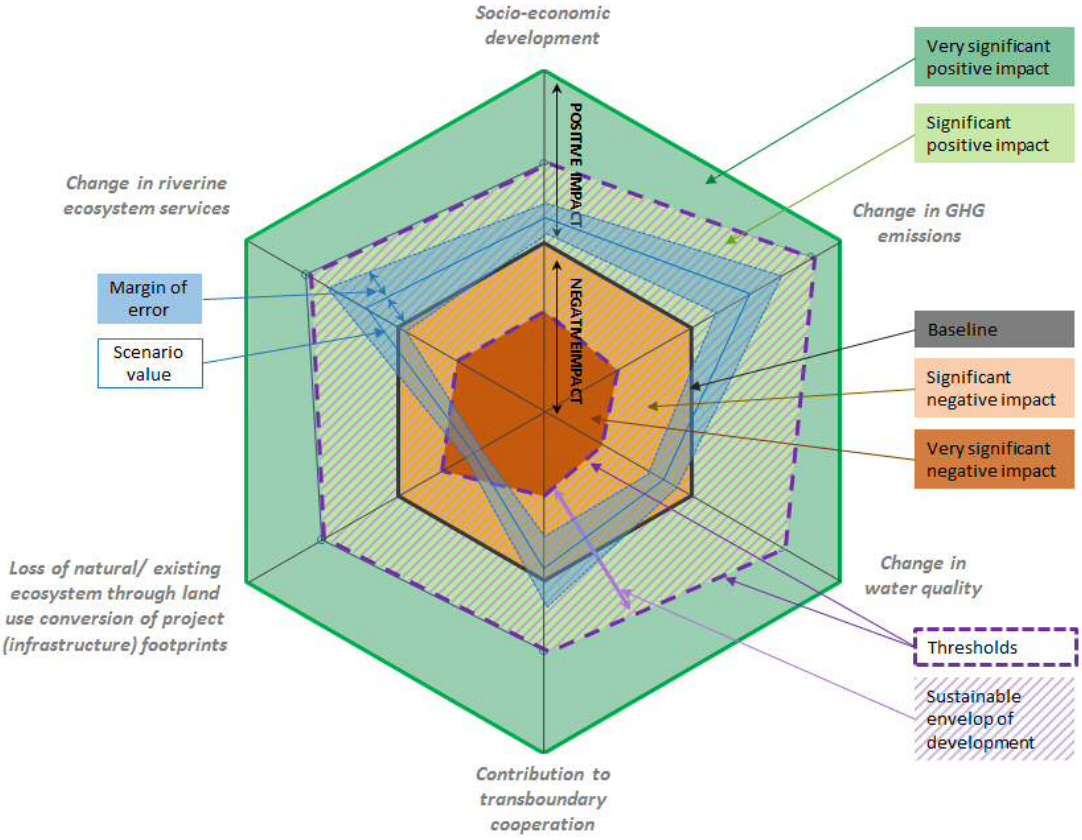


Figure 4-4: Example of scenario positioned on the SSEA analytical framework, presented as key to interpretation of Table 4.3.

In line with the schematic in Figure 4-4, the schematic above shows how Table 4-3 has to be interpreted:

- Positive impact:
  - Light green significant
  - Dark green: very significant
- Negative impact:
  - Light orange: significant
  - Dark orange: very significant

Table 4-3: Summary of main positive and negative environmental and social impacts of each alternative

	Baseline	Precautionary principle options		Compromise options		Full development options	
	Sc 0	Sc 1	Sc 2	Sc 3a	Sc 3b	Sc 4a	Sc 4b
Irrigation demand							
Irrigation - total demand (ha)	128 092	554 870	554 870	554 870	756 076	756 076	756 076
Irrigation demand which can be satisfied most of the time							
% of the irrigation demand which can be satisfied	76%	69%	98%	43%	47%	85%	95%
Additional food production							
Cereals / rootcrops / fruits / bananas production (tons/year)	0	43 816	44 325	39 731	54 879	62 771	63 104
Livesotock production - meat (tons/year)	0	753 643	762 523	685 061	947 290	1 080 948	1 086 767
Livesotock production - milk (tons/year)	0	13 771	16 951	12 591	11 978	15 537	16 490
Aquacutlure, fisheries and fish farming production (tons/year)	0	1 484 668	1 706 891	1 214 727	1 623 296	2 166 488	2 283 770
Contribution to food security							
Total additional persons fed		2 405 718	2 683 907	2 009 661	2 727 186	3 525 706	3 677 535
% of additional persons fed compared to the BAS total projected population in 2056		15%	17%	13%	17%	22%	23%
Hydropower - Energy produced							
Hydropower - Energy produced (GWh/year)	42	3 946	12 274	11 246	11 246	12 303	11 428
Storage capacity							
Combined theoretical storage capacity of hydropower, irrigation and multipurpose dams (BCM)	0.1	8.2	20.9	20.9	20.9	20.9	20.9
Access to water for social groups and associated risks of conflicts							
Degree of risks of interruptions in or increased competition over access to water for productive and other purposes and associated risk of conflicts and displacement		-	- -	-	- -	- - -	- - -
Physical and economical displacement and associated risks of conflicts							
Estimation of No of people to be resetled		124 319	126 190	126 190	178 241	178 241	178 241
Estimation of possible conflict risk due to irrigation and HP footprints (the lower the rank the higher the impact)		11	7	10	8	5	4
Cumulative impacts on wetlands							
Total surface area of wetland impacted (ha)		- 275 147	- 433 447	- 275 947	- 430 247	- 610 147	- 613 247
% of wetlands of Gambella National Park impacted		23%	30%	14%	44%	68%	68%
% of wetlands in Kob migration corridors impacted		13%	18%	8%	43%	63%	64%
Encroachment into protected areas							
Total encroachment into main protected areas (ha)		-	-	-	8 803	14 463	16 388
Encroachment into forests							
Enchroachment into forests (incl. riparian forests) (ha)		11 930	11 930	11 930	59 750	79 864	79 864
% of BAS current forest surface area		1%	1%	1%	3%	4%	4%
Transboundary cooperation							
MAR entering the White Nile (BCM)	12.30	9.54	8.93	10.58	9.85	8.37	7.54
Geomorphological changes							
% of the Baro catchment surface area controlled by dams	6%	23%	68%	68%	68%	68%	68%
Flood reduction							
% Decrease in Flood Peak relative to Baseline at Gambella for a 50-years flood		11%	57%	15%	15%	57%	57%

The main findings can be summarized as follows:

- The absence of Tams and Birbir dams significantly reduces the impact on the surface area of wetlands compared with a situation including Tams and Birbir without any specific management rules
- The absence of Tams and Birbir dams significantly reduce the potential negative impacts on Baro and Sobat geomorphology, since these dams are located significantly further downstream on the Baro compared to the other hydropower dams.
- The absence of Tams and Birbir dams **significantly** reduce the hydropower generation opportunities since these dams have the highest installed capacity and biggest reservoirs.
- The exclusion of sensitive areas (protected areas, Kob migration areas, forests areas) from irrigation schemes significantly reduce the impacts on these areas and also allows a reduction of the hydrological impact on wetlands, especially on Gambella plains.
- The introduction of dam operating/reservoir management rules aiming at conserving some natural flow patterns allows a **significant reduction** of the hydrological impacts on wetlands and therefore makes it possible for the scenario to remain within the limits of the sustainable development space for the relevant dimensions
- At the same time, the introduction of dam operating/reservoir management rules aiming at conserving some natural flow patterns **does not result in a major reduction** in energy production compared with the management of the dams aimed at maximizing hydropower.
- However, the introduction of dam operating/reservoir management rules aiming at conserving some natural flow patterns **reduce the water available** for irrigation.
- Dam operating/reservoir management rules aiming at either maximizing hydropower or irrigation lead to **very similar performances** and environmental and social impacts.

Bearing in mind the **caveat that this is based on best estimates which have to be improved as part of implementation of the IWRDMPLan,** the analysis of alternatives has permitted a better understanding of the **limits of the system**, which can be summarized as follows:

- If all hydropower dams are implemented, the conservation of wetlands (reduction which remains in the “sustainable development space”) is associated with an irrigable area (large-scale irrigation) of between 250 000 and 350 000 ha.
- If Tams and Birbir are not implemented, the conservation of wetlands (reduction which remains in the sustainable development space) is associated with an irrigable area of around 400 000 ha.
- If all hydropower dams are implemented, the avoidance of encroachment into protected areas, forests and Kob migration areas is associated with an irrigable area of around 550 000 ha. However this **option does not allow the conservation of wetlands**.
- Irrigation water saving measures lead to **higher satisfaction** of the irrigation water demand and allow better conservation of the Gambella wetlands but lead **to higher negative impacts** on the Machar Marshes.
- If properly managed, Tams dam can support the development of Sobat irrigation in South Sudan.
- From a technical point of view, the feasibility of irrigation projects can be critically discussed, especially through the following considerations:
    - Previous irrigation master plans had already dismissed some of the irrigation schemes whose implementation costs were prohibitive. This should be taken into consideration when prioritising implementation so that the least feasible schemes are left till last, when the best information may be available to judge their real feasibility
    - During the design phase, the surface area under irrigation should be revised to match with the volume of water available considering other upstream and downstream water uses and environmental flows. This should lead to higher irrigation water demand satisfaction rates. This highlights the absolute need for coordinated and integrated cross-sectoral planning form the earliest stages.

- Regarging social aspects, the comparison of alternative, the analyis has highlighted the following main considerations:
  - The improvement of food security at the BAS level will depend strongly on the type of the planned agricultural production. If only cash crops and crops for export are cultivated (as currently indicated in the agricultural leases available in the Gambella region), no improvement of food security is expected. In addition, a degradation is at stake considering the loss of access to existing agricultural and pasture land. On the contrary, if a significant and sufficient area is allocated to local farmers and dedicated to local markets, irrigation development is deemed to have an overall positive effect on food security.
  - Most hydropower is located in the Ethiopian highlands where there is already high population density and pressure on arable land.
  - Population increase around reservoirs may also lead to conflict regarding access to reservoirs for watering livestock. Reservoirs may also attract herders and pastoralists to the area, thereby increasing competition and conflicts between groups.
  - Pastoralists are likely to experience problems in accessing traditional water sources and grazing areas for their livestock due to significant project footprints.
  - In general, displaced people are likely to experience conflicts with host communities and government.
  - Decrease in the flooding of main rivers (Baro, Alwero, Gilo, Akobo, Sobat, lower Pibor) and subsequent decrease of Gambella plains and Machar Marshes may have implications for soil fertility and therefore the productivity of recession agriculture and the replenishment of marshes and wetlands which provide water for livestock and other important livelihood resources. This will impact especially for the sedentary Annuak, the pastoral Nuer, the Berta and other pastoral ethnic groups from Sudan migrating to the Machar Marshes during the dry season.

The potential implications of climate change can be summarised as follows:

- Average high temperature are supposed to increase by around 2°C on the entire BAS area from 2040 to 2055 compared to the reference period 1986-2005. This will lead to higher evapotranspiration and therefore increase the water demand for agriculture in case annual rainfall patterns remain stable.
- There is no such explicit trend for rainfall patterns since climatic model show similar increase and decrease at the same time. However, the temporal and geographical distribution of rainfall patterns might change, which could affect the cropping calendars of both rainfed and irrigated agriculture.
- Climate change will also lead to a higher frequency of extrem events such as floods and droughts. As a consequence, the IWRDPlan will have to include response mechanism to address these major risks.Moving from the main findings of the SSEA and the Econoomic and Financial Analysis to the IWRDM Plan.

ECONOMIC AND FINANCIAL ANALYSES

Introduction

While the application of the SSEA analytical framework was focused on developing an appreciation of the available development space, the economic and financial analysis, largely through the application of a cost-benefit analysis (CBA), was aimed at investigating the financial and economic relevance of each alternative as well as the programme of development as a whole. This was achieved by evaluating the differential of costs and benefits between the situation with programme and the situation without (baseline scenario).

The CBA distinguishes the financial part of the scenario (i.e. the profitability from the investors' point of view) and the economic part (i.e. the "profitability" or relevance of the scenario from the whole society's point of view. Two analyses were therefore conducted:

- A financial analysis which allows the assessment the profitability of the projects in the investors' point of view. The analysis takes into account the financial costs and benefits, i.e. the investments and OandM costs and the revenues of the activity implemented (hydropower, irrigation, fish farming or rizipisiculture);
- An economic analysis which evaluates the viability of the scenario in the society's point of view. This analysis takes into account the financial costs and benefits plus the externalities[1] of the projects.

For both analysis, three main indicators were computed:

- The Net Present Value (NPV) by summing the positive and negative discounted cash flows over the time period;
- The Benefits/Costs ratio : It should be superior to 1 for the project to be viable;
- The Internal Rate of Return (IRR), which determines the discount rate that would make the NPV equal to zero. It should be superior to the discount rate applied in the analysis (10% for the financial cash flows and 5% of the externalities).

The CBA provided results disggregated at the geographical level (Ethiopia and South Sudan parts of the basin) and by economic sector.

As already indicated, in order to appreciate the relevance of a scenario for society as a whole, the economic analysis of the CBA combines the financial costs and the benefits of projects and positive and negative externatilies. The benefits of projects (energy production, agricultural production) are assessed and presented as part of the SSEA and the CBA. Positive (eg. Jobs created, fisheries development in reservoirs) and negative (eg. loss of wetlands, …) externalities are assessed as part of the SSEA and then converted into a monetary value as part of the CBA. As a result, the **combination of the SSEA and the CBA replaces a Multicriteria analysis.** This approach is deemed to allow a **better objectification**, while avoiding the subjective weighting which implies a multicriteria analysis.

Figure 4-5 highlights the links between the SSEA and the CBA.

[1] An externality is a cost or benefit generated by an activity and that affects a party that did not choose to incur this cost or benefits (e.g. degradation of downstream wetlands due to a modification of flows from a hydropower station, indirect employment created from a new activity, etc

Figure 4-5: Monetarization of the environmental and social benefits and risks identified within the SSEA in the economic analysis of the CBA

SSEA	CBA
Socio-economic development	
• Flood reduction	• Avoided damages
• Food security	• Increase of life expectancy
• Energy security	• Cascading development
• Employment	• Number of jobs
• Acess to water	• Livestock and fisheries development
Changes to riverine ecosystem services	
• Instream flows	• Navigable period
• Wetlands and floodplains	• Value of ecosystem
• Geomorphology	
Conversion of existing ecosystems – project footprint	
• Physical and economical displacement	• Value of ecosystem
• Encroachment into natural and sensitive areas	• Value of ecosystem
Transboundary cooperation	
• Contribution to regional and national economic growth	• Welth generated by energy production and food production (agriculture, livestock and fisheries)
• Level of transboundary cooperation and management required	
• Flows downstream of Sobat/White Nile confluence	• Avoided deforestation
Water quality	
GHG emissions	

NB1: Althouth the economic analysis monetarizes most of the social and the environmental impacts it is important to keep in mind some impacts can't reasonably be included in the economic analysis.

NB2: The Economic Internal Return Rate (EIRR) and the Economic Net Present Value (ENPV) are not sufficient to appreciate the relevance of the projects. Thus the results of the economic analysis should be put in perspective with the SSEA results.

If we look at the overall results, all the scenarios appear to have a positive Financial Net Present Value (FNPV)[2] and Economic Net Present Value (ENPV)[3]. The difference between the FNPV and the ENPV corresponds to the externalities.

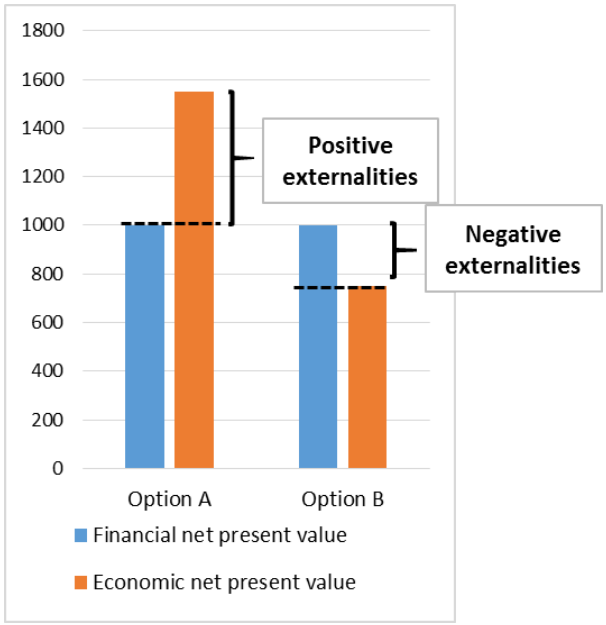


Figure 4-6 : Example of FNPV and ENVP with positive and negative externalities

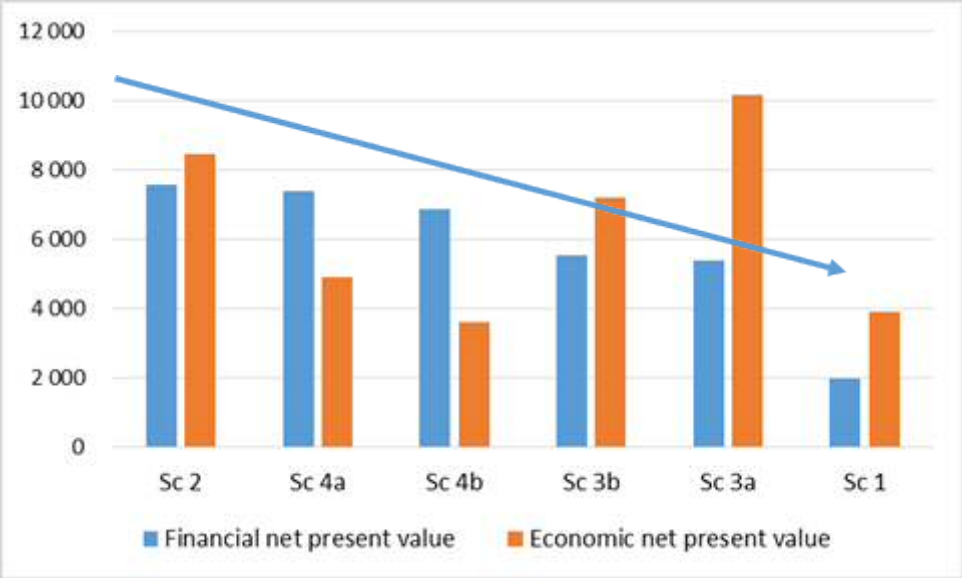
Financial Analysis

The results of the financial analysis are summarised in Figure 4-7.

2 The FNPV gives an indication of the profitability from the investors' point of view.

3 The ENPV gives and indication of the "profitability" or relevance of the scenario from the whole society's point of view.

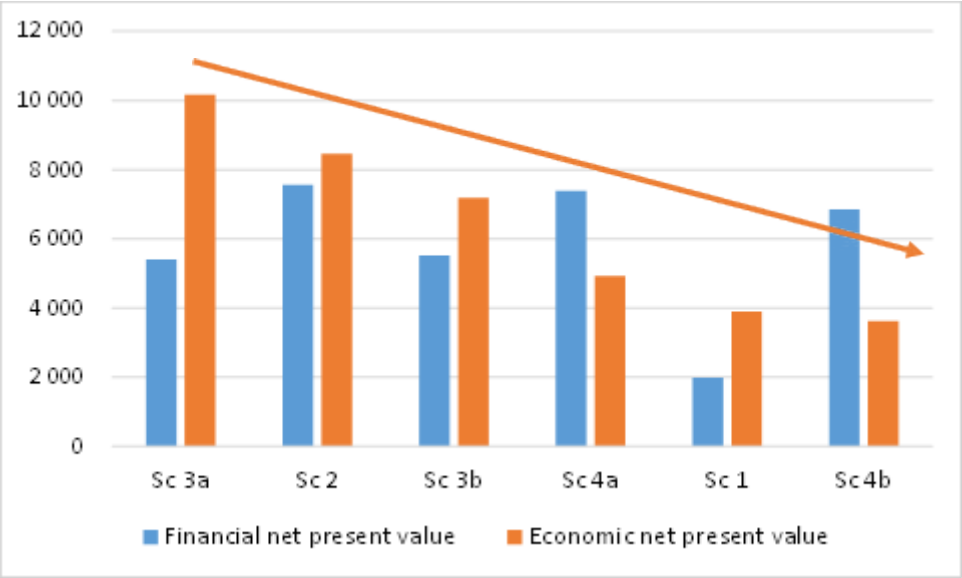
Figure 4-7: Scenarios sorted according to the FNPV from the highest to the lowest (in blue)



Economic analysis

The results of the economic analysis are summarise in Figure 4-8

Figure 4-8: Scenarios sorted by the ENPV from the highest to the lowest (in orange).



Conclusions

The findings of the economic and financial analyses have not been used to choose or recommend a particular scenario. Rather they have made it possible to fully understand the reasons behind the results and these can be fully taken into account in defining an appropriate development pathway.

4.2.4 Way forward

4.2.4.1 Introduction

As already briefly presented, the iterative and consultative SSEA process made use of an analytical framework to investigate a range of potential water resources management and development scenarios as well as looking at impacts of improved irrigation efficiency and climate change. The findings have been presented and discussed with stakeholders with the aim of reaching consensus on a preferred development pathway that will shape the core of the IWRDMPlan. The consensus reached is summarised in Sections 4.2.4.2 top 4.2.4.6.

4.2.4.2 A Development "Pathway"

- The SSEA does not recommend a specific scenario to be taken forward to the IWRDM Plan since a preferred scenario cannot be conclusively agreed given the paucity of hydro-environmental and socio-economic data of the BAS, resulting in significant uncertainties in the SSEA findings. Instead a **"development pathway"** has been adopted and proposed. This pathway has the following important characteristics:
  - The pathway is aimed at leading to the **maximising sustainable development**. The first steps will be clearly defined. Later steps will be less clearly defined
  - **Precautionary principle**. The first projects to be implemented will be those which are known to have major benefits and minimal negative impacts
  - **Integrated approach**. While the "best" (high benefit, low negative impact) projects should be chosen, this should negate the importance of an integrated approach to project choice and implementation (including sequencing) that takes into account upstream/downstream linkages etc.
  - **Multipurpose opportunities** should be maximised in order that benefits are as shared as possible. This means that project and programme feasibility should fully take into account the positive externalities of maximising multi-sectors involvement.
  - **Adaptability**. The pathway is increasingly less defined into the future making adaptation to changes in direction more straightforward. The vision of the BAS basin is fixed, but how to achieve it is not. Movement along the pathway will be monitored and evaluated on a continuous basis and the necessary adaptation measures identified and implemented. Adaptation will be especially responsive to i) changes in the knowledge base and ii) lack of adequate progress towards the realisation of objectives. Stakeholder feedback will be critical.
- The scenario/options analysis has been used to guide the understanding of the sustainable development space within the sub-basin and to make a number of recommendations to be taken up in the IWRDM Plan. This understanding has made it possible to identify a large number of highly beneficial development projects with generally manageable negative impacts. How best to implement these projects in a mutually coordinated and coherent way as a group of actions to be implemented early in the Plan is part of the process of defining first steps along the pathway.

4.2.4.3 Maximising sustainable development without causing significant harm

- It is agreed that the aim of the Plan (and its future revisions and extensions, bearing in mind that 25 years is a relatively short period of time) will be to maximise sustainable development, without causing significant harm downstream. This is in line with the agreed vision and strategic objectives.

- A large number of development projects were identified and included in the scenario analysis. It is clear also that there is some potential for development which has not yet been identified in the form of concrete projects. None of the identified (and potential) development should be excluded from the plan, all projects identified in the various scenarios, or simply potential not yet identified in the form of projects such as on the Baro, Akobo or Pibor Rivers). Projects or combinations of projects which have been shown to result in more negative impacts will be included in the IWRDM Plan (without timeline) and indicated as "deferred" until the system is better understood in terms of their environmental and socio-economic impacts (+ve and -ve) and possible mitigation and conservation measures.

4.2.4.4 Specific recommendations/guidelines for the development of hydropower and large-scale irrigation (from the SSEA)

- The SSEA makes a number of recommendations to guide the design of the plan. These include specific recommendations related to large-scale hydropower and irrigation. The SSEA recommends
  - To further identify project characteristics, design and implementation modalities that maximise multipurpose and transboundary benefits and minimize social and environmental negative impacts.
  - Once identified, that the implementation of the IWRDM Plan should start with the projects and actions of limited negative impact. As such, for irrigation, the priority is given to projects which do not encroach into sensitive areas. This would include implementation of large-scale hydropower development on the Baro River (managed on the principles of transboundary cooperation) and irrigation in both Ethiopia and South Sudan supported by the resultant flow regulation.

4.2.4.5 Detailing of the Plan - priorities

- The IWRDM Plan should be developed in detail (in terms of proposed sequencing and scheduling) only for the projects and actions of limited negative impact that can be implemented in the first 10 years of the plan
- Following on from the above point, the IWRDM Plan should include, as a top priority action, the detailed design and implementation of a basin wide environmental monitoring programme aimed at a major improvement in the understanding of the environmental (and socio-economic) functioning of the BAS sub-basin. This is an absolute requirement for the IWRDMPlan to be successfully implemented.

4.2.4.6 Importance of Adapative Management

- The IWRDM Plan is to be developed as a "living Plan", with explicit provision for adaptation in response to results as indicated by strong monitoring and evaluation and adaptive management systems.

4.2.5 Sequencing timeline

The timeline for implementation of the IWRDMPlan has been detailed for the first ten years only. This in line with stakeholder discussions and the resultant recommendations of the SSEA. The following main assumptions are as follows:

- Development of irrigation and hydropower starts immediately respecting the precautionary principle with respect to prioritising/sequencing of development.

- Irrigation of command areas falling within what are currently considered as ecologically sensitive areas will be deferred until a better understanding of the sub-basin has been obtained and/or alternative command areas can be identified. No timeline for implementation of deferred projects is provided in the implementation schedule. However, one of the roles of the plan would be to prepare, understand, mitigate if necessary so the plan will include activities aimed at preparing the way for the possible implementation of "deferred" projects.
- All the hydropower projects in the Ethiopian highlands are implemented within the first 20 years of the plan. This would start immediately with Tams and Geba, both of which are close to starting construction. These would be followed by Genji, then Baro 1 and 2 and finally Birbir. The best order of sequencing from the transboundary perspective would be investigated as an action in the Plan. While only the first 10 years of hydropower project implementation is detailed, it has been necessary to assume that most or all of the other projects will be implemented since this has an impact of the future availability of water downstream
- It should be noted that the large majority of the least environmentally sensitive irrigation is on the Baro River. These are also the schemes that would be supported by hydropower driven flow regulation by Tams and other hydropower schemes.
- It has been assumed that that the large-scale irrigation schemes will be implemented at the average rate of +/- 12,000 ha per year over 40 years. The implication is that the hydropower development programme will always be ahead of the irrigation water demand requirements in terms of the required regulation of flows.

4.2.6 Environmental and Social Management Plan (ESMP)

The SSEA includes an Environmental and Social Management Plan (ESMP) which has to be implemented as part of the overall IWRDMPlan. Specific Institutional responsibilities have been defined as part of the ESMP.

The ESMP includes a Monitoring and Evaluation framework/Plan specifically aimed at checking whether Plan implementation respects the agreed SSEA recommendations and which must include an adaptive management system.

The proposed measures for the maximisation and/or enhancement of positive impacts, together with offset measures as set out in the SSEA report are included in Chapter 10 of the SSEA Report. For the measures of the ESMP to be affectively observed and **included as part of the implementation of the IWRDMPlan**, they have been discussed in detail as they relate to each of the strategic actions in in Chapter 5 of this report, where the IWRDMPlan is presented in more detail.

4.3 DEVELOPMENT OF STRATEGIC ACTIONS

A number of strategic actions need to be carried out in order for the strategic objectives to be realised. In this sub-section of the report a set of strategic actions are developed for each and all of the strategic objectives. The aim has been to develop an exhaustive set of strategic actions which can then be disaggregated into specific actions and then into more detail as required.

The strategic actions are categorised as:

- "Direct" (often infrastructure-orientated) strategic actions. These are the central key strategic actions that must be carried out in order to realise the particular strategic objectives.

- Enabling strategic actions. These are the strategic actions that are important, usually necessary, in order facilitate the successful achievement of the direct actions. These are many in number. All, or most are relevant for each direct strategic action, but some are particularly key depending on the particular direct strategic action being supported.
- Cross-cutting strategic actions. These are the actions which cut across all of the strategic objectives. They are not enabling in nature, but rather represent issues and challenges that should be taken into account if direct strategic actions are to be effectively planned and implemented.

In Table 4-4 each of the strategic objectives the summary of an analysis carried out to identify the Strategic Direct, Enabling and Cross-cutting Actions required to achieve agreed Strategic Objective are presented. It should be noted that these actions are strategic and sometimes purposely general in nature in order not to create an unmanageable number of actions at the strategic level. For example, the strategic enabling action “Develop and implement the necessary institutional framework”, will be broken up into specific actions that relate to achievement of the specific strategic objectives in Chapter 5.

Table 4-4: Strategic Direct, Enabling and Cross-cutting Actions required to achieve agreed Strategic Objectives

Strategic Objectives (SO)	Infrastructure / Direct Strategic Actions (D)	Enabling Strategic Actions (E)	Cross-cutting Strategic Actions (C)
SO1: To contribute to food security, livelihood enhancement, poverty reduction and the protection and conservation of biological resources through stakeholder-driven management of wetlands, watersheds and other important natural resources;	D1.1: Develop and implement (local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable livelihood enhancement, poverty reduction and the protection and conservation of biological resources D1.2: Develop and implement basinwide plan for taking to scale of multipurpose IWRM-style water resources development and management projects.	E.1: Develop and implement the necessary institutional framework E2: Build capacity in IWRM, ecosystem and natural resources management (at the transboundary, national and local levels) E3: Promote and ensure appropriate stakeholder participation E4: Develop and implement appropriate and effective communication strategies and plans E5: Develop and implement monitoring and evaluation, and adaptive management systems E6: Develop non-water sector infrastructure and services to support water-resources development and benefit sharing (roads, urbanisation, communications, etc) E7: Plan and implement integrated basinwide environmental monitoring system E8: Carry out regular and adhoc water resources, water quality and environmental flow requirements assessments E9: Ensure adequate financing mechanisms and funding are in place and available E10: Carry out regular and adhoc flood-risk mapping and land-use planning exercises	C1: Mainstream climate change considerations C2: Ensure appropriate and effective mainstreaming of gender considerations
SO2: Taking into account the comparative advantages of the different parts of the sub-basin to sustainably develop water resources for hydropower, irrigation, water supply and sanitation and other sectors with the dual aims of reducing poverty within the sub-basin and generating revenue;	D2.1: Develop economic sectors such as hydropower, irrigation, water supply, fisheries and other water sector projects, maximising multipurpose opportunities D2.2: Develop water sector infrastructure and services to support benefit sharing (navigation, interconnection etc)		
SO3:To ensure transboundary and inter/intra sectoral cooperation and benefit sharing with a view to minimizing resource-based conflicts through optimized management and use of water and associated resources	D3.1: Develop and implement (local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable benefit sharing and conflict resolution D3.2: Plan and implement conjunctive, optimised management of u/s hydropower schemes in support of development projects and d/s ecosystems/ EFRs D3.3: Plan and implement the appropriate development of groundwater resources and groundwater/ surface water conjunctive use.		
SO4: To manage water resources so that disasters associated with flood and drought can be prevented and/or mitigated	D4.1: Manage upstream hydropower reservoirs in order to support flood reduction and availability of water downstream D4.2: Plan and implement the conjunctive use of ground and surface water resources		

5. DETAILING THE PLAN

5.1 INTRODUCTION

5.1.1 Timeline

The plan is set out over 25 years although the economic analysis was carried out over a period of 40 years. 40 years is considered the shortest possible time to implement all projects under the scenarios of maximum development and assumes an elevated rate of implementation for irrigation projects, approximately 12,000ha per year, something which has not been achieved in the past anywhere in the region. It was important to include all the potential development in the economic analysis, otherwise it would not be possible to compare one scenario or option with another. However, the duration of the plan is only 25 years, but of course it will be both modified and extended in the future.

While the plan is set out over a period of 25 years, it has been detailed on an annual basis for only the first 10 years. This is in line with stakeholder recommendations expressed at the regional workshop in January 2017 (see earlier section on Timeline).

5.1.2 Detailing of specific actions

In the previous chapter of the report a number of strategic actions were identified. However, since these are at the strategic level, they are not implementable as they stand. They have to be disaggregated into more concrete specific actions. Once these specific actions are agreed, they can easily be further detailed into activities that take into account the resources available. This has already been done as part of this study for a number of “short-term” and “medium/long-term” projects. This means that immediate implementation of the plan can proceed.

In the following sections the specific actions required to achieve each of the strategic objectives are provided together with the institutional responsibilities. An indication of which specific actions have already been further detailed through the proposed short-term and medium/long-term projects is also provided.

5.1.3 Integration of the Environmental and Social Management Plan (ESMP)

Chapter 10 of the SSEA Report lays out the Environmental and Social Management Plan (ESMP=. According to the AfDB guidelines, the scope of an ESMP should be “determined by the assessment of the magnitude and significance of the environmental and social risks and impacts of the project and should be commensurate with these anticipated risks and impacts. The management measures should be feasible and cost-effective and **phased with scheduled activities** of the project (AfDB, 2014). This means that the specific needs required to ensure that the ESMP is implemented as part of the IWRDMPlan should be integrated into the IWRDMPlan. For this reason, the measures that have been detailed in the ESMP are also presented and detailed for each of the strategic objectives in the following sections.

5.2 DETAILING THE SPECIFIC ACTIONS AND INTEGRATING ESMP MEASURES

5.2.1 Strategic Objective 1

5.2.1.1 Overview

Strategic Objective 1 is *"to contribute to food security, livelihood enhancement, poverty reduction and the protection and conservation of biological resources through stakeholder-driven management of wetlands, watersheds and other important natural resources;"*

The objective is to be realised through the implementation of two key direct actions:

- D1.1: Develop and implement (local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable livelihood enhancement, poverty reduction and the protection and conservation of biological resources
- D1.2: Develop and implement basinwide plan for taking to scale of multipurpose IWRM-style water resources development and management projects.

As with all the direct strategic actions there are a number of enabling and cross-cutting strategic actions.

5.2.1.2 Specific Actions

The focus of interventions aimed at achieving this critical strategic objective is local. The local focus is easily forgotten in the strategic level planning process. Indeed, it has been pointed out by stakeholders that there seems to be a high level of focus on large-scale hydropower and irrigation development and not enough on small-scale developments and the conservation of the natural resources on which many people depend. While it is beyond the scope of this plan to detail (usually localised level) small-scale projects, it is clear that the development of small-scale interventions is critical. The IWRDMPLan has a role to play in ensuring that the micro-level IWRM-style interventions that are so critical to a sustainable approach to water resources and related natural resources management, are implemented basinwide. One way of dealing with this is to present a "programme "of local level interventions in the form of demonstration projects, which when taken to scale represent real basinwide solutions to some of the key challenges. This idea has been behind the identification of short-term projects during the course of this study. Feasibility studies have been prepared for all three short-term projects and are available as standalone reports:

- **Feasibility Study for the Majang multipurpose project**. The Majang multipurpose development project has been defined in accordance with the major needs of Dunchaye Kebele, in Majang zone, Ethiopia. In this remote area, there is a need to improve food security and develop the economy particularly through access to the market. The project also includes extensive livelihood based watershed management activities to protect the remnant forests threatened by deforestation for charcoal making (the project is located within a biosphere reserve). The main components are:
  - Micro-hydropower generation with a production estimated to be around 1 GWhrs/annum. This is particularly important as this remote area is not going to be connected to the national electric grid
  - Small scale irrigation with the development of 220 ha for the following crops: maize, sorghum, potatoes, soybeans, dry beans, avocados and vegetables.
  - Aquaculture: an initial development of 20 ponds is proposed
  - Watershed management: livelihood-based watershed management activities are proposed such as bee keeping, reforestation and fruit production.

The proposed project can serve as an excellent demonstration of a multipurpose integrated water resources project applied at the small-scale with direct and sustainable socio-economic and livelihood benefits for the communities. There are opportunities for replicability through experience sharing with neighboring communities. There are opportunities to increase the economic feasibility of the proposed project through agro-processing and other value-added activities. It would also be possible to intensify aquaculture production and increase yields.

- **Feasibility study for the Kinyeti River multipurpose development project**. The Kinyeti River multipurpose development project is centred around the construction of a multipurpose dam and associated reservoir (capacity of 45 Mm^3) in Eastern Equatoria, South Sudan, upstream of Torit city. The dam would be the first major infrastructure in an area where food insecurity and conflicts over water resources are prevalent. The main objective of the project is to make water resources available all year long for key activities such as hydropower production, potable water and irrigation. Component include:
  - Hydropower generation with a production estimated to be around 8 GWhrs/annum) could supply up to 80,000 people and significantly reduce significantly the pressure on existing forest resources
  - Reliable access to water for Torit to supply up to 100,000 inhabitants (projection to 2041) and reduce waterborne diseases.
  - Capture fisheries in the reservoir.
  - Development of irrigation (initially 1,000 ha) and aquaculture (100 ponds of 200 m2) for food production and economic development.
  - Reliable access to water for the livestock should limit conflicts over the resources
  - Creation of a favourable environment for the development of ecotourism. Torit is ideally surrounded by the Badingillo floodplains, Imatong Mountains and Kidepo game reserve and close to Juba.
- **Design details for the Akobo-Gambella floodplains transboundary development programme**. The Akobo-Gambella floodplains transboundary development programme has been designed to reduce extreme poverty and improve livelihoods in an area of the BAS sub-basin which is highly vulnerable (conflicts over the resources, food insecurity, no access to a safe source of water, etc.). The Akobo-Gambella area is not easily accessible and there is currently no infrastructures (roads, electricity, etc.). The proposed programme is straightforward to implement and aimed at replication. It is articulated around solar pumping and includes generic components such as potable water supply, sanitation, livestock watering, capture fisheries, aquaculture, small scale irrigation and capacity building. The implementation of the programme will include field work to select pilot areas, identify specific needs and refine these generic components.

It is important to stress that a key selection criteria for these projects was their replicability. In addition to the delivery of these type of interventions as indicated by Startegic Action D1.1, the Plan will have an important role to play in seeing that the implementation of localised small-scale IWRM-style actions are taken to scale. This will ensure that the vital (from all perspectives including the transboundary one) source areas are maintained in good condition and that the livelihoods of those living in their vicinity are enhanced. It will also ensure that vital wetlands are protected and conserved supporting both biodiversity and local livelihoods. The second direct strategic action (D1.2) aimed at supporting Strategic Objective 2, the Development and implement basinwide plan for taking to scale of multipurpose IWRM-style water resources development and management projects, has been redefined as a priority medium/long-term project and terms of reference for its implementation have been developed as part of this study:

- **Livelihood-based Watershed Management – Taking to Scale for a Basinwide Impact.** As already stated above, it is important that the IWRDMPlan presents appropriate solutions, not just the planning and prioritizing of large-scale water resources development options. One way of dealing with this is to present a “programme “of local level interventions in the form of small-scale demonstration projects, which, when taken to scale, represent real basinwide solutions to some of the key environmental and socio-economic challenges such as high levels of sediment transport, lack of food security etc. This project will support the identification of small-scale livelihood-based watershed management projects followed by the design and implementation of a programme to take the approach to scale. Further details are provided in Annex 3 with the detailed terms of reference provided in Annex 4.

The required specific actions for the realisation of this strategic objective are detailed in Table 5-1. It should be noted that the implementation of all specific actions should start within the first ten years of IWRDMPlan implementation, most of them as early as possible.

Table 5-1: Required Specific Actions and Institutional Responsibilities to achieve Strategic Objective 1

Strategic Action	*Specific Actions and timeline*[1]	
D1.1: Develop and implement (local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable livelihood enhancement, poverty reduction and the protection and conservation of biological resources	• Design and implement Kinyeti River Multipurpose Development Project (hydropower, irrigation/agriculture, aquaculture, water supply or the different components; ***Feasibility study has been prepared for fast-tracking of this as short-term project, see separate report***	• GoSS with ENTRO facilitation/support
	• Design and implement Akobo-Gambella Floodplains transboundary development programme at chosen pilot demonstration sites ***Feasibility study has been prepared for fast-tracking of this as short-term project, see separate report***	• GoE and GoSS with ENTRO facilitation/support
	• Design and implement Majang Multipurpose Development project in Dunchaye sub-catchment (hydropower, irrigation/agriculture, aquaculture, water supply or the different component. ***Feasibility study prepared for fast-tracking of this as short-term project, see separate report***	• GoE with ENTRO facilitation/support
	• Design and implement Cingaineta River Multipurpose Development Project in Kapoeta North, South and East through actions in the Cingaineta River catchment aimed at reversing environmental degradation, increasing the availability of water during the dry season, improving food security and developing opportunities for livelihood enhancement. See Annex 3	• GoSS with ENTRO facilitation/support
	• Design and implementation of further local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable livelihood enhancement, poverty reduction and the protection and conservation of biological resources	• GoE and GoSS with ENTRO facilitation/support
D1.2: Develop and implement basinwide plan for taking to scale of multipurpose IWRM-style water resources development and management projects	• In consultation with stakeholders, draw up basinwide plan for taking to scale of multipurpose IWRM-style water resources development and management projects; ***ToR have been developed, see Annex 4***	• ENTRO to lead working with the countries
	• Develop monitoring and evaluation framework and adaptive management system for application at the national/transboundary levels; ***ToR have been developed, see Annex***Z	• ENTRO to lead working with the countries
	• Implement basinwide plan (including monitoring and evaluation framework) for taking to scale of multipurpose IWRM-style water resources development and management projects; ***ToR have been developed, see Annex 4***	• Countries with support of ENTRO
E1: Develop and implement the necessary institutional framework	• Develop and operationalize the necessary institutional framework at the project level for planning, intersectoral coordination, local administration and community/beneficiary participation; ***ToR have been developed, see Annex 4***	• ENTRO facilitate GoE and GoSS
	• Develop and operationalize the necessary institutional framework for the different levels of management (see D1.1), including basinwide planning, intersectoral coordination, local administration and community/beneficiary levels; ***ToR have been developed, see Annex 4***	• ENTRO lead with dialogue and coordination with countries
E2: Promote and ensure appropriate stakeholder participation	• Consult with and fully involve stakeholders at all levels (sectoral institutions, local administration, beneficiaries) for selected 3 short-term projects in planning, design and implementation, including formation of project steering committees; ***Process started during compilation of feasibility study documents***	• Each country and coordination when transboundary
E3: Develop and implement appropriate and effective	• Develop comprehensive communication strategy and implementation plan for supporting the achievement of this strategic objective aiming at all levels of stakeholders (for i) overall implementation of the direct strategic action at the	• ENTRO to lead and consult basinwide

communication strategies and plans	basinwide level and ii) at the individual project level; ***ToR have been developed, see Annex 4***	
	• Implement communication plan at the basinwide, national, regional and project levels	• Several actors, from regional states, GoE and GoSS, supported by ENTRO
E4: Develop and implement monitoring and evaluation, and adaptive management systems	• Develop and operationalize monitoring and evaluation and adaptive management systems at the programme level (as related to overall strategic objective); ***ToR have been developed, see Annex 4***	• ENTRO to lead, in close cooperation with the countries
	• Develop and operationalize monitoring and evaluation and adaptive management systems at the project level for each multipurpose IWRM-style water resources development and management project; ***Specified in Feasibility studies for selected short-term projects***	• Duty of countries for standalone projects. Joint committee for transboundary projects to be facilitated by ENTRO
E5: Develop non-water sector infrastructure and services to support water-resources development and benefit sharing (roads, urbanization, communications, etc)	• Carry out a detailed needs and gap analysis in terms of non-water infrastructure and services required to support the sustainability of small-scale IWRM-style projects **and their taking to scale; *ToR have been developed, see Annex 4,***	• Duty of each country, to be shared and coordinated
	• Work with non-water sector institutions at the regional, national and local levels to develop and implement an infrastructure and services development support strategy and plan; ***ToR have been developed, see Annex 4,***	• Duty of each country, to be shared and coordinated. ENTRO to facilitate at regional scale
E6: Plan and implement integrated basinwide environmental monitoring system	• Develop a strategy and associated guidelines for the planning of local (project) level environmental monitoring in order to best contribute to project needs as well as the basinwide system; ***ToR have been developed, see Annex 4,***	• ENTRO to lead with close coordination and common standards along the basin (countries)
	• Plan, design and implement project-focused environmental monitoring system (climate, hydrology, water quality etc): ***ToR have been developed, see Annex 4,***	• Duty of each country. Use of common agreeable standards
	• Collect and analyse data and inform monitoring and evaluation programme for adaptive management.	• Duty of each country, to be shared and coordinated on common standards. ENTRO to facilitate at regional scale
E7: Carry out regular and adhoc water resources, water quality and environmental flow requirements assessments	• Carry out assessments as required to inform project design on a project by project basis	• Duty of each country
	• Evaluate environmental flow requirements on a project by project basis and build into the project design	• Joint committee of countries, dialogue facilitated by ENTRO
E8: Ensure adequate financing mechanisms and funding are in place and available	• Investigate and put in place measures to promote the overall programme of development of small-scale IWRM-style based projects and its taking to scale in order to attract financing. ***ToR have been developed, see Annex 4,***	• ENTRO to facilitate/support and closely liaise with countries
	• Develop financing model for individual projects based on cost-benefit analysis and sustainability with access to credit for start-up, but costs borne by beneficiaries. ***Process has been developed as part of feasibility studies for selected short-term projects***	• Duty of countries for standalone projects. Joint committee for transboundary projects to be facilitated by ENTRO
E9: Carry out regular and adhoc flood-risk mapping and land-use planning exercises	• None	• N/A
C1: Mainstream climate change considerations	• Evaluate potential climate change impacts at the localized level, especially as they relate to potential project implementation	• Duty of each country, to be shared and coordinated on common standards.
	• Mainstream climate change considerations into planning, design and implementation of individual projects. ***Process has been developed as part of feasibility studies for selected short-term projects***	• ENTRO to lead and coordination with countries
C2: Ensure appropriate and effective	• Develop a section of the gender mainstreaming strategy focused on ensuring and promoting gender mainstreaming at the project level	• Duty of each country, to be shared and coordinated on common standards.

mainstreaming of gender considerations	• Implement gender mainstreaming measures as integral part of each project; ***Process has been developed as part of feasibility studies for selected short-term projects***					• Duty of each country, to be shared and coordinated on common standards.	
Start in	0 – 3 years	Start in	4 – 10 years	Start in	11 - 25 years	Deferred	No timeframe

5.2.1.3 Integrating proposed ESMP measures into the IWRDMPlan

There is a wide range of measures included in the ESMP aimed at maximising and enhancing the actions proposed in the IWRDMPlan relating to the attainment of strategic objective 1. There are also some offset measures and specific monitoring and evaluation requirements. These are summarised together with an indication of institutional responsibilities in *Table 5-2*.

Table 5-2: *Checklist of ESMP Measures to be integrated into implementation of direct strategic actions*

Proposed ESMP management measures	Specific measures proposed	Institutional responsibilities
Direct Action D1.1: Develop and implement (local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable livelihood enhancement, poverty reduction and the protection and conservation of biological resources.		
• Enhancement of **food and nutrition security** in and around irrigation projects	**MAXIMISATION /ENHANCEMENT** • Smallholder irrigation schemes are encouraged • Increased access to improved sources of drinking water and sanitation. **OFFSET MEASURES** • Provision of alternative subsistence and livelihood **MONITORING AND EVALUATION** • Monitoring of the IWRDMPlan to include monitoring measures on food and nutrition security.	**Ethiopia**: federal Ministries resp for Agriculture; Water, Irrigation, Energy. Water & Agriculture Bureaus/Offices at local level. **South Sudan**: ministries resp for Agriculture & Water. Agriculture & Water Departments in State/country. • Coordination & collaboration with various stakeholders & developers/private sectors
• Enhancement of **local employment** in all projects	**MAXIMISATION /ENHANCEMENT** • Smallholder irrigation schemes • Capacity building and hiring of local staff • Close cooperation with local authorities to ensure development of value added opportunities, social needs etc.	**Ethiopia**: federal ministries resp for Labour & Social Affairs; Agriculture; Water, Irrigation, Energy & Electricity. Water & agriculture bureaus/offices at local level. • **South Sudan**: ministries resp for labour; agriculture & water. Agriculture & Water Departments in States/counties. • Coordination with various stakeholders & developers
• Enhancement of **energy security**	**MAXIMISATION /ENHANCEMENT** • Improved connection to the national grid for urban poles and extensive rural electrification programmes • Attractive electricity prices to encourage the use electricity instead of charcoal/wood	• **Ethiopia**: Ethiopian Electric Corporation • **South Sudan**: ministry of Energy
• Minimisation of **water quality issues** associated with implementation of dams and irrigation schemes	**MINIMISATION** • Removal of organic matter in the reservoirs to avoid initial eutrophication issues • Erosion prevention upstream of dams water catchments to avoid sediment accumulation • Optimisation of irrigation to limit water releases and infiltration after filed application • Minimization of the use of fertilizers and pesticides • Implementation of sanitation and waste water management plans **OFFSET** • Provision of all communities using the river as the main source of supply for fresh water with a reliable clean alternative: all affected villages shall be sensitized about the quality of water in the River, especially if water is no longer drinkable	**Ethiopia**: federal Ministry of Health; Ministry of Water, Irrigation, Energy & Electricity. Health & Water Bureaus/Offices at local level. • **South Sudan**: Ministry of Health & Water. Health & Water Departments in States/counties.

• Minimisation of **drowning** in irrigation canals (people, cattle, wildlife)	**MINIMISATION** • Include the mitigation of this risk into the design of irrigation schemes • Prohibit access to canals to avoid crossing • Organize prevention campaigns **RESTORATION** • Restore access by constructing bridges for people, cattle and wildlife	**Ethiopia**: Ministry of Environment, Forest & Climate Changes; Water, Irrigation, Energy & Electricity. Environment, Health & Water Bureaus/Offices at local level. • **South Sudan**: Ministries of Environment, Health & Water. Environment, Health & Water Departments in States/counties.
• Avoidance and minimisation of i) **potential conflicts** on upstream/down stream) water resources and ii) **changes to riverine ecosystem services** and geomorphologic al changes	**AVOIDANCE** • Avoidance of extreme infra-daily variation of river flow immediately downstream hydropower dams through the construction of a small regulation dam directly downstream of the main dam **MINIMISATION** • Conservation of flood flows downstream dams to ensure that an adequate area is flooded each year through dam operation rules • Definition of environmental flows downstream each project • Inclusion of tools to allow periodic flushing of sediments within dam design to implement the recommended "environmental sediment regime" • Inclusion of fish ladder within dam design	• **Joint Committees** of the two states, including members from the following: **Ethiopia**: Ministries of Environment, Forest and Climate Changes; Water, Irrigation, Energy and Electricity. Environment, Health and Water Bureaus/Offices at local levels. • **South Sudan**: Ministries of Environment, Health and Water; Environment. Health and Water Departments in States/counties.
• Minimisation of potential impacts related to **conversion of arable land** and population impacted by projects footprints	**MINIMISATION** • Exclusion of dense/ gathered settlement/villages from irrigation schemes • Conservation of communal grazing areas and conservation of access to grazing areas outside project footprints	**Ethiopia**: Ministry of Environment, Forest and Climate Changes; Water, Irrigation, Energy and Electricity; Environment and Water Bureaus/Offices at local level. • **South Sudan**: Ministries of Environment and Water. Environment and Water Departments in States/counties.
• Avoidance and minimisation of impacts related to **conversion of natural ecosystems**	**AVOIDANCE** • Avoidance of protected areas and other sensitive areas **MINIMISATION** • Conservation of ecological corridors within irrigation schemes / Project delineation to reduce habitat fragmentation	**Ethiopia:** Ministry of Environment, Forest and Climate Changes; Water, Irrigation, Energy and Electricity. Environment and Water Bureaus/Offices at local level. • **South Sudan**: Ministries of Environment and Water. Environment and Water Departments in States/counties.
Direct Action D1.2: Develop and implement basinwide plan for taking to scale of multipurpose IWRM-style water resources development and management projects		
• Enhancement of **food and nutrition security** in and around irrigation projects	**MAXIMISATION /ENHANCEMENT** • Smallholder irrigation schemes are encouraged • Increased access to improved sources of drinking water and sanitation. **OFFSET MEASURES** • Provision of alternative subsistence and livelihood	**Ethiopia**: federal Ministries resp for Agriculture; Water, Irrigation, Energy. Water and Agriculture Bureaus/Offices at local level. **South Sudan**: ministries resp for Agriculture and Water. Agriculture and Water Departments in State/country. • Coordination and collaboration with various stakeholders and developers/private sectors
• Enhancement of **local employment** in all projects	**MAXIMISATION /ENHANCEMENT** • Smallholder irrigation schemes • Capacity building and hiring of local staff Close cooperation with local authorities to ensure development of value added opportunities, social needs etc.	**Ethiopia**: federal ministries resp for Labour and Social Affairs; Agriculture; Water, Irrigation, Energy and Electricity. Water and agriculture bureaus/offices at local level. • **South Sudan**: ministries resp for labour; agriculture and water. Agriculture and Water Departments in States/counties. • Coordination with various stakeholders and developers
• Enhancement of **energy security**	**MAXIMISATION /ENHANCEMENT** • Improved connection to the national grid for urban poles and extensive rural electrification programmes Attractive electricity prices to encourage the use electricity instead of charcoal/wood	• **Ethiopia**: Ethiopian Electric Corporation • **South Sudan**: ministry of Energy

• Avoidance and minimisation of **risks of conflicts on transboundary water resources**	**AVOIDANCE** • Definition and respect of targets for river flows at key river nodes, downstream of projects **MINIMISATION** • Include discussions on benefit sharing (Eg : rural electrification and interconnection between countries producing electricity and countries impacted by upstream hydropower development) and risks sharing (Eg: Costs of mitigation measures being taken over by upstream countries where development occurs)	• **Joint Committees** of the two states, including members from the following: **Ethiopia**: Ministries of Environment, Forest and Climate Changes; Water, Irrigation, Energy and Electricity. Environment, Health and Water Bureaus/Offices at local levels. • **South Sudan**: Ministries of Environment, Health and Water; Environment. • Health and Water Departments in States/counties.
• Minimisation of potential impacts related to **conversion of arable land** and population impacted by projects footprints	**MINIMISATION** • Exclusion of dense/ gathered settlement/villages from irrigation schemes • Conservation of communal grazing areas and conservation of access to grazing areas outside project footprints	**Ethiopia**: Ministry of Environment, Forest and Climate Changes; Water, Irrigation, Energy and Electricity; Environment and Water Bureaus/Offices at local level. • **South Sudan**: Ministries of Environment and Water. Environment and Water Departments in States/counties.
• Avoidance and minimisation of impacts related to **conversion of natural ecosystems**	**AVOIDANCE** • Avoidance of protected areas and other sensitive areas **MINIMISATION** • Conservation of ecological corridors within irrigation schemes / Project delineation to reduce habitat fragmentation	**Ethiopia:** Ministry of Environment, Forest and Climate Changes; Water, Irrigation, Energy and Electricity. Environment and Water Bureaus/Offices at local level. • **South Sudan**: inistries of Environment and Water. Environment and Water Departments in States/counties.

5.2.2 Strategic Objective 2

5.2.2.1 Overview

Strategic Objective 2 is *"Taking into account the comparative advantages of the different parts of the sub-basin to sustainably develop water resources for hydropower, irrigation, water supply and sanitation and other sectors with the dual aims of reducing poverty within the sub-basin and generating revenue;"*

The objective is to be realised through the implementation of two key direct actions:

- D2.1: Develop economic sectors such as hydropower, irrigation, water supply, fisheries and other water sector projects, maximising multipurpose opportunities
- D2.2: Develop water sector infrastructure and services to support benefit sharing (navigation, interconnection etc)D1.1: Develop and implement (local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable livelihood enhancement, poverty reduction and the protection and conservation of biological resources

As with all the direct strategic actions there are a number of enabling and cross-cutting strategic actions.

5.2.2.2 Specific Actions

Specific actions to be included in the aim of realising this strategic objective will include the implementation of large-scale hydropower and irrigation and the multipurpose developments that go with them. As indicated earlier, only the command areas that do not impact on sensitive areas will be considered for implementation during the first ten years of the plan.

Figure 5-1, taken from the SSEA shows the location of the identified irrigation scheme command areas and the extent to which some of them encroach into sensitive areas. Linked with Figure 5-1, Table 5-3 lists the irrigation command areas and shows what percentage of each is considered to be outside the sensitive areas. It is for the countries to prioritise which specific schemes are implemented and this plan does not attempt to dictate this choice beyond the following recommendations:

- There is strong justification for prioritising development of irrigation schemes such as 20, 21, 22, 24 and 25 (all using water from the Baro River) and 31 (taking water from the Sobat River).
  - These will make use of the fact that flows in the Baro River will be regulated by the TAMS Dam, the largest and most downstream of the proposed dams/reservoirs on the Baro River.
  - Progress towards implementation of the TAMS Dam is well-advanced and is likely to precede significant irrigation development.
  - Development of irrigation from the Sobat will depend on some degree of regulation and can therefore also be supported by the TAMS Dam.
  - This development will require an integrated approach focussing on the Baro-Sobat component of the system. A “medium/long-term” project profile has been developed in this regard and prioritised by the countries for implementation (see Annex 3 and Annex 4).
- A number of related projects/interventions are considered to be critical either in their own rights or in supporting the implementation of large-scale multipurpose projects on the Baro River. They include:
  - **Transboundary Hydro-meteorological and Environmental monitoring system and Environmental Flows Assessment**. Work carried out in carrying out the basinwide SSEA has shown that there is a critical shortage of hydro-meteorological and natural resources data throughout the basin. In much of the sub-basin there are no data collection programmes in place. Planning based on a high level of uncertainty is unwise and potentially costly. The proposed project will see the sustainable operationalisation of a monitoring system for meteorology, hydrological, water quality, sediment transport and land use. As a second step, making use of the new data collected, the environmental flow requirements at all critical points around the sub-basin will be assessed and agreed.

    A brief project profile for this project is included in Annex 3.
  - **Machar Marshes integrated water resources management plan.** The Machar Marshes are poorly understood in terms of both the existing socio-economic conditions and hydro-environmental functioning. Its status is highly dependent on flows coming from the Baro River upstream which are likely to change over time in the future as upstream development proceeds. It is critical to establish an agreed integrated water resources management plan for the Machar Marshes which makes adequate provision for the sustainable development of livelihoods in this area of the basin where there are highly vulnerable communities who rely on services provided by the marshes.

    A brief project profile for this project is included in Annex 3.
  - **Flood-Risk Mapping and Early-Warning System.** A major driver of flooding in the low-lying downstream areas such as the Gambella Plains, are the large river flows emanating from the highlands in Ethiopia. The project will analyse the relationship between upstream flows and flooding extent in priority risk areas. It will include an analysis of the relationship between rainfall in the source areas of the main rivers and floods generated in these rivers and will investigate the potential impacts of climate change. A real-time or quasi-real-time early warning system will then be developed aimed at providing early warning of high discharge levels in the rivers while these flows are still some distance from the areas susceptible to flooding

    A brief project profile for this project is included in Annex 3.

- **Regional Transport and Navigation Development Project**. An important focus of the project is on the Baro River and its connectivity to the Sobat and the White Nile/Main Nile system but the study will i) investigate and evaluate the feasibility of investments to improve the role of navigation in the sub-basin within the context of regional transport and access to markets as a whole, ii) to carry out the necessary planning and design work to get the project ready for implementation and iii) implement the project itself. The study will look carefully at the transport needs that will be generated by accelerated development within the sub-basin, assuming that a major driver in this accelerated development will be the rapid expansion of commercial irrigation in both the Gambella Region of Ethiopia and on the Sobat River in South Sudan

  A brief project profile for this project is included in Annex 3.

- Prioritisation should focus on further investigating potential which could not be fully investigated up to now. This includes the Akobo Akobo – Pibor transboundary multipurpose development project There are areas of potential for the multipurpose development for water resources in South Sudan which have not been adequately investigated as a result of the security situation. The objective of the project is to investigate through reconnaissance to the feasibility study level, the feasibility of a multipurpose project development based on storage on the Akobo River forming the joint border between South Sudan and Ethiopia and the development of hydropower, irrigation, fisheries, water supply and livestock watering…..

A brief project profile for this project is included in Annex 3 and terms of reference for implementation of the required studies in Annex 4

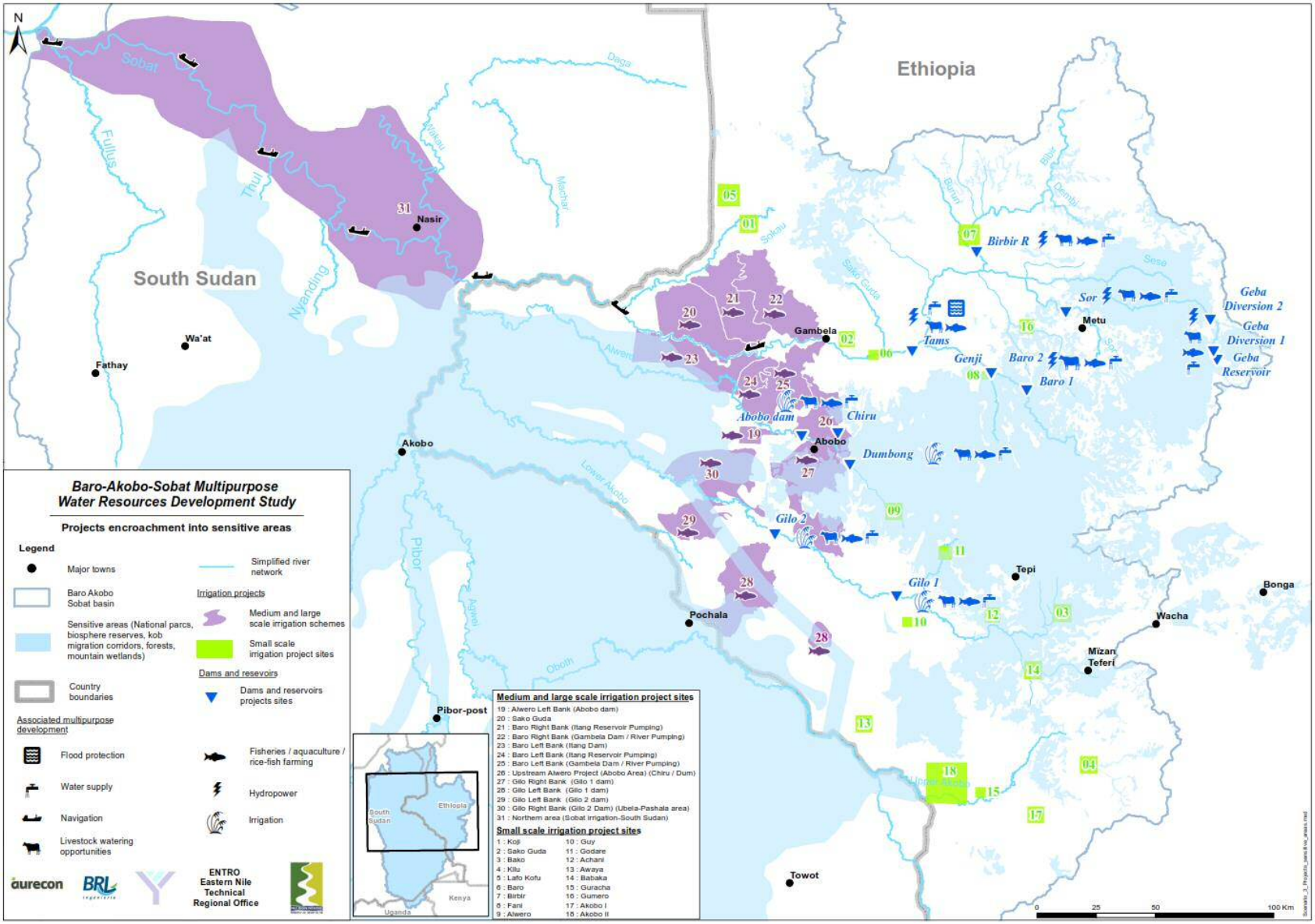


Figure 5-1: Encroachment of irrigation schemes into sensitive areas (area in light blue on the map)

Table 5-3: Application of avoidance measures concerning irrigation (S No 1 to 18: small-scale projects; S No 19 to 31: large scale projects)

S. No	Name	Total area (Sc 3b, 4a & 4b)		Resulting area (after exclusion of sensitive areas) (Sc 1, 2 & 3a)	
		Gross Area (ha)	Net Area (ha)	Net Area (ha)	% of net total area
1	Koji	6 000	4 590	4 590	100%
2	Sako Guda	4 600	3 519	3 519	100%
3	Bako	6 000	4 590	-	0%
4	Kilu	5 600	4 284	4 182	98%
5	Lafo Kotu	9 000	6 885	6 885	100%
6	Baro	2 000	1 530	1 530	100%
7	Birbir	8 000	6 120	5 373	88%
8	Fani	1 200	918	282	31%
9	Alwero	5 500	4 208	0	0%
10	Guy	1 800	1 377	1 377	100%
11	Godare	3 300	2 525	666	26%
12	Achani	4 300	3 290	911	28%
13	Awaya	5 000	3 825	3 825	100%
14	Babaka	6 000	4 590	803	18%
15	Guracha	2 000	1 530	1 530	100%
16	Gumero	4 000	3 060	1 307	43%
17	Akobo I	5 000	3 825	3 825	100%
18	Akobo II	30 000	22 950	22 950	100%
19	Alwero, Abobo Dam, gravity	13 600	10 404	10 404	100%
20	Baro River, right bank, Itang Dam, gravity conveyance	66 581	50 949	50 949	100%
21	Scheme 2 + relift p/station + additional canal	57 495	43 984	43 984	100%
22	Scheme 3A (Baro River, right bank, Gambella Dam, gravity conveyance) +	67 740	51 821	51 821	100%
23	Baro River, left bank, Itang Dam, gravity conveyance	61 900	47 354	17 888	38%
24	Baro River, left bank, Itang Dam p/station, canal	15 832	12 111	12 111	100%
25	Baro River, left bank, Gambella Dam, gravity conveyance	57 018	43 619	43 619	100%
26	Alwero River, right bank, Chiru + Dumbong Dam, gravity conveyance	34 665	26 550	20 781	78%
27	Gilo River, right bank, Gilo 1 Dam, gravity	81 346	62 230	29 437	47%
28	Gilo River, left bank, Gilo 1 Dam, gravity	79 652	60 934	8 945	15%
29	Gilo River, left bank, Gilo 2 Dam, gravity	33 855	25 899	1 791	7%
30	Gilo River, right bank, Gilo 2 Dam, gravity	61 325	46 914	12 861	27%
31	Sobat	94 118	72 000	69 032	96%

All of the relevant strategic actions need to be expressed in terms of specific actions that can be implemented. The proposed specific actions are included in Table 5-4.

Table 5-4: Required Specific Actions and Institutional Responsibilities to achieve Strategic Objective 2

Strategic Action	Specific Actions and timeline[1]	Institutional Responsibilities
D2.1: Develop hydropower, irrigation, water supply, fisheries and other water sector projects, maximizing multipurpose opportunities	• Basinwide strategy for early consideration/mainstreaming of multipurpose approach in to the planning and design of water resources development infrastructure, including agreement to early and maximum transparency on development plans that have potential transboundary impact or needs	• ENTRO to lead working with the countries
	• Reconnaissance, prefeasibility and feasibility study, design and implementation of Akobo MPP ***ToR have been developed, see Annex 4***	• GoSS and a joint committee with GoE and supported by ENTRO
	• Reconnaissance, prefeasibility and feasibility studies for other potential projects in South Sudan	•
	• Plan and design "Integrated BAS Hydropower and Irrigation Development Programme"; Phase 1; Baro-Sobat Component, including detailed sequencing, operating principles and management rules (taking into account ESMP etc). ***ToR have been developed, see Annex 4***	• Duty of the countries to form a joint committee with support of ENTRO
	• Design, implement, operate and manage Geba hydropower project (Geba A reservoir, Geba Diversion 1 and Diversion 2 Projects) including related multipurpose opportunities (capture fisheries, water supply etc)	• GoE and a joint committee with GoSS
	• Design, implement, operate and manage Tams hydropower project including related multipurpose opportunities (capture fisheries, water supply etc, navigation support etc)	• GoE and a joint committee with GoSS
	• Design, implement, operate and manage Sor 2 hydropower project including related multipurpose opportunities (water supply etc)	• GoE and a joint committee with GoSS
	• Design, implement, operate and manage Genji hydropower project including related potential multipurpose opportunities (water supply etc)	• GoE and a joint committee with GoSS
	• Design, implement, operate and manage Baro 1 and Baro 2 hydropower projects including related potential multipurpose opportunities (capture fisheries, water supply etc)	• GoE and a joint committee with GoSS
	• Design, implement, operate and manage Birbir hydropower project including related multipurpose opportunities (capture fisheries, water supply etc, navigation support etc)	• GoE and a joint committee with GoSS
	• Design, implement, operate and manage Baro River, right bank (previously Itang Dam), gravity conveyance (50,949ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc)	• GoE, information and coordination with GoSS
	• Design, implement, operate and manage Sobat sub-catchment irrigation schemes (69,032ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc)	• GoSS with support of ENTRO
	• Design, implement, operate and manage Baro River, right bank (previously pumping from Itang Dam), gravity conveyance, additional canal (43,984ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc)	• GoE, information and coordination with GoSS
	• Design, implement, operate and manage Baro River, Scheme 3A, previously Gambella Dam, gravity conveyance, high lift pumping and additional canals (51,821ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc	• GoE, information and coordination with GoSS
	• Design, implement, operate and manage Baro River, left bank, previously Itang Dam, gravity conveyance (17,888ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc	• GoE, information and coordination with GoSS

	• Design, implement, operate and manage Baro River, left bank, previously Itang Dam with pump station and canal, (12,111ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc	• GoE, information and coordination with GoSS
	• Design, implement, operate and manage Baro River, right bank (previously Gambella Dam), gravity conveyance (43,619ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc)	• GoE, information and coordination with GoSS
	• Design, implement, operate and manage Alwero River, right bank, Chiru + Dumbong Dam, gravity conveyance (20,781ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc)	• GoE, information and coordination with GoSS
	• Plan and design "Integrated BAS Hydropower and Irrigation Development Programme"; Phase 2; Gilo Component, including investigation of hydropower potential and upstream storage as alternative to Gilo 1 and/or 2 Dams (detailed sequencing, operating principles and management rules (taking into account ESMP etc)	• GoE with facilitation of ENTRO on regional dimension
	• Design, implement, operate and manage Gilo River , right bank, Gilo 1 Dam, gravity conveyance or alternatives (29,437ha), including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc	• GoE and a joint committee with GoSS
	• Design, implement, operate and manage Gilo River, right bank, Gilo 2 Dam, gravity conveyance or alternatives (12861ha), including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc	• GoE and a joint committee with GoSS
	• Design, implement, operate and manage individual Gilo River hydropower and irrigation projects (up to +/- 86,129ha) in line with Integrated BAS Hydropower and Irrigation Development Programme"; Phase 2, Gilo Component, including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc	• GoE and a joint committee with GoSS with facilitation by ENTRO
	•	•
D2.2: Develop water sector infrastructure and services to support benefit sharing (navigation, interconnection etc)	• Investigate, plan and assess feasibility of different options of the Ethiopia - South Sudan electric power interconnection	• ENTRO to support the joint committee of the two countries
	• Design, implement and operate the Ethiopia - South Sudan electric power interconnection	• Joint committee of the two countries
	• Investigate navigation/river transport opportunities to be supported by increased level of regulation in Baro River and increased agricultural production, especially in Gambella area and compile detailed pre-feasibility study. ***See Project Profiles in Annex 3***.	• ENTRO to lead in close cooperation with countries
	• If feasible, design enhanced navigation and river/intermodal transport system linking production areas in Ethiopia with downstream ports and consumption centres ***See Project Profiles in Annex 3***.	• ENTRO to support and search funds in close cooperation with countries
	• Implement and operate enhanced navigation and river/intermodal transport system linking production areas in Ethiopia with downstream ports and consumption centres ***See Project Profiles in Annex 3***.	• A specific treaty or agreement between countries
E1: Develop and implement the necessary institutional framework	• Develop and operationalize the necessary institutional framework at the transboundary and national levels for programme implementation (eg for the Integrated BAS Hydropower and Irrigation Development Programme" (see D2.1); Phase 1; Baro-Sobat Component) including planning and intersectoral coordination, local administration and community/beneficiary participation; ***See ToR in Annex 3***	• ENTRO to lead with stakeholders
	• Develop and operationalize the necessary institutional framework for the implementation of major transboundary water resources development infrastructure, including systems/protocols for data sharing, transparency, monitoring and evaluation and adaptive management. different levels of management (see D2.1), including planning, intersectoral coordination, local administration and community/beneficiary levels	• ENTRO to lead with stakeholders
E2: Promote and ensure appropriate	• Consult with and fully involve stakeholders at all levels (transboundary and regional organisations, national planning and	• ENTRO to lead with stakeholders

stakeholder participation	sectoral institutions, local administration etc) concerned with development of large-scale water resources infrastructure programmes (eg for the Integrated BAS Hydropower and Irrigation Development Programme" (see D2.1); Phase 1; Baro-Sobat Component). ***See ToR in Annex 4***	
E3: Develop and implement appropriate and effective communication strategies and plans	• Develop comprehensive communication strategy and implementation plan for supporting the achievement of this strategic objective aiming at all levels of stakeholders (for i) overall implementation of the direct strategic action at the basinwide level and ii) at the individual project level	• ENTRO to lead with stakeholders
	• Implement communication plan at the basinwide, national, regional and project levels	• ENTRO to lead with stakeholders
E4: Develop and implement monitoring and evaluation, and adaptive management systems	• Develop and operationalize monitoring and evaluation and adaptive management systems at the programme level (eg for the Integrated BAS Hydropower and Irrigation Development Programme" (see D2.1); Phase 1; Baro-Sobat Component). ***See ToR in Annex 4***	• ENTRO to support and facilitate common standards to be defined by countries in line with the DSS
	• Develop and operationalize monitoring and evaluation and adaptive management systems at the project level for each large-scale water multipurpose water resources development and management project	• ENTRO to support and facilitate common standards to be defined by countries in line with the DSS
E5: Develop non-water sector infrastructure and services to support water-resources development and benefit sharing (roads, urbanization, communications, etc)	• Carry out a detailed needs and gap analysis in terms of non-water infrastructure and services required to support the sustainability of large-scale water resources development projects, especially agriculture production	• Duty of each country, to be shared and coordinated
	• Work with non-water sector institutions at the regional, national and local levels to develop and implement an infrastructure and services development support strategy and plan	• Duty of each country, to be shared and coordinated. ENTRO to facilitate at regional scale
E6: Plan and implement integrated basinwide environmental monitoring system	• Develop a strategy and associated guidelines for the planning of transboundary level environmental monitoring in order to better understand the baseline situation and transboundary project impacts	• ENTRO to lead with close coordination and common standards along the basin (countries)
	• Plan, design and implement project-focused environmental monitoring system (climate, hydrology, water quality etc) ***See Annex 3***	• Duty of each country. Use of common agreeable standards
	• Collect and analyse data and inform monitoring and evaluation programme for adaptive management.	• Duty of each country, to be shared and coordinated on common standards. ENTRO to facilitate at regional scale
E7: Carry out regular and adhoc water resources, water quality and environmental flow requirements assessments	• Carry out assessments as required to inform transboundary water resources development programme and component project design (on a project by project basis)	• Joint committee of countries, dialogue facilitated by ENTRO
	• Evaluate transboundary environmental flow requirements based on improved understanding of the baseline and planned large-scale water resources development programmes.	• ENTRO to facilitate/support and closely liaise with countries
E8: Ensure adequate financing mechanisms and funding are in place and available	• Investigate and put in place measures to promote the overall integrated and sustainable development programme aimed at attracting financing for adequate planning	• ENTRO to facilitate and lobbying with the countries
	• Develop financing models for individual projects based on cost-benefit analysis and sustainability, including PPPs, turnkey, BDO solutions etc.	• The countries with facilitation/support from ENTRO
E9: Carry out regular and adhoc flood-risk mapping and land-use planning exercises	• Plan and carry out basinwide flood risk and land use mapping exercise making use of remotely sensed products, outputs of the proposed environmental data collection programme (see E6) etc ***Project Profile in Annex 3***	• ENTRO to lead with stakeholders, in line with the DSS
	• Plan and carry out detailed flood risk and land use mapping as related to individual projects making use of remotely sensed products, outputs of the proposed environmental data collection programme (see E6) etc	• Countries with strong support of ENTRO, in line with the DSS

C1: Mainstream climate change considerations	• Evaluate potential climate change impacts at the basinwide level and how they may relate to the implementation of basinwide development programmes (eg for the Integrated BAS Hydropower and Irrigation Development Programme" (see D2.1); Phase 1; Baro-Sobat Component).	• ENTRO to lead and coordination with countries
	• Mainstream climate change considerations into planning, design and implementation of individual projects	• Duty of each country, to be shared and coordinated on common standards.
C2: Ensure appropriate and effective mainstreaming of gender considerations	• Develop a section of the gender mainstreaming strategy focused on ensuring and promoting gender mainstreaming at the transboundary programme development level (strategic planning, design etc)	• Duty of each country, to be shared and coordinated on common standards.
	• Implement gender mainstreaming measures as integral part of each project	• Duty of each country, to be shared and coordinated on common standards.

Note 1: Timeline colour coding

Start in	0 – 3 years	Start in	4 – 10 years	Start in	11 - 25 years	Deferred	No timeframe

5.2.2.3 Integrating proposed ESMP measures into the IWRDMPlan

There is a wide range of measures included in the ESMP aimed at maximising and enhancing the actions proposed in the IWRDMPLan relating to the attainment of Strategic Objective 2. There are also some offset measures and specific monitoring and evaluation requirements. These are summarised together with an indication of institutional responsibilities in Table 5-5.

Table 5-5: Checklist of ESMP Measures to be integrated into implementation of direct strategic actions

Proposed ESMP management measures	Specific measures proposed	Institutional responsibilities
Direct Action D2.1: Develop economic sectors such as hydropower, irrigation, water supply, fisheries and other water sector projects, maximising multipurpose opportunities		
• Enhancement of **food and nutrition security** in and around irrigation projects	**MAXIMISATION /ENHANCEMENT** • Smallholder irrigation schemes are encouraged • Sharing between local markets and export allows significant improvement in access of food on local markets, • Increased access to improved sources of drinking water and sanitation.	• **Ethiopia**: federal Ministries resp. for Agriculture; Water, Irrigation, Energy. Water & Agriculture Bureaus/Offices at local level. • **South Sudan**: ministries resp. for Agriculture & Water. Agriculture & Water Departments in State/country. • Coordination & collaboration with various stakeholders & developers/private sectors
	OFFSET MEASURES • Provision of alternative subsistence and livelihood	
	MONITORING AND EVALUATION • Monitoring of the IWRDMPlan to include monitoring measures on food and nutrition security.	
• Enhancement of **local employment** in all projects	**MAXIMISATION /ENHANCEMENT** • Smallholder irrigation schemes • Capacity building/ hiring of local staff • Close cooperation with local authorities to ensure development of value added opportunities, social needs etc.	• **Ethiopia**: federal ministries resp. for Labour & Social Affairs; Agriculture; Water, Irrigation, Energy & Electricity. Water & agriculture bureaus/offices at local level. • **South Sudan**: ministries resp. for labour; agriculture & water. Agriculture & Water Departments in States/counties. • Coordination with various stakeholders & developers
	MONITORING AND EVALUATION • Monitoring of the IWRDMPlan to include monitoring measures on employment	

• Enhancement of **energy security**	**MAXIMISATION /ENHANCEMENT** • Improved connection to the national grid for urban poles and extensive rural electrification programmes • Attractive electricity prices to encourage the use electricity instead of charcoal/wood **MONITORING AND EVALUATION** • Monitoring of the IWRMDP to include monitoring measures on energy security	• **Ethiopia**: Ethiopian Electric Corporation • **South Sudan**: ministry of Energy
• Minimisation of **water quality issues** associated with implementation of dams and irrigation schemes	**MINIMISATION** • Removal of organic matter in the reservoirs prior to filling • Erosion prevention in watershed upstream reservoirs • Optimisation of irrigation to limit water releases and infiltration after field application • Minimization of the use of fertilizers and pesticides • Implementation of sanitation and waste water management plans **OFFSET** • Provision of all communities previously reliant on the river with a reliable clean alternative: sensitisation of all affected villages re quality of water in the River..	• **Ethiopia**: federal Ministry of Health; Ministry of Water, Irrigation, Energy & Electricity. Health & Water Bureaus/Offices at local level. • **South Sudan**: Ministry of Health & Water. Health & Water Departments in States/counties.
• Minimisation of **drowning** in irrigation canals (people, cattle, wildlife)	**MINIMISATION** • Include the mitigation of this risk into the design of irrigation schemes • Prohibit access to canals to avoid crossing • Organize prevention campaigns **RESTORATION** • Restore access by constructing bridges for people, cattle and wildlife	• **Ethiopia**: Ministry of Environment, Forest & Climate Changes; Water, Irrigation, Energy & Electricity. Environment, Health & Water Bureaus/Offices at local level. • **South Sudan**: Ministries of Environment, Health & Water. Environment, Health & Water Departments in States/counties.
• Avoidance and minimisation of **potential conflicts** on transboundary water resources	**AVOIDANCE** • Definition and respect of targets for river flows at key river nodes, downstream of projects: - Baro, Gilo, Sobat at their various confluences - Main Nile downstream of the confluence with the Blue Nile **MINIMISATION** • Implementing "upstream-downstream" appoach and more especially Initiate discussions on **i) benefit sharing** (Eg : rural electrification and interconnection between countries producing electricity and countries impacted by upstream hydropower development) and **ii) risks sharing** (Eg: Costs of mitigation measures being taken over by upstream countries where development occurs)	• **Joint Committees** of the two states, including members from the following: • **Ethiopia**: Ministries of Environment, Forest & Climate Changes; Water, Irrigation, Energy & Electricity. Environment, Health & Water Bureaus/Offices at local levels. • **South Sudan**: Ministries of Environment, Health & Water; Environment. Health & Water Departments in States/counties.
• Avoid and minimise **changes to riverine ecosystem services** and geomorphological changes	**AVOIDANCE** • Avoidance of extreme infra-daily variation of river flow immediately downstream hydropower dams through the design of regulation dams **MINIMISATION** • Conservation of flood flows downstream dams to ensure that an adequate area is flooded each year (managed flood releases through dams operation rules) • Water saving measures, at least for the most consumptive uses (irrigation). This should be achieved through: - Choice of adequate crops; - Design and construction of efficient water conveyance infrastructure; - Choice of efficient irrigation methods; - Study reuse opportunities - Efficient irrigation management • Definition of environmental flows downstream each project • Definition of an "environmental sediment regime" • Inclusion of tools to allow periodic flushing of sediments within dam design to implement the recommended "environmental sediment regime" • Inclusion of fish ladder within dam design	• **Joint Committees** of the two states, including members from the following: • **Ethiopia**: Ministries of Environment, Forest & Climate Changes; Water, Irrigation, Energy & Electricity. Environment, Health & Water Bureaus/Offices at local levels. • **South Sudan**: Ministries of Environment, Health & Water; Environment. Health & Water Departments in States/counties.

	RESTORATION • Transfer of coarse sediment stored / stopped from upstream the dam to downstream the dam • Mobility space of rivers, lateral erosion leading to alluvial sediment recharge • Reconnection of annexes (wetlands, ponds, floodplain) to the river in case of severe bed incision	
	OFFSET • Study emblematic, endangered or protected species related to water to better understand how they can be affected by changes in flow regimes and wetlands size • Management and restoration of existing and unprotected wetlands • Restoration of river crossing points for cattle and wildlife to offset crossing issues due to high regulated low flows • Financing conservation initiatives / programs through NGOs activities • Preventive and curative treatment of invasive aquatic plants	
• Minimisation of potential impacts related to **conversion of arable land** and population impacted by projects footprints	**MINIMISATION** • Exclusion of dense/ gathered settlement/villages from irrigation schemes • Conservation of communal grazing areas and conservation of access to grazing areas outside project footprints	• **Ethiopia**: Ministry of Environment, Forest & Climate Changes; Water, Irrigation, Energy & Electricity; Environment & Water Bureaus/Offices at local level. • **South Sudan**: Ministries of Environment & Water. Environment & Water Departments in States/counties.
	OFFSET • Provide access to irrigation to the local population	
• Avoidance and minimisation of impacts related to **conversion of natural ecosystems**	**AVOIDANCE** • Avoidance of protected areas and other sensitive areas	• **Ethiopia:** Ministry of Environment, Forest & Climate Changes; Water, Irrigation, Energy & Electricity. Environment & Water Bureaus/Offices at local level. • **South Sudan**: Ministries of Environment & Water. Environment & Water Departments in States/counties.
	MINIMISATION • Conservation of ecological corridors within irrigation schemes / Project delineation to reduce habitat fragmentation • Conservation of important species	
• Minimise and offset **GHG emissions**	**MINIMISATION** • Development of agro-forestry within irrigation schemes and valorisation of vegetation resulting from land clearance to reduce GHG emissions due to vegetation burning • Control of vegetation clearance to reduce methanization risks and to reduce GHG emissions due to vegetation burning	• **Ethiopia**: Ministry of Environment, Forest & Climate Changes; Ministry of Water, Irrigation, Energy & Electricity. Environment & Water Bureaus/Offices at the local levels. • **South Sudan**: Ministries of Environment & Water. Environment & Water Departments in States/counties
	OFFSET • Afforestation and forest restoration to offset NO_2 releases due to agriculture development	
Direct Action D2.2: Develop water sector infrastructure and services to support benefit sharing (navigation, interconnection etc)		
• Enhancement of **food and nutrition security** in and around irrigation projects	**MAXIMISATION /ENHANCEMENT** • Sharing between local markets and export allows significant improvement in access of food on local markets	• **Ethiopia**: federal Ministries resp. for Agriculture; Water, Irrigation, Energy. Water & Agriculture Bureaus/Offices at local level. • **South Sudan**: ministries resp. for Agriculture & Water. Agriculture & Water Departments in State/country. • Coordination & collaboration with various stakeholders & developers/private sectors
• Enhancement of **energy security**	**MAXIMISATION /ENHANCEMENT** • Improved connection to the national grid for urban poles and extensive rural electrification programmes • Attractive electricity prices to encourage the use electricity instead of charcoal/wood	• **Ethiopia**: Ethiopian Electric Corporation • **South Sudan**: ministry of Energy

5.2.3 Strategic Objective 3

5.2.3.1 Overview

Strategic Objective 3 is *"To ensure transboundary and inter/intra sectoral cooperation and benefit sharing with a view to minimizing resource-based conflicts through optimized management and use of water and associated resources"*

The objective is to be realised through the implementation of three key direct actions:

- D3.1: Develop and implement (local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable benefit sharing and conflict resolution
- D3.2: Plan and implement conjunctive, optimised management of u/s hydropower schemes in support of development projects and d/s ecosystems/ EFRs
- D3.3: Plan and implement the appropriate development of groundwater resources and groundwater/ surface water conjunctive use. D2.1: Develop economic sectors such as hydropower, irrigation, water supply, fisheries and other water sector projects, maximising multipurpose opportunities

As with all the direct strategic actions there are a number of enabling and cross-cutting strategic actions.

5.2.3.2 Specific Actions

OPTIMIZED MANAGEMENT AND USE OF WATER AND ASSOCIATED RESOURCES AT THE LOCAL LEVEL

Of the three direct strategic actions identified, the first, D3.1, has already been identified (although expressed slightly differently), as necessary to contribute to food security, livelihood enhancement, poverty reduction and the protection and conservation of biological resources through stakeholder-driven management of wetlands, watersheds and other important natural resources. Localised small-scale IWRM style projects are also seen as having an important role to play in sustainable benefit sharing and conflict resolution at the local level. The three short-term projects already introduced and detailed in Section 5.2.1.2 can be seen as specific actions under Direct strategic action D3.1. In particular, the proposed Akobo-Gambella floodplains transboundary development programme has been designed to reduce extreme poverty and improve livelihoods in an area of the BAS sub-basin which is **characterised by conflicts over the resources, food insecurity, no access to a safe source of water, etc.**.

OPTIMIZED MANAGEMENT AND USE OF WATER AND ASSOCIATED RESOURCES AT BASINWIDE LEVEL

Direct strategic action D3.2 is focused on optimised management at the sub-basin and transboundary levels, recognising that this is essentially associated with the conjunctive and optimised planning, development, management and operation of upstream hydropower schemes and their associated reservoir storage in support of downstream development projects (large-scale irrigation, water supply, livestock watering etc) and ecosystems (inlcuding the ecoservices they provide and the livelihoods that they support).

- A number of related projects/interventions are considered to be critical either in their own rights or in supporting the implementation of Direct Action D3.2. They include :

- **Transboundary Hydro-meteorological and Environmental monitoring system and Environmental Flows Assessment**. This critical project has already been introduced in section 5.2.2.2. Optimising the management and operation of upstream storage in order to support downstream environmental flow requirements clearly requires the improved knowledge base that this intervention will bring.

  A brief project profile for this project is included in Annex 3.

- **Integrated BAS hydropower, irrigation and multipurpose development programme—Phase 1: Baro/Sobat component**. This "medium/long-term" project has been introduced in Section 5.2.2.2 above in support of Startegic Objective 2, "taking into account the comparative advantages of the different parts of the sub-basin to **sustainably develop water resources for hydropower, irrigation, water supply and sanitation and other sectors** with the dual aims of reducing poverty within the sub-basin and generating revenue. However, this project is also aimed at providing recommendations and clear guidelines on the sequencing, operating principles and management rules of priority large scale hydropower projects and associated development on the Baro and Sobat rivers so that the development of the available water resources is optimised and **supports transboundary and inter/intra sectoral cooperation and benefit sharing with a view to minimizing resource-based conflicts**..

OPTIMIZED MANAGEMENT AND CONJUNCTIVE USE OF SURFACE AND GROUNDWATER

Direct strategic action D3.3, the planning and implementation the appropriate development of groundwater resources and groundwater/ surface water conjunctive use, recognises that conjunctive use of surface and groundwater can play a significant role in the optimised the availability of water and addressing conflict management, especially at the local level.

All of the relevant strategic actions need to be expressed in terms of specific actions that can be implemented. The proposed specific actions are included in *Table 5-6*.

Table 5-6: Required Specific Actions under each of the Strategic Actions in order to achieve Strategic Objective 3

Strategic Action	Specific Actions and timeline[1]	Institutional Responsibilities
D3.1: Develop and implement (local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable benefit sharing and conflict resolution	• See specific actions detailed for D1.1. These are unchanged and will contribute to ensuring transboundary and inter/intra sectoral cooperation and benefit sharing with a view to minimizing resource-based conflicts. ***Feasibility studies have been developed as part of this study***	• ENTRO to lead working with the countries
D3.2: Plan and implement conjunctive, optimized management of u/s hydropower schemes in support of development projects and d/s ecosystems/ EFRs	• Agree on principles (transboundary/national) and develop a strategy for the BAS and its main sub-catchments;	• ENTRO to lead in close cooperation with countries
	• Define environmental flow requirements at key points around the system ***See Annex 3 of Project profiles developed under this study***	• The countries with support from ENTRO
	• Using the improved data available, build detailed basinwide water resources simulation (planning, allocation, balance, environmental flow requirements etc) models to support optimized management and satisfaction of EFRs.	• ENTRO to lead in close cooperation with countries
	• Implement agreed conjunctive, optimized management of u/s hydropower schemes in support of development projects and d/s ecosystems/ EFRs. ***See ToR developed as part of this study in Annex 4***	• Joint committee with support from ENTRO

	• Monitor and evaluate implementation of agreed conjunctive, optimized management of u/s hydropower schemes in support of development projects and d/s ecosystems/ EFRs ToR	• ENTRO to lead in close cooperation with countries
D3.3: Plan and implement the appropriate development of groundwater resources and groundwater/ surface water conjunctive use.	• Investigate and plan potential opportunities for groundwater development and opportunities for conjunctive use of ground and surface water resources at local and transboundary levels; ***See Cingaeta/Kapoeta Project profile in Annex 3***	• The countries with shared information and support from ENTRO
	• Carry out reconnaissance studies and implement data collection programmes as necessary	• The countries with shared information and support from ENTRO
	• Implement conjunctive use of ground and surface water resources at local and transboundary levels. ***See Cingaeta/Kapoeta Project Profile in Annex 3***	• The countries with shared information
E1: Develop and implement the necessary institutional framework	• Develop and operationalize the necessary institutional framework at the project level for planning, intersectoral coordination, local administration and community/beneficiary participation	• ENTRO and stakeholders
	• Develop and operationalize the necessary institutional framework for the different levels of management, including basinwide planning, intersectoral coordination, local administration and community/beneficiary levels ***See ToR in Annex 4***	• ENTRO and stakeholders with joint committee when necessary
E2: Promote and ensure appropriate stakeholder participation	• Consult with, and fully involve stakeholders at all levels (transboundary and regional organisations, national planning and sectoral institutions, local administration etc) concerned with water resources development and management in order to ensure equitable benefits and conflict management. ***See ToR in Annex 4***	• ENTRO and stakeholders
E3: Develop and implement appropriate and effective communication strategies and plans	• Develop comprehensive communication strategy and implementation plan for supporting the achievement of this strategic objective aiming at all levels of stakeholders (for i) overall implementation of the direct strategic action at the basinwide level and ii) at the individual project level	• ENTRO and stakeholders
	• Implement communication plan at the basinwide, national, regional and project levels	• ENTRO and stakeholders
E4: Develop and implement monitoring and evaluation, and adaptive management systems	• Develop and operationalize monitoring and evaluation and adaptive management systems at the programme level (as related to overall strategic objective of optimised inter and intra-sector cooperation and reduced conflict)	• ENTRO to support and facilitate common standards to be defined by countries in line with the DSS
	• Develop and operationalize monitoring and evaluation and adaptive management systems at the project level with aggregation to the basinwide level.	• ENTRO to support and facilitate common standards to be defined by countries in line with the DSS
E5: Develop non-water sector infrastructure and services to support water-resources development and benefit sharing (roads, urbanization, communications, etc)	• Set up appropriate inter-sectoral planning "committees" at the transboundary and national levels to ensure that the planning and implementation of water resources development projects are in line with other sectoral plans, and vice versa.	• The countries, coordinated in the committees and facilitated by ENTRO
	• Report back to sectors to ensure that the support infrastructure and services requirements of the water sector are adequately taken into account.	• The countries, coordinated in the committees and facilitated by ENTRO
E6: Plan and implement integrated basinwide environmental monitoring system	• Ensure that data needs and potential impacts of non-water sector developments are considered in the planning and implementation of the integrated basinwide environmental monitoring system	• ENTRO to deliver guidelines with stakeholders
	• Collect and analyse data and inform monitoring and evaluation programme for adaptive management.	• The countries in coherence with guidelines and the DSS
E7: Carry out regular and adhoc water resources, water quality and environmental flow	• Ensure that agreement on environmental flow requirements take into account the potential for conflict over resources.	• ENTRO supervision and guidelines with stakeholders
	• Evaluate transboundary environmental flow requirements based on improved understanding of the baseline and planned large-scale water resources development programmes.	• Agreement between the countries with facilitation of ENTRO

requirements assessments		
E8: Ensure adequate financing mechanisms and funding are in place and available	• Investigate and put in place measures to promote the overall programme of development of small-scale IWRM-style based projects and its taking to scale in order to attract financing	• ENTRO to lead and lobby with the countries
	• Develop financing model for individual projects based on cost-benefit analysis and sustainability with access to credit for start-up, but costs borne by beneficiaries.	• The countries
E9: Carry out regular and adhoc flood-risk mapping and land-use planning exercises	• None	• N/A
C1: Mainstream climate change considerations	• Evaluate potential climate change impacts at the localized level, especially as they relate to potential project implementation	• Duty of each country, to be shared and coordinated on common standards
	• Mainstream climate change considerations into planning, design and implementation of individual projects	
C2: Ensure appropriate and effective mainstreaming of gender considerations	• Develop a section of the gender mainstreaming strategy focused on ensuring and promoting gender mainstreaming at the project level	• Duty of each country, to be shared and coordinated on common standards.
	• Implement gender mainstreaming measures as integral part of each project	

Note 1: Timeline colour coding

Start in	0 – 3 years	Start in	4 – 10 years	Start in	11 - 25 years	Deferred	No timeframe

5.2.3.3 Integrating proposed ESMP measures into the IWRDMPlan

There is a wide range of measures included in the ESMP aimed at maximising and enhancing the actions proposed in the IWRDMPLan relating to the attainment of Strategic Objective 2. There are also some offset measures and specific monitoring and evaluation requirements. These are summarised together with an indication of institutional responsibilities in the following table.

Table 5-7: Checklist of ESMP Measures to be integrated into implementation of direct strategic actions

Proposed ESMP management measures	Specific measures proposed	Institutional responsibilities
Direct Action D3.1: Develop and implement (local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable benefit sharing and conflict resolution		
Refer to ESMP Measures to be integrated into implementation for strategic objective 1, direct action D1.1		
Direct Action D3.2: Plan and implement conjunctive, optimized management of u/s hydropower schemes in support of development projects and d/s ecosystems/ EFRs		
• Avoid and minimise **risks of conflicts on transboundary water resources**	**AVOIDANCE** • Definition and respect of targets for river flows at key river nodes, downstream of projects	• **Joint Committees** of the two states, including members from the following: • **Ethiopia**: Ministries of Environment, Forest & Climate Changes; Water, Irrigation, Energy & Electricity. Environment, Health & Water Bureaus/Offices at local levels. • **South Sudan**: Ministries of Environment, Health & Water; Environment.
	MINIMISATION • Implementing "upstream-downstream" integrated management of resources • Discussions on benefit and risks sharing	
• Avoid and minimise **changes to riverine ecosystem services and geomorphological changes**	**AVOIDANCE** • Avoidance of extreme infra-daily variation of river flow immediately downstream hydropower dams through the construction of a small regulation dam directly downstream of the main dam	
	MINIMISATION • Conservation of flood flows downstream dams to ensure that an adequate area is flooded each year through dam operation rules • Definition of environmental flows downstream each project	

	• Inclusion of tools to allow periodic flushing of sediments within dam design to implement the recommended "environmental sediment regime" • Inclusion of fish ladder within dam design	• Health & Water Departments in States/counties.
	OFFSET • Study emblematic, endangered or protected species related to water to better understand how they can be affected by changes in flow regimes and wetlands size • Management and restoration of existing and unprotected wetlands • Restoration of river crossing points for cattle and wildlife to offset crossing issues due to high regulated low flows • Financing conservation initiatives / programs through NGOs activities • Preventive and curative treatment of invasive aquatic plants	
D3.3: Plan and implement the appropriate development of groundwater resources and groundwater/ surface water conjunctive use		
• Offset **water quality issues** in the basin	**OFFSET** • Potential decrease of water quality in the basin should be offset by the provision of groundwater as a reliable and clean alternative	• **Ethiopia**: federal Ministry of Health; Ministry of Water, Irrigation, Energy & Electricity. Health & Water Bureaus/Offices at local level. • **South Sudan**: Ministry of Health & Water. Health & Water Departments in States/counties.

5.2.4 Strategic Objective 4

5.2.4.1 Overview

Strategic Objective 4 is *"To manage water resources so that disasters associated with flood and drought can be prevented and/or mitigated"*

The objective is to be realised through the implementation of two key direct actions:

- D4.1: Manage upstream hydropower reservoirs in order to support flood reduction and availability of water downstream
- D4.2: Plan and implement the conjunctive use of ground and surface water resources D3.1: Develop and implement (local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable benefit sharing and conflict resolution.

As with all the direct strategic actions there are a number of enabling and cross-cutting strategic actions.

5.2.4.2 Specific Actions

Although the aims are different, both of the direct strategic actions D4.1 and D4.2 are also included as actions required to achieve other strategic objectives.

Direct actions D3.2 and D4.1 are both focussed on the management of upstream hydropower schemes/reservoirs. In pursuit this strategic objective (SO4), the aims are i) to reduce flood risk and ii) increase the availability of water downstream during times of drought. The **Integrated BAS hydropower, irrigation and multipurpose development programme—Phase 1: Baro/Sobat component**, already introduced is a "medium/long-term" project that will take into account the potential to reduce flooding downstream. Another medium/long-term project that hase been profiled is aimed at supporting startegic action D4.1:

- **Flood-Risk Mapping and Early-Warning System**. A major driver of flooding in the low-lying downstream areas such as the Gambella Plains, are the large river flows emanating from the highlands in Ethiopia. The project will analyse the relationship between upstream flows and flooding extent in priority risk areas. It will include an analysis of the relationship between rainfall in the source areas of the main rivers and floods generated in these rivers and will investigate the potential impacts of climate change. A real-time or quasi-real-time early warning system will then be developed aimed at providing early warning of high discharge levels in the rivers while these flows are still some distance from the areas susceptible to flooding.

  A brief project profile for this project is included in Annex X.

Direct actions D3.3 and D4.2 are both concerned with the conjunctive use of ground wand surface water. In pursuit this strategic objective (SO4), the aims are i) to increase the availability of water downstream during times of drought.

All of the relevant strategic actions need to be expressed in terms of specific actions that can be implemented. The proposed specific actions are included in the following table.

Table 5-8: Required Specific Actions under each of the Strategic Actions in order to achieve Strategic Objective 4

Strategic Action	Specific Actions and timeline[1]	Institutional Responsibilities
D4.1: Manage upstream hydropower reservoirs in order to support flood reduction and availability of water downstream	• Design and put in place appropriate decision-support systems based on agreed management rules and improved environmental data collection network to support flood warning and drought mitigation	• ENTRO to lead working with the countries
	• Use the decision-support system to manage upstream hydropower reservoirs and all aspects of related water resources management infrastructure	• Joint committee with support from ENTRO
	• Use the decision-support/flood warning system to support flood preparedness downstream	• Joint committee with support from ENTRO
D4.2: Plan and implement the conjunctive use of ground and surface water resources	• Investigate potential and opportunities for development of groundwater in support of local development and as part of conjunctive support to large-scale surface water development	• The countries with shared information and support from ENTRO
	• Develop a strategy and implementation plan for the development of groundwater in the basin, with a focus on conjunctive use opportunities	• The countries with shared information and support from ENTRO
E1: Develop and implement the necessary institutional framework	• Design and agree on the appropriate transboundary institutional framework for the management of hydropower reservoirs to support downstream irrigation, flood reduction and availability of water downstream and to support flood warning	• ENTRO with stakeholders
	• Put in place and ensure capacity and functionality of the agreed institutional framework at the transboundary and national levels	• The countries with

		facilitation of ENTRO
E2: Promote and ensure appropriate stakeholder participation	• Consult with and fully involve stakeholders at transboundary and national levels to ensure that modalities for implementation of the proposed decision-support systems are fully supported and workable	• ENTRO with stakeholders
	• Consult with stakeholders at all levels to ensure that the planning, design and implementation of the proposed flood warning system is effective	• ENTRO with stakeholders
E3: Develop and implement appropriate and effective communication strategies and plans	• Develop comprehensive communication strategy and implementation plan for supporting the achievement of this strategic objective aiming at all levels of stakeholders for i) coordinated management of overall implementation of the direct strategic action at the basinwide level and ii) at the local level (especially for flood warning	• ENTRO with stakeholders
	• Implement communication plan at the basinwide, national, regional and project levels	• ENTRO with stakeholders
E4: Develop and implement monitoring and evaluation, and adaptive management systems	• Develop and operationalize monitoring and evaluation and adaptive management systems at the programme level (as related to overall strategic objective)	• ENTRO to support and facilitate common standards to be defined by countries in line with the DSS
	• Develop and operationalize monitoring and evaluation and adaptive management systems at the local level, especially for flood warning t	• ENTRO to support and facilitate common standards to be defined by countries in line with the DSS
E5: Develop non-water sector infrastructure and services to support water-resources development and benefit sharing (roads, urbanization, communications, etc)	• Of limited applicability for this strategic objective	• ENTRO to deliver guidelines with stakeholders
E6: Plan and implement integrated basinwide environmental monitoring system	• Ensure that flood warning aspects are built into the design of the environmental monitoring system including real-time monitoring where appropriate.	• The countries in coherence with guidelines and the DSS
	• Collect and analyse data and inform monitoring and evaluation programme for adaptive management of the flood/early warning system.	
E7: Carry out regular and adhoc water resources, water quality and environmental flow requirements assessments	• Of limited applicability for this strategic objective	• N/A
E8: Ensure adequate financing mechanisms and funding are in place and available	• Investigate financing options for supporting the sustainable transboundary management and associated institutional and capacity-related needs) of upstream water resources development infrastructure (esp hydropower)	• The countries in close cooperation
E9: Carry out regular and adhoc flood-risk mapping and land-use planning exercises	• Plan and cost flood risk mapping for Gambella/Akobo flood plains and other areas, prioritising those with higher levels of human settlement	• The countries in close cooperation
	• Carry out flood risk mapping exercise on all priority areas	• Duty of each country, to be shared and coordinated on common standards
	• Carry out flood risk mapping on all remaining vulnerable areas	

C1: Mainstream climate change considerations	• Evaluate potential climate change impacts on flooding and drought through regional downscaling exercises and application of results for the generation of "future" climate data sets.	• Duty of each country, to be shared and coordinated on common standards
	• Based on the use of "future" climate data sets, mainstream climate change considerations into the calculation of drought sequences and peak flood magnitude and return period.	
C2: Ensure appropriate and effective mainstreaming of gender considerations	• Develop a section of the gender mainstreaming strategy focused on ensuring and promoting gender mainstreaming with respect to impacts of drought and flood	• ENTRO to lead working with the countries
	• Implement gender mainstreaming measures into all aspects of drought and flood management	• Joint committee with support from ENTRO

Note 1: Timeline colour coding

Start in	0 – 3 years	Start in	4 – 10 years	Start in	11 - 25 years	Deferred	No timeframe

5.2.4.3 Integrating proposed ESMP measures into the IWRDMPlan

There is a wide range of measures included in the ESMP aimed at maximising and enhancing the actions proposed in the IWRDMPLan relating to the attainment of Strategic Objective 2. There are also some offset measures and specific monitoring and evaluation requirements. These are summarised together with an indication of institutional responsibilities in the following table.

Table 5-9: Checklist of ESMP Measures to be integrated into implementation of direct strategic actions

Proposed ESMP management measures	Specific measures proposed	Institutional responsibilities
Direct Action D4.1: Manage upstream hydropower reservoirs in order to support flood reduction and availability of water downstream		
• Avoid and minimise **risks of conflicts on transboundary water resources**	**AVOIDANCE** • Definition and respect of targets for river flows at key river nodes, downstream of projects **MINIMISATION** • Implementing "upstream-downstream" integrated management of resources • Discussions on benefit and risks sharing	• **Joint Committees** of the two states, including members from the following: • **Ethiopia**: Ministries of Environment, Forest & Climate Changes; Water, Irrigation, Energy & Electricity. Environment, Health & Water Bureaus/Offices at local levels. • **South Sudan**: Ministries of Environment, Health & Water; Environment. Health & Water Departments in States/counties.
• Avoid and minimise **displacement and loss of life, property and assets resulting from natural disasters in the basin**	**AVOIDANCE** • Preparation and adoption of disaster management plans at all levels **MINIMISATION** • Preparation and adoption of disaster management plans at all levels **OFFSET** • Provision of basic necessities and health care for affected people	• **Ethiopia**: Disaster Prevention & Preparedness Commission • **South Sudan**: Ministry of Humanitarian Affairs & Disaster Management
D4.2: Plan and implement the conjunctive use of ground and surface water resources		
• Offset **water quality issues** in the basin	**OFFSET** • Potential decrease of water quality in the basin should be offset by the provision of groundwater as a reliable and clean alternative	• **Ethiopia**: federal Ministry of Health; Ministry of Water, Irrigation, Energy and Electricity. Health and Water Bureaus/Offices at local level. • **South Sudan**: Ministry of Health and Water. Health and Water Departments in States/counties.

5.3 IMPLEMENTATION STRATEGY

5.3.1 Introduction

Implementation of the IWRDMPlan is a major undertaking and will require that those institutions and key person(s) supervising the overall implementation have a clear idea of all aspects of the proposed programme.

5.3.2 Implementation principles

The strategy for implementation is defined by a number of key principles including:

- Implementation of large-scale projects should be planned, designed, implemented and operated from a transboundary perspective and with a high level of cooperation
- The implementation of small-scale short-term projects (eg multipurpose IWRM-style projects) is a critical part of the strategy since they ensure the commitment and involvement of stakeholders at grass roots level and when taken to scale can also have a transboundary impact.
- Management at all levels is very important. It is important that responsibilities for implementation of the Plan are clearly mapped out.
- The importance of building capacity and other strategic enabling actions should not be underestimated. These actions are as important as the direct strategic actions themselves.
- The choice of a development pathway starting with the implementation of low impact projects implies a number of key guiding principles:
  - Phased Development of Baro River Hydropower taking into account upstream/downstream linkages
  - Phased development of large-scale irrigation, starting with the least environmentally-sensitive projects on the Baro River since these are supported by the Baro River hydropower developments
  - Immediate implementation of a transboundary hydro-environmental monitoring network
- Important role of the result-based monitoring and evaluation framework, adaptive management underpinned by continuously improving knowledge base, stakeholder consultation, updating of models etc. Stakeholder consultation includes some major institutional actors who have not been adequately involved thus far.
- Rapid start-up of priority actions, those planned for starting within the next five years
- Important overall coordination role of ENTRO in order to avoid unilateral (national and sectoral approach
- Implementation to be supported by a communication strategy aimed at promoting the existence and importance of the Plan to a wide range of stakeholders.

5.3.3 Implementation schedule

A preliminary detailed draft implementation schedule is included as Annex 3. The summary overleaf includes only the direct strategic actions and their associated activities. It should be stressed that this preliminary version is included to provide a point of departure for discussion at the upcoming workshop and is largely based on the compromise scenarios/options. The schedule has been developed in MSExcel and will also be used as a costing tool in order to arrive at a budget for implementation of the whole plan and its various components.

Figure 5-2: Implementation Schedule for Direct Actions

Strategic Actions and Associated Specific Actions	Status	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028 to 2033	2034 to 2042	Deferred (no timeframe)?
DIRECT STRATEGIC ACTIONS														
D1.1 and D3.1: Develop and implement (local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable livelihood enhancement, poverty reduction and the protection and conservation of biological resources														
Design and implement Kinyeti River Multipurpose Development Project (hydropower, irrigation/agriculture, aquaculture, water supply or the different components	*ST-Feasibility Study done under this project*													NO
Design and implement Akobo-Gambella Floodplains transboundary development programme at chosen pilot demonstration sites	*ST-Feasibility Study done under this project*													NO
Design and implement Majang Multipurpose Development project in Dunchaye sub-catchment (hydropower, irrigation/agriculture, aquaculture, water supply or the different component	*ST-Feasibility Study done under this project*													NO
Design and implement Cingaineta River Multipurpose Development Project in Kapoeta North, South and East through actions in the Cingaineta River catchment aimed at reversing environmental degradation, increasing the availability of water during the dry season, improving food security and developing opportunities for livelihood enhancement	*MT-LT-Project profile prepared under this project*													NO
Design and implementation of further local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable livelihood enhancement, poverty reduction and the protection and conservation of biological resources														NO
D1.2: Develop and implement basinwide plan for taking to scale of multipurpose IWRM-style water resources development and management projects														
In consultation with stakeholders, draw up basinwide plan for "Livelihood-based watershed management – taking to scale for a basin wide impact".	*ToR prepared under this project*													NO
Develop monitoring and evaluation framework and adaptive management system for application at the national/transboundary levels	*ToR prepared under this project*													NO
Implement basinwide plan (including monitoring and evaluation framework) for taking to scale of multipurpose IWRM-style water resources development and management projects	*ToR prepared under this project*													NO
D2.1: Develop hydropower, irrigation, water supply, fisheries and other water sector projects, maximising multipurpose opportunities														
Basinwide strategy for early consideration/mainstreaming of multipurpose approach in to the planning and design of water resources development infrastructure, including agreement to early and maximum transparency on development plans that have potential transboundary impact or needs	*Initiated in this study*													NO
Reconnaissance, prefeasibility and feasibility study, design and implementation of Akobo multipurpose project	*ToR prepared under this study*													NO
Plan and design "Integrated BAS Hydropower and Irrigation Development Programme "; Phase 1; Baro-Sobat Component, including detailed sequencing, operating principles and management rules (taking into account ESMP etc)	*ToR prepared under this study*													NO
Design, implement, operate and manage Geba hydropower project (Geba A reservoir, Geba Diversion 1 and Diversion 2 Projects) including related multipurpose opportunities (capture fisheries, water supply etc)	*Design underway (GoE)*													NO
Design, implement, operate and manage Tams hydropower project including related multipurpose opportunities (capture fisheries, water supply etc, navigation support etc)	*Design underway (GoE)*													NO
Design, implement, operate and manage Sor 2 hydropower project including related multipurpose opportunities (water supply etc)	*Feasibility completed (GoE)*													NO
Design, implement, operate and manage Genji hydropower project including related potential multipurpose opportunities (water supply etc)	*Pre-feasibility complete (GoE)*													NO
Design, implement, operate and manage Baro 1 and Baro 2 hydropower projects including related potential multipurpose opportunities (capture fisheries, water supply etc)	*Pre-feasibility complete (GoE)*													NO
Design, implement, operate and manage Birbir hydropower project including related multipurpose opportunities (capture fisheries, water supply etc, navigation support etc)	*Pre-feasibility complete (GoE)*													NO
Design, implement, operate and manage Baro River, right bank (previously Itang Dam), gravity conveyance (50,949ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc)	*Pre-feasibility complete (GoE)*													NO
Design, implement, operate and manage Sobat sub-catchment irrigation schemes (69,032ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc)	*Pre-feasibility complete (GoSS)*													Yes-Small part (3000/72000ha)

Design, implement, operate and manage Baro River, right bank (previously pumping from Itang Dam), gravity conveyance, additional canal (43,984ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc)	*Pre-feasibility complete (GoE)*														NO
Design, implement, operate and manage Baro River, Scheme 3A, previously Gambella Dam, gravity conveyance, high lift pumping and additional canals (51,821ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc	*Pre-feasibility complete (GoE)*														NO
Design, implement, operate and manage Baro River, left bank, previously Itang Dam, gravity conveyance (17,888ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc	*Pre-feasibility complete (GoE)*														Yes- part (5769/26550ha)
Design, implement, operate and manage Baro River, left bank, previously Itang Dam with pump station and canal, (12,111ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc	*Pre-feasibility complete*														NO
Design, implement, operate and manage Baro River, right bank (previously Gambella Dam), gravity conveyance (43,619ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc)	*Pre-feasibility complete (GoE)*														NO
Design, implement, operate and manage Alwero River, right bank, Chiru + Dumbong Dam, gravity conveyance (20,781ha) including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc)	*Pre-feasibility complete (GoE)*														Yes- part (29466/47354ha)
Plan and design "Integrated BAS Hydropower and Irrigation Development Programme "; Phase 2; Gilo Component, including investigation of hydropower potential and upstream storage as alternative to Gilo 1 and/or 2 Dams (detailed sequencing, operating principles and management rules (taking into account ESMP etc)															NO
Design, implement, operate and manage Gilo River , right bank, Gilo 1 Dam, gravity conveyance or alternatives (29,437ha), including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc	*Pre-feasibility complete (GoE)*														Yes- part (32793/62230ha)
Design, implement, operate and manage Gilo River , right bank, Gilo 2 Dam, gravity conveyance or alternatives (12861ha), including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc	*Pre-feasibility complete (GoE)*														Yes- large part (34053/46914ha)
Design, implement, operate and manage individual Gilo River hydropower and irrigation projects (up to +/- 86,129ha) in line with Integrated BAS Hydropower and Irrigation Development Programme"; Phase 2, Gilo Component, including related multipurpose opportunities (integrated aquaculture, water supply, stock watering etc	*Pre-feasibility complete (GoE)*														Yes- large part (75393/86129/ha)
D2.2: Develop water sector infrastructure and services to support benefit sharing (navigation, interconnection etc)															
Investigate, plan and assess feasibility of different options of the Ethiopia - South Sudan electric power interconnection															NO
Design, implement and operate the Ethiopia - South Sudan electric power interconnection															NO
Investigate navigation/river transport opportunities to be supported by increased level of regulation in Baro River and increased agricultural production, especially in Gambella area and compile detailed pre-feasibility study	*MT-LT-Project profile prepared under this project*														NO
If feasible, design enhanced navigation and river/intermodal transport system linking production areas in Ethiopia with downstream ports and consumption centres	*MT-LT-Project profile prepared under this project*														NO
Implement and operate enhanced navigation and river/intermodal transport system linking production areas in Ethiopia with downstream ports and consumption centres	*MT-LT-Project profile prepared under this project*														NO
D3.2: Plan and implement conjunctive, optimized management of u/s hydropower schemes in support of development projects and d/s ecosystems/ EFRs															
Agree on principles (transboundary/national) and develop a strategy for the BAS and its main sub-catchments															NO
Define environmental flow requirements at key points around the system	*MT-LT-Project profile prepared under this project*														NO
Using the improved data available, build detailed basinwide water resources simulation (planning, allocation, balance, environmental flow requirements etc) models to support optimized management and satisfaction of EFRs.	*MT-LT-Project profile prepared under this project*														NO
Implement agreed conjunctive, optimized management of u/s hydropower schemes in support of development projects and d/s ecosystems/ EFRs	*Included in ToR prepared (D2.1) under this study*														NO
Monitor and evaluate implemntation of greed conjunctive, optimized management of u/s hydropower schemes in support of development projects and d/s ecosystems/ EFRs															NO

D3.3: Plan and implement the appropriate development of groundwater resources and groundwater/ surface water conjunctive use		
Investigate and plan potential opportunities for groundwater development and opportunities for conjunctive use of ground and surface water resources at local and transboundary levels		NO
Carry out reconnaissance studies and implement data collection programmes as necessary		NO
Implement conjunctive use of ground and surface water resources at local and transboundary levels		NO
D4.1: Manage upstream hydropower reservoirs in order to support flood reduction and availability of water downstream		
Design and put in place appropriate decision-support systems based on agreed management rules and improved environmental data collection network to support flood warning and drought mitigation	*Included in ToR prepared (D2.1) under this study*	NO
Use the decision-support system to manage upstream hydropower reservoirs and all aspects of related water resources management infrastructure	*Included in ToR prepared (D2.1) under this study*	NO
Use the decision-support/flood warning system to support flood preparedness downstream	*MT-LT-Project profile prepared under this project*	NO
D4.2: Plan and implement the conjunctive use of ground and surface water resources		
Investigate potential and opportunities for development of groundwater in support of local development and as part of conjunctive support to large-scale surface water development		NO
Develop a strategy and implementation plan for the development of groundwater in the basin, with a focus on conjunctive use opportunities		NO

6. ECONOMIC ANALYSIS OF THE PLAN

6.1 INTRODUCTION

The economic analysis takes into account all the identified projects, not just those that have been identified as short-term projects or those which have been prioritised as the three selected medium-term and long-term projects. The detailed analysis is included as Annex 6 to this report.

6.2 COST-BENEFIT ANALYSIS

6.2.1 Introduction

The costs-benefit analysis (CBA) consists of determining **the financial and economic relevance of a project** by evaluating the differential of costs and benefits between the situation with project and the situation without project (baseline scenario). In the current study, the CBA aims at assessing the financial and socio-economic feasibility of the action plan (i.e. *Are the benefits higher than the costs ?*) and assessing the robustness of the action plan (i.e. *How vary the profitability of the plan when key variables vary?*).

Two analysis are conducted:

- **a financial analysis** which makes it possible to assess the profitability of the projects from the investors 'point of view. The analysis takes into account the financial costs and benefits, i.e. the investments and O&M costs and the revenues of the activity implemented (hydropower, irrigation, fish farming or rizipisiculture). This analysis is presented in paragraph 2.1.
- **an economic analysis** which evaluates the viability of the projects from society's point of view. This analysis takes into account the financial costs and benefits plus the externalities of the projects.

  An externality is a cost or benefit generated by an activity and that affects a party that did not choose to incur this cost or benefits (e.g. degradation of downstream wetlands due to a modification of flows from a hydropower station, indirect employment created from a new activity, etc.). The analysis distinguishes the environmental, social and economic externalities. It makes it possible to appreciate the relevance of the project for the society as a whole. It is presented in paragraph 2.2.

NB: It is important to keep in mind that the economic analysis does not allow the monetarization of all the impacts of the scenarios. The Economic Internal Return Rate (EIRR) and the Economic Net Present Value (ENPV) are not sufficient to appreciate the relevance of the projects. Thus the results of the economic analysis should be put in perspective with the SSEA results.

For both analysis, three main indicators are computed:

- **The Net Present Value (NPV)** by summing the positive and negative discounted cash flows over the time period,
- **The Benefit/Cost ratio** : It should be superior to 1 for the project to be viable,
- **The Internal Rate of Return (IRR)**, which determines the discount rate that would make the NPV equal to zero. It should be superior to the discount rate applied in the analysis (10% for the financial cash flows and 5% of the externalities).

The CBA distinguishes different levels of analysis:

- **Geographically:** the analysis distinguishes the impacts for the Ethiopian part of the BAS and the Sudanese part of the BAS.

- **By economic sector:** the analysis presents the financial and economic relevance for each economic sector that are developed in the scenarios: hydropower, irrigation, fish farming and rizipisiculture,

6.2.2 Details of calculation

The details of the calculations, including assumptions are presented in Chapter 2 of Annex 6. The analysis tales into account hydropower (large and small), irrigation (large and small), fish farming, rizipisiculture, livestock production (including dairy) and externalities.

A sensitivity analysis was also performed (see Section 2.3 in Annex 6).

6.3 CONCLUSIONS

The action plan has good economic ratios, even if they are lower than the financial ones, due to the fact that the total of the externalities (positive and negative summed) are negative: the Economic Net Present Value is **5 020 MUSD** and the economic rate of return is **54,4 %.** The Benefits/Costs ratio equals to **1.23.**

Analyzed by sector on an aggregated basis, all the sectors will have benefits on the society except the large-scaled irrigation in South Sudan which appear negative due to important negative environmental externalities. These negative externalities should be addressed and may be improved by transboundary measures.

The following table presents the economic ratio for each economic sector and country.

Table 6-1: Economic ratios for each economic sector and country

Sector	**EIRR** (%)	**ENPV** (MUSD)	Economic benefits/costs
Hydropower project in Ethiopia	51%	2 418	1
Hydropower project in South Sudan	16%	119	2
Small scaled irrigation in Ethiopia	NR	925	2
Large scaled irrigation in Ethiopia	42%	1 627	2
Large scaled irrigation in South Sudan	9%	-528	0,9
Fish farming and rizipisiciculture in Ethiopia	NR	27	318
Fish farming and rizipisiciculture in South Sudan	56%	5	210

7. INSTUTIONAL FRAMEWORK

7.1 INTRODUCTION

The IWRDMPlan has been developed with any eye on immediate implementation. In this way the momentum that has been gained over the last 2 years, together with the involvement of key stakeholders at the national levels and ENTRO itself, can be maintained. The intention was reinforced in the design of the study by the requirement to carry out feasibility studies for three short-term projects and to compile terms of reference for 3 medium-long-term projects. The idea is that there should be no significant delay in moving forward with the three short-term projects and carrying out the feasibility studies for the medium/long-term projects. All of them are transboundary in nature and it will be necessary for transboundary institutional arrangements to be in place to move them forwards.

The institutional responsibilities for the implementation of the various specific actions have already been indicated in the tables detailing the specific actions in Chapter 5. The responsibilities that relate to implementation of the Environmental and Social Management Plan are also detailed in a set of tables in Chapter 5. This provides the detailed building blocks of the institutional framework and are discussed further in Section 7.3. The proposed institutional responsibilities are based on stakeholder consultation and the functional analysis presented in Section 7.2.

7.2 FUNCTIONAL ANALYSIS FOR IWRDMPLAN IMPLEMENTATION

In the following table the functions that have to be performed for implementation of the IWRDMPlan are summarised together with consideration of the potential institutional actors.

Table 7-1: Functional Analysis for IWRDMPLan Implementation

Functions for BAS IWRDMPLan	Detail of Functions	Actors - comments
Policy Formulation and Cooperation	Develops basin-wide policies for water management	This will be a major output of the BAS IWRMD Plan. In addition it should be imagined that the two countries sharing the BAS catchment dedicate specific means (in depth studies, coordination meetings…etc.) in view of ensuring harmonization of coordinated water management policies in the BAS catchment. This is to be naturally supported and facilitated by NBI/ENSAP/ENTRO
Strategic Planning	Develops medium to long-term strategic options for basin-wide water development and management.	This is the BAS IWRMD Plan. The key point is to ensure that both countries and stakeholders are committed and willing for implementation. ENTRO is certainly a strong support and lead for this function.
	Develops strategic options for sector development and/or management	This relates to the multi-sector nature of the BAS IWRMD Plan. This requires a coordination in each country under the auspices of the Ministries in charge of water, as well as a bilateral coordination at least for some items: hydropower generation, watershed management etc.
Water Resources Management	Coordinates member states re. land and water management activities (can include agricultural water use)	This depends on the accuracy and willingness stemming from strategic options as above mentioned. The quality and the frequency of bilateral coordination between the two states will determine the efficiency of this function (example of big dams to be operated for the lager benefits).
	Water Allocation/Quota Management	The water allocation/quota issue is still controversial in the Nile Basin and especially the ENSAP region. A specific attention must be paid to this issue in order to build a safe arrangement in the future. This would be under the auspices of NBI/ENSAP. A specific effort is to be paid (first rank priority) to improve and densify the hydro-meteorological network especially in South Sudan.
	Water Quality Management	This remains a field of very limited knowledge and understanding. Monitoring of quality will need specific preparation and investment specifying parameters, means and cooperation agreements between the two countries, and in line with NBI/ENSAP activities
	Protecting and conserving ecosystems and environment	The SVP NTEAP provided a strategic environmental framework for the management of the transboundary waters and environment challenges in the Nile River Basin. The ENSAP Watershed Management Project Established sustainable framework for the management of selected watersheds to improve living conditions of the people, enhance agricultural productivity, protect the environment, reduce sediment transport and siltation of infrastructure, and prepare for sustainable development oriented investments. However, a specific research program anticipating future specific ESIA is to be set up in addition, specially aiming at a better understanding of the functioning of wetlands and marshes. These particular ecosystems could possibly be heavily impacted by some activities (big dams) and they are of international interest. The two countries together should consider carefully this issue under the umbrella of NBI/ENSAP.

Functions for BAS IWRDMPLan	Detail of Functions	Actors - comments
	Operational rules and procedures (e.g. flow management)	Operation rules and procedures regarding water quantity should be considered especially for the medium and long term when large infrastructures are likely to be implemented. This should be at least on a bilateral basis, but not ignoring that other member states of ENSAP are concerned which will eventually lead to a more general discussion
	Emergency Measures (floods, spills, droughts...)	The ENSAP FPEW project strengthens the existing capacities of the EN countries in flood forecasting, mitigation and management. In addition specific provisions for future large infrastructures must be addressed by the two countries.
Knowledge Management	Collects and/or collates basin information and manages quality assurance - Develops and Operates Decision Support Systems	The SVP WRPM project developed the Nile-DSS, which includes a large information management system. However, in depth research for the BAS IWRMD Plan study demonstrates that there are many gaps in basic knowledge of hydro-meteorology in the basin. Any initiative and implementation will need to collect significant additional data over a sufficient period of time. This is especially true for wetlands and marshes of South Sudan where no data are available. This is a first priority action to be considered in the Plan with support of IGAD HYCOS and donors.
	Protocols for harmonizing/sharing data, and KM programs	Depends / relates with the previous item when operationalized
Water Resources Development	Mobilizes resources for water resources development projects	Each country (Ethiopia and South Sudan) expresses the intention to keep autonomous and address activities/projects on a case by case approach. However, it is sure that acting in a cooperative manner and benefiting of the umbrella of ENSAP/ENTRO will greatly enhance opportunities and chances for resources mobilization.
	ESIA *(develop criteria – harmonize, develop criteria, supervision)*	Joint ESIA are needed as soon as activities have transboundary nature. The recommendation would be that ESIA will not be limited to separate studies but will address cumulative effects. Support of ENSAP/ENTRO is a real opportunity.
	Mitigation measures for transboundary impacts (including ESIA.)	Depends / relates with the previous item when operationalized. Specific involvement and strong commitment of BAS countries is necessary.
	Safeguard measures such as relocation…	Depends / relates with the previous item when operationalized. Specific involvement and strong commitment of BAS countries is necessary.
	(Pre) Feasibility and design studies of specific developments	Depending on the nature of activities and developments, each country could be directly in charge on its own territory. For developments with transboundary effects, it is desirable that a bilateral arrangement would be set up or use the vehicle of ENTRO.
	Decision making to implement on various components of the BAS IWRMD Plan	Components with effects in one country only would pertain to the said country. Components/activities with transboundary effects should be decided on basis of sound design studies and ESIA by the two countries together (and even possibly other countries). The umbrella of ENCOM/ENSAP/ENTRO would therefore to be used for facilitating the dialogue and support an agreement.
	Engineering, Procurement and Construction	Activities in one country only without transboundary effects would pertain to the country alone (e.g. program of boreholes for water supply). ENTRO could support the engineering activities. Procurement and construction, as per the countries' views, would remain the duty of each country.
	Owns	As per the views expressed by the two countries, ownership would be lying strictly in each country
	Operates or Manages Infrastructure (e.g. dams)	As soon as large infrastructures are at stake with transboundary effects, the recommendation would be to set up a dedicated permanent technical Committee aimed at evaluating and when necessary adapting operation rules (yearly at least)

7.3 SPECIFIC INSTITUTIONAL ROLES AND RESPONSIBILITIES

7.3.1 Introduction

In addition to the functional analysis summarised in Section 7.2, a SWOT Analysis looking at potential Institutional roles has also been carried out and in included as Annex 7.

7.3.2 Implementation/coordination of the Plan

As already indicated, The IWRDMPlan has been developed with any eye on immediate implementation and to make use of the momentum that has been gained over the last 2 years and prior to this bearing in mind that the Baro-Akobo-Sobat Multipurpose Water Resources Development Study Project is one of the seven (7) projects identified in the IDEN Project. The objective of the ENTRO formulated IDEN Project is to initiate a regional, integrated, multipurpose development project through a first set of investments that confer tangible, win-win gains and demonstrate joint action between the Eastern Nile countries. It is proposed that ENTRO coordinates and promotes implementation of the IWRDMPlan in mline with the detailed recommendations that are presented in Chapter 5.

In particular, ENTRO should manage

- The proposed three medium/long-term project feasibility studies. ENTRO is seen as having a central role to play in the implementation of the three projects after completion of the feasibility studies
- Support the countries in the implementation of the three short-term projects bearing in mind that these projects will provide a foundation for the “Livelihood-based watershed management – taking to scale for a basin wide impact” medium/long-term project for which ENTRO should take the lead in coordinating.
- Managing the design of the proposed basin hydro-environmental monitoring network. ENTRO should also play a role in coordinating implementation at the national levels and ensuring the sharing of data. This project includes moving towards a definition of the environmental flow requirements basinwide.
- Overall monitoring and evaluation and coordinating of, and adaptive management measures for, the IWRDMPlan.

7.3.3 National level

As indicated in Chapter 5, there are wide range of government ministries which will be implicated for implementation of projects at the national level.

7.3.4 Environmental and Social Management Plan

The SSEA includes an Environmental and Social Management Plan (ESMP). This is highly transboundary in nature and is vital in ensuring the environmental and social sustainability of the IWRDMPlan. It is essential that the ESMP is managed at the transboundary level. It is proposed that ENTRO takes on this task and is adequately capacitated to perform the required activities.

7.3.5 Monitoring and Evaluation, Adaptive Management

Monitoring and evaluation will take place at a number of levels from the project level upwards to monitoring and evaluation of whether the plan is achieving is strategic objectives. ENTRO should coordinate and partially manage the overall monitoring and evaluation of the implementation of the IWRDMPlan.

8. MONITORING AND EVALUATION

8.1 INTRODUCTION

Monitoring and evaluation is required to ensure that the various parts of the implementation of the IWRDM Plan are on track **and that they will lead to the desired outcomes**, essentially progress towards meeting the strategic objectives and realising the Vision. A monitoring and evaluation system is only effective if the understanding of the desired outcomes is clear and measurable in some way, hence the development of indicators is critical.

The overall aim of the monitoring and evaluation tasks can be seen in two distinct parts:

- To develop a monitoring and evaluation framework aimed at tracking progress towards the achievement of the strategic objectives of the IWRM Plan and
- To provide feedback on the implementation process in terms of whether actions are being carried out according to the planned timeline and on budget.

These two levels of monitoring and evaluation are shown in Figure 8-1.

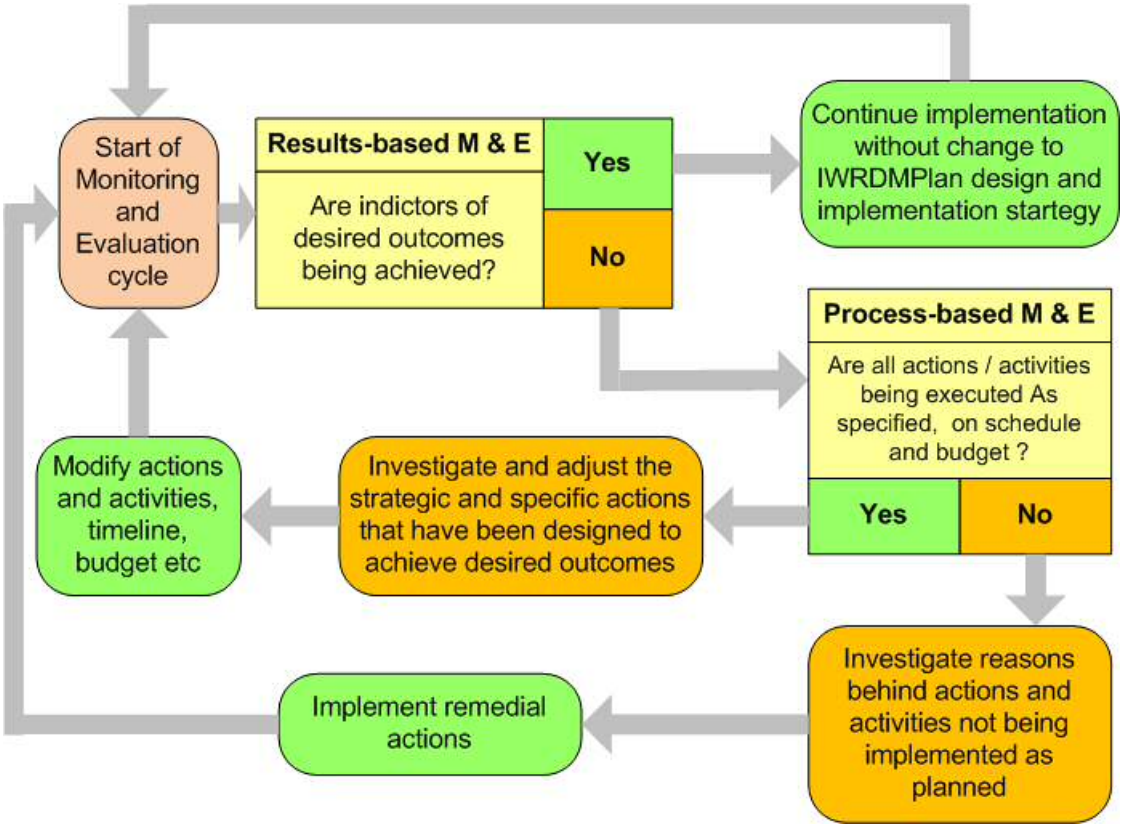
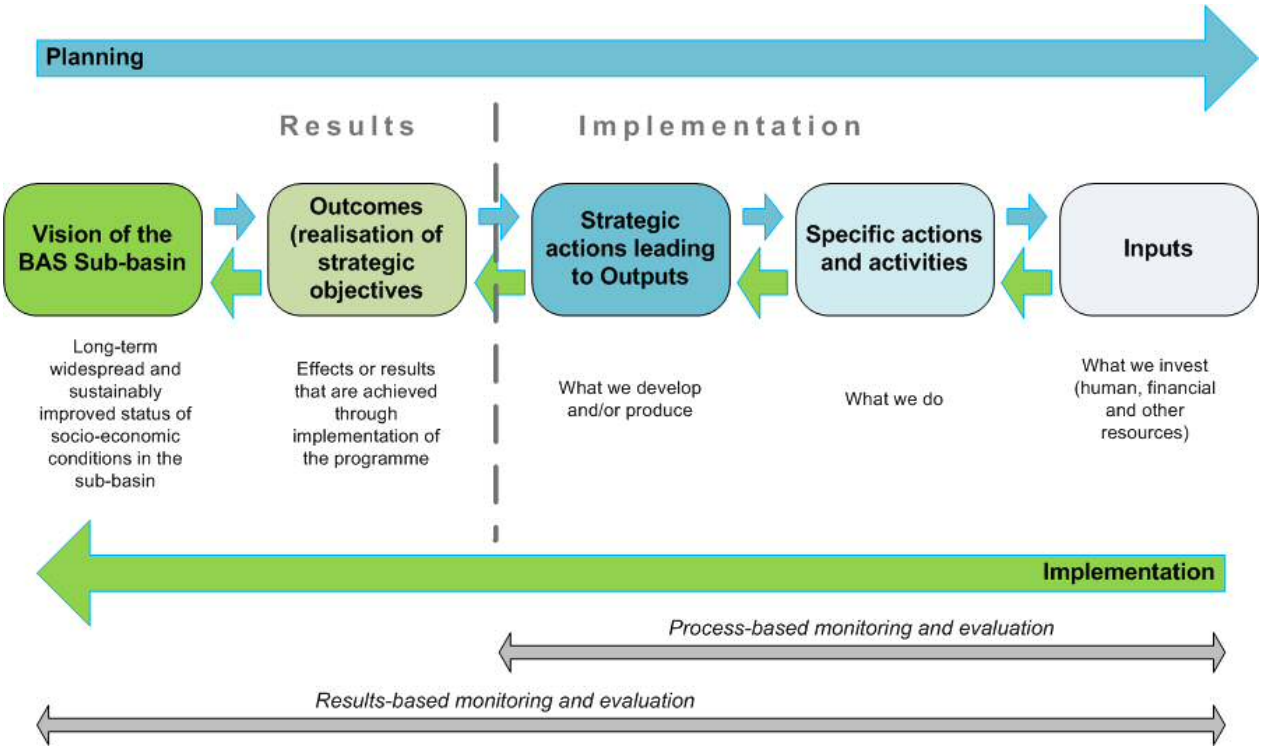


Figure 8-1: Interaction of result-based and process-based monitoring and evaluation

While process-based monitoring and evaluation is important for the monitoring of budget and expenditure, and of inputs by different institutions and individuals, it is the results-based monitoring and evaluation which is the focus of the majority of the section of the report.

Figure 8-2 illustrates how the results-based monitoring and evaluation framework is built during the planning process and takes full cognisance of the programme's vision and related strategic objectives and desired outcomes. Clearly if the results are to be achieved, clear indication of these results must be built into the framework. Process-based monitoring and evaluation (sometimes referred to as the traditional approach) is effectively based on whether the planned actions and activities are being carried out as planned. They do not take into account whether these actions are being effective or not.

Figure 8-2: Results-based monitoring covers both planning and impelmenation (based on UNDP; 2016)



8.2 RESULTS-BASED MONITORING AND EVALUATION

8.2.1 Overview

As already indicated in Figure 8-2, it is very important to understand the linkages between planning and monitoring and evaluation. Good planning provides the foundation for a robust monitoring and evaluation process. Planning, monitoring and evaluation all have important roles to play in ensuring the monitoring and evaluation is effective and useful and that adaptive management can result in order to keep the programme on track towards its desired outcomes

- Without proper planning and clear articulation of intended results, it is not clear what should be monitored and how; hence monitoring cannot be done well.
- Without effective planning (clear results frameworks),the basis for evaluation is weak; hence evaluation cannot be done well.
- Without careful monitoring, the necessary data is not collected; hence evaluation cannot be done well.
- Monitoring is necessary, but not sufficient for evaluation.
- Monitoring facilitates evaluation, but evaluation uses additional new data collection and different frameworks for analysis.

- Monitoring and evaluation of a programme will often lead to changes in programme plans. This may mean further changing or modifying data collection for monitoring purpose (part of the adaptive management process)

8.2.2 Outcomes

It is important that our desired outcome relate to the vision and strategic objectives and that the actions in the plan are there. The desired outcomes are a vital part of the results-based framework:

The Vision is effectively the overall outcome. Indicators of its achievement will not relate to any specific actions. Realisation of the strategic objectives leads to specific outcomes, the sum of which equal achievement of the vision.

A preliminary assessment of the desired outcomes are summarised for each strategic objective. In line with best practices these have been limited in number

Table 8-1: Preliminary assessment of Desired Outcomes for each Strategic Objective

Strategic Objective	Desired Outcomes	Explanatory Notes
To contribute to food security, livelihood enhancement, poverty reduction and the protection and conservation of biological resources through stakeholder-driven management of wetlands, watersheds and other important natural resources;	• Poverty is reduced at the local level, with wider impacts following taking to scale	• "Local" level is stressed because this is the direct aim of these interventions. When taking to scale is taken into account and impacts are aggregated, basinwide (and beyond) poverty reduction can be anticipated. Focus on livelihood enhancement is important to keep focus on water-related activities (agriculture etc)
	• Biological resources (biodiversity and eco services) are protected and conserved at the local level;	• The focus is on the "local" scale because this the focus of these interventions. When taking to scale is taken into account and impacts are aggregated, basinwide conservation and management benefits can be anticipated
	• Project planning, implementation, operation and management is led by stakeholders / beneficiaries	• All aspects of sustainability (including reduced conflict) require that the proposed interventions are stakeholder driven
Taking into account the comparative advantages of the different parts of the sub-basin to sustainably develop water resources for hydropower, irrigation, water supply and sanitation and other sectors with the dual aims of reducing poverty within the sub-basin and generating revenue;	• Large-scale hydropower developed and affordable electricity supplied within the basin and at the national levels	• Affordable electricity is taken as major contributor to poverty reduction, especially given that it will reduce reliance on already stretched natural resources and indirectly contribute to improved levels of health, education, female empowerment
	• Large-scale irrigation developed and contributing to both food self-sufficiency within the basin and revenue generation	• The development of sustainable large-scale irrigation will generate revenue directly and indirectly (urbanisation, indirect employment etc) and local food self-sufficiency if +/-20% is set aside for this. This will collectively support poverty reduction.
	• Access to improved water source and sanitation is the norm throughout the basin	• This is an important outcome in the support of poverty reduction. It will be directly supported by the increased availability of water (storage, regulation and groundwater) and by development-driven urbanisation.
	• Substantial increase in fisheries and livestock production levels	• An increase in capture and commercially-driven aquaculture and improved livestock productivity will support both revenue generation, poverty reduction and food security
	• South Sudan connected to Ethiopian hydropower production via interconnection	• This outcome is taken as necessary if the earlier desired outcome (access to affordable electricity) is to be realised. Gambella-Juba interconnection assumed but not obligatory
	• Improved river transport access to national and transboundary markets for sub-basin produce, especially irrigation production	• This outcome is considered necessary if the large-scale agriculture production, especially in and around Gambella Plains, is to contribute to regional food security and economic growth. River transport is not the only option
To ensure transboundary and	• Frequency and scale of conflict is reduced	• Conflict over natural resources is a critical problem which should be addressed by the inter-sectoral

inter/intra sectoral cooperation and benefit sharing with a view to minimizing resource-based conflicts through optimized management and use of water and associated resources		approach to development of small-scale multipurpose-style projects. Large-scale projects (flow regulation by hydropower) can also contribute.
	• High level of cooperation and planning between sectors and within the water sector at national and transboundary levels	• It is assumed that high levels of inter-sectoral cooperation from the earliest possible stage in the planning process can contribute to the equitable sharing of water and natural resources and conflict prevention/ resolution
To manage water resources so that disasters associated with flood and drought can be prevented	• Major reduction in the number of lives lost and cost of flood damage as a result of flooding	• This outcome will be achieved through reduced levels of flooding (increased flow regulation/ flood absorption) in some areas and improved flood preparedness
	• Flows below drought-level discharges become rarer than current situation	• Extreme low flows may be reduced as a result of increased flow regulation. NB agriculture-realted drought is taken into account under food security aspects

8.2.3 Results-based framework

8.2.3.1 Introduction

Based on the above desired outcomes, a preliminary version of the results-based monitoring and evaluation framework has been developed and is summarised in Table 8-2.

8.2.3.2 Indicators and hydro-environmental monitoring

One of the “medium-long-term projects that has been profiled (see Annex 3) is the basinwide hydro-environmental monitoring project”. As shown in the schedule presented earlier, this is a top priority project and an absolute requirement to support choices in implementation of the IWRDMPlan going forward. The data that will be collected through this proposed network is also critical for the monitoring and evaluation process. Many of the indicators proposed in Table 8-2 will depend on improved data being available.

Table 8-2: Results-based framework in support of monitoring and evaluation of progress towards strategic objectives

	Outcome Indicators	Baseline	Mid-term Target (10 years)	End of Project Target 25 years)	Assumptions
STATEGIC OBJECTIVE 1: To contribute to food security, livelihood enhancement, poverty reduction and the protection and conservation of biological resources through stakeholder-driven management of wetlands, watersheds and other important natural resources					
Outcome 1.1; Livelihoods enhanced, poverty is reduced at the local level, with wider impacts following taking to scale	• UNDP human poverty index (or similar) for the localized area (sub-catchment/ kebele/ boma including intervention)	• To be ascertained from available UNDP information at project start-up for the smallest unit of analysis available	• 50% greater Improvement than average of no-project areas or average for the zone/county	• 100% greater Improvement than average of no-project areas or average for the zone/county	•
	• UNDP human poverty index (or similar) for the larger areas (woreda and zone), Boma/county), where project replication/taking to scale is taking place	• To be ascertained from available UNDP information at project start-up for the smallest unit of analysis available	• 25% greater Improvement compared to baseline for the zone/county	• 50% greater Improvement compared to baseline for the zone/county	•
	• # persons/($ earned) engaged in aquaculture/fisheries irrigation, honey production, services	• To be established during inception on project by project basis for each S-C IWRM intervention through socio-economic survey	• 50% increase compared to baseline	• 100% increase compared to baseline	•
	• Average crop yields for selected rainfed areas	• To be established during inception on project by project basis for each S-C IWRM intervention	• To be agreed in consultation with technical bureau, extension services etc	• To be agreed in consultation with technical bureau, extension services etc	•
	• Access to improved water and sanitation	• To be established during inception on project by project basis. Information available in feasibility studies for some projects	• >90%, to be agreed with relevant line ministry representation at local level	• >95% to be agreed with relevant line ministry representation at local level	•

	• Access to electricity	• Currently 0 (apart from limired diesel generation) in all selected S-C IWRM project sites	• >50%, to be agreed with stakeholders and relevant line ministry representation at local level	• >95% to be agreed with stakeholders and relevant line ministry representation at local level	•
Outcome 1.2; Biological resources (biodiversity and eco services) are protected and conserved at the local level We need one for land degradation	• Area of good condition forest in the catchment area of S-C IWRM intervention	• To be based on data in Feasibility studies and confirmed during inception through field visit and satellite imagery	• Less than 2% loss. To be finalized during project inception	• No further loss	
	• Area of good condition in wetland in the catchment area of S-C IWRM intervention	• To be based on data in Feasibility studies and confirmed during inception through field visit and satellite imagery	• Less than 10% loss. To be finalized during project inception	• No further loss	
	• Access to electricity/GWhrs:annum consumed	• Effectively zero at identified S-C IWRM project sites	• To be agreed during project inception	• To keep pace with population growth since medium-term target	
	• Areas of good condition forest and wetland for the for the larger areas where project replication/taking to scale is taking place	• To be based on data in Feasibility studies and confirmed during inception through available data and satellite imagery	• Number (% or has) to be established for each larger area (zone/county) in consultation with stakeholders and ministry expertise	• Number (% or has) to be established for each larger area (zone/county) in consultation with stakeholders and ministry expertise	
	• Levels of sediment transport in selected streams;	• To be established during inception through sampling as part of basinwide hydro-environmental monitoring network	• 30% reduction in sub-catchments of proposed interventions • 15% reduction in larger sub-catchments in which replication is proceeding	• 50% reduction in sub-catchments of proposed interventions • 30% reduction in larger sub-catchments in which replication is proceeding	

	• Change in base flows in selected streams	• To be established during inception through sampling as part of basinwide hydro-environmental monitoring network	• 30% increase in sub-catchments of proposed interventions • 15% increase in larger sub-catchments in which replication is proceeding	• 50% increase in sub-catchments of proposed interventions • 30% increase in larger sub-catchments in which replication is proceeding	
	• Levels of concentration of a set of key water quality variables at key monitoring sites basin-wide. (part of basinwide hydro-environmental monitoring network	• To be established during inception through sampling as part of basinwide hydro-environmental monitoring network	• No deterioration (?)	• No deterioration	
Outcome 1.3; Project planning, implementation, operation and management is led by stakeholders / beneficiaries	• Level of consultation with stakeholders (including beneficiary communities) during S-C IWRM project selection and planning	• N/A	• Once per year	Once per year	
	• Level of autonomy in operation and management of S-C IWRM interventions	• To be established during inception through discussions with stakeholders at project level	• Full autonomy (includes ability to pay for contracted out maintenance	• Full autonomy (includes ability to pay for contracted out maintenance	
	• # ha irrigation, MW installed, ha aquaculture etc independently and sustainably managed at community level (local and wider scale)	• To be established during inception through discussions with stakeholders at project level	• 100%	• 100%	
Outcome 1.4; S-C IWRM style projects are taken to scale in appropriate parts of the basin	• % implementation of basin-wide integrated watershed management "action" plan (covered by ToR of MT/LT projects)	• Not started	• In line with plan to be built under MT/LT project	• In line with plan to be built under MT/LT project	
	• Areas of land actively applying integrated watershed/wetland	• To be established under the ToR of MT/LT projects)	• In line with plan to be built under MT/LT project	• In line with plan to be built under MT/LT project	

	management "best" practices;				
STRATEGIC OBJECTIVE 2: Taking into account the comparative advantages of the different parts of the sub-basin to sustainably develop water resources for hydropower, irrigation, water supply and sanitation and other sectors with the dual aims of reducing poverty within the sub-basin and generating revenue					
Outcome 2.1: Large-scale hydropower developed and affordable electricity supplied within the basin and at the national levels	• Number of HP MW installed capacity disaggregated by sub-basin/admin areas	• Information readily available. (Only 5MW Sor currently)	• To be in line with agreed scheduling of HP installations	• To be in line with agreed scheduling of HP installations (not er decided)	
	• HP GWh/year generated in the basin, disaggregated by sub-basin/admin areas	• Information is available	• Draft figures available from WR modelling runs under this project and will relate to final agreed scheduling	• Draft figures available from WR modelling runs under this project and will relate to final agreed scheduling (not yet decided)	
	• % of people connected to the local or national electricity grid disaggregated by sub-basin/admin areas	• Information is available	• 50%	• 85%	
Outcome 2.2: Large-scale irrigation developed and contributing to both food self-sufficiency within the basin and revenue generation	• #ha or tonnes of food produced for local consumption, disaggregated by sub-basin/admin areas	• Currently limited	• To be calculated as a percentage of the irrigation planned in schedule of IWRMDPlan	• To be calculated as a percentage of the irrigation planned in schedule of IWRMDPlan (not yet decided)	
	• Revenue generated disaggregated by sub-basin/admin areas	• Currently limited	• To be calculated as a function of the irrigation planned in schedule of IWRMDPlan	• To be calculated as a function of the irrigation planned in schedule of IWRMDPlan (not yet decided)	
	• Number of people employed in the irrigation sector basinwide and in each country/district (revenue generation)	• Currently limited	• To be calculated as a function of the irrigation planned in schedule of IWRMDPlan	• To be calculated as a function of the irrigation planned in schedule of IWRMDPlan (not yet decided)	
	• Tonnes/$ generated per m^3 of water consumed (crop	• Numbers from Alwero scheme to be verified	• Irrigation efficient targets to be set in consultation and	• At least equal or better to 10 year target	

	per drop), disaggregated by sub-basin/admin areas		taking into account best practices		
Outcome 2.3: Access to improved water source and sanitation is the norm throughout the basin	• % of people with access to potable water basin-wide and by country/district/sub-basin;	• Available numbers to be disaggregated	• 85% to be agreed with relevant line ministry representation at national levels	• 95% to be agreed with relevant line ministry representation at national levels	
	• % of people with access to sanitation basin-wide and by country/district/sub-basin	• Available numbers to be disaggregated	• 70% to be agreed with relevant line ministry representation at national levels	• 90% to be agreed with relevant line ministry representation at national levels	
	• Health – water-related diseases, key statistics basin-wide and by country/district/sub-basin	• Reference to national censuses	• To be agreed in consultation with health ministries	• To be agreed in consultation with health ministries	
Outcome 2.4: Substantial increase in fisheries and livestock production levels	• Livestock offtake rates and revenue earned from meat sales disaggregated by sub-basin/admin areas	• Information in baseline to be checked and disaggregated in consultation with line ministries	• Assumptions made in economic analysis to be discussed with line ministries and local authorities	• Assumptions made in economic analysis to be discussed with line ministries and local authorities	
	• Dairy production / sales disaggregated by sub-basin/admin areas	• Information in baseline to be checked and disaggregated in consultation with line ministries	• Assumptions made in economic analysis to be discussed with line ministries and local authorities	• Assumptions made in economic analysis to be discussed with line ministries and local authorities	
	• Fish production / sales disaggregated by sub-basin/admin areas	• Information in baseline to be checked and disaggregated in consultation with line ministries	• Assumptions made in economic analysis to be discussed with line ministries and local authorities	• Assumptions made in economic analysis to be discussed with line ministries and local authorities	
Outcome 2.5: Improved river transport access to national and transboundary markets for sub-	• Tonne-kilometres of riverine transport between Gambella and Sobat mouth disaggregated by reach and direction	• Information in the baseline to be verified during inception of proposed MT/LT project	• To be proposed as part of proposed MT/LT project	• To be planned as part of proposed MT/LT project	
	• Tonne off/onloaded, disaggregated by ports within the sub-basin	• Information in the baseline to be verified during inception of	• To be proposed as part of proposed MT/LT project	• To be planned as part of proposed MT/LT project	

basin produce, especially irrigation production		proposed MT/LT project			
	• Tonnes of produce from sub-basin irrigation schemes	• Currently zero (?)	• To be proposed as part of proposed MT/LT project	• To be planned as part of proposed MT/LT project	
STRATEGIC OBJECTIVE 3: To ensure transboundary and inter/intra sectoral cooperation and benefit sharing with a view to minimizing resource-based conflicts through optimized management and use of water and associated resources					
Outcome 3.1: Frequency and scale of conflict is reduced	• # and scale of conflicts over resources at the local level, disaggregated to sub-basin and administrative levels	•	•	•	•
	• Level of transboundary agreement over allocation of water resources for development and conservation in all countries	• Draft CFA • Approved IWRDMPlan	• Protocol for adaptive management of the IWRDMPlan in place and operational	• Protocol for adaptive management of the IWRDMPlan in place and operational	
Outcome 3.2: High level of cooperation and planning between sectors and within the water sector at national and transboundary levels	• CFA agreed and operational	• Draft CFA	• CFA adopted and operational	• CFA adopted and operational	
	• BAS sub-basin IWRDMPlan agreed and implementation started/ongoing	• Approved IWRDMPlan	• Protocol for adaptive management of the IWRDMPlan in place and operational	• Protocol for adaptive management of the IWRDMPlan in place and operational	
	• % of basinwide hydro-environmental monitoring network in place with full sharing of all collected data between countries and ENTRO	• Very limited as defined in project baseline	• Proposed hydro-environmental monitoring network in place and operational with full data sharing with ENTRO support	• Proposed hydro-environmental monitoring network in place and operational with full data sharing (run by countries only)	
	• #/$ of all large-scale water resource development projects for which multi-sectoral mechanism is in place for planning, design and implementation	• Effectively zero	• Assumptions made in economic analysis to be discussed with line ministries and local authorities	• Assumptions made in economic analysis to be discussed with line ministries and local authorities	
	• #/%/volume of water storage for which Management/operational rules, agreed by both	• Effectively non-existant	• Proposed MT/LT project (Baro/Sobat MPP development programme) to define targets	• Proposed MT/LT project (Baro/Sobat MPP development programme) to define targets	

	countries are in place and operational				
	• #/% of large-scale projects for which ENTRO is an active stakeholder in i) planning, ii) design and iii) implementation	• limited	• Proposed MT/LT project (Baro/Sobat MPP development programme) will define ENTRO's roles	• Proposed MT/LT project (Baro/Sobat MPP development programme) will define ENTRO's roles	
STRATEGIC OBJECTIVE 4: To manage water resources so that disasters associated with flood and drought can be prevented					
Outcome 4.1; Major reduction in the number of lives lost and cost of flood damage as a result of flooding	• Peak flood magnitude discharges at key stations	• Based on existing hydrological data at key points	• Reduction despite climate change	• Continued reduction despite climate change	
	• Magnitude of seasonal minimum and maximum discharge	• Based on existing hydrological data at key points	• Reduction despite climate change	• Continued reduction despite climate change	
	• Number of people killed by floods per year basinwide and in each country/district	• Based on available data	• 50% reduction	• 75% reduction	
	• Cost of flood damage per year basinwide and in each country/district	• Detailed information is lacking	• Decreasing trend towards reduction despite increased value of infrastructure	• Continued decreasing trend despite increased value of infrastructure	
Outcome 4.2: Flows below drought-level discharges become rarer than current situation	• Statistics of low flow hydrology at key points in the system. These statistics will provide a number of sub-indicators	• Based on existing hydrological data at key points	• Increasing trend in discharge despite climate change	• Increasing trend in discharge despite climate change	

8.3 PROCESS-BASED MONITORING AND EVALUATION

8.3.1 Overview

The other side of monitoring and evaluation refers to evaluation of progress of implementation of planned actions and activities, irrespective of whether they are achieving the desired progress towards realization of the strategic objective. These are much more straightforward to design at least in terms of whether activities are being performed according to the programme or not. More complicated is the design of mechanism to react to the delays that monitoring and evaluation system may highlight. It is the ability of programme management to react to an identified problem that will ensure the sustainability of the programme.

8.3.2 Budget Planning

During the Inception Phase for Plan implementation a budget plan should be set up based on the finalised implementation schedule.

8.3.3 Progress with Implementation

It is envisaged that ENTRO will play the leading role in the overall coordination of the monitoring and evaluation of progress with implementation of the IWRDM Plan. Implementation of the Plan is described using an annual time step at this stage but a more detailed time step should be developed during the inception phase together with the detailing of activities.

8.4 ADAPTIVE MANAGEMENT

The adaptive management of the Plan will be a critical part of implementation. Adaptive management is an integral part of the monitoring and evaluation process.

ANNEXES

Annex 1: Sustainable Development Goals (SDGs)

Sustainable Development Goals

Goal 1. End poverty in all its forms everywhere

1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day

1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions

1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable

1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance

1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters

1.a Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions

1.b Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round

2.2 By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons

2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment

2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality

2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed

2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries

2.b Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round

2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility

Goal 3. Ensure healthy lives and promote well-being for all at all ages

3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births

3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births

3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases

3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being

3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol

3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents

3.7 By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes

3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all

3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination

3.a Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate

3.b Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all

3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States

3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes

4.2 By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education

4.3 By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university

4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship

4.5 By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations

4.6 By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy

4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development

4.a Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all

4.b By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries

4.c By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States

Goal 5. Achieve gender equality and empower all women and girls

5.1 End all forms of discrimination against all women and girls everywhere

5.2 Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation

5.3 Eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation

5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate

5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life

5.6 Ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the Programme of Action of the International Conference on Population and Development and the Beijing Platform for Action and the outcome documents of their review conferences

5.a Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws

5.b Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women

5.c Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels

Goal 6. Ensure availability and sustainable management of water and sanitation for all

6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all

6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

6.b Support and strengthen the participation of local communities in improving water and sanitation management

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services

7.2 By 2030, increase substantially the share of renewable energy in the global energy mix

7.3 By 2030, double the global rate of improvement in energy efficiency

7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries

8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors

8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services

8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead

8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value

8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training

8.7 Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms

8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment

8.9 By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products

8.10 Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all

8.a Increase Aid for Trade support for developing countries, in particular least developed countries, including through the Enhanced Integrated Framework for Trade-related Technical Assistance to Least Developed Countries

8.b By 2020, develop and operationalize a global strategy for youth employment and implement the Global Jobs Pact of the International Labour Organization

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all

9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries

9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets

9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities

9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending

9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States

9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities

9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020

Goal 10. Reduce inequality within and among countries

10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average

10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status

10.3 Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard

10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality

10.5 Improve the regulation and monitoring of global financial markets and institutions and strengthen the implementation of such regulations

10.6 Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions

10.7 Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies

10.a Implement the principle of special and differential treatment for developing countries, in particular least developed countries, in accordance with World Trade Organization agreements

10.b Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmes

10.c By 2030, reduce to less than 3 per cent the transaction costs of migrant remittances and eliminate remittance corridors with costs higher than 5 per cent

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums

11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons

11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries

11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage

11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations

11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management

11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities

11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning

11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels

11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials

Goal 12. Ensure sustainable consumption and production patterns

12.1 Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries

12.2 By 2030, achieve the sustainable management and efficient use of natural resources

12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses

12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment

12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse

12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle

12.7 Promote public procurement practices that are sustainable, in accordance with national policies and priorities

12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature

12.a Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production

12.b Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products

12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities

Goal 13. Take urgent action to combat climate change and its impacts[b]

13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

13.2 Integrate climate change measures into national policies, strategies and planning

13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to

address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible

13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution

14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans

14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels

14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics

14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information

14.6 By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation[c]

14.7 By 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism

14.a Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries

14.b Provide access for small-scale artisanal fishers to marine resources and markets

14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of “The future we want”

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements

15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally

15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world

15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development

15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species

15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed

15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products

15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species

15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts

15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems

15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation

15.c Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

16.1 Significantly reduce all forms of violence and related death rates everywhere

16.2 End abuse, exploitation, trafficking and all forms of violence against and torture of children

16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all

16.4 By 2030, significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime

16.5 Substantially reduce corruption and bribery in all their forms

16.6 Develop effective, accountable and transparent institutions at all levels

16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels

16.8 Broaden and strengthen the participation of developing countries in the institutions of global governance

16.9 By 2030, provide legal identity for all, including birth registration

16.10 Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements

16.a Strengthen relevant national institutions, including through international cooperation, for building capacity at all levels, in particular in developing countries, to prevent violence and combat terrorism and crime

16.b Promote and enforce non-discriminatory laws and policies for sustainable development

Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

Finance

17.1 Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection

17.2 Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of gross national income for official development assistance (ODA/GNI) to developing countries and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries

17.3 Mobilize additional financial resources for developing countries from multiple sources

17.4 Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress

17.5 Adopt and implement investment promotion regimes for least developed countries

Technology

17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism

17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed

17.8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology

Capacity-building

17.9 Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the Sustainable Development Goals, including through North-South, South-South and triangular cooperation

Trade

17.10 Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda

17.11 Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020

17.12 Realize timely implementation of duty-free and quota-free market access on a lasting basis for all least developed countries, consistent with World Trade Organization decisions, including by ensuring that preferential rules of origin applicable to imports from least developed countries are transparent and simple, and contribute to facilitating market access

Systemic issues

Policy and institutional coherence

17.13 Enhance global macroeconomic stability, including through policy coordination and policy coherence

17.14 Enhance policy coherence for sustainable development

17.15 Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development

Multi-stakeholder partnerships

17.16 Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries

17.17 Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships

Data, monitoring and accountability

17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts

17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries

Annex 2: Stakeholder Workshop session on Vision and Strategic Objectives

INTRODUCTION

During the Baseline workshop (16-18 April 2016), one of the groupwork sessions was put over to the definition of a Vision Statement and its related strategic objectives. The works was done in 3 groups and was followed by a plenary report-back session. The outputs of the three groups was captured on MS Word or MS Powerpoint and presented for discussion and the files provided to the Consultant. Unfortunately the file provided by Group 2 was corrupted and despite numerous efforts a replacement file was never found.

The outputs of Groups 1 and 3 are provided below:

VISION STATEMENT

The following suggestions for a Vision Statement were developed and discussed by Group 1:

- Efficient utilization of available water resources of BAS while taking into account environmental element for the benefit of its inhabitants
- Efficient development and management of natural resources of BAS basin for betterment of the people and environment
- Sustainable water resources management through shared vision for prosperity of the inhabitant of BAS
- Sustainable development and management of BAS basin
- To achieve sustainable soci-economic development through integrated natural resources management
- Water resources development undertaking which aims at fostering socioeconomic of the basin
- Sustainable and integrated management of the natural resources' for the wellbeing
- Well development and manage of water

The following Vision Statement was proposed :

Sustainably developed and managed BAS river basin with secured wellbeing of its inhabitants.

Group 3 first considered "What is broken?"

- Our opportunities:
  - We have water
  - People are there
  - Land is available
  - Will and desire for cooperation
- But ….
  - Our water resources are not developed
  - The sub-basin is not secure; no peace
  - Development requires cooperation among countries
  - Most areas are in accessible
  - Poverty is widespread

Proposed Vision Statement

A sustainably managed and developed river sub-basin with prosperous, connected, peacefully and mutually co-existing societies.

Alternatives considered:

- A well understood, managed and sustainably developed river sub-basin with prosperous peaceful societies
- A well understood, managed and sustainably developed river sub-basin with prosperous, connected and peacefully co-existing societies
- A well understood, managed and sustainably developed river sub-basin with prosperous, connected and peacefully and mutually co-existing societies
- Sustainable socio-economic development of the sub-basin through well developed water resources (?)
- Relegating remoteness to history, a well understood, managed and sustainably developed river sub-basin with prosperous peaceful societies

STRATEGIC OBJECTIVES

Group 1 came up with the following list of strategic objectives:

- Balanced development of the water resources
- Management of the floods and droughts
- Food security and Livelihoods improvement through Wetland and watershed management
- Management of resource base conflicts
- Ensure cooperation and trans-boundary water resources management
- Protection and conservation of the biological resources

Group 3 came up with the following list of strategic Objectives

- To sustain water, land, ecosystem and related resources
- To develop water resources to alleviate food insecurity and reduce poverty
- To invest in infrastructural facilities
- To develop water, land and related resources considering the comparative advantages of different parts of the sub-basin
- To ensure peace and security among the inhabitants of the sub-basin
- To enhance cooperation among sub-basin inhabitants for shared benefits
- To enhance human and institutional capacities for sustainable management of the water, land, ecosystems and related resources
- To formulate and operationalize disaster mitigation strategies

Annex 3: Project Profiles for selected Medium/long-term Projects

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Title of document	**Baro Akobo Sobat multipurpose water resources development study**
Document Reference	**800838**
Reference No.	**Project profiles for medium and long term projects – V1**

Date of publication	Ref. No :	Observations	Compiled by	Verified and validated by
10 March 2017	V1	Project profiles for medium and long term projects	Steve Crerar and team	Jean-Michel Citeau, Steve Crerar

BARO-AKOBO-SOBAT MULTIPURPOSE WATER RESOURCES DEVELOPMENT STUDY PROJECT

Project profiles for medium and long term projects

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1. INTRODUCTION

CONTEXT OF THE MEDIUM/LONG TERM PROJECTS WITHIN THE OVERALL STUDY

The Baro-Akobo-Sobat multipurpose water resources development study project was launched in March 2015. The study comprises 4 components: (i) Strategic Social Environmental Assessment (SSEA) and Integrated Water Resources Development and Management Plan (IWRDMP), (ii) Identification and preparation of short term projects, (iii) Identification and profiling of medium and long-term projects, and(iv) Project implementation support

As stated in the terms of references, the main outputs of Component 3 include, for three selected medium-long term projects:

- Analysis of key features of the projects and list of tasks,
- Terms of Reference of feasibility study, including ESIA
- Institutions, organizational arrangements and communication plans and
- Roadmap for each project.

SPECIFIC OBJECTIVES OF THIS REPORT

This report provides preliminary information for a short-list of nine potential priority medium/long term projects. Following the selection of three projects, a more detailed analysis of the key features of the project will be carried out and terms of references will be compiled as per the study's terms of reference

2. LIST OF SELECTED MEDIUM AND LONG TERM PROJECTS

2.1 OVERVIEW OF THE 10 PROJECTS

Nine projects are proposed for discussion and selection through ENTRO. It should be noted that the nine projects are transboundary in nature and will provide shared benefits:

- Transboundary Hydro-meteorological and Environmental monitoring system and Environmental Flows Assessment
- Integrated BAS hydropower, irrigation and multipurpose development programme - Phase 1: Baro/Sobat component
- Machar marshes integrated water resources management plan
- Akobo transboundary multipurpose development project
- Flood-Risk Mapping and Early-Warning System
- Boma-Gambella transboundary national park
- Kapoeta Pibor and Cingaineta
- Livelihood-based Watershed Management – Taking to Scale for a Basinwide Impact
- Regional Transport and Navigation Development Project

2.2 TRANSBOUNDARY HYDRO-METEOROLOGICAL AND ENVIRONMENTAL MONITORING SYSTEM AND ENVIRONMENTAL FLOWS ASSESSMENT

2.2.1 Brief description of the project

This long-term project proposes to develop an extensive hydro-meteorological and environmental monitoring system in the sub-basin and based on an assessment of the information collected to determine the environmental flow requirements at key points in the system. This project is essential to better understand the hydrological patterns in the sub-basin and assess with more certainty the impacts of development. It will provide benefits in the short, medium and long terms.

2.2.2 Project Rationale

2.2.2.1 Project Objectives

The overall project objective is to achieve a major improvement in the understanding of the hydro-meteorological and environmental functioning of the BAS system. This improved understanding will be used to achieve other objectives including, under this project, the determination of environmental flow requirements at key points in the system.

2.2.2.2 Relevance within the BAS IWRDM Plan

Work carried out as part of the scoping phase and in drawing up the baseline situation of the BAS sub-basin has shown that there is a critical shortage of hydro-meteorological and natural resources data throughout the basin. There are major gaps and many of the data are old or missing and the literature references often cross quote each other. In much of the sub-basin there are no data collection programmes in place.

This has presented major challenges for activities such as hydrological and water resources modelling and resulted in uncertainties regarding results of the models. As an example, the Machar marshes are barely known and yet their consideration is central in the water resources modelling.

These uncertainties have been taken into account using sensitivity analyses and estimation of margins of error in the Strategic Social and Environmental Assessment which informs the Plan. However, it was emphasized by the key stakeholders of the basin that these uncertainties are too significant to have a clear vision of the impacts related to water resources development in the basin. There is therefore a need to rapidly improve the quality and coverage of data so that these uncertainties can be reduced and stakeholders reassured going forward. It has been agreed by all countries that the regular updating of the IWRDMPlan and its development priorities will depend on much improved knowledge of system functioning and this is a critical and urgent need.

2.2.2.3 Transboundary Benefits and/or Impacts

The study is of critical importance with respect to ensuring that the transboundary benefits of development are maximised and the impacts minimized. Most of the proposed developments that will result in changes to the flow regime are upstream in the form of either large-scale hydropower schemes in the highlands or irrigation schemes with significant abstraction requirements. Optimizing the operation of upstream storage and assessing the limits of abstraction for irrigation and other requirements can only be achieved once the hydrology and related ecological requirements and services are properly understood.

2.2.2.4 Socio-economic Benefits and/or Impacts

The work already done in the SSEA and options analysis, albeit based on generally poor data, has shown that the maximization of economic benefits (with externalities fully taken into account) occurs when there is a sustainable balance of development and conservation of eco-services. Benefits of implementing a monitoring system will result in informed strategic decisions at both the basin scale and at project level. The potential socioeconomic benefits of a highly improved understanding of the overall BAS system will be orders of magnitude greater than the cost of data collection, processing and analysis.

2.2.3 Proposed activities / Key Components

2.2.3.1 Hydro-meteorological monitoring

Hydro-meteorological monitoring is essential to improve the knowledge of the hydrological functioning in the basin, especially the dynamic of inundation of the many important wetlands.

HYDROLOGICAL MONITORING

An extensive river gauging network (83 stations in total) historically existed in the Baro-Akobo-Sobat sub-basin, with most of the major rivers and spills having been gauged at some time even though it might have been only for short or intermittent periods.

It is proposed to ensure a long term monitoring through the operationalization of the existing stations. Several additional gauging stations may be required, especially for the Machar marshes to understand the link between the marshes and upstream rivers. It should be noted that during a field mission commissioned by ENTRO in 2012, water level and flow measurement sites in Machar Marshes have been proposed. Remote sensing can also play an important role, but ground truthing and calibration using conventional water level stations is indispensable.

METEOROLOGICAL MONITORING

There are currently 15 active meteorological stations in Ethiopia while there is only one active in South Sudan (Malakal). It is thus proposed as a first step, to bring into service the stations at Torit and Kapoeta and to establish two new stations at Pibor Post and Faddoi. During project inception, additional automatic climate stations will be proposed for installation in secure locations (government offices, schools etc). These stations have relatively low cost and will provide data with high temporal resolution.

2.2.3.2 Environmental monitoring

The environmental monitoring mostly includes water quality monitoring, sediment loads monitoring, erosion monitoring and land use/land cover monitoring. It will also include biodiversity and fish surveys to be carried out at regular intervals, starting with a baseline survey.

WATER QUALITY MONITORING

Water quality monitoring should not be implemented only at project level. An extensive network of water quality sampling has been defined in the “National Nile Basin Water Quality Monitoring Baseline Report for Ethiopia” carried out by Merid (2005). The study highlights the fact that *“for the combined use of quality and quantity data, the hydrological measurement and water quality sampling should be carried out, as far as possible, at the same location.”* Furthermore, while water quality does not seem currently to be a problem in the basin, the development of several sectors (irrigation and oil extraction for instance) requires an effective monitoring system of water quality for both surface water and groundwater.

SEDIMENT LOADS AND EROSION

There is no extensive suspended sediment load database available in the basin and data collection appears to have ended in 1990 with only 100 samplings available at 11 gauging stations. The analysis of sediment loads and erosion is essential to monitor the impact of land use changes in the highlands on downstream areas.

LAND USE/LAND COVER MONITORING

This monitoring is important to identify where there are needs and opportunities to implement watershed management programmes, especially in the highlands where there is deforestation. It would also be useful in the lowlands, in remote areas where land allocation and land use are sometimes not really well known. The influence of land use in the modelling of rainfall-runoff and infiltration relationships is critical. The monitoring of trends in land use changes over time will be achieved through the application of remote sensing combined with the development of GIS databases.

2.2.3.3 Environmental Flows Assessment

As was stressed in the SSEA Report, there is a critical need for a much improved understanding of the environmental flow requirements at all the critical points around the basin. This requires an assessment based on extensive fieldwork. One possible approach, which relies on a significant level of stakeholder consultation places considerable importance on understanding the value of environmental goods and services. The approach is outlined in Figure 2-1.

As can be seen from Figure 2-1, the involvement of stakeholders is important throughout the process.

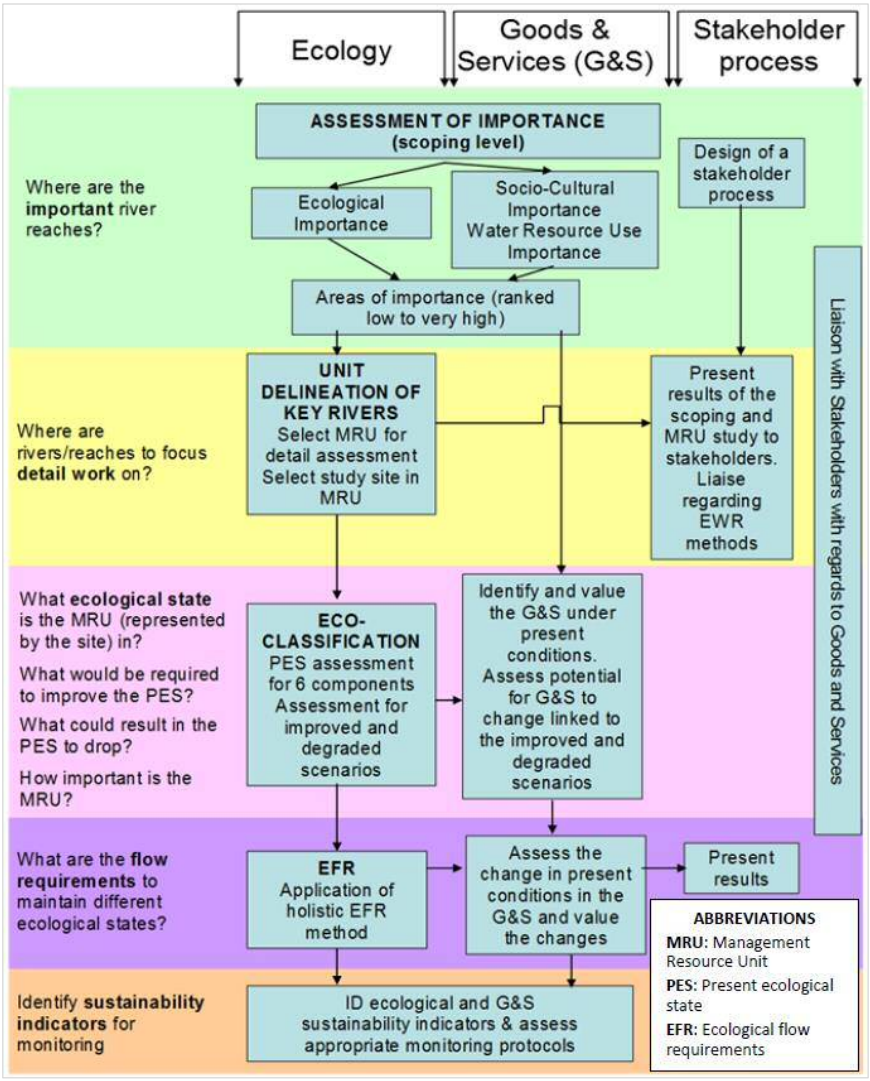


Figure 2-1: Process for identification of environmental flow requirements and subsequent monitoring

2.2.3.4 Project implementation

A high level of cooperation between the basin states will be required and ENTRO should play a major coordination role and provide technical support.

2.2.3.5 Capacity Building

The aim of the capacity-building programme, to be delivered at both the transboundary and national levels will be to ensure that the entire system can be run by the national organisations responsible for hydro-climatic and environmental monitoring. There will also be a specialised capacity-building component, including on-the job training, on the assessment of environmental flow requirements.

2.2.4 Preliminary budget and timeline

Implementation and operational costs are relatively low in comparison with the potential benefits The cost of collecting and disseminating hydro-climatological and environmental data has never been as low as a result of low-cost sensors and loggers, cell-phone technology (GSM/GPRS) and remote sensing techniques. The use of remote sensing, GIS tools and databases will be central to project design and represent good value for money.

Table 2-1: Hydro-environmental monitoring and EFR Assessment; Preliminary Budget and Timeline

Phase	Duration (years)	Tentative Budget (USD)
Planning, design and mobilisation	0.75 years	200,000
Implementation / construction, baseline surveys	2.25 years	3,000,000
Environmental Flows assessment	3 years (as from star of Year 4)	5,000,000
Operation (supported) and maintenance	5.0 (as from start of Year 4)	2,500,000 (500,000 per year)
Operation (independent) and maintenance	13 years	1,700,000 (100,000 per year)
	Total (over 25 years)	**12,220,000**
	Total (first 8 years)	**10,520,000**

2.3 INTEGRATED BAS HYDROPOWER, IRRIGATION AND MULTIPURPOSE DEVELOPMENT PROGRAMME - PHASE 1: BARO/SOBAT COMPONENT

2.3.1 Brief description of the project

This project focuses on what is referred to in the IWRDMPlan as *Phase 1 of the development of hydropower and associated transboundary development* opportunities (irrigation, fisheries, navigation) *on the Baro River and its tributaries*. This includes the development of opportunities on the Sobat River which are dependent to a large extent on flows coming from the Baro River. The proposed study shall make recommendations on the sequencing, operating principles and management rules of priority large scale hydropower projects (TAMS and Geba dams) and associated development on the Baro river.

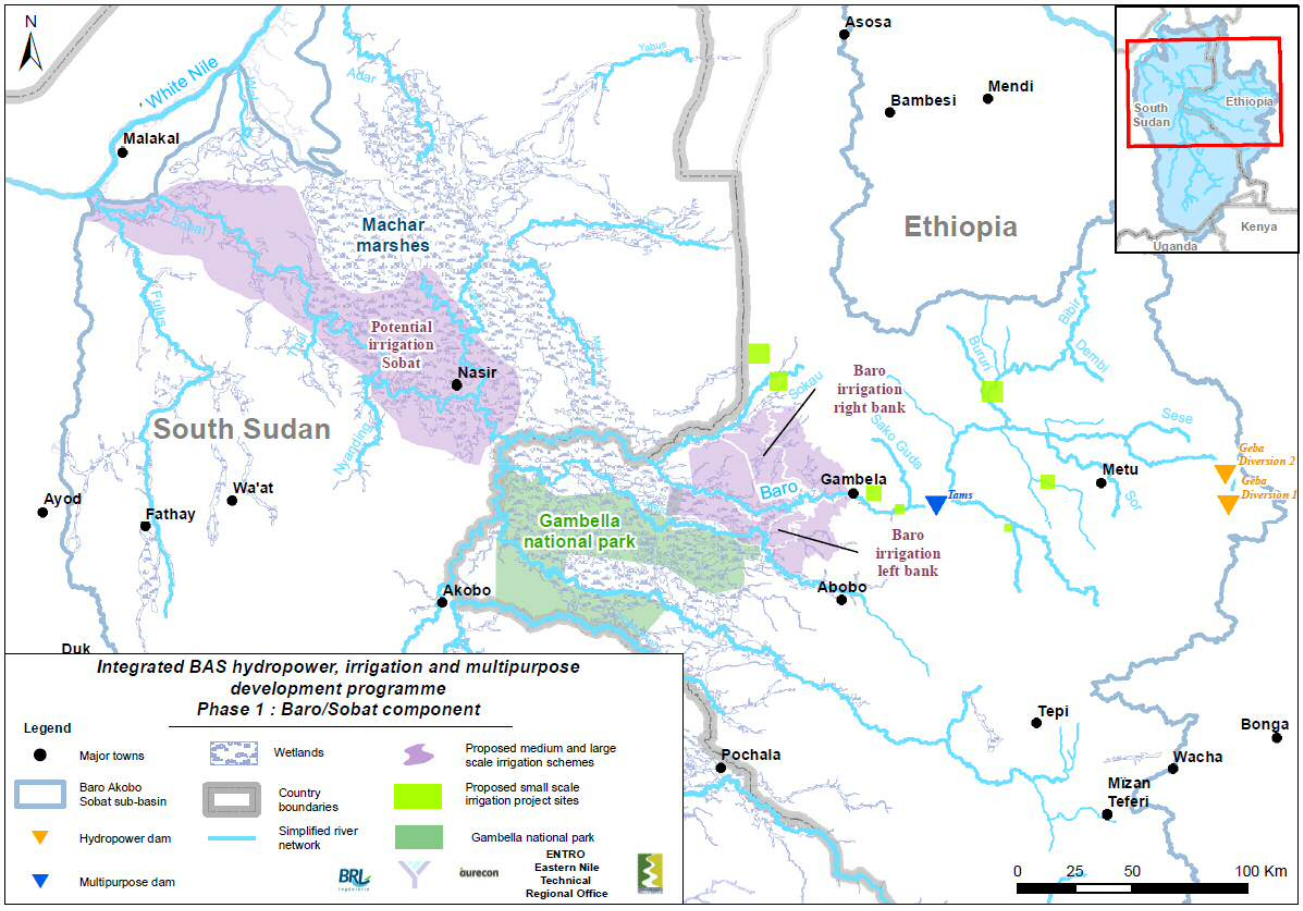


Figure 2-2: Location of Tams Dam upstream of irrigation developments on Baro and Sobat Rivers

2.3.2 Project Rationale

2.3.2.1 Project Objectives

The project objective is to plan, design and implement in an optimised and sustainable manner, the integrated BAS hydropower, irrigation and multipurpose development programme - Phase 1: Baro/Sobat component. Implementation of the proposed project infrastructure will generally be carried out by the countries but with a transboundary coordination component

2.3.2.2 Relevance within the BAS IWRDM Plan

Proposed projects in the BAS sub-basin which are included in the IWRDM plan should meet the following criteria:

- Be multipurpose in nature
- Integrate downstream water needs
- Provide transboundary and shared benefits

The TAMS Dam is a planned major hydropower dam in Ethiopia (proposed installed capacity of 1,700 MW) and as such, represents a project of regional importance. The project is scheduled for implementation (design) from the beginning of the plan. Geba 1 and 2 projects will be soon launched (capacity of 372 MW). In order to make sure that the above criteria are respected, the detailed sequencing, operating principles and management rules of the two projects should be established following the recommendations of the SSEA (mostly in terms of the environmental and social stakes and, regulation of the flow to support downstream irrigation and ecoservices).

The project is an agreed and scheduled part of the IWRDMPlan.

N.B: This study is closely linked to the "Hydro-meteorological and environmental monitoring system" project as there is currently a lack of data to carry out this study. As such this study should be initiated once the first monitoring data are released. There are, however planning and preparatory aspects, including agreement and implementation of institutional arrangements for transboundary cooperation throughout the process, that can be started immediately

2.3.2.3 Transboundary Benefits and/or Impacts

The entire focus of this programme is on optimizing transboundary benefits and supporting long-term environmental and socioeconomic sustainability. The implementation of large-scale infrastructure with the potential to store large quantities of water and to change the hydrological regime has to be carried from a transboundary perspective throughout the length of the project cycle to ensure that transboundary benefits are shared, to anticipate potential negative impacts and avoid environmental and socioeconomic shocks.

2.3.2.4 Socioeconomic Benefits and/or Impacts

The proposed developments are aimed at bringing economic growth and socioeconomic benefits at the regional, national and local levels. Optimising these benefits requires the coordinated transboundary project that is proposed in the project.

2.3.3 Proposed activities / key Components

2.3.3.1 Detailed technical analysis

In order to follow the recommendations from the SSEA of the current study, the proposed project should look at:

- Identification of flow requirements for consumptive and non-consumptive water uses on the Baro and on the Sobat. It is suggested vised that the study takes into account the relative significance of the Sobat in the White Nile System and potential impact on flows downstream of the confluence of the Sobat and the White Nile.
- Identification of an environmental flow required to conserve water related biodiversity patterns, especially with regard to wetlands. An important part of this task is the quantification of the potential supply of goods and services under current and future altered conditions

Based on the above findings, the study should investigate alternative development and management options for the upstream infrastructure in order to maximise **sustainable and transboundary** socio-economic development. The investigation will make use of refined water resources and economic models and drawing on new and improved data that should start becoming available as a result of other components of the IWRDMPlan. A high level of cooperation between the basin states will be required and ENTRO should play a major coordination role and provide technical support.

2.3.3.2 Development of a detailed implementation plan and schedule

Given that the TAMS hydropower project is close to implementation, there is some urgency to start this project. Given also its dependency on an improved knowledge base, it is important that work on this aspect is also given priority. Preliminary conclusions and recommendations are required within 3 years of implementation, and detailed operational procedures agreed and ready for implementation within 5 years. The project will also allow for a 5 year monitoring and evaluation framework and associated adaptive management system to be implemented. Application of these systems should continue beyond the ten years but should be managed by the basin countries without project support.

2.3.3.3 Project implementation

A high level of cooperation between the basin states will be required and ENTRO should play a major coordination role and provide technical support.

2.3.3.4 Capacity Building

It is important that all parties are able to evaluate the technical work and make informed judgements on the conclusions. ENTRO should play a role in supporting the required capacity building both in country and at ENTRO with joint country capacity building sessions

2.3.4 Preliminary budget and timeline

Implementation and operational costs are relatively low in comparison with the potential benefits. The budget and timeline are summarised in Table 2-2.

Table 2-2: Integrated BAS multipurpose development programme - Phase 1: Baro/Sobat component; Preliminary Budget and Timeline

Phase	Duration (years)	Tentative Budget (USD)
Planning, design and mobilisation, including agreement of institutional arrangements	0.75 years	200,000
Data collection and analysis, stakeholder consultation[1]	2.25 years (initiated by Year 0.5)	2,000,000
Modelling work: Phase 1	2 years (as from start of Year 2)	1,000,000
Modelling work: Phase 2	2 years (as from start of Year 4)	1,000,000
Monitoring and evaluation and adaptive management programme	5 years (as from start of Year 6)	2,500,000 (500,000 per year)
	Total (over 10 years)	**6,700,000**

Note 1: This is supplementary to the hydro-environmental monitoring programme proposed elsewhere in the IWRDMPLan. It is assumed that this parallel programme will be implemented

2.4 MACHAR MARSHES INTEGRATED WATER RESOURCES MANAGEMENT PLAN

2.4.1 Brief description of the project

The proposed study is an Integrated Water Resources Management Plan for the Machar Marshes located in Upper Nile State in South Sudan. The Machar Marshes are poorly understood in terms of both the existing socio-economic conditions and hydro-environmental functioning. Its status is highly dependent on flows coming from the Baro River upstream which are likely to change over time in the future as upstream development proceeds.

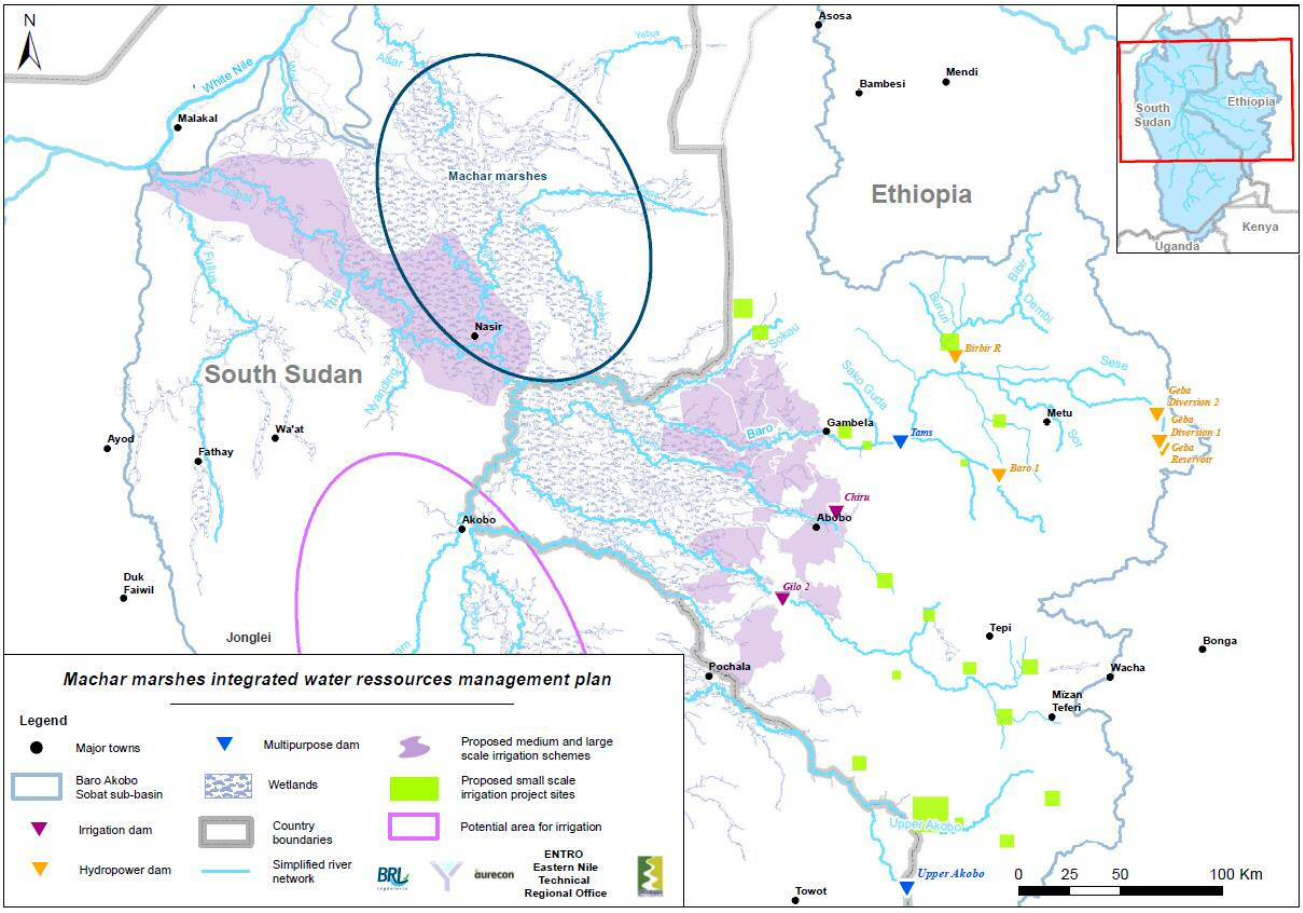


Figure 2-3: Location of the Machar Marshes

2.4.2 Project Rationale

2.4.2.1 Project Objectives

The objective of the project is to establish an agreed integrated water resources management plan for the Machar Marshes. The plan should put emphasis on the sustainable development of livelihoods in this area of the basin where there are highly vulnerable communities who rely on services provided by the wetlands.

2.4.2.2 Relevance within the BAS IWRDM Plan

During the course of the Baro-Akobo-Sobat multipurpose water resources development study project, a strategic social and environmental assessment (SSEA) was carried out in order to guide the design of the IWRDMPlan, especially in terms of cumulative and basinwide socio-economic and environmental impacts. The SSEA was hampered by a lack of adequate data and information, and in particular on the status and functioning of the Machar Marshes.

The Machar Marshes are currently relatively pristine and support the livelihood of local communities, especially for potable water supply, agriculture, water for the livestock, fisheries. It is clear that this could change quite significantly as a result of the planned implementation of upstream water resources development infrastructure, as well as due to land used changes. In view of their importance with respect to biodiversity and the related provision of ecological services, it is critical to use the available pre-development window of opportunity to establish a management plan for the Machar Marshes. As part of the management plan, there should be an extensive baseline study with field surveys to define more precisely the environmental and socio-economic features of the area and their dependence to the wetlands.

It is thus critical to acquire data and propose a management plan for the marshes which takes into account upstream planned development and downstream water needs. The proposed project relates strongly to other agreed activities of the IWRDMPLan, namely:

- Transboundary Hydro-meteorological and Environmental monitoring system and Environmental Flows Assessment
- Integrated BAS hydropower, irrigation and multipurpose development programme - Phase 1: Baro/Sobat component

2.4.2.3 Transboundary Benefits and/or Impacts

Agreement on a management plan for the Machar Marshes has significant transboundary implications, both in terms of operational implications for upstream infrastructure and development and on flows further down the system.

2.4.2.4 Socio-economic Benefits and/or Impacts

The focus of the IWRDMPlan has been on the development of large-scale water resources development infrastructure with their relatively straightforward evaluation of socioeconomic benefits, albeit in cognizance of the potential environmental and socioeconomic impacts downstream. The socioeconomic benefits related to the Machar Marshes, in particular to the environmental services that they provide, are not well enough understood or quantified. Development of an informed integrated management plan for the Machar Marshes will provide this information which can then be used as the IWRDMPLan for the basin as whole is further developed.

2.4.3 Proposed activities / Key Components

2.4.3.1 Proposed activities

Activities proposed as part of the project can be guided by the strategic objectives of the “Wetland Management Strategy” published in 2013 by the NBI:

- Objective 1: Strengthen the knowledge base on wetlands of transboundary importance in the Nile Basin to support basin-wide conservation, management, planning and restoration efforts.

  In order to reach this objective, it is proposed to carry out reconnaissance missions, stakeholders’ consultation and data collection (mainly hydrological and water-related environmental and socio-

economic data). Consultations should involve Sudan as Sudanese pastoralists are migrating with their livestock for grazing during the dry season.

- Objective 2: Raise awareness and undertake advocacy efforts to build consciousness around the important role of wetlands and their ecosystem functions for the basin's development.

  Although the Machar marshes are not currently well known, it is acknowledged that they provide many ecosystem services and sustain livelihood activities such as fisheries, hunting, potable water supply, sanitation, firewood collection, etc. The management plan will integrate the enhancement of livelihood activities with the conservation of the wetlands.

- Objective 3: Develop and promote a basin-wide approach for the sustainable and cooperative management of wetlands taking into account the full variety of wetland uses.

  Objective 3 relate to the basin-wide approach that should be taken for wetlands management, including upstream developments and downstream needs. This is in line with the proposed project "Integrated BAS Hydropower, Irrigation And Multipurpose Development Programme - Phase 1: Baro/Sobat Component". To this end, the project should include the definition of adequate river flows and spills to satisfy water requirements based on socio-economic and environmental needs.

- Objective 4: Strengthen national policies and institutional capacities for the effective management of wetlands with basin-wide importance.

- Objective 5: Strengthen basin-wide access to finance for wetland management and the capacity for development of feasible projects in the Nile Basin.

  Objective 4 and 5 relate to capacity building for the effective management of the wetlands (countries and institutions). This should be a major part of the plan.

The elaboration of the IWRM Plan for the Machar marshes should be the opportunity to assess the relevance of designated the wetlands as a protected area such as RAMSAR site. This application was already successfully carried out for the Sudd in South Sudan.

2.4.3.2 Capacity building

The project will provide a major opportunity for capacity building in a number of areas on which capacity is generally lacking. Activities should be implemented in close cooperation with the relevant institutions in both countries and involving ENTRO. Provision of on-the-job capacity building is seen as an excellent vehicle for this type of project.

2.4.4 Preliminary budget and timeline

Implementation and operational costs are relatively low in comparison with the potential benefits. The budget and timeline are summarised in Table 2-3.

Table 2-3: Machar Marshes integrated water resources management plan; Preliminary Budget and Timeline

Task	Duration (years)	Tentative Budget (USD)
Strengthening of knowledge base on wetlands of transboundary importance in the Nile Basin[1] Includes environmental and socioeconomic surveys	3 years (initiated by Year 0.5)	2,000,000
Awareness raising and Advocacy on wetland systems	3 years (initiated by Year 0.5)	500,000
Development of basinwide approach as part of proposed project "*Integrated BAS Hydropower, Irrigation And Multipurpose Development Programme - Phase 1: Baro/Sobat Component". Modelling work: Phase 1"*	2 years (as from start of Year 4)	1,000,000
Strengthening of national policies and institutional capacities for effective management of wetlands of transboundary significance	4.5 years (as from start of Year 0.5) (200,000 per year)	900,000
Develop and implement of capacity building programme	5 years (as from start of Year 2) (200,000 per year)	1,000,000
Development and implementation of Monitoring and evaluation and adaptive management programme	5 years (as from start of Year 6) (200,000 per year)	1,000,000
	Total (over 10 years)	**6,400,000**

Note 1: This is supplementary to the hydro-environmental monitoring programme proposed elsewhere in the IWRDMPLan. It is assumed that this parallel programme will be implemented

2.5 Akobo – Pibor transboundary multipurpose development project

2.5.1 Brief description of the project

The recently completed irrigation masterplan for the Republic of South Sudan did not cover the whole country at the same level of detail or rigour as a result of the ongoing conflict situation. One of the areas that was not included was the Akobo River. A rapid preliminary desktop study has been carried out in order to provide a framework for a more detailed assessment. This assessment would be the central aim of this project and would include the assessment of hydropower on the upper part of the joint South Sudan / Ethiopia border section of the Akobo River, irrigation further downstream and associated multipurpose development opportunities.

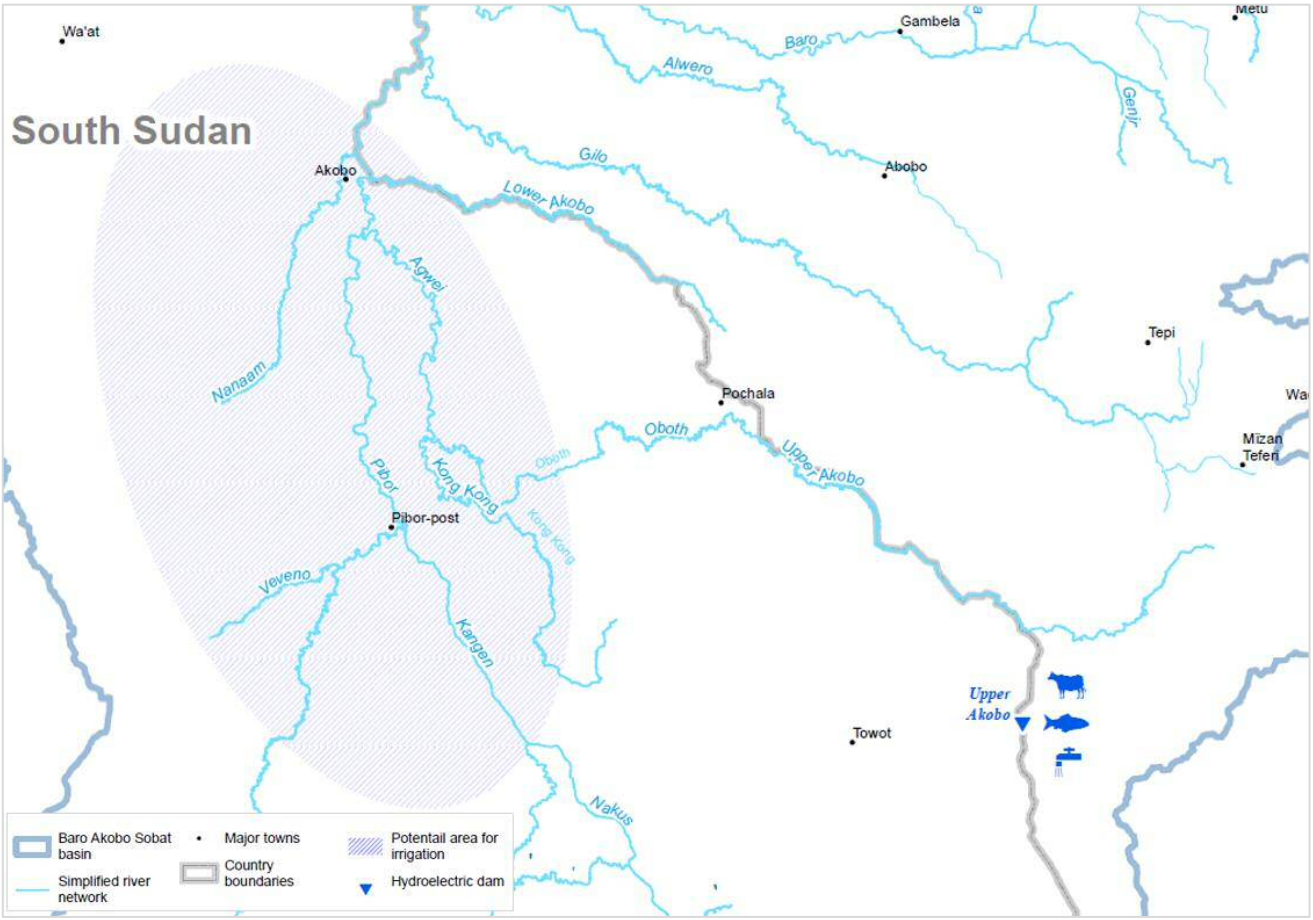


Figure 2-4: Location of potential for hydropower (Upper Akobo) and irrigation potential

There are significant falls on the upper part of the Akobo River where it forms the joint border between Ethiopia and South Sudan, so there may be opportunities for hydropower. In the 4 km stretch of river shown in Figure 2-5 , the river falls by almost 100m.

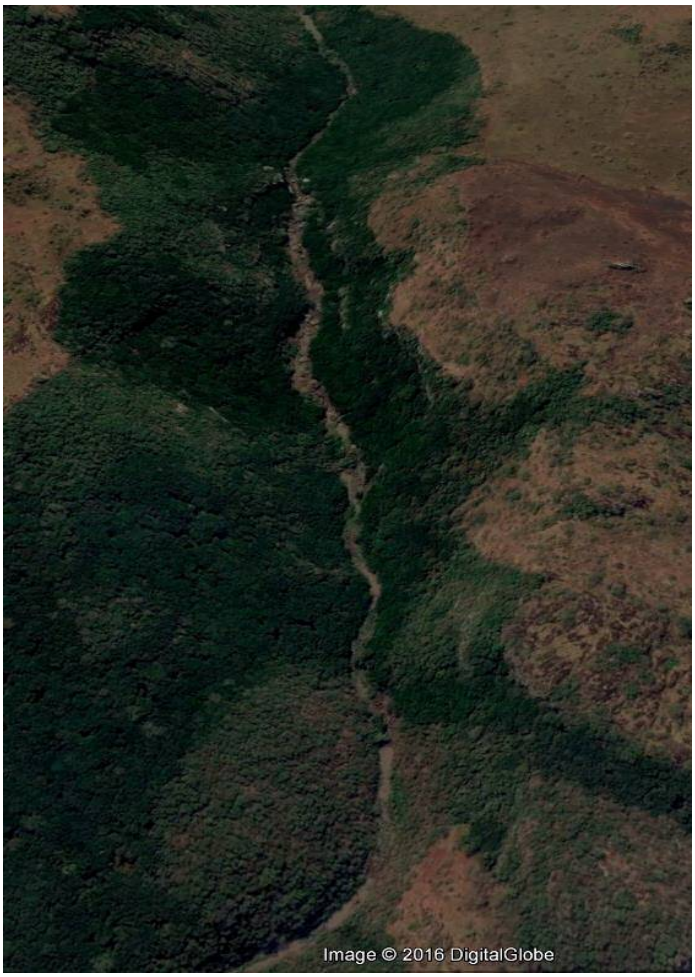


Figure 2-5: 4km stretch of the Akobo River on the joint border where there is a significant fall

2.5.2 Project Rationale

2.5.2.1 Project Objectives

The objective of the project is to investigate through reconnaissance to the feasibility study level, the feasibility of a multipurpose project development based on storage on the joint border between South Sudan and Ethiopia.

2.5.2.2 Relevance within the BAS IWRDM Plan

There are already many development projects existing on the Ethiopian side of the basin which are included in the IWRDMPlan. Several of these have been studied up to pre-feasibility and feasibility level. On some, such as the TAMS Dam, design is planned in the immediate future. Large, medium and small-scale infrastructure projects in the South Sudan part of the basin are lacking although there is clearly potential. There is little development proposed on the Akobo and Pibor Rivers. While flows in the Pibor are relatively small, the mean annual runoff (MAR) of the Akobo River at its highest is around 4 billion m^3. It is important that this potential is properly studied with the aim of identifying one or more significant projects that can be integrated into the IWRDMPlan.

2.5.2.3 Transboundary Benefits and/or Impacts

The proposed area to be investigated for hydropower, storage and regulation is on the joint border between South Sudan and Ethiopia. Generation of power and other opportunities generated through the storage of water (water supply, fisheries, livestock watering etc) are transboundary.

2.5.2.4 Socio-economic Benefits and/or Impacts

This is an area in which there is currently very little development. The generation of electricity, large-scale irrigation development and the development of fisheries and other sectors could provide an major economic boost to the area.

2.5.3 Proposed activities / Key Components

2.5.3.1 Project Preparation

PREPARATORY WORK

- Detailed review of available data an information
- Discussions with stakeholders

RECONNAISSANCE

A comprehensive reconnaissance phase is proposed. This will cover all the necessary area with a focus on:

- Flyover of the upper Akobo aimed at preliminary reconnaissance of i) potential dam sites on the upper part of the joint border portion of the Akobo River and ii) irrigation potential in the area as indicated in Figure 2-4
- Ground-based reconnaissance of potential dam and hydropower sites combined with limited topographic surveys
- Based on existing maps and medium resolution satellite imagery, investigate potential irrigation command areas outside of protected areas and with suitable characteristics
- Selection of sites to be included in the comparative pre-feasibility study

COMPARATIVE FEASIBILITY STUDY AND PRE-FEASIBILITY STUDY OF PREFERRED OPTIONS

- Comparative feasibility study of potential multipurpose developments. This may include different combinations of one or more storage sites with different potential irrigation command areas and water transfer/abstraction option. All reasonable options should be investigated through an initial screening process and then a comparative pre-feasibility study.

FEASIBILITY STUDY AND PRELIMINARY DESIGN OF PREFERRED MULTIPURPOSE PROJECT

- Undertake feasibility studies including social, economic and financial analyses, and environmental impact assessments to prepare the projects for implementation.
- Preliminary design at sufficient level of detail to allow development of bankable project documents

CAPACITY BUILDING

The entire process, from reconnaissance right through to the preparation of a bankable project documents should be carried out in close cooperation with a team of South Sudan technical counterparts.

2.5.3.2 Project Design and Implementation

To be detailed at the end of the project preparation phase

2.5.4 Preliminary budget and timeline

The estimated budget and timeline for project preparation are provided in Table 2-4. 5 years have been allowed for project implementation, but this will depend on the scale of the project selected.

Table 2-4: Akobo – Pibor transboundary multipurpose development project; Preliminary Budget and Timeline

Task	Duration (years)	Tentative Budget (USD)
Project Preparation Phase		
Preparatory work including data review and consultation	0.25 years	500,000
Reconnaissance	0.75 years	500,000
Comparative feasibility study and Pre-feasibility studies of preferred options	1 year	1,000,000
Capacity building	1.5 years	900,000
	Total (over 2 years)	**2,900,000**
Project Design and Implementation	5 years	

Note 1: This is supplementary to the hydro-environmental monitoring programme proposed elsewhere in the IWRDMPLan. It is assumed that this parallel programme will be implemented

2.6 FLOOD-RISK MAPPING AND EARLY-WARNING SYSTEM

2.6.1 Brief description of the project

A major (although not the only) driver of flooding in the low-lying downstream areas are the large river flows emanating from the highlands in Ethiopia. The relationship between discharges in the Baro River and other rivers discharging into the Gambella flood plains and flooding extent is not well understood. If this relationship can be better quantified, it becomes possible to predict the likely extent of flooding downstream based on river discharge information coming from upstream.

There are two main areas of activity in the proposed project:

- Analysis of the relationship between upstream flows and flooding extent in priority risk areas. This will also include an analysis of the relationship between rainfall in the source areas of the main rivers and floods generated in these rivers and will investigate the potential impacts of climate change
- Development of a real-time or quasi-real-time early warning system aimed at providing early warning of high discharge levels in the rivers while these flows are still some distance from the areas susceptible to flooding.

The project will build on ENTRO's Flood Preparedness and Early Warning project (FPEW) which was launched in 2007 and has been providing assistance to national, regional and local authorities in various regions, including Gambella, through early warnings and capacity building for preparedness. The project enhances regional collaboration and improves national capacity in mitigation, forecasting, early warning, emergency preparedness, and response to floods. Typical early warning information include rainfall forecasts and expected flood extents and inundation levels.

2.6.2 Project Rationale

2.6.2.1 Overview

The Gambella Plains to the west of Gambella flood almost every year. This flooding is mainly caused by the limited conveyance capacity of the mild sloping Baro, Alwero, Gilo and Akobo rivers upstream of their confluence with the Pibor River. This is exacerbated by the backwater effects from the Pibor and Sobat Rivers, direct heavy rainfall over the flood plains and deforestation in the upper catchment areas, which increases the flood runoff response and flood volumes and also leads to excessive sedimentation.

Aerial surveys during previous flood events has shown that the flooded area can be extensive. During the extreme flood in 1988, an area of nearly 10,000 km^2 was inundated along the Gambella Plain during October and November. Apart from the almost annual floods, extreme floods in the region have occurred in 1934, 1946, 1962, 1996, 2007, 2010 and 2014.

The areas within the plains that are subject to regular flooding are mainly used as pastures and for recession agriculture. Many people in the Gambella region live along the river banks which make them susceptible to flooding. Structures within the floodplain include cattle enclosures, isolated tukuls and several large villages, especially along the Baro River. During the 1988 flood, a significant portion of Gambella and almost the entire town of Itang were flooded with severe socio-economic impacts due to administrative buildings, houses, hotels, the power station and roads being inundated in Gambella. Although the flooding has severe negative impacts due to loss of life, structural damage to infrastructure, displacement, health risks and water logging of pastures and crops, the annual floods also support recession agriculture and provide fertile pastures to support the extensive cattle farming in the area.

An improved understanding of the relationship between incoming floods and the flooding that will result, will help in better land use planning and management of risk. When this is coupled to an effective flood warning system stakeholders will be able to move to safety and minimise the risk of damage to property

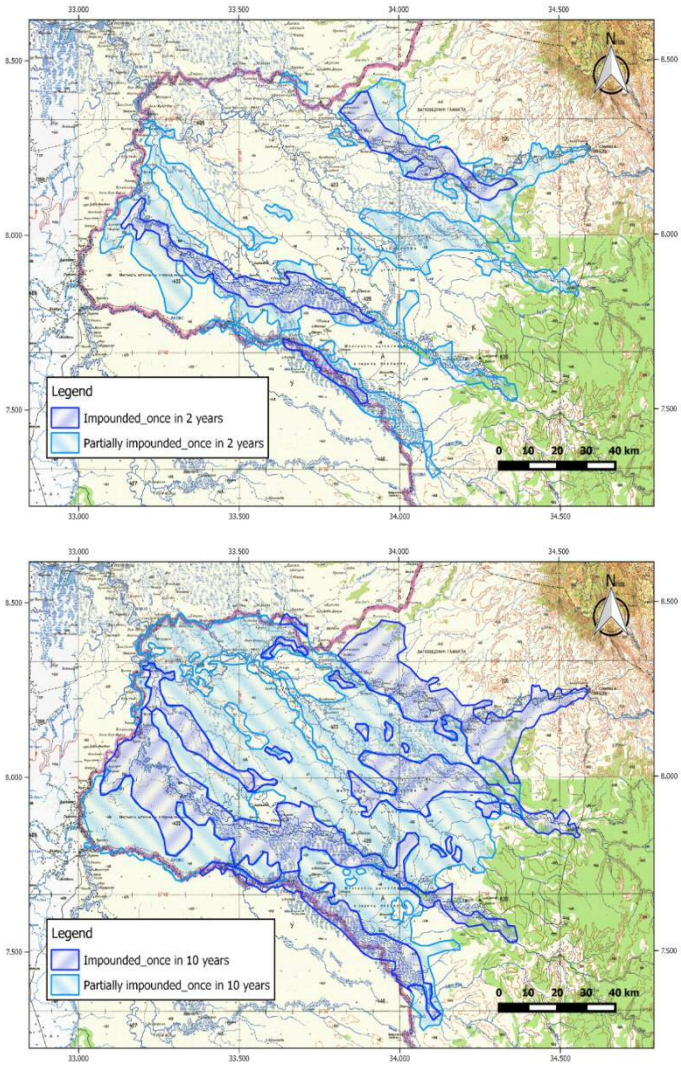


Figure 2-6: Extent of flooding in Gambella flood plains with 2 and 10 years return periods

2.6.2.2 Project Objectives

The objectives of the project are

- to map flood risk in terms of discharge and associated return period for both the current situation and for the future once projects have been implemented and
- to design and implement are "real"-time early warning system based on i) the forecasting and measurement of precipitation and ii) on real-time discharge measurements upstream of susceptible areas and flood flow forecasting

2.6.2.3 Relevance within the BAS IWRDM Plan

Strategic Objective 4 of the IWRDMPlan is "To manage water resources so that disasters associated with flood and drought can be prevented and/or mitigated". There are both enabling and cross-cutting enabling strategic actions in the IWRDMPlan which directly reflect the proposed project. They are detailed into specific actions as follows:

- Enabling Strategic Action: Carry out regular and adhoc flood-risk mapping and land-use planning exercises. Specific actions are:
  - Plan and cost flood risk mapping for Gambella/Akobo flood plains and other areas, prioritizing those with higher levels of human settlement
  - Carry out flood risk mapping exercise on all priority areas
  - Carry out flood risk mapping on all remaining vulnerable areas
- Mainstream climate change considerations. Specific actions are indicated as
  - Evaluate potential climate change impacts on flooding and drought through regional downscaling exercises and application of results for the generation of "future" climate data sets.
  - Based on the use of "future" climate data sets, mainstream climate change considerations into the calculation of drought sequences and peak flood magnitude and return period.

The first part of the proposed project is entirely in line with these strategic and specific actions. Aimed at supporting the same strategic objective, there is also the following important direct strategic action:

- Manage upstream hydropower reservoirs in order to support flood reduction and availability of water downstream. Three specific actions are detailed:
  - Design and put in place appropriate decision-support systems based on agreed management rules and improved environmental data collection network to support early warning drought mitigation
  - Use the decision-support system to manage upstream hydropower reservoirs and all aspects of related water resources management infrastructure

- Use the decision-support/flood warning system to support flood preparedness downstream

The proposed project will therefore play a significant role in implementation of the IWRDMPlan.

2.6.2.4 Transboundary Benefits and/or Impacts

The project will provide a number of transboundary benefits including:

- Information and products for improved land use planning with associated environmental and socioeconomic benefits
- Flood protection based on improved knowledge products
- Reduced loss of life and property

2.6.2.5 Socio-economic Benefits and/or Impacts

Improved flood awareness, early warning and protection will greatly contribute to a reduction in negative impacts such as loss of life, structural damage to infrastructure, displacement, health risks and water logging of pastures and crops.

2.6.3 Proposed activities / Key Components

2.6.3.1 Flood risk mapping

MAPPING OF FLOOD-PRONE AREAS

- Use of topographic mapping, satellite imagery, lidar surveys and topographic surveys for mapping of flood plains and river cross sections.

FLOOD FREQUENCY ANALYSIS

- Review of all existing information, (flood studies, existing preparatory studies for infrastructure, hydrological data) for information in historical floods and estimates of peak floods and return periods.
- Field investigations including collection of anecdotal evidence to examine extent and frequency of historical flooding events.
- Flood frequency analysis for all rivers feeding flood prone areas

FLOOD ROUTING AND FLOOD RISK MAPPING FOR CURRENT SITUATION

- Setting up and calibration of flood routing models for each of the rivers systems
- Development of flood risk maps for range of return periods.

2.6.3.2 Design and Implementation of Early warning system

DESIGN OF EARLY WARNING SYSTEM

Activities will be focussed around two main areas.

- The collection of real-time data (precipitation, river flows etc) and its input into models to provide information on floods as they are generated in the upland areas. The level of complexity required and possible will be investigated and developed accordingly.

- Assessment of options for the communication and sharing of data on a real-time basis. This will include consideration of the data needs identified in the previous step and for the transmission of warnings and forecasts to stakeholders in flood prone areas. It will also include a major stakeholder consultation effort to ensure that the proposed system will be fit for purpose.

IMPLEMENTATION OF EARLY WARNING SYSTEM

The system will be implemented in phases, first for priority areas as identified during the flood risk mapping and then for all flood prone areas.

2.6.3.3 Capacity building

Capacity building will be a key element throughout the design and implementation process. This will required at the local, national and transboundary levels.

2.6.4 Preliminary budget and timeline

The estimated budget and timeline for project preparation are provided in Table 2-5.

Table 2-5: Flood-risk mapping and Early warning system project; Preliminary Budget and Timeline

Task	Duration (years)	Tentative Budget (USD)
Flood risk mapping		
Mapping of flood-prone areas	2 years	3,000,000
Flood frequency analysis	1 years	250,000
Flood routing and flood risk mapping	1 year	1,250,000
Capacity building	5 years (100,000 per year	500,000
	Total (over 4 years)	**5,000,000**
Early Warning System		
Design of early warning system	2 years (start end of Year 3)	500,000
Implementation of early warning system; Phase 1	3 years (start end of Year 5)	2,000,000
Implementation of early warning system; Phase 2	3 years (start end of Year 7)	2,000,000
Capacity building	5 years (100,000 per year)	500,000
	Total (over 5 years)	**5,000,000**
	Overall total (10 years)	**10,000,000**

2.7 BOMA-GAMBELLA TRANSBOUNDARY NATIONAL PARK

2.7.1 Brief description of the project

The project aims at designating Boma-Gambella as one transboundary national park to strengthen transboundary cooperation and enhance effective protection. Preliminary activities have already been implemented as part of the project of transboundary cooperation between South Sudan and Ethiopia led by the HoA-REC for the management of Boma and Gambella national parks.

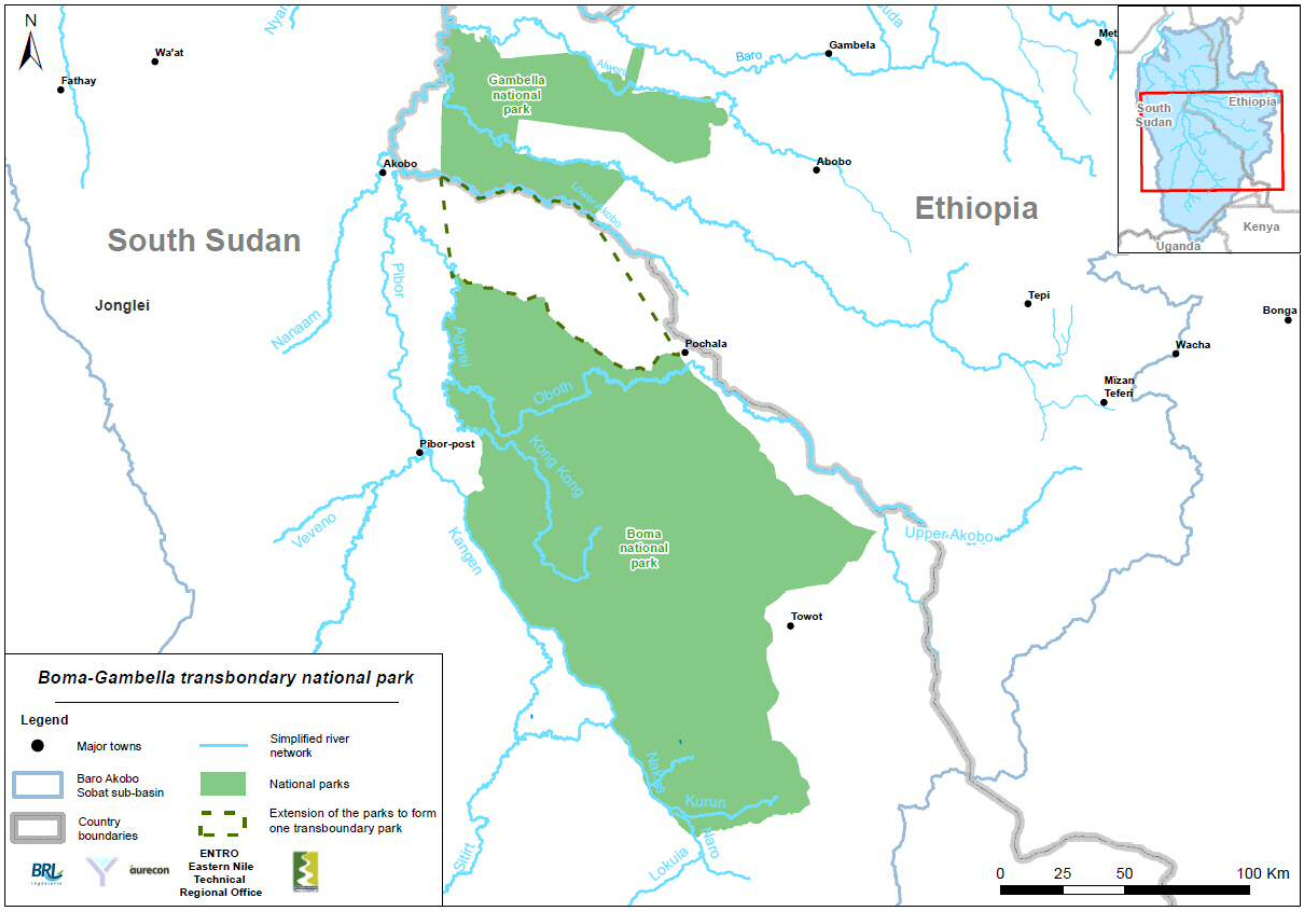


Figure 2-7: Designation of the Boma-Gambella transboundary national park

2.7.2 Project Rationale

2.7.2.1 Project Objectives

This project aims at ensuring a more effective protection of the two existing national parks through cooperation between Ethiopia and South Sudan. This should limit poaching and deforestation and secure the migration corridor for large mammals such as giraffes, elephants, white eared kobs, etc. The establishment of a transboundary national park and the protection of the ecosystem is a prerequisite for the development of ecotourism.

2.7.2.2 Relevance within the BAS IWRDM Plan

The designation of Boma-Gambella as a transboundary national park is in line with several initiatives already existing such as the project “Strengthening Biodiversity Management in the Boma-Gambella Landscape” led by the HoA-REC&N which advocates the designation of a transboundary network of protected areas to secure the migration corridors of large mammals.

The designation of the transboundary national park should be complemented by the identification of water-related projects (including monitoring activities and management plans) required to conserve the existing water-related biodiversity patterns (for instance key water points during the migration of the fauna) and enhance livelihoods in these protected areas. Ecosystem services provided by the rivers (Baro, Alwero, Gilo, Akobo and Pibor) should also be studied in depth to ensure that these services are not decreased with future developments upstream in the basin.

There is a great opportunity to develop ecotourism in this area of the sub-basin and this activity could be highly lucrative. This should be kept in mind throughout the project (the effective protection of the park being a point of departure).

This project and the key elements for an effective protection and management of the transboundary park should be taken into account during the implementation of projects that may impact the park ecosystem. For instance, the “BAS hydropower, irrigation and multipurpose development programme – Phase 1 Baro/Sobat component” and the “Akobo Pibor transboundary multipurpose development project” may have harmful impacts on habitats (loss and alteration) due to agricultural expansion. There might also be modifications of the hydrographic features of the area.

2.7.2.3 Transboundary Benefits and/or Impacts

There will be direct positive externalities related to the establishment of the park, especially to limit deforestation and fight against poaching.

2.7.2.4 Socio-economic Benefits and/or Impacts

As already emphasized, although there are no direct economic benefits, this will enhance the potential for ecotourism in this area.

2.7.3 Proposed activities

The establishment of the Boma-Gambella Transboundary Steering Committee (TBSC) was agreed in October 2015. A tripartite agreement between IGAD and the Ministries of Foreign Affairs in South Sudan and Ethiopia was finalised. The designation of a transboundary national park should be carried out by this existing committee. ENTRO could have a role in this designation and further in the elaboration of a management plan which takes into account the surroundings water related developments.

2.7.3.1 Designation of the transboundary national park

The designation of a transboundary national park will be reached through a Memorandum of Agreement (MoA) outlining common objectives, especially regarding: extension of the limits of the two national parks to establish one transboundary park, conservation objectives, institutional arrangements, funding, timeframes, timing, community engagement etc. should lead to the establishment of the national park. This will strengthen the capacities of the TBSC and will allow for the development of a management plan.

2.7.3.2 Management plan for the transboundary national park

A management plan for the transboundary park is crucial to improve the current understanding of the features of the park and propose adequate measures especially for:

- Livelihood enhancement through tourism development, fishery activities, shea nuts production, etc.
- Biodiversity conservation

2.7.4 Preliminary budget and timeline

Table 2-6: Boma-Gambella Transboundary National Park; Preliminary Budget and Timeline

Task	Duration (years)	Tentative Budget (USD)
Project Preparation Phase		
Preparatory work to enable designation (demarcation, conservation objectives, institutional arrangements, funding, timeframes, timing, community engagement etc)	3 years	2,000,000
Physical delimitation and formal legal designation of the park	1.5 years	3,000,000
Development and implementation of Transboundary Management and Park Development Plan, inlcuding limited infrastructure	5 years	10,000,000
Capacity building	5 years	1,000,000
	Total (over 2 years)	**16,000,000**
Project Implementation	5 years	

2.8 Cingaineta River Multipurpose Development Project

2.8.1 Brief description of the project

The Cingaineta River (shown also as “Singaita” on many maps, and also referred to as Khawr Thingaita, Khor Thingaita, Rigl Thimgaita, Singeitta on some maps) flows through Kapoeta in in Eastern Equatoria state of South Sudan. The river takes its source in the Didinga foothills of the Imatong Mountains. This is an area of relatively low rainfall but intense rainstorms during the rainy season (March to August) are frequent and can turn a sandy dry bed can turn it into a raging, impassable flood overnight. Flood recession flows are very short as a result of both the rainfall patterns and the degraded condition of the source areas.

The water resources of the Cingaineta River and its tributaries are untapped. This project will investigate options for the development and management of these resources in order to provide a more reliable water source for those living in and around Kapoeta. The project will be multipurpose in nature, looking at how the development of water resources can also support aquaculture, stock watering and small-scale irrigation. The project area (see Figure 2-8) includes the entire catchment of the Cingaineta River and will look at resolving issues from the top (Didinga Hills/Imatong Mountains) of the catchment to the bottom (seasonal wetlands at the confluence of the Cingaineta River and tributaries coming from the west) in order to improve the sustainable access to water and to make available to support improved livelihoods.

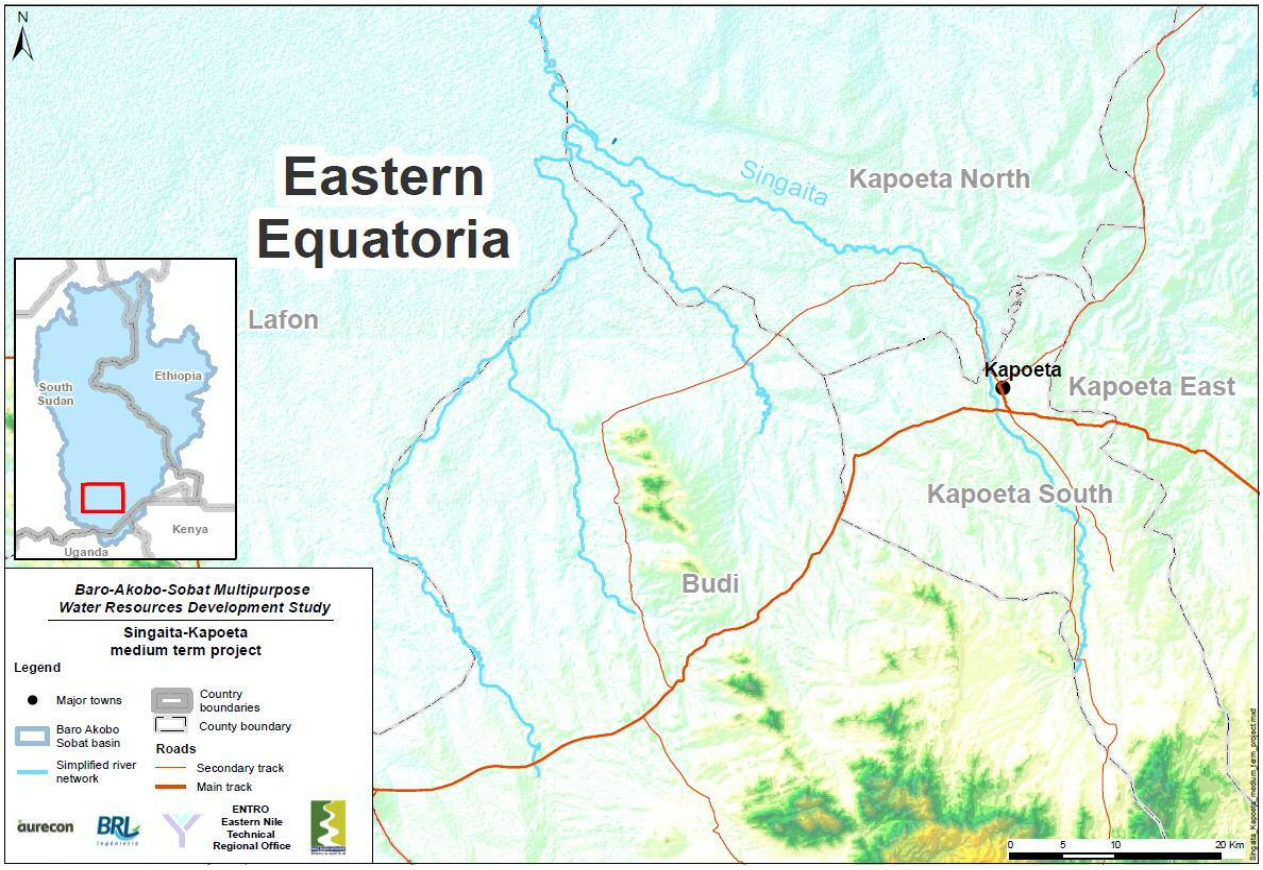


Figure 2-8: Location of the Cingaineta (Singaita) River and Kapoeta town in Eastern Equatoria

2.8.2 Project Rationale

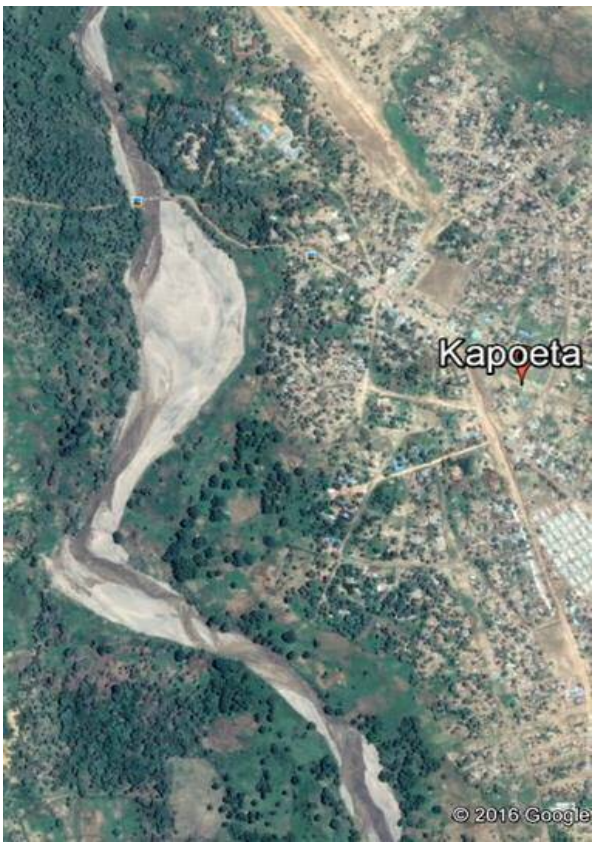
2.8.2.1 Project Objectives

The overall objective of the project is to at improve the livelihoods of both agro-pastoralists and pastoralists living in the Kapoeta North, South and East counties through actions in the Cingaineta River catchment aimed at reversing environmental degradation, increasing the availability of water during the dry season, improving food security and developing opportunities for livelihood enhancement

2.8.2.2 Relevance within the BAS IWRDM Plan

2.8.2.3 Transboundary Benefits and/or Impacts

The Cingaineta catchment is located in the Upper part of the Pibor catchment. The Pibor is one of the main tributaries of the transboundary Baro-Akobo-Sobat (BAS) Sub-catchment. Restoring catchments in the source areas of the tributaries of the BAS sub-catchment will contribute to the overall status of the sub-basins water resources. Under Strategic Objective 1 of the IWRDMPLan which is aimed at *contributing to food security, livelihood enhancement, poverty reduction and the protection and conservation of biological resources through stakeholder-driven management of wetlands, watersheds and other important natural resources"*, one of the strategic actions is to "*develop and implement (local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable livelihood enhancement, poverty reduction and the protection and conservation of biological resources".* This project is one such project, but will also include the development of a catchment management plan for the whole Cingaineta catchment.



2.8.2.4 Socio-economic Benefits and/or Impacts

In a study carried out by the Drylands Coordination Group on Natural Resource Management in the Didinga Hills in 2005 mapped livelihoods in the area and also analysed related natural resource management problems. It was found that the four highest problems (after livestock raiding) were: as follows:

- Erosion, acknowledged by community members as being caused by overgrazing, cultivation on steep slopes and cutting of trees;
- Livestock diseases, caused by fleas, lice and dirty water;

Figure 2-9: Cingaineta River at Kapoeta

- Inadequate water caused by droughts, clearance of forests, siltation of dams/lakes and
- Inadequate food (hunger-gaps) caused by droughts, poor agricultural practices and poor storage.

These are all socioeconomic areas that would be addressed by the proposed project.

2.8.3 Proposed activities

2.8.3.1 Reconnaissance and baseline surveys

This tasks will include several activities including:

- Baseline natural resources survey making use of satellite imagery, available maps and reconnaissance on the ground. Identification of natural resources issues and hotspots will be largely based on a combination of stakeholders' discussions and observation on the ground
- Socioeconomic surveys through observation and meetings with stakeholders
- Implementation of climate stations and river gauging network on the Cingaineta River. A minimum of 3 river stations should be considered at suitable sites upstream, close to Kapoeta and just upstream of the wetland situated at the confluence with tributaries coming from the south-west. These will be installed with community support and should include cableways for discharge measurement.
- Development of information system (knowledge base) and mapping in line with best practices

2.8.3.2 Prefeasibility and feasibility studies

This tasks will include several activities including:

- Selection of livelihood and natural resources management and development options compared as integrated packages.
- Comparative feasibility study
- Feasibility study and development of bankable project document

2.8.3.3 Project design and implementation

This tasks will include project design and implementation in two 3 year phases:

2.8.3.4 Capacity building

This will be carried out as part of the entire project cycle.

2.8.4 Preliminary budget and timeline

Table 2-7: Cingaineta River Multipurpose Development Project; Preliminary Budget and Timeline

Task	Duration (years)	Tentative Budget (USD)
Project Preparation Phase		
Reconnaissance and baseline surveys (Baseline NR survey, Socioeconomic surveys, Climate and River Gauging network, Information system and mapping products)	1 years (River monitoring continues into implementation)	550,000
Feasibility studies (Project selection, Pre-feasibility studies, Feasibility study)	1.5 years (start at Year 1.5)	350,000
Project design	1 years	200,000
Capacity building	4 years	200,000
	Total (over 3 years)	**1,300,000**
Project Implementation (Phase 1)	(3 years, starts at begin of Year 3)	**6,300,000**
Project Implementation (Phase 2)	(5 years, starts at begin of Year 6)	**6,300,000**
	Total (10 years)	**13,000,000**

2.9 LIVELIHOOD-BASED WATERSHED MANAGEMENT – TAKING TO SCALE FOR A BASINWIDE IMPACT

2.9.1 Brief description of the project

While the IWRDMPlan has a regional focus, it would be wrong to assume that catchment management plans for large basins and sub-basins, because they are supposed to be strategic in nature, do not need to include the micro-level IWRM-style interventions that are so critical to a sustainable approach to water resources and related natural resources management at the local level. If stakeholders are to be involved in the identification of issues and needs, it is important that the resultant Plan presents appropriate solutions, not just the planning and prioritizing of large-scale water resources development options. One way of dealing with this is to present a "programme "of local level interventions in the form of small-scale demonstration projects, which, when taken to scale, represent real basinwide solutions to some of the key environmental and socio-economic challenges such as high levels of sediment transport, lack of food security etc

This project will support the identification of small-scale livelihood-based watershed management with an emphasis on the development of sustainable Multisectoral opportunities followed by the design and implementation of a programme to take the approach to scale.

2.9.2 Project Rationale

2.9.2.1 Project Objectives

The objective of the project is ensure that livelihood-based watershed management interventions, often implemented at a small-scale are taken to scale basinwide in order to contribute meaningfully at the basinwide scale in terms of both socio-economic and environmental benefits.

2.9.2.2 Relevance within the BAS IWRDM Plan

Strategic Objective of the IWRDMPlan is "to contribute to food security, livelihood enhancement, poverty reduction and the protection and conservation of biological resources through stakeholder-driven management of wetlands, watersheds and other important natural resources". In order to realise this strategic objective there are two strategic direct actions presented in the IWRDMPlan as follows:

1) Develop and implement (local-level) multipurpose IWRM-style water resources development and management projects aimed at sustainable livelihood enhancement, poverty reduction and the protection and conservation of biological resources
2) Develop and implement basinwide plan for taking to scale of multipurpose IWRM-style water resources development and management projects

A number of specific actions have been indicated in the IWRDMPLan under each of these strategic actions. Under 1), three short-term multipurpose IWRM-style projects are specified for implementation following the feasibility studies prepared under this study. Strategic Objective 2) is more strategic in nature at the transboundary level. It includes the following specific actions:

- In consultation with stakeholders, draw up basinwide plan for taking to scale of multipurpose IWRM-style water resources development and management projects
- Develop monitoring and evaluation framework and adaptive management system for application at the national/transboundary levels
- Implement basinwide plan (including monitoring and evaluation framework) for taking to scale of multipurpose IWRM-style water resources development and management projects

The objectives of this project are entirely in line with aims of 2) and therefore highly relevant within the BAS IWRDMPlan.

2.9.2.3 Transboundary Benefits and/or Impacts

The result can ultimately be that all the key watersheds are well-managed. This will contribute to both improved livelihoods and also to reduced erosion and resultant sediment loads. A well-managed watershed will also result in improved infiltration and baseflow contribution to river flows and will also contribute to reducing the magnitude of floods generated in the uplands.

This concept is very important for the mainstreaming of climate change since it is those communities, subsistence farmers etc, whose livelihoods are most intertwined with climate variability and the status of natural resources, who are most vulnerable to climate change. Mainstreaming localized sustainable land and water management practices into wider-scale catchment plans is a key part of climate mainstreaming and climate resilience at both the local and basinwide levels.

2.9.2.4 Socio-economic Benefits and/or Impacts

As already indicated, a key part of the objective of the project is to generalize the enhancement of livelihoods to the basinwide scale. Socioeconomic benefits will be based on a sustainable approach to natural resources development and management.

2.9.3 Proposed activities / Key Components

2.9.3.1 Literature review and lessons learned

Livelihood-based watershed management and the implementation of small-scale multipurpose IWRM-style projects are not new. These types of projects have been implemented in many parts of the basin, some with the support on ENTRO. It will be important to review these projects and to learn lessons. The short-term projects studied to feasibility level and proposed for implementation will also provide lessons to be taken into consideration. This process will include a significant amount of stakeholder consultation.

2.9.3.2 Draw up basinwide plan

A basinwide plan will be drawn up in in close consultation with stakeholders. Priority areas will include those which have high levels of environmental degradation and socio-economic deprivation, and where the approach can work in a sustainable manner. The rationale behind the plan should take into account the fact that access to credit and markets as well as opportunities for adding value (agro-processing etc) can be improved through economies of scale. These economies of scale can be built through the development of project clusters which can justify improved roads, agro processing and storage cooperatives etc.

2.9.3.3 Monitoring and evaluation framework

An effective results-based monitoring and evaluation framework and associated adaptive management system for application at the local and transboundary levels. Application of the framework should be ongoing with many of the key success indicators (change in baseflow, sediment transport levels, peak floods etc) monitored as part of an improved basinwide hydro-environmental monitoring effort.

2.9.3.4 Implement basinwide plan

(including monitoring and evaluation framework) for taking to scale of multipurpose IWRM-style water resources development and management projects

2.9.3.5 Capacity Building

Capacity building will be required at two levels:

- First, at local level, it is obviously a key component to ensure the project implementation;
- At a wider level, capacity building will also be important for experience sharing to take projects concepts to scale.

2.9.4 Preliminary budget and timeline

The estimated budget and timeline for project preparation and implementation are provided in Table 2-8. 5 years have been allowed for project implementation, but this will depend on the scale of the project selected.

Table 2-8: Livelihood-based Watershed Management – Taking to Scale for a Basinwide Impact; Preliminary Budget and Timeline

Task	Duration (years)	Tentative Budget (USD)
Project Preparation		
Literature review and lessons learned, including workshops	1 year	100,000
Draw up basinwide plan including reconnaissance and project feasibility studies	2 years	2,000,000
Development of the monitoring and evaluation framework and adaptive management plan	0.5 year	75,000
Capacity building at project preparation level and plan for during implementation	1 years	150,000
	Total (over 2 years)	**2,325,000**
Implementation of the basinwide plan		
Phase 1: High priority areas	8 years (2,000,000 per year)	16,000,000
Phase 2: Generalisation to all suitable areas	15 years (2,000,000 per year)	30,000,000
Implementation of the monitoring and evaluation plan and adaptive management	23 years (50,000 per year)	1,150,000
	Total (over 23 years)	**47,150,000**
	Grand Total (over years)	**49,475,000**

2.10 REGIONAL TRANSPORT AND NAVIGATION DEVELOPMENT PROJECT

2.10.1 Brief description of the project

An important focus of the project is on the Baro River and its connectivity to the Sobat and the White Nile/Main Nile system but the study will also look at this navigation link within the regional transport context, recognizing that the viability of any initiatives to improve the navigability of any reach of river is dependent on both the navigability of other reaches and the general level of connectivity to the overall transport system and the markets that it serves.

2.10.2 Project Rationale

2.10.2.1 Project Objectives

The objectives of the study are i) to investigate and evaluate the feasibility of investments to improve the role of navigation in the sub-basin within the context of regional transport and access to markets as a whole, ii) to carry out the necessary planning and design work to get the project ready for implementation and iii) project implementation. The study will look carefully at the transport needs that will be generated by accelerated development within the sub-basin, assuming that a major driver in this accelerated development will be the rapid expansion of commercial irrigation in both the Gambella Region of Ethiopia and on the Sobat River in South Sudan.

2.10.2.2 Relevance within the BAS IWRDM Plan

One of the two direct strategic actions defined in the IWRDMPlan in support of Strategic Objective "*taking into account the comparative advantages of the different parts of the sub-basin to sustainably develop water resources for hydropower, irrigation, water supply and sanitation and other sectors with the dual aims of reducing poverty within the sub-basin and generating revenue",* is to ***Develop water sector infrastructure and services to support benefit sharing (navigation, interconnection etc).*** This proposed project is aimed at contributing to this strategic action and is defined in the IWRDMPlan as a specific action.

Figure 2-10: Navigable reaches of the Nile (all year round and seasonal)

Just as the transport sector is crucial in the socioeconomic development of nations and regions, it will also be critical in the development of the Baro-Akobo-Sobat sub-basin, especially given the relatively isolated status of much of the basin. Transport is inextricably linked to, and exerts a strong influence on, other sectors of the economy. Cheap and efficient transport services provide effective support to agricultural and industrial production, trade, regional integration, tourism, and to social and administrative services that are key to development.

Large quantities of agricultural produce grown on the proposed irrigation schemes in both countries as part of BAS IWRDMPlan implementation will have to be moved to distant markets. At present (see Figure 2-10), navigation from Gambella to the confluence of the Sobat and the White Nile is only seasonal. The improved navigability of the BAS system, potentially allowing the movement of produce all the way from Gambella to both Juba and Khartoum, could play a significant role in the feasibility of proposed developments under the IWRDMPlan.

2.10.2.3 Transboundary Benefits and/or Impacts

When looking at the potential for navigation it is necessary to look beyond the potential in the existing (or historical) context of (river) transport in the area. One of the strategic conclusions of the Eastern Nile countries in the recent Multisector Investment Opportunity Analysis (MSIOA, 2014) was that there should be a move towards a regional approach to food security. According to the MSIOA, such a regional approach would imply "*a regional approach to markets and the entire logistic chain getting produce to principal regional market centres. Maximising food production should be achieved from a regional perspective rather than a national one, with a focus on the most efficient use of the available water resources within the system as a whole*". Bearing this in mind, on a regional perspective, the place for navigation in the transport sector could be highly significant.

2.10.2.4 Socio-economic Benefits and/or Impacts

Potential socioeconomic benefits are many. Improved cost-effective transportation links to major centres would act as a catalyst for the development or irrigation in the basin and the development of navigation would bring employment opportunities along the length of the river system. A generally improved transport network of which the improved riverine transport would be a part, would support socio-economic growth in general.

2.10.3 Proposed activities / Key Components

The development of river transport cannot be considered in isolation of the rest of the transport sector and of related needs for various commodities. The entire logistical chain has to be taken into consideration including intermodal facilities to ensure the rapid transition from road/rail to river and vice versa.

2.10.3.1 Feasibility study

Activities would include the assessments of:

- Possible approaches to maintaining a navigable river from Gambella to Sobat mouth. Assessment of vessel types/sizes
- Connectivity with existing and potential overland transport
- Port infrastructure and intermodal transfer facilities requirements
- Potential demand
- Institutional aspects/implications
- Costs and economic analysis of options
- Analysis of feasibility under different scenarios

2.10.3.2 Design Phase

Based on the most feasible option, preparation of design for all aspects (regulation, dredging, port infrastructure, development of support infrastructure and services).

2.10.3.3 Implementation

The project would be jointly developed by both South Sudan and Ethiopia and potentially Sudan. Coordination of investigation and feasibility studies could be carried out by ENTRO

2.10.4 Preliminary budget and timeline

Table 2-9: Regional Transport and Navigation Development Project; Preliminary Budget and Timeline

Task	Duration (years)	Tentative Budget (USD)
Project Preparation Phase		
Reconnaissance and Feasibility study	2 years	2,000,000
Design	2 years	1,500,000
Capacity building	4 years	1,000,000
	Total (over 4 years)	**4,500,000**
Project Implementation	10 years (starting from start of Year 5)	To be detailed during feasibility

Annex 4: ToRs for selected Medium/Long-term Projects

Under Development

Annex 5: Preliminary IWRDMPlan Implementation Schedule

(See separate excel file)

Annex 6: Economic and Financial Analysis of the BAS IWRDMPlan

ECONOMIC AND FINANCIAL ANALYSIS OF THE BAS IWRDM PLAN

1. METHODOLOGY OF THE COSTS-BENEFIT ANALYSIS

1.1 OBJECTIVE AND METHOD

The costs-benefits analysis (CBA) consists of determining **the financial and economic relevance of a project** by evaluating the differential of costs and benefits between the situation with project and the situation without project (baseline scenario). In the current study, the CBA aims at assessing the financial and socio-economic feasibility of the action plan (i.e. *Are the benefits higher than the costs ?*) and assessing the robustness of the action plan (i.e. *How vary the profitability of the plan when key variables vary?*).

Two analysis are conducted:

- **a financial analysis** which makes it possible to assess the profitability of the projects from the investors 'point of view. The analysis takes into account the financial costs and benefits, i.e. the investments and O&M costs and the revenues of the activity implemented (hydropower, irrigation, fish farming or rizipisiculture). This analysis is presented in paragraph 2.1.
- **an economic analysis** which evaluates the viability of the projects from society's point of view. This analysis takes into account the financial costs and benefits plus the externalities of the projects.

  An externality is a cost or benefit generated by an activity and that affects a party that did not choose to incur this cost or benefits (e.g. degradation of downstream wetlands due to a modification of flows from a hydropower station, indirect employment created from a new activity, etc.). The analysis distinguishes the environmental, social and economic externalities. It makes it possible to appreciate the relevance of the project for the society as a whole. It is presented in paragraph 2.2.

NB: It is important to keep in mind that the economic analysis does not allow the monetarization of all the impacts of the scenarios. The Economic Internal Return Rate (EIRR) and the Economic Net Present Value (ENPV) are not sufficient to appreciate the relevance of the projects. Thus the results of the economic analysis should be put in perspective with the SSEA results.

For both analysis, three main indicators are computed:

- **The Net Present Value (NPV)** by summing the positive and negative discounted cash flows over the time period,
- **The Benefit/Cost ratio** : It should be superior to 1 for the project to be viable,
- **The Internal Rate of Return (IRR)**, which determines the discount rate that would make the NPV equal to zero. It should be superior to the discount rate applied in the analysis (10% for the financial cash flows and 5% of the externalities).

The CBA distinguishes different levels of analysis:

- **Geographically:** the analysis distinguishes the impacts for the Ethiopian part of the BAS and the Sudanese part of the BAS.
- **By economic sector:** the analysis presents the financial and economic relevance for each economic sector that are developed in the scenarios: hydropower, irrigation, fish farming and rizipisiculture.

1.2 GENERAL ASSUMPTIONS

The analysis is conducted over a 40 years period.

1.2.1 Inflation rate

The costs and benefits are in USD2016. The TP01 Index is used to update costs of hydropower and irrigation projects.

1.2.2 Exchange rate

The currency used is the US dollar. The fluctuations of the exchange rates are not taken into account. For projects within Ethiopia, the assumption on the exchange rate is 1 USD = 22.26 ETB (4th November 2016).

1.2.3 Discount rate

Two discount rates are used for the calculation of costs and benefits:

- For the financial costs and benefits: 10%/year
- For the externalities: 5%/year

2. DETAILS OF CALCULATION

The second part of the report presents the assumptions and the main results for the financial analysis (paragraph 2.1) and the economic analysis (paragraph 2.2).

2.1 FINANCIAL COSTS AND BENEFITS

The financial analysis concerns the economic sectors that are planned to be developed in the scenarios, that is to say: hydropower, irrigation, fish farming and rizipisiculture. The economic sectors that are indirectly impacted (fishery in dams' reservoirs and livestock through improvement of water and food provision) are externalities of the projects and thus assessed in the paragraph 2.2.

2.1.1 Assumptions

2.1.1.1 Hydropower

Twelve hydropower dams are studied, nine of which are presented in the second draft of the SSEA, two are short term projects presented in independent reports (Majang and Kinyeti projects) and one (Akobo transboundary multipurpose project) is a long term project presented in the report "Project profiles for medium and long term projects".

The investment costs and O&M costs are presented in the table below. It is assumed that the O&M costs represent 1% of the investment costs and that the mitigation costs represent 3% of the investments costs except for TAMs for which it is 6%. The benefits of hydropower are computed using the amount of electricity produced and the price of 0.1 USD/Kwh (*Source: TAMs Feasibility study, 2014*).

The lifetime of the infrastructure is assumed to be 40 years. The non-depreciated amount of the investment is recognized as a gain at the end of the study period.

The order of priority of each project and the starting date are used to spread the costs and benefits over the time period.

Table 1 : Investment and O&M costs for hydropower projects

Site	Type (dams/run of river)	Storage capacity (Mm3)	Installed Capacity (MW)	TOTAL INVESTMENT COST 2016 USD	O&M Cost (USD/Year)	Year of Cost Estimation	Source
Sor	R-o-R	0	5	Existing dam			
Sor	Dam	311	10	36 182 000	212 000	1996	Tams project, 1997
Bibir R	Dam	2 700	467	431 376 000	2 523 000	1996	Tams project, 1997
Geba Diversion 1	R-o-R	0	215	470 543 000	3 607 000	2005	Annexe C feasibility study, 2005
Geba Diversion 2	R-o-R	0	157	196 070 000	1 503 000	2005	Annexe C feasibility study, 2005
Baro 1	Dam	1 337	166	414 146 000	3 352 000	2006	Annex 3G Detailed cost estimate, feasibility study, 2006
Baro 2	Dam	73	479	387 477 000	3 136 000	2006	Annex 3G Detailed cost estimate, feasibility study, 2007
Genji	Dam	1,5	216	142 127 000	1 150 000	2006	Annex 3G Detailed cost estimate, feasibility study, 2008
Tams	Dam	10 000	1 000	2 998 879 000	31 220 000	2014	Feasibility study, Vol. 9, 2014
Geba A	Dam	860	180	102 430 000	599 000	1996	Tams project, 1997
Akobo transboundary multipurpose development project	Dam		100	350 000 000	35 000 000	2017	BRLi estimation
Majang	R-o-R	0	0,16	640 000	25 600	2017	BRLi estimation
Kinyeti	Dam	45	2,9	3 900 000	39 000	2017	BRLi estimation

Table 2 : Project priority

Site	Type (dams/run of river)	Existing/proposed	Orden of Priority	Starting date	Ending date
Sor	R-o-R	Existing			
Sor	Dam	Proposed/Up	1	2017	2020
Bibir R	Dam	Proposed	4	2033	2038
Geba Diversion 1	R-o-R	Proposed	1	2017	2020
Geba Diversion 2	R-o-R	Proposed	1	2017	2020
Baro 1	Dam	Proposed	3	2028	2032
Baro 2	Dam	Proposed	3	2028	2032
Genji	Dam	Proposed	2	2023	2027
Tams	Dam	Proposed	1	2017	2022
Geba A	Dam	Proposed	1	2017	2020
Akobo transboundary multipurpose development project	Dam	Proposed	1	2017	2020
Majang	R-o-R	Proposed	1	2017	2020
Kinyeti	Dam	Proposed	1	2017	2020

2.1.1.2 Irrigation schemes

22 small-scale irrigation projects (including diffuse projects) and 14 large-scaled irrigation projects are studied. The tables below present the investment and O&M costs, the cropping pattern and the gross margin for each crop.

Table 3 : Investment costs, O&M costs and order of priority for irrigation projects

Site	Country	Type of project	Investment cost (USD 2016)	Annual O&M cost (USD/years)	order of Priority	Starting date	Ending date
Diffuse	Ethipia and S	Small-scale	448 490 854	4 484 909	1	2017	2014
Koji	Ethiopia	Small-scale	103 871 700	1 038 717	2	2021	2021
Sako Guda	Ethiopia	Small-scale	35 893 800	358 938	2	2021	2021
Bako	Ethiopia	Small-scale	65 178 000	651 780	3,7	2026	2026
Kilu	Ethiopia	Small-scale	42 840 000	428 400	3,6	2025	2025
Lafo Kotu	Ethiopia	Small-scale	988 686 000	9 886 860	2	2022	2022
Baro	Ethiopia	Small-scale	18 819 000	188 190	3,9	2026	2026
Bibir	Ethiopia	Small-scale	101 592 000	1 015 920	3,2	2024	2024
Fani	Ethiopia	Small-scale	21 297 600	212 976	3,1	2024	2024
Alwero	Ethiopia	Small-scale	161 166 400	1 611 664	3,8	2026	2026
Guy	Ethiopia	Small-scale	105 478 200	1 054 782	3,1	2024	2024
Godare	Ethiopia	Small-scale	43 430 000	434 300	3,11	2026	2026
Achani	Ethiopia	Small-scale	41 783 000	417 830	3,4	2024	2024
Awaya	Ethiopia	Small-scale	128 520 000	1 285 200	2	2022	2022
Babaka	Ethiopia	Small-scale	70 686 000	706 860	3,5	2025	2025
Guracha	Ethiopia	Small-scale	26 928 000	269 280	2	2021	2021
Gumero	Ethiopia	Small-scale	55 998 000	559 980	3,3	2025	2025
Akobo I	Ethiopia	Small-scale	47 812 500	478 125	2	2022	2022
Akobo II	Ethiopia	Small-scale	589 815 000	5 898 150	2	2022	2023
Alwero, Abobo dam	Ethiopia	Large-scale	-	-			
Baro River, right bank, Itang Dam, gravity conveyance	Ethiopia	Large-scale	398 528 295	3 985 283	1	2017	2021
Baro River, right bank, pumping from Itang Dam, gravity convey	Ethiopia	Large-scale	549 587 535	5 495 875	1	2022	2025
Scheme 3A (Baro River, right bank, Gambella Dam, gravity conv	Ethiopia	Large-scale	588 640 789	5 886 408	1	2026	2030
Baro River, left bank, Itang Dam, gravity conveyance	Ethiopia	Large-scale	421 580 473	4 215 805	3	2049	2052
Baro River, left bank, Itang Dam p/station, canal	Ethiopia	Large-scale	118 762 822	1 187 628	1	2029	2029
Baro River, left bank, Gambella Dam, gravity conveyance	Ethiopia	Large-scale	446 214 868	4 462 149	1	2031	2034
Alwero River, right bank, Chiru + Dumbong Dam, gravity convey	Ethiopia	Large-scale	235 601 594	2 356 016	2,1	2034	2036
Gilo River, right bank, Gilo 1 Dam, gravity	Ethiopia	Large-scale	873 905 038	8 739 050	2,2	2037	2041
Gilo River, left bank, Gilo 1 Dam, gravity	Ethiopia	Large-scale	961 020 063	9 610 201	2,4	2043	2047
Gilo River, left bank, Gilo 2 Dam, gravity	Ethiopia	Large-scale	315 862 857	3 158 629	2,5	2046	2048
Gilo River, right bank, Gilo 2 Dam, gravity	Ethiopia	Large-scale	410 522 489	4 105 225	2,3	2042	2045
Sobat	South Souda	Large-scale	769 384 441	7 693 844	1	2017	2023
Majang	Ethiopia	Small-scale	1 403 223	198 000	1	2017	2020
Kinyeti	South Souda	Small-scale	15 264 156	450 000	1	2017	2020
Akobo transboundary multipuropose development project	South Souda	Large-scale	458 000 000	13 500 000	1	2017	2020
Cingaineta River Multipurpose Development project	South Souda	Small-scale	3 816 000	112 500	NR	NR	NR

Tableau 1 : Cropping pattern for large-scaled schemes, small-scaled schemes and rainfed area

	Large scale		Small scale				Rainfed	
Concerned area	Dumbog/ Abodo/Gilo1/Gil o2/ Baro/Itang	Sobbat	Birbir	Gaba	Alwero/Gillo/ Baro	Irrigation diffuse	Rainfed Ethiopia	Rainfed Suddan
Maize (grain) WS ,RF	5%	40%	30%	25%	35%	30%	38%	40%
Maize (grain) DS, Ir	7%	30%	30%	35%	35%	33%		
Rice WS , RF								
Rice WS, Ir	25%							
Rice DS, Ir	25%							
Sorghum (grain) WS, RF		21%	11%	0%	25%	12%	30%	21%
Sorghum (grain) DS, Ir		25%	0%	0%	25%	8%		
Small grains WS, RF			25%	0%	0%	8%		
Wheat WS, RF			0%	25%	0%	8%		
Teff WS, RF			0%	30%	0%	10%		
Sugarcane , Ir	35%							
Cotton, Ir	15%							
Groundnut WS , Ir	4%	10%	0%	0%	11%	4%		10%
Groundnut DS, Ir		5%						
Soybean WS , Ir	5%						3%	
Soybean DS, Ir	11%							
Vegetables WS, Ir		1%						1%
Vegetables DS, Ir	1%	10%	0%	22%	0%	7%		
Small vegetable WS, Ir			0%	0%	1%	0%		
Small vegetable DS, Ir			0%	0%	10%	3%		
Tomato DS, Ir			0%	18%	0%	6%		
Dry beans WS, Ir		13%	7%	0%	13%	7%	7%	13%
Dry beans DS, Ir		20%	8%	0%	20%	9%		
Peppers WS, Ir			15%	10%	0%	8%		
Peppers DS, Ir			30%	20%	0%	17%		
Potato DS, Ir							9%	
Fodder, RF	1%							
Fruit			2%	0%	0%	1%	2%	
Banana, Ir		5%		0%	5%	3%	1%	5%
CROPPING INTENSITY	134%	180%	158%	185%	180%	175%	90%	90%

Tableau 2 : Gross margin (USD/ha)

Crop	Gross margin USD/ha
Maize (grain) WS ,RF	304
Maize (grain) DS, Ir	-90
Rice WS , RF	753
Rice WS, Ir	329
Rice DS, Ir	329
Sorghum (grain) WS, RF	162
Sorghum (grain) DS, Ir	-240
small grains WS, RF	1 009
Wheat WS, RF	632
Teff WS, RF	800
Sugarcane , Ir	8 080
Cotton, Ir	2 224
Groundnut WS , Ir	1 331
Groundnut DS, Ir	1 331
Soybean WS , Ir	337
Soybean DS, Ir	337
Vegetables DS, Ir	12 361
Vegetables WS, Ir(RF Garlic)	12 361
Small vegetable WS, Ir(RF Head cabbag	1 958
Small vegetable DS, Ir	602
Tomato DS, Ir	5 035
Dry beans WS, Ir(RF)	150
Dry beans DS, Ir	150
Peppers WS, Ir(RF)	1 830
Peppers DS, Ir	1 830
Potato DS, Ir	2 772
Fodder, RF	1 395
Fruit	4 629
Banana, Ir	4 629

2.1.1.3 Fish farming

The following are the the assumptions for the evaluation of fish farming costs and benefits:

- Fish farming represents 1% of irrigated areas,
- The average size of ponds is 300 m²,
- The average yield is 2.5 tons/ha/year,
- The investment costs equals 159 USD/ton,
- The gross margin equals 276 USD/ton.

2.1.1.4 Rizipisiculture

The following are the assumptions for the evaluation of rizipisiculture costs and benefits:

- Rizipisiculture represents 1% of irrigated areas of rice,
- The average yield is 650 kg/ha/year,
- The number of alvins per ha is 2500 which costs 0.03 USD.
- The investment costs equals 159 USD/ton,
- The gross margin equals 276 USD/ton.

2.1.2 Main results of the financial analysis

The overall plan has good financial ratios: the total Financial Net Present Value is **7 964 MUSD** and the financial rate of return is **1415%.**

Analyzed by sector on an aggregated basis, all the sector will profit from the action plan. Indeed, all the economic sectors present:

- A Financial Internal Rate of Return (FIRR) superior to 10%,
- A positive Financial Net Present Value (FNPV) *(sum of all discounted cash flows over the time period)* and,
- A ratio benefits/costs superior to 1.

Figure 1 : Financial profitability for each economic sector and country

Sector	Financial Internal Rate of Return (%)	Financial Net Present Value (MUSD)	Benefits/Costs
Hydropower projects in Ethiopia	367%	6 154	12
Hydropower projects in South Sudan	16%	119	2
Small scaled irrigation in Ethiopia	NR	1 249	5
Large scaled irrigation in Ethiopia	38%	1 351	16
Large scaled irrigation in South Sudan	21%	480	3
Fish farming and rizipisiciculture in Ethiopia	NR	11	139
Fish farming and rizipisiciculture in South Sudan	48%	2	94

2.2 EXTERNALITIES

Hydropower and irrigation projects generate different externalities for the environment, the local economy and the population. Due to their very nature (they are not priced in the market), externalities are difficult to monetarize. Not all the externalities could have been evaluated in the CBA. The following table presents the externalities of the projects and either or not they are taken into account in the CBA.

Table 4 : Externalities of the project and method of evaluation

Externality	Details	Positive/Negative impact	Taken into account in the CBA analysis	Method of evaluation
ENVIRONMENTAL EXTERNALITIES				
Avoided cost of deforestation	The installation of hydropower dams will allow to reduce deforestation as charcoal is the first source of energy used in the region. Besides the irrigation schemes, as they provide a better crop yield than rainfed agriculture, will favor a reduction of land use for agriculture and thus limit deforestation.	**Positive externality**	**Yes**	Economic value of forest per ha*Preserved area of forest **For hydropower:** Preserved area = production of biomass per ha*conversion coefficient (weight of wood equivalent to one GWh) **For agriculture:** Preserved area = surplus of agricultural area in the scenario without project * % of forested area * inertia coefficient
Environmental footprint	The land use for dams and irrigation schemes jeopardize a part of natural land	**Negative externality**	**Yes**	Economic value of the different land use per ha*Destroyed area
Degradation of downstream wetlands	The modification of flows impacts the downstream flooded areas and the state of wetlands	**Negative externality**	**Yes**	Economic value of wetlands per ha*Destroyed area
Degradation of downstream rivers services	The modification of flows impacts the services of downstream rivers	**Negative externality**	No	Not evaluated
GHG emissions	The GHG emissions increase due to the projects	**Negative externality**	**Yes**	Increase in GHG emissions*Carbon price
ECONOMIC EXTERNALITIES				
Local development due to new infrastructures (roads, …)	The construction of new infrastructures will stimulates the local economy with new services (school, hospital, shops, etc.)	**Positive externality**	No	Not evaluated
Development of fishery in the reservoir	The dams' reservoirs will allow to develop fishery	**Positive externality**	**Yes**	Production of fish*Gross margin
Improvement of livestock conditions	The dams will favor the access to water for livestock and the large-scaled irrigation schemes will produce fodder and secure the livestock feeding. This leads to a change from pastoralism towards agro-pastoralism practices, a better weight of the livestock and an increase of the off-take rate.	**Positive externality**	**Yes**	Increase in the amount of meat and milk produced*Price
Navigation	The dams will regulate the flows and impact the number of navigable days	**Positive externality**	**Yes**	Avoided investment costs of the construction of a road between Gambella and Baro mouth
SOCIAL EXTERNALITIES				
Employment	Development of agriculture, hydropower, fishery employment	**Positive externality**	**Yes**	Average labor costs*number of created jobs
Flooding protection	The hydropower dams will regulate the flows and reduce the flooding hazards	**Positive externality**	**Yes**	Average annual avoided costs of flooding
Health improvement	The development of the local economy, the provision of water, food and electricity will improve the health of the population	**Positive externality**	**Yes**	Increase in the life expectancy*Average salary
Energy security	Hydropower projects will favor the access to energy	**Positive externality**	No	Not evaluated

2.2.1 Assumptions

2.2.1.1 Environmental externalities

AVOIDED COSTS OF DEFORESTATION DUE TO HYDROPOWER

The construction of hydropower dams will allow to provide energy at the regional level. As the current main source of energy used is charcoal, the hydropower projects will generate a reduction of deforestation.

The reduction of deforestation is evaluated from the following data:

- Conversion coefficient: 1 ton of humid wood equals 0.0022 GWh (source: CRPF Limousin)
- Total economic value of Ethiopian forests: 1000 USD/ha (source: BRLi from CEEPA, Accounting for the value of the environment, 2010 and TEEB, 2007),
- The biomass coefficient for Ethiopian forest: 200 tons/ha,
- Surface of preserved forest: 279 km².

AVOIDED COSTS OF DEFORESTATION DUE TO IRRIGATION SCHEMES

The irrigation schemes will provide a better crop yield than rainfed agriculture. They will favor a reduction of land use for agriculture and thus limit deforestation. The following assumptions are made:

- The irrigated crop yield is on average 1.4 higher than the rainfed crop yield,
- The surface of forest on agricultural new land represents 10% of the total area,
- The economic value of forest equals 1000 USD/ha (see: Table 5).

ENVIRONMENTAL FOOTPRINT

The environmental footprint of the projects is evaluated from the total economic value of each type of land use destroyed and the surface destroyed. The value of the land uses concerned are shown in the flowing table.

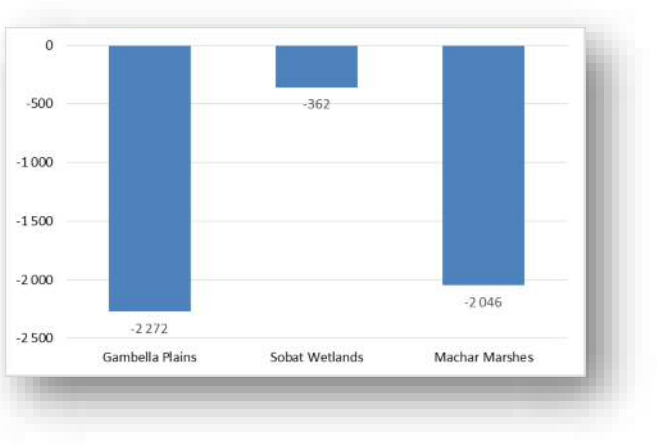
Table 5 : Economic value of each land used concerned by the projects' footprint

Type of land use	Total economic value (USD/ha)	Source
Forest	1000	BRLi from CEEPA, 2010 and De Groot et al, 2010
Wetlands	890	BRLi from Gowdy, 2008
Savanna	752	De Groot et al, 2010
Pastureland	430	BRLi (yield of pastureland*fodder price)
Irrigated areas	860	BRLi (average of small scaled schemes' gross margin)

DEGRADATION OF DOWNSTREAM WETLANDS SERVICES

Three main downstream wetlands are impacted by the regulation of the flows by the dams: Gambella plains, Sobat wetlands and Machar Marshes. Their surface will decrease. The chart below shows the loss of the average annual maximum surface for each wetland. The economic analysis uses this loss (of the maximum area) to monetarize the impact as the wetlands services depend on this surface area. The costs of the degradation of the downstream wetlands services is evaluated from the economic value of wetlands (see table above: 890 USD/ha).

Figure 2 : Loss of the average annual maximum surface area (km²) for the three downstream wetlands imapcted



RISE IN GHG EMISSIONS

The clearing and the burning of lands during the construction and the creation of the dams' reservoirs will rise the GHG emissions. They are evaluated at a value of 4.4 Mt. This externality is assessed from the quantity of GHG emission and the lowest carbon price on the market at the international level (1 USD/ton; World Bank, 2015).

Table 6 : Emission of CO_2 eq for each scenario

Tonnes of CO2eq emissions per year (10^6 T)		
Scenarios	**Land clearing for irrigation development**	**GHG emissions from the reservoirs**
Sc0	0,04	0,01
Sc1	2,78	0,33
Sc2	2,78	0,35
Sc3a	2,78	0,35
Sc3b	4,05	0,35
Sc4a	4,05	0,35
Sc4b	4,05	0,35

2.2.1.2 Social externalities

INCREASE OF EMPLOYMENT

The projects will create employment. The analysis distinguishes direct and indirect employment. The global assumptions are:

- The number of working days per year is assumed to be 242,
- The average labor cost equals 2 USD/day
- The fishermen earning is 1.8 USD/day.

For the hydropower sector, it is assumed that the number of full time job per GWh marketed is 0.2 and for the fisheries and the fish farming sector, it is assumed that one fisherman is needed for the production of 3 tons of fish per year.

The direct employment for the agricultural sector is evaluated from a ratio of full time equivalent per hectare per year for each crop. The assumptions are shown on the following table:

Table 7 : Full time equivalent worker/ha/year for each crop

Crops	Full time equivalent workers/ha/year
Maize (grain) WS ,RF	0,14
Maize (grain) DS, Ir	0,14
Rice WS , RF	0,29
Rice WS, Ir	0,29
Rice DS, Ir	0,29
Sorghum (grain) WS, RF	0,14
Sorghum (grain) DS, Ir	0,14
small grains WS, RF	0,14
Wheat WS, RF	0,14
Teff WS, RF	0,14
Sugarcane , Ir	0,17
Cotton, Ir	0,62
Groundnut WS , Ir	0,41
Groundnut DS, Ir	0,41
Soybean WS , Ir	0,37
Soybean DS, Ir	0,37
Vegetables DS, Ir	0,37
Vegetables WS, Ir(RF Garlic)	0,37
Small vegetable WS, Ir(RF Head cabbage)	0,37
Small vegetable DS, Ir	0,37
Tomato DS, Ir	0,37
Dry beans WS, Ir(RF)	0,37
Dry beans DS, Ir	0,37
Peppers WS, Ir(RF)	0,37
Peppers DS, Ir	0,37
Potato DS, Ir	0,37
Fodder, RF	0,14
Fruit	0,37
Banana, Ir	0,37

The assumptions concerning the indirect employment are showned in the table below :

Table 8 : Assumptions for the assessment of the creation of indirect employment

Sector	Indirect job creation
Agriculture	30% of direct agricultural employment upstream and 50% downstream
Hydropower	300% of direct hydropower employment
Fisheries	100% of direct fishery employment
Other indirect employment	20% of all employments

IMPROVEMENT OF HEALTH

The access to electricity, the improvement of the access to water and to food security will lead to a better general health of the beneficiary population (cf. Table 9). It is considered that over the first ten years of the project the life expectancy will increase of one year in the case of a full development of both hydropower and irrigation.

Table 9 : Part of the population who benefits from the projects per basin

Sub-basin	Part of the population who benefits from HP	Part of the population who benefits from the irrigation schemes
Machar marshes	13%	20%
Birbir	10%	15%
Geba	9%	16%
Alwero	1%	30%
Gilo	5%	40%
Lower Akobo	2%	8%
Agwei	6%	0%
Upper Akobo	5%	11%
Upper Pibor East	18%	0%
Upper Pibor West	9%	0%
Lower Pibor	4%	0%
Sobat	14%	26%
Baro	5%	33%

The benefits of the increase of the life expectancy is evaluated from the average salary (2 USD/day) and the life expectancy (63 years (World Bank)).

2.2.1.3 Economic externalities

IMPROVEMENT OF LIVESTOCK CONDITIONS

The creation of the dams' reservoirs and the fodder crop development will favor the livestock productivity and encourage a change of practices from pastoralism towards agro-pastoralism. Currently the split between pastoralism and agro-pastoralism is 75% - 25% and the project will lead to a repartition 70%-30%.

The basins concerned are: Marmachar Marshes, Birbir, Geba, Alwero, Gilo, Lower and Upper Akobo, Sobat and Baro.

The other changes are the rising of the off-take rate (from 2% to 5% for pastoral system and from 5% to 10% for agro-pastoral system). The weight of the livestock will increase as well (see table below) and the production of milk also.

Table 10 : Assumptions for meat production

	Without scenario				With scenarios			
	Cattle	Sheep	Goats	Chicken	Cattle	Sheep	Goats	Chicken
Average alive weight (kg)	300	25	25	1	450	35	35	1
Rate weight meat/alive weigth	0,4	0,4	0,4	0,7	0,4	0,4	0,4	0,7

Table 11 : Assumptions for milk production

	Without scenario	With scenario
% of femel for cattle	50%	50%
% of dairy cow milk among femel cattle	30%	60%
Average production/head/day (l)	1,0	2,5
Number of days of production/year	263	263

INCREASE OF THE NUMBER OF NAVIGABLE DAYS BETWEEN GAMBELLA AND BARO MOUTH

The number of navigable days on the Baro river between Gambella and the confluence with the Sobat will increase. This benefit is evaluated from the avoided investment cost of the construction of a road between Gambella and Baro mouth, that represents 160 km. The investment cost of a road is around 444 300 USD/km (updated cost from M. Abebe, 2003).

2.2.2 Evaluation of the externalities

The sum of the externalities over the time period is presented on the chart and the table below. The environmental externalities are negative and the social and economic externalities are positive. The total is negative which mean the negative externalities are more important than the positive externalities.

Figure 3 : Externalities of the projects (Millions 2016USD)

Environmental externalities	
Avoided costs of deforestation HP	823
Avoided costs of deforestation - Irrigation	513
Total environmental footprint	-18 302
Degradation of downstream wetlands	-25 811
Rise of GHG emissions	-2 902
Preservation of ecosystem (Boma-Gambella park)	798
Total environmental externalities	**-44 880**
Total discounted externalities environmental externalities	***-14 126***
Social externalities	
Fisheries employment	34
Fish farming employment	56
Rizipisciculture employment	2
Agricultural employment in Ethiopia	2 747
Agricultural employment in Sudan	1 644
Hydropower employment	4 093
Other employment	1 715
Flooding protection	52
Health improvement	17 272
Externalities of Kinyeti project	247
Total Social externalities	**27 863**
Total discounted social externalities	***9 012***
Economic externalities	
Meat production in Ethiopia	499
Meat production in Sudan	1 415
Milk production in Ethiopia	1 159
Milk production in Sudan	3 031
Fisheries (indirect HP profits)	32
Increase in the number of navigable days	71
Externalities of Majang project	2
Total economic externalities	**6 210**
Total discounted social externalities	***2 070***
Total externalities	**-10 807**
Total discounted externalities	**-3 044**

2.2.3 Main results of the economic analysis

The action plan has good economic ratios, even if they are lower than the financial ones, due to the fact that the total of the externalities are negative: the Economic Net Present Value is **5 020 MUSD** and the economic rate of return is **54,4 %.** The Benefits/Costs ratio equals to **1.23.**

Analyzed by sector on an aggregated basis, all the sector will be benefic on the society except the large-scaled irrigation in South Sudan which appear negative due to important negative environmental externalities.

The following table presents the economic ratio for each economic sector and country.

Tableau 3 : Economic ratios for each economic sector and country

Sector	EIRR (%)	ENPV (MUSD)	Economic benefits/costs
Hydropower project in Ethiopia	51%	2 418	1
Hydropower project in South Sudan	16%	119	2
Small scaled irrigation in Ethiopia	NR	925	2
Large scaled irrigation in Ethiopia	42%	1 627	2
Large scaled irrigation in South Sudan	9%	-528	0,9
Fish farming and rizipisiciculture in Ethiopia	NR	27	318
Fish farming and rizipisiciculture in South Sudan	56%	5	210

2.3 SENSITIVITY ANALYSIS

The sensitivity analysis aims to identify the project's critical variables. The process involves changing project variables by a given percentage and noting the respective changes in financial and economic performance of the project as measured by the net present value. As part of this process, the identified variables are varied one at a time, keeping the other variables constant.

A sensitivity analysis is applied to the project items that are numerically large or where there is considerable uncertainty: Investment costs, O&M costs, hydroelectricity price, crops benefits, benefits from livestock development, benefits from fish farming and rizi-pisciculture, environmental externalities and social externalities. The variation on the variables which are tested go from -20% to +20%.

The results show a very good robustness of the action plan as none of the variations implies a negative net present value or a benefits/costs ratio inferior to 1. It should be noted that the large-scaled irrigation in South Sudan present a negative economic NPV in any cases.

The details are presented in the table below.

VARIATION OF INVESTMENT COSTS

	-20%			-10%			0%			10%			20%		
	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C
Global	9 206	6 263	1,3	8 584	5 641	1,3	7 963	5 020	1	7 341	4 399	1,2	6 720	3 777	1,2
Hydropower projects in Ethiopia	6 628	2 893	1,4	6 391	2 655	1,4	6 154	2 418	1	5 916	2 181	1,4	5 679	1 944	1,4
Hydropower projects in South Sudan	119	119	1,7	119	119	1,7	119	119	2	119	119	1,7	119	119	1,7
Small scaled irrigation in Ethiopia	1 000	675	1,4	1 124	800	1,5	1 249	925	2	1 374	1 050	1,8	1 499	1 175	1,9
Large scaled irrigation in Ethiopia	1 297	1 573	1,5	1 324	1 600	1,6	1 351	1 627	2	1 377	1 653	1,6	1 404	1 680	1,7
Large scaled irrigation in South Sudan	457	-552	0,9	469	-540	0,9	480	-528	1	492	-516	0,9	504	-504	1,0
Fish farming and rizipisiciculture in Ethiopia	11	27	113,6	11	27	167,4	11	27	318	11	27	3 181,3	11	27	-397,7
Fish farming and rizipisiciculture in South Sudan	2	5	75,0	2	5	110,6	2	5	210	2	5	2 101,2	2	5	-262,7

VARIATION OF O&M COSTS

	-20%			-10%			0%			10%			20%		
	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C
Global	8 099	5 156	1,2	8 031	5 088	1,2	7 963	5 020	1	7 895	4 952	1,2	7 827	4 884	1,2
Hydropower projects in Ethiopia	6 205	2 470	1,4	6 179	2 444	1,4	6 154	2 418	1	6 128	2 392	1,4	6 102	2 367	1,4
Hydropower projects in South Sudan	121	121	1,7	120	120	1,7	119	119	2	118	118	1,7	117	117	1,7
Small scaled irrigation in Ethiopia	1 249	925	1,6	1 249	925	1,6	1 249	925	2	1 249	925	1,6	1 249	925	1,6
Large scaled irrigation in Ethiopia	1 351	1 627	1,6	1 351	1 627	1,6	1 351	1 627	2	1 351	1 627	1,6	1 351	1 627	1,6
Large scaled irrigation in South Sudan	484	-525	0,9	482	-526	0,9	480	-528	1	479	-530	0,9	477	-532	0,9
Fish farming and rizipisiciculture in Ethiopia	11	27	318,1	11	27	318,1	11	27	318	11	27	318,1	11	27	318,1
Fish farming and rizipisiciculture in South Sudan	2	5	210,1	2	5	210,1	2	5	210	2	5	210,1	2	5	210,1

VARIATION OF HYDROELECTRICIRY PRICE

	-20%			-10%			0%			10%			20%		
	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C
Global	6 126	3 184	1,1	7 045	4 102	1,2	7 963	5 020	1	8 881	5 938	1,3	9 799	6 856	1,3
Hydropower projects in Ethiopia	4 366	631	1,2	5 260	1 524	1,3	6 154	2 418	1	7 047	3 312	1,5	7 941	4 206	1,6
Hydropower projects in South Sudan	63	63	1,4	91	91	1,5	119	119	2	147	147	1,9	176	176	2,0

VARIATION OF CROPS BENEFITS

	-20%			-10%			0%			10%			20%		
	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C
Global	6 790	3 847	1,2	7 376	4 433	1,2	7 963	5 020	1	8 549	5 606	1,3	9 136	6 193	1,3
Small scaled irrigation in Ethiopia	1 249	924	1,6	1 249	925	1,6	1 249	925	2	1 249	925	1,6	1 250	926	1,6
Large scaled irrigation in Ethiopia	1 351	1 627	1,6	1 351	1 627	1,6	1 351	1 627	2	1 351	1 627	1,6	1 351	1 627	1,6
Large scaled irrigation in South Sudan	480	-528	0,9	480	-528	0,9	480	-528	1	480	-528	0,9	480	-528	0,9
Fish farming and rizipisiciculture in Ethiopia	11	27	318,1	11	27	318,1	11	27	318	11	27	318,1	11	27	318,1
Fish farming and rizipisiciculture in South Sudan	2	5	210,1	2	5	210,1	2	5	210	2	5	210,1	2	5	210,1

VARIATION OF MEAT AND MILK BENEFITS

	-20%			-10%			0%			10%			20%		
	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C
Global	7 963	4 596	1,2	7 963	4 808	1,2	7 963	5 020	1	7 963	5 232	1,2	7 963	5 444	1,3
Hydropower projects in Ethiopia	6 154	2 205	1,4	6 154	2 311	1,4	6 154	2 418	1	6 154	2 525	1,4	6 154	2 631	1,4
Hydropower projects in South Sudan	119	119	1,7	119	119	1,7	119	119	2	119	119	1,7	119	119	1,7

VARIATION OF FISH FARMING AND RIZIPISCIULTURE BENEFITS

	-20%			-10%			0%			10%			20%		
	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C
Global	7 960	5 514	1,3	7 961	5 239	1,2	7 963	5 020	1	7 964	4 841	1,2	7 966	4 692	1,2
Fish farming and rizipisiciculture in Ethiopia	11	31	363,0	11	29	338,1	11	27	318	11	26	301,8	11	24	288,2
Fish farming and rizipisiciculture in South Sudan	2	6	239,2	2	5	223,1	2	5	210	2	5	199,5	2	5	190,7

VARIATION OF ENVIRONMENTAL EXTERNALITIES

	-20%			-10%			0%			10%			20%		
	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C
Global	7 995	7 877	1,4	7 979	6 448	1,3	7 963	5 020	1	7 947	3 591	1,2	7 931	2 163	1,1
Hydropower projects in Ethiopia	6 154	2 361	1,4	6 154	2 389	1,4	6 154	2 418	1	6 154	2 447	1,4	6 154	2 475	1,4
Hydropower projects in South Sudan	119	119	1,7	119	119	1,7	119	119	2	119	119	1,7	119	119	1,7
Small scaled irrigation in Ethiopia	1 249	922	1,6	1 249	923	1,6	1 249	925	2	1 249	927	1,6	1 249	928	1,6
Large scaled irrigation in Ethiopia	1 351	1 596	1,6	1 351	1 611	1,6	1 351	1 627	2	1 351	1 642	1,6	1 351	1 657	1,6
Large scaled irrigation in South Sudan	480	-529	0,9	480	-529	0,9	480	-528	1	480	-527	0,9	480	-527	0,9
Fish farming and rizipisiciculture in Ethiopia	11	27	318,1	11	27	318,1	11	27	318	11	27	318,1	11	27	318,1
Fish farming and rizipisiciculture in South Sudan	2	5	210,1	2	5	210,1	2	5	210	2	5	210,1	2	5	210,1

VARIATION OF SOCIAL EXTERNALITIES

	-20%			-10%			0%			10%			20%		
	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C
Global	7 963	3 108	1,1	7 963	4 058	1,2	7 963	5 020	1	7 963	5 994	1,3	7 963	6 981	1,3
Hydropower projects in Ethiopia	6 154	2 091	1,4	6 154	2 254	1,4	6 154	2 418	1	6 154	2 582	1,4	6 154	2 745	1,4
Hydropower projects in South Sudan	119	119	1,7	119	119	1,7	119	119	2	119	119	1,7	119	119	1,7
Small scaled irrigation in Ethiopia	1 249	798	1,5	1 249	861	1,6	1 249	925	2	1 249	989	1,7	1 249	1 052	1,7
Large scaled irrigation in Ethiopia	1 351	1 627	1,6	1 351	1 627	1,6	1 351	1 627	2	1 351	1 627	1,6	1 351	1 627	1,6
Large scaled irrigation in South Sudan	480	-528	0,9	480	-528	0,9	480	-528	1	480	-528	0,9	480	-528	0,9
Fish farming and rizipisiciculture in Ethiopia	11	27	318,1	11	27	318,1	11	27	318	11	27	318,1	11	27	318,1
Fish farming and rizipisiciculture in South Sudan	2	5	210,1	2	5	210,1	2	5	210	2	5	210,1	2	5	210,1

VARIATION OF INTEREST RATE

	2%			4%			6%			8%		
	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C	FNPV	ENPV	B/C
Global	8 515	5 572	1,3	7 963	5 020	1	7 369	4 426	1,2	6 737	3 794	1,2
Hydropower projects in Ethiopia	6 427	2 692	1,4	6 154	2 418	1	5 860	2 124	1,4	5 547	1 811	1,4
Hydropower projects in South Sudan	119	119	1,7	119	119	2	119	119	1,7	119	119	1,7
Small scaled irrigation in Ethiopia	1 249	925	1,6	1 249	925	2	1 249	925	1,6	1 249	925	1,6
Large scaled irrigation in Ethiopia	1 454	1 730	1,6	1 351	1 627	2	1 240	1 515	1,6	1 121	1 397	1,6
Large scaled irrigation in South Sudan	529	-479	0,9	480	-528	1	428	-581	0,9	372	-636	0,9
Fish farming and rizipisiciculture in Ethiopia	11	27	318,1	11	27	318	11	27	318,1	11	27	318,1
Fish farming and rizipisiciculture in South Sudan	2	5	210,1	2	5	210	2	5	210,1	2	5	210,1

3. SCHEME MANAGEMENT OPTIONS

The issue of the sustainable operation and maintenance (O&M) of medium to large public irrigation infrastructure is quite complex and until now no ideal alternative has been found. However, a number of options have been tried across the world in order to set up adapted Management Units in charge of the operation and maintenance (O&M) of irrigation infrastructure. Each country and each scheme has its own features that make the issue even more complicated. International experience shows three main options for the management of public infrastructure in the irrigation sector:

- Management through a Public Institution;
- Management through Water Users Associations (WUAs); and
- Management through a Public Private Partnership (PPP) arrangement.

Often other alternatives are tried that combine the above options. For example, under the Kpong Irrigation Scheme (KIS) an initial plan was to have a participatory management between the Public Institution (GIDA) and the Farmers' Groups (OACS) with the farmers' groups formed and legalised as a Cooperative.

Management through a Public Institution, such as GIDA in Ghana, has shown limitations. And, these limitations are generally noted worldwide. Other forms of public institutions such as the "Office of Irrigation" in Morocco or the Ouest African Scheme Development Companies for large irrigation schemes such as SAED (Senegal); SODAGRI (Senegal), ONAHA (Niger), ON (Mali), and SONADER (Mauritania), have all faced a number of problems in terms of irrigation scheme management and sustainable O&M, which have required very direct institutional and procedural reforms.

3.1 REVIEW OF INTERNATIONAL PRACTICES IN TERMS OF PUBLIC MANAGEMENT

Functions of Public Irrigation Organisations:

Public Irrigation Organisations have been implemented in West Africa since the 1970's. They were the major actors of rural development at that time but their role and missions have been reduced after realizing their lack of efficiency. Today, they are still important stakeholders of irrigation systems and agricultural development. They generally can play multiple roles. For example, in West Africa, they have at least four functions:

(i) The authority for infrastructure projects: They initiate and monitor the design and construction of the infrastructure, which are realized by private sector companies (Consultants and Contractors) selected on the basis of a request for tender.

(ii) Irrigation management, operation and maintenance of the irrigation infrastructure: This function is more and more delegated to Water Users' Associations (WUAs). The repositioning of the responsibility for the irrigation maintenance between Public Organizations and WUAs is usually determined according to the type of irrigation network, where the Public Organizations are in charge of the maintenance of the primary networks (main or main and secondary) while the WUAs manage either the secondary and tertiary networks or just the tertiary network.

(iii) Support and advice to farmers: Public Organizations provide support and advice to farmers concerning three main activities; irrigation techniques, improvement and development of farms and in some cases creation of farmers' cooperatives/associations to manage irrigated areas (training on administrative and financial management).

(iv) Land Management: This last function is more or less important according to the degree of involvement of third parties; farmers, private sector, etc.

The role of Public Organisations has considerably evolved since their creation. They used to be the main actors of irrigation and agricultural development but their internal functioning has been put into question by farmers and International Donors. Public Organizations turned out to be inefficient (bureaucratic burdens, corruption, etc.) and highly expensive. Their costs (notably labour costs) were supported by the Government (National or Regional). Besides, despite the enormous amount of money spent, Public Organizations were not conducive to improving the value of irrigated areas. This explains why the size of Public Organisations was reduced during the 1980's and their missions (tasks and activities) partly transferred to Local Associations or Cooperatives.

Lessons Learnt:

After several decades of experience, it is now possible to see more clearly the good practices in terms of Public Organizations for irrigation. Their omnipresence in irrigation and agricultural development turned out to be inefficient, but this did not lead to their suppression. They, indeed, have a key role to play as they have experience and knowledge of the agricultural sector. The formulation of a few recommendations can be done for redefining their place in rural areas:

- First they should develop interconnections with the other actors/parties that have emerged (WUAs and Cooperatives, private companies for PPP, etc.) and rely on them for specific functions or missions where they appear to be more relevant and efficient;
- As the economic impacts of the management and operation of the public organizations on Government budgets were significant, they should be financially autonomous. This implies the implementation of a sustainable pricing policy for irrigation services.

  This is a tricky point as it is essential to also consider the social acceptance of the pricing policy (farmers/irrigators/users ability to pay). The pursuit of the two goals, cost recovery and social acceptance, is not always easy as cost recovery implies higher water prices, which is definitely necessary if irrigated agriculture is to be sustainable. Otherwise the management remains with the public sector with Government again accepting the funding or assists with subsidy funding. The agricultural policy has a role to play here. Indeed, the proper functioning of the water sector depends on the performance of the agricultural sector, and thus on the agricultural policy. To finance a sustainable irrigation system, farmers must have sufficient income through increased productivity. The agricultural policy has to guide the choice of crops towards high value added crops or easily marketable crops. Besides, to facilitate the social acceptance of price increases in the water charges/fees, the Government should implement, at the same time, several measures to maintain the farmers' revenue/income; preferential tariffs, subsidies for more efficient irrigation techniques, an awareness campaign, etc.
- Public Organizations have witnessed a "skills drain" as salaries are low and experienced employees prefer working for the private sector, which are more remunerative and as the public organisations are restructured in terms of size and their missions in an endeavour to decrease the high levels of bureaucracy and costs. To maintain a reasonable level of specialist skills, a recommendation would be to put in place a more rewarding and incentive wages policy for the public organisations.

Specific Risks:

Public organizations face specific risks.

First they can represent a constraint for farmers as they limit their autonomy to manage agricultural and irrigation development.

Secondly, farmers can be reluctant to pay for irrigation services as they are not guaranteed that it will improve the services (corruption, investment in other fields, etc.). A low collection rate of the fees would induce a low cost recovery and lead to a reduction in the irrigation service provided; an inadequate infrastructure maintenance program leading to the deterioration of the infrastructure which subsequently leads to a poor and inefficient delivery of water to the farmers which in turn leads to a stronger reluctance by the farmers to pay their water charges, etc. To avoid this vicious cycle and assure the sustainability of irrigation schemes, the farmers' participation is essential at all stages.

Another risk is due to the progressive withdrawal of the Government from the economic sectors. Public organizations have to find other sources of financing that might not be as steady as Government funding. This can represent a risk for investments in the long-term as irrigation pricing policy, in a number of countries, only allows the Scheme Management Entity to only recover the scheme's O&M costs. This is definitely very poor policy from Governments through their lack of understanding or their means of "political favour". Irrigation pricing, the water charge, must be inclusive of all of the following costs; management (administration and financial), staffing, training, operational costs, maintenance program costs, future planned replacement of infrastructure and equipment costs, irrigation and agricultural training costs and extension costs, etc. Failure to include will at some stage ensure that the irrigation scheme fails to be sustainable. The "true cost of water" needs to be applied from immediately after the commissioning of the irrigation scheme following construction or rehabilitation.

3.2 REVIEW OF INTERNATIONAL PRACTICES IN TERMS OF PPP IN THE IRRIGATION SECTOR

This section discusses the various types of contractual arrangements that may be entered into between Government Agencies and Private Sector Entities under a PPP.

Table 3-1, below illustrates the diversity of PPP arrangements that can be designed, using three main criteria, namely:

- The source of the revenue for the Private Sector Operator (paid by the final users or paid by the public authority, the contracting authority);
- The different functions assigned to the Private Sector Partner through the PPP contract (design, construction, etc.);
- The contribution (if any) of the Private Sector Partner to the capital expenditure (CAPEX) of the Project.

The various options are worth discussing. The contracting authority can request the private partner to; (a) finance infrastructure (i.e. provide funds to pay for infrastructure costs through equity and loans), (b) design infrastructure (e.g., prepare alternatives to provide the services, use innovative technologies and approaches in the construction phase), and/or (c) manage and maintain the infrastructure (e.g. define the organisational structure, staff requirements, incentives and salary package, operational procedures and manuals, maintenance manual). For revenue, the private sector partner could rely on either or a combination of; user fees, payments from the public contracting authority, or funds made available by the Government as payment, or as a subsidy to the operator for providing the service.

The contribution of the Private Sector Partner to CAPEX can range from 0% to 100%. The level of risk borne by the Private Sector Operator can vary widely from one case to another and from one model to another. The higher the risk, the higher should be the return offered to the Private Sector Partner as the incentive provided by the Contracting Public Authority. And, the higher the return, the higher will be the cost to the final users. The Contracting Authority, with the help of transaction advisors, has to find the correct trade-off by allocating risks to the party able to best bear these risks so as to reduce the burden on the final users. For instance, if the Contracting Authority has the power to change the nature of the service provided through a Legislative or Regulatory Act, then the Private Sector Partner has to be protected from such a move. The Private Sector Partner can insure itself from the occurrence of such an event, or the Contracting Authority can provide a formal commitment to avoid such a change. Both actions have the same effect, but the first one will increase the cost of providing the service, while the second will have no effect on costs.

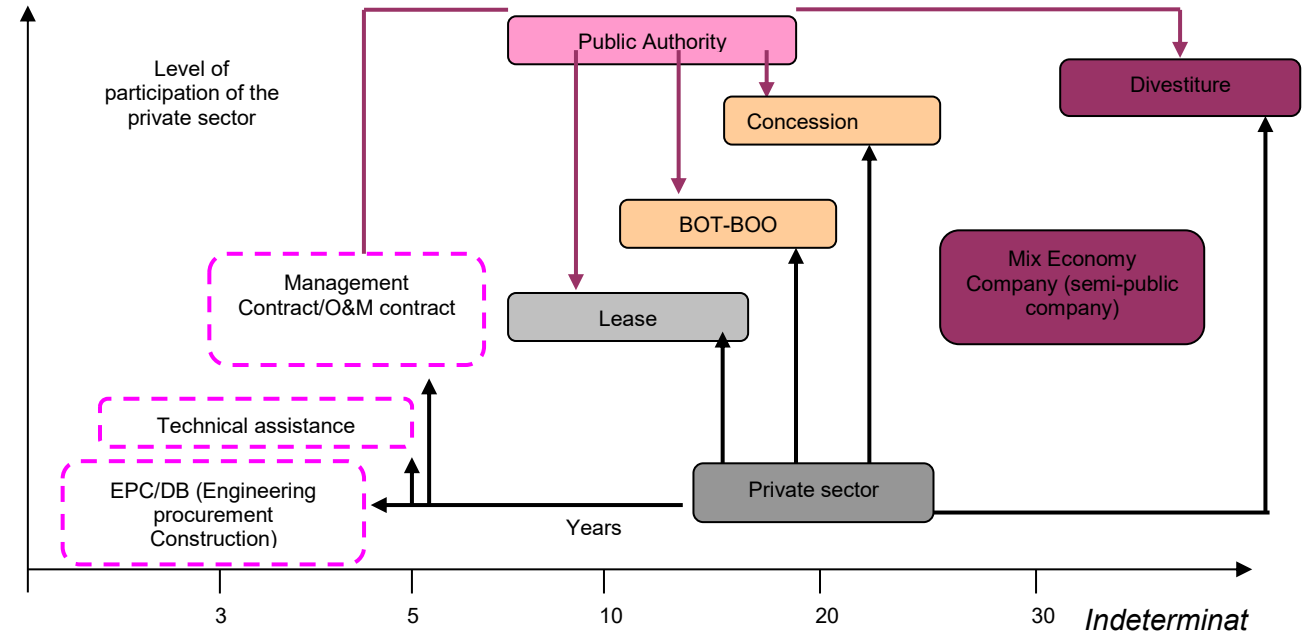
Table 3-1: Main PPP Transaction Models according to Origin of Revenue for Private Sector Partner and Functions Delegated and Sharing of Investment Functions

Origin of revenues for private operator	Functions under responsability of private operator	Participation of private operator in investment functions (capital costs) ?	
		Yes	No
Services paid to the private operator **by the final users (farmers)** - Public Service Delegation (PSD)	Design	Concession	Lease / Affremage
	Construction		
	Transfer of infrastructures after completion of construction		
	Operation & Maintenance		
	Ownership of O&M assets		
	Ownership of infrastructures	Divestiture	
	Possible transfer of infrastructures after completion of PPP contract		
Services paid to the private operator by the **Public Authority**	Design	BOT	Manag. contract
	Construction/supervision of work		
	Management (staff of private operator in Public Entity)		
	Operation & Maintenance		O&M contract
	Ownership of O&M assets		EPC - DB
	Transfer of infrastructures after completion of construction		DBO = EPC + O&M contracts
	Ownership of infrastructures	BOO	

Legend:
Differences between lease and affermage is in the rent paid to the Contracting Authority (lease fees: fixed rent / Affermage fees : varying on revenues collected from users)
BOT : Build Operate Transfer
BOO: Buid Operate Own
Manag. Contract : Management contract
O&M Contract : Operation & Maintenance contract
EPC / DB : Engineering Procurement Construction (also called Design Build)
DBO : Design Build Operate (contract with EPC + O&M together)
Source: BRLi

Figure 3-1 below provides additional information on the different forms of PPP based on two other important criteria, namely:

- The duration of the contract; and
- The implication for the private sector.



Source: A Particular PPP; Mix economic society; V. CASTRO ET J. JANSSENS; AFD; fev2011

Figure 3-1: Comparison of PPP Models - Duration and Level of Participation

The x-axis represents the years of contract. The closer the PPP Model is on the right side of the graphic, the longer will be the duration over which the Public Authority and Private Sectors are engaged.

The vertical axis represents the level of participation of the Private Sector. The higher the PPP Model on the graphic, the higher will be the level of participation of the Private Sector.

To date, the number of PPP within irrigation sectors and schemes around the World is rising and the most frequent arrangement set-ups are; (i) Concessional arrangement (ii) Contract management arrangement, and (iii) Semi-public company. In addition to the projects that have already been implemented under a PPP (Morocco/Ethiopia/Brazil/France/Spain/etc.), a number of feasibility studies for PPP implementation are in process or have been carried out over the last six years with examples in; Morocco, Zambia, Malawi, Albania, Tajikistan, Philippines, Swaziland, Ethiopia, Bangladesh, and Ghana, etc.

Below is a review of some of the current International experiences in PPP for the irrigation sector.

The most well-known PPP experiences in the irrigation sector are summarized in a table in **Appendix C.**

<u>Lessons Learnt</u>:

The most important lesson to be learnt from the experience in other countries is to avoid complex contracts (i.e., contracts with multiple objectives). It is better to break a large contract into several smaller and separate contracts. Complex contracts entail complex operational procedures and relationships, which have the tendency of delaying project implementation and bringing about conflicts between the contracting parties.

The main points to consider for establishing a successful PPP are:

- Even if the PPP is not always the best option, it is a tool for improving accountability and quality of public I&D service delivery. It allows a transition from the well-known vicious cycles to a virtuous cycle:

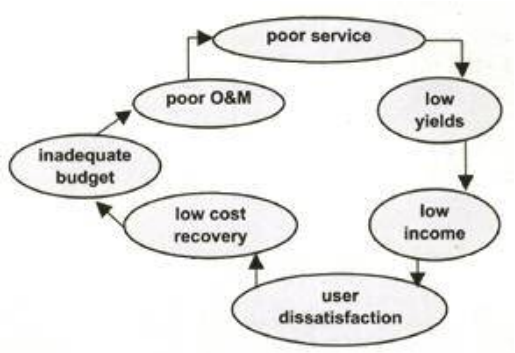


Figure 3-2: Vicious Circle of I&D Services

- The PPP arrangement must have an initial focus on O&M only. The full cost recovery (investment and financial cost) is a long term objective.
- The PPP is not a panacea to cover finance gaps of the Public Authority (private participation in the CAPEX are always under 50%).
- All the risks need to be identified and covered and be transparent.
- There are many shades of grey (each PPP is specific).
- It is important to set up incentivised service delivery (Performance Based Contracts; Value Management Proposals, place a value on O&M)
- There is a need to carefully select PPP projects:
  - There is more interest towards structuring PPP arrangement on new schemes or extensions (easier);
  - There is less risk to structure a PPP on projects with commercial farmers (better ability to pay).
- To keep the arrangement simple, it is important to limit the delivery of additional services (e. g. extension, marketing, inputs).

Specific Risks for PPPs in Irrigation:

PPPs in the irrigation sector face specific risks as listed below:

- There are only a few relevant Private Sector Companies with skills in O&M.
- Water scarcity, an unsecured water supply, can be a major obstacle.
- The problems related to water pricing valuation (marketing of products) require special attention.
- In some countries, it can be difficult for the farmers to consider irrigation services as commercial services (social acceptance to pay for water delivery).
- PPP arrangement requires a strong and efficient Regulatory Authority.
- There is a lack of experience in terms of PPP in many countries.
- The legal environment is not always adapted to a PPP form of arrangement and contracting.

Annex 7: SWOT Analysis of Institutional roles in IWRDMPlan Implementation

As a provisional conclusion and before defining options to be scrutinized by the stakeholders, the Consultant proposes to address the situation under the format of a tentative SWOT analysis targeting the challenge of this institutional role.

STRENGTHS

The major strength lies obviously in the existence of NBI/ENSAP/ENTRO. This is at the same time a legal framework and a source of various services developed since the establishment of these bodies. As an example, it is easy to mention the constitution of the Nile DSS: this tool has been developed and is shared by all riparian countries. Many other activities have been performed either in the frame of the SVP by the NBI or at the Eastern Nile scale by ENSAP/ENTRO.

It is worth underlining the existence of ENTRO as a major strength: ENTRO is endowed with full legal status and is able to conduct directly or to steer numerous and various activities (like the present IWRM Plan study). It is recommended that ENTRO would continue to manage and steer different studies which will be needed pursuant to the BAS multipurpose water resources development study. Indeed, ENTRO as an institution and the persons belonging to ENTRO have gained high experience for years on the situation of the BAS, the stakeholders expectations etc. and this is to be properly enhanced.

Another strength is that the BAS river basin is almost pristine in the meaning of the absence of large hydraulic infrastructures and more generally a low use of water resources. This keeps the door wide open for formulating development strategies and even for organizational arrangements to support such strategies.

The BAS river basin is also endowed with multiple natural resources, not only water but also land, the natural environment, fishes etc. This brings the idea in mind that a real IWRM process can be imagined and set up with a true integrated approach. There is the potential to address the nexus food-energy-environment, with significant benefits shared by the two countries and various categories of stakeholders.

WEAKNESSES

Purely from an institutional point of view, it is to be stressed that the Cooperative Framework Agreement has not been put into force. This is certainly a gap in itself and beyond this situation, it appears that very little institutional organization has been developed since 2010. This situation is not counterbalanced by other mechanisms such as possible bilateral agreement relating to development based on water resources, nor future management and operation of activities having transboundary effects.

Due, among others, to the insecure situation of South Sudan in the most recent years, there is little preparedness for large developments based on water in general. Despite several master plans have been issued recently at national scale (agriculture, irrigation…), it is doubtful that grass root level consultation of stakeholders was possible. When the security situation comes back to normal, it will be of higher importance to determine the priorities with the stakeholders.

One major weakness is relating to data, for water resources and many other items. A lot of data are old or totally missing and the literature references often cross quote each other. This is first a technical issue, but not only. This is also an organizational issue when considering that developing a much more extensive and reliable monitoring network should be put at the first rank of priorities (hydro-meteorology especially). As an example, the *Machar marshes* are almost not known at all, except from qualitative description, most often old. Due to the extreme value of this ecosystem, of international importance, which is also a source of livelihood for many people, any large hydraulic infrastructure will need very careful evaluation (ESIA, possibly resettlement action plan…). This can only be envisaged in the frame of a close cooperation between the two countries, through: exchange of data, water information system, global ESIA (not case by case) etc.

OPPORTUNITIES

Among opportunities, it is of importance to underline that the two countries sharing the BAS river basin are confident to each other. One highly positive and concrete aspect of this confidence is the simple fact of conducting such a big strategic study on the BAS in good cooperation.

Important outputs of this study will be: i) setting up a strategic vision on the long term and ii) address and study priority projects. Preparation of organization of these priority projects should be launched quite rapidly between the two countries.

One particular opportunity, or more generally conducive conditions, is the fact that the two countries sharing the BAS river basin own some comparable administrative and institutional organization as far as water is concerned, i.e. i) the Minister in charge of water is responsible for transboundary aspects ii) the two countries are organized on basis of regional states iii) the two countries have set up a water council or high water council which are in charge of the multi sector approach, that is fostering the IWRM philosophy iv) in both countries, the catchments (or river basins) and possibly sub-catchments are the key institutions for managing water. Ethiopia is well advanced in this direction with three River Basin Authorities already created, three others to be created in the short term, including the BAS.

Another aspect to be considered as an opportunity is the idea of keeping flexible in building an institutional arrangement. It is actually difficult to make propositions and imagine solutions ahead of a development program. The nature and the magnitude of activities incorporated in such a program will widely determine the requested ad hoc arrangement. In particular, would the program consider medium and long term investments for large infrastructures, this could leave enough time to decision makers to organize and negotiate the most appropriate mechanism. In the short, a simple mechanism could be used, serving as a transitional arrangement to be revisited and strengthened when and if necessary.

THREATS

In such an ambitious endeavor, threats are potentially numerous and of high impact. Some of them deserve to be identified.

Case by case approach and implementation remaining in charge of each country separately: several stakeholders expressed this idea during consultations. If this idea may prove efficient for some “simple” activities (for instance, developing drinking water supply on basis of boreholes), as soon as the transboundary nature of the BAS is concerned, this will be much more complex or even hazardous (example of a series of big dams). A series of activities are to be carefully planned and conducted at river basin scale, such as:

- Feasibility studies, ESIA
- Detailed design, in depth mitigation measures, regime of storage/release, environmental flows, cost benefit analysis and optimal/equitable sharing of effects
- Decision to do the considered development
- Financial resources mobilization
- Construction
- Operation and maintenance

This last item is crucial as the previous steps. In fact it is not the reality that one could rely on a single initial rule of operation of big dams. There are plenty of possible situations which will need to adapt, even slightly, operation at least on a yearly basis. Let's think about plentiful hydrology one year, likely to give rise to floods; on the contrary we can imagine dryer years which would request anticipation in storage. In other words, a specific hydro-meteorological model is strongly requested, and, as part of the regular exchange of information/data, both countries will be concerned in that example. One option is certainly to create a specific joint committee in that purpose.

Another important threat is related to thinking the long term. Most people are really enthusiast with the perspective of generating development and responding to the huge needs of the population in various sectors. However, it must be clearly understood that implementation of such a plan may be over several decades, which is an intrinsic feature. The more carefully planned institutional arrangement from the beginning (not excluding several successive steps), the easier will be the capacity to address the long term, organize efforts and secure resources mobilization.

The present study is addressing strictly the BAS sub basin; the original idea and intention was to incorporate the White Nile up to Khartoum, as previously done in preliminary studies. For financial resources obstacles, this was not made possible. The question remains of the relationship and fair discussions with the downstream countries along the Nile. The suggestion is that this could be organized at early stage when the first drafts of the Plan are available.