Document of
The World Bank

Report No: ICR00002631

# IMPLEMENTATION COMPLETION AND RESULTS REPORT
(TF-94549, P103639)

ON A

NILE BASIN TRUST FUND GRANT

IN THE AMOUNT OF US$6.5 MILLION

TO THE

EASTERN NILE TECHNICAL REGIONAL OFFICE (ENTRO)

FOR AN

EASTERN NILE PLANNING MODEL PROJECT

June 28, 2013

AFTN2
AFCRI
Africa Region

## CURRENCY EQUIVALENTS

(Exchange Rate Effective December 31, 2012)

Currency Unit = Ethiopian Birr (ETB)
1.00 = US$ 0.0549
US$ 1.00 = 18.20

## FISCAL YEAR

July 1 – June 30

## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| CAS | Country Assistance Strategy |
| CADSWES | Center for Advanced Decision Support for Water and Environmental Systems |
| CFA | Cooperative Framework Agreement |
| CRA | Cooperative Regional Assessment |
| CSO | Civil Society Organization |
| CWRAS | Country Water Resources Assistance Strategy |
| DEM | Digital Elevation Model |
| DSS | Decision Support System |
| EA | Environmental Assessment |
| ENCOM | Eastern Nile Council of Ministers |
| ENMOS | Eastern Nile Multi-purpose Optimization System |
| ENPM | Eastern Nile Planning Model |
| ENSAP | Eastern Nile Subsidiary Action Program |
| ENTRO | Eastern Nile Technical Regional Office |
| FEWS | Flood and Early Warning System |
| FPEW | Flood Preparation and Early Warning |
| GAMS | General Algebraic Modeling System |
| GCM | Global Circulation Model |
| GIS | Geographic Information System |
| HEC | Hydrologic Engineering Center |
| HEC-HMS | Hydrological Modeling System |
| HEC-RAS | River Analysis System |
| HEC-ResSiM | Reservoir System Simulation |
| ICR | Implementation Completion Report |
| IFR | Interim Financial Report |
| IGBP | International Geosphere Biosphere Program |
| ISR | Implementation Status and Results |
| IT | Information Technology |

| | |
|---|---|
| JMP | Joint Multi-purpose Program |
| JMP1-ID | First Joint Multi-purpose Program Identification |
| $Km^2$ | Kilometer square |
| m | Meter |
| M&E | Monitoring and Evaluation |
| MCA | Multi-Criteria Analysis |
| MODIS | Moderate-resolution Imaging Spectroradiometer |
| MOIWR | Ministry of Irrigation and Water Resources (Sudan) |
| MoU | Memorandum of Understanding |
| MOWR | Ministry of Water Resources (Ethiopia) |
| MTR | Mid-Term Review |
| MWRI | Ministry of Water Resources and Irrigation (Egypt) |
| NBI | Nile Basin Initiative |
| NBTF | Nile Basin Trust Fund |
| NCORE | Nile Cooperation for Results |
| NDVI | Normalized Difference Vegetation Index |
| NGO | Non-Government Organization |
| PAD | Project Appraisal Document |
| PCR | Project Completion Report |
| PDO | Project Development Objective |
| RIBASIM | River Basin Simulation Model |
| SAESS | Strategy for Addressing Environmental and Social Safeguards |
| SLR | Sea Level Rise |
| SWAT | Soil and Water Assessment Tool |
| WUA | Water Users Association |

| | |
|---|---|
| Vice President: | Makhtar Diop (AFRVP |
| Country Director: | Colin Bruce (AFRVP) |
| Sector Manager: | Johathan S. Kamkwalala (AFTN2) |
| Project Team Leader: | Nagaraja Rao Harshadeep (AFTN1) |
| ICR Team Leader: | Nagaraja Rao Harshadeep (AFTN1) |

**COUNTRY**
**Project Name**

## CONTENTS

| A. Basic Information | | | |
|---|---|---|---|
| Country: | Africa | Project Name: | Eastern Nile Planning Model |
| Project ID: | P103639 | L/C/TF Number(s): | TF-94549 |
| ICR Date: | 06/28/2013 | ICR Type: | Core ICR |
| Lending Instrument: | TAL | Grantee: | NBI/ENTRO |
| Original Total Commitment: | US$ 6.50 million | Disbursed Amount: | US$ 4.35M |
| Revised Amount: | US$ 6.50 million | | |
| **Environmental Category: C** | | | |
| **Implementing Agency:** Eastern Nile Technical Regional Office (ENTRO) | | | |
| **Cofinanciers and Other External Partners:** N/A | | | |

| B. Key Dates | | | | |
|---|---|---|---|---|
| **Process** | **Date** | **Process** | **Original Date** | **Revised / Actual Date(s)** |
| Concept Review: | 12/05/2006 | Effectiveness: | 09/30/2008 | 09/09/2009 |
| Appraisal: | 07/29/2009 | Restructuring(s): | | 08/31/2012 |
| Approval: | 09/01/2009 | Mid-term Review: | 04/11/2011 | 06/27/2011 |
| | | Closing: | 10/30/2012 | 12/31/2012 |

| C. Ratings Summary | |
|---|---|
| **C.1 Performance Rating by ICR** | |
| Outcomes: | Satisfactory |
| Risk to Development Outcome: | Moderate |
| Bank Performance: | Satisfactory |
| Grantee Performance: | Moderately Satisfactory |

| C.2 Detailed Ratings of Bank and Grantee Performance (by ICR) | | | |
|---|---|---|---|
| **Bank** | **Ratings** | **Grantee** | **Ratings** |
| Quality at Entry: | Moderately Satisfactory | Government: | Moderately Satisfactory |
| Quality of Supervision: | Satisfactory | Implementing Agency/Agencies: | Satisfactory |
| **Overall Bank Performance:** | Satisfactory | **Overall Grantee Performance:** | Moderately Satisfactory |

| C.3 Quality at Entry and Implementation Performance Indicators | | | |
|---|---|---|---|
| **Implementation Performance** | **Indicators** | **QAG Assessments (if any)** | **Rating** |
| Potential Problem Project at any time (Yes/No): | No | Quality at Entry (QEA): | None |
| Problem Project at any time (Yes/No): | No | Quality of Supervision (QSA): | None |
| DO rating before Closing/Inactive status: | Moderately Satisfactory<br>[Note: Rated "Satisfactory" in final ISR submitted before project close but archived Jan 8, 2013] | | |

| D. Sector and Theme Codes | | |
|---|---|---|
| | **Original** | **Actual** |
| **Sector Code (as % of total Bank financing)** | | |
| General water, sanitation and flood protection sector | 95 | 95 |
| Public administration- Water, sanitation and flood protection | 5 | 5 |
| | | |
| **Theme Code (as % of total Bank financing)** | | |
| Environmental policies and institutions | 3 | 3 |
| Water resource management | 97 | 97 |

| E. Bank Staff | | |
|---|---|---|
| **Positions** | **At ICR** | **At Approval** |
| Vice President: | Makhtar Diop | Obiageli Katryn Ezekwesili |
| Country Director: | Colin Bruce | Richard G. Scobey |
| Sector Manager: | Jonathan S. Kamkwalala | Ashok K. Subramanian |
| Project Team Leader: | Nagaraja Rao Harshadeep | Nagaraja Rao Harshadeep |
| ICR Team Leader: | Nagaraja Rao Harshadeep | |
| ICR Primary Author: | Rita E. Cestti | |

## F. Results Framework Analysis

**Project Development Objectives (from Project Appraisal Document)**
The development objective of the ENPM Project is that countries in the Eastern Nile operationalize an improved decision support modeling framework to identify water-related investments and evaluate them in a regional context.

**Revised Project Development Objectives (as approved by original approving authority)**
Not revised.

**(a) PDO Indicator(s)**

| Indicator | Baseline Value | Original Target Values (from approval documents) | Formally Revised Target Values | Actual Value Achieved at Completion or Target Years |
|---|---|---|---|---|
| **Indicator 1 :** | Strengthened Institutions: Number of senior professionals in Regional and National Institutions using ENPM | | | |
| Value quantitative or Qualitative) | None | At least four (regional level) and two each (national-level) are proficient in appropriate use of ENPM system tools | | A large number of professionals working in regional and national institutions that are using ENPM products. |
| Date achieved | 10/30/2009 | 10/30/2009 | | 12/31/2012 |
| Comments (incl. % achievement) | Achievement: 100%<br><br>It includes several professionals in NBI institutions, 46 graduate students and young faculty in key universities in the Eastern Nile, and government professionals. | | | |
| **Indicator 2 :** | Strengthened Institutions: Number of regional and national meetings facilitated by ENPM outputs | | | |
| Value quantitative or Qualitative) | None | At least one (regional) and one each (national) meetings | | Large number of well attended workshops organized at regional and national level in Egypt, Ethiopia, Sudan, and recently South Sudan. |
| Date achieved | 10/30/2009 | 10/30/2009 | | 12/31/2012 |
| Comments (incl. % achievement) | Achievement: 100%<br><br>Regional meetings (e.g. January 2010 Nazareth, October 2011 Addis Ababa, September 2012 Mekele, December 2012 Juba)<br>National Workshops (March 2012 Bahir Dar, May 2012 Khartoum, May 2012 Cairo, Jul 2012 Alexandria, Nov 2012 Khartoum, Dec 2012 Cairo) | | | |
| **Indicator 3 :** | Planning Facilitation: Number of projects in Eastern Nile for which Investment Strategies are based on ENPM analysis | | | |
| Value quantitative or Qualitative) | None at beginning of project | Key Eastern Nile projects analyzed (at least one major joint multipurpose/national investment) | | A range of Eastern Nile regional and national project options were analyzed using ENPM tools related to irrigation, watershed management, power systems, etc. to contribute to the development of investment strategies |
| Date achieved | 10/30/2009 | 10/30/2009 | | 12/31/2012 |
| Comments (incl. % achievement) | Achievement: 100%<br><br>A range of multi-purpose project options were analyzed using ENPM Project tools (e.g. Blue Nile mainstream dams), and several national activities (including flood management. The Nile Cooperation for Results Project design is informed by ENPM. | | | |

**(b) Intermediate Outcome Indicator(s)**

| Indicator | Baseline Value | Original Target Values (from approval documents) | Formally Revised Target Values | Actual Value Achieved at Completion or Target Years |
|---|---|---|---|---|
| **Indicator 1 :** | Comprehensive knowledge base developed | | | |
| Value (quantitative or qualitative) | Fragmented databases with limited accessibility | Centralized database developed; State of Eastern Nile Report; Data sharing | | Systematic geodatabases development and institutionalized; State of Eastern Nile Report developed in addition to EN Atlas and EN in a Changing Climate Report; Sharing improved |
| Date achieved | 10/30/2009 | 10/30/2012 | | 12/21/2012 |
| Comments (incl. % achievement) | Fully achieved. Significant achievement to develop systematic knowledge base (on projects, climate, hydrology, hydraulics, economic, social, environmental, and other aspects) and a suite of knowledge products. Web portal with online mapping developed. | | | |
| **Indicator 2 :** | Appropriate interfacing with other activities (especially NBI Nile DSS) | | | |
| Value (quantitative or qualitative) | Basic level discussions to synergize but many issues in coordination (especially with Nile DSS) still unclear. | Appropriate synergy of ENPM with other activities in the region. In particular, synergy with Nile Basin DSS on software adapters and use of DSS framework. | | Robust and meaningful collaboration established with several ENTRO and other NBI projects. |
| Date achieved | 10/30/2009 | 10/30/2012 | | 12/21/2012 |
| Comments (incl. % achievement) | Significant synergy with the NileDSS activities (co-financing consultancy for NileDSS development, equipment for Ministries, etc.). In addition, projects such as the EN Joint Multipurpose Project benefitted significantly from the ENPM. | | | |
| **Indicator 3 :** | Data management and analysis interfaces developed | | | |
| Value (quantitative or qualitative) | None | Interfaces developed and fully operational | | Several interfaces developed (GIS, interactive PDFs, EN One System Inventory interactive tool, thematic and sub-basin toolkits, web portal, model results visualization); Software adapters co-financed with WRPM for NileDSS |
| Date achieved | 10/30/2009 | 10/30/2012 | | 12/21/2012 |
| Comments (incl. % achievement) | Fully achieved. Innovative interfaces developed for a variety of ways of visualizing datasets and modeling inputs/outputs. | | | |
| **Indicator 4 :** | Fully-functional ENPM Models developed | | | |
| Value (quantitative or qualitative) | NileDSS modules under development | ENPM modeling tools developed and applied | | A suite of ENPM modeling tools developed (including SWAT, Ribasim, RiverWare, HEC suite, NileDSS, Mike Basin, ENMOS, flood forecasting, Toolkits, etc.). |
| Date achieved | 10/30/2009 | 10/30/2012 | | 12/21/2012 |

| | | | | |
|---|---|---|---|---|
| Comments (incl. % achievement) | Fully achieved. ENTRO developed/customized and used a range of public-domain and commercial models (simulation, optimization, multi-criteria) to analyze investments and management options in the EN. | | | |
| **Indicator 5 :** | ENPM Model used to evaluate investment options for sustainable planning and management of the Eastern Nile. | | | |
| Value (quantitative or qualitative) | None | At least three projects tested | | Models used to evaluate many more than the 3 projects targeted under different scenarios. |
| Date achieved | 10/30/2009 | 10/30/2012 | | 12/21/2012 |
| Comments (incl. % achievement) | Fully achieved. Many versions of investments in storage, hydropower, irrigation, etc. evaluated along with specialized models for floods, fisheries, and climate scenarios. | | | |
| **Indicator 6 :** | Regional and National ENPM institutions created and operationalized | | | |
| Value (quantitative or qualitative) | ENPM coordination staff in place; University networks not constituted | ENTRO Regional ENPM office fully staffed and equipped; National Units established; Regional Working Groups (RWGs) meet quarterly; University networks established | | ENPM mainstreamed into ENTRO Water Planning Unit; substantial in-house capacity developed; National units and RWGs not active after preparation; Good University networks built |
| Date achieved | 10/30/2009 | 10/30/2012 | | 12/21/2012 |
| Comments (incl. % achievement) | Substantially achieved. Although government participation was more limited due to the prevailing cooperation challenges during implementation, ENTRO worked very closely with academia in Egypt, Ethiopia, S Sudan, and Sudan, and setup an internship program | | | |
| **Indicator 7 :** | Adequate Capacity-building and Training activities undertaken | | | |
| Value (quantitative or qualitative) | Fragmented capacity and poor skill-base in many EN countries, very limited academic cooperation in EN. | 50 trained<br>2 workshops<br>1 study tour<br>5 trainings<br>Improved ENTRO capacity<br>Improved documentation (incl. user manuals) and sharing | | Large number of people trained (10 decision makers, 8 senior professionals, >60 younger professionals) in >21 workshops (many associated with study tours) and trainings. Reports, factsheets developed; Internships, meetings, web portal help sharing |
| Date achieved | 10/30/2009 | 10/30/2012 | | 12/21/2012 |
| Comments (incl. % achievement) | Fully achieved. Built community of modelers in the EN, networks of universities, setting up of an innovative internship/young professional program, technical capacity building and information access in the public domain. User manuals developed. | | | |
| **Indicator 8 :** | Adequate ENPM Project Management | | | |
| Value (quantitative or qualitative) | TOR/RFP for Consultant drafted | Procurement (incl. ENPM Consultant) completed; Project coordination effective; Regular reporting and adaptive management. | | Implementation modality changed through effective adaptive management. Procurement completed (firms, individual consultants, IT hardware/ software/ models, books, etc.); effective reporting/ communication with the |

| | | | | |
|---|---|---|---|---|
| | | | | World Bank team |
| Date achieved | 10/30/2009 | 10/30/2012 | | 12/21/2012 |
| Comments (incl. % achievement) | Effectively achieved. In-house capacity strengthened at ENTRO. Critical procurements completed. ENTRO had qualified ENPM Regional Coordinators, Water Planning Head, Executive Directors and fiduciary staff to oversee work all through project. | | | |

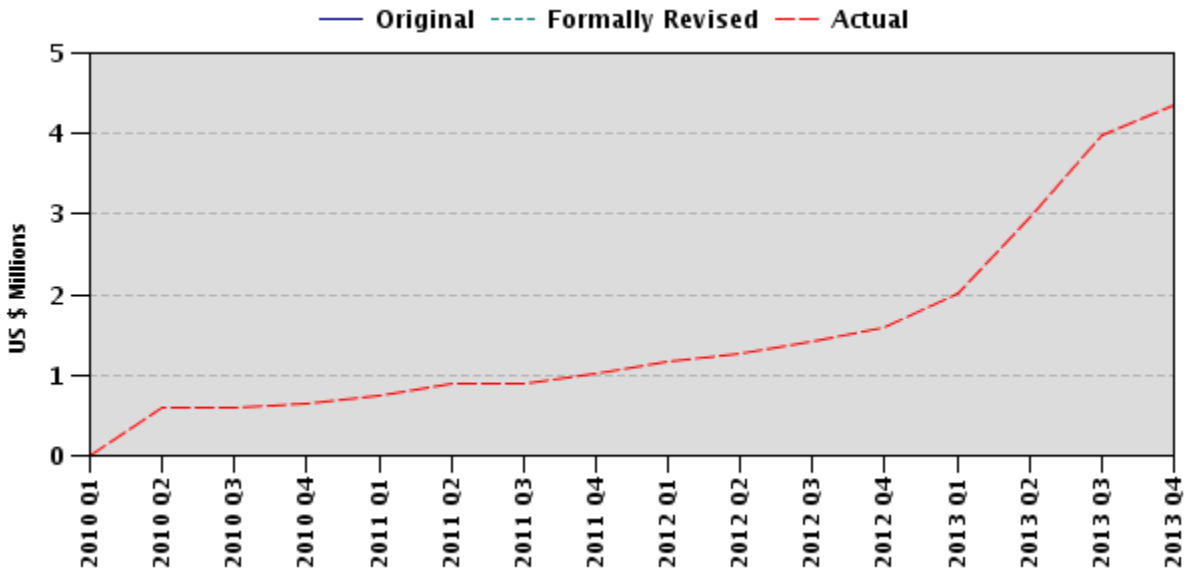
## G. Ratings of Project Performance in ISRs

| No. | Date ISR Archived | DO | IP | Actual Disbursements (US$ millions) |
|---|---|---|---|---|
| 1 | 06/04/2010 | Moderately Satisfactory | Moderately Satisfactory | 0.65 |
| 2 | 03/27/2011 | Moderately Satisfactory | Moderately Satisfactory | 0.89 |
| 3 | 04/26/2012 | Moderately Satisfactory | Moderately Satisfactory | 1.53 |
| 4 | 01/08/2013 | Satisfactory | Satisfactory | 2.95 |

## H. Restructuring (if any)

| Restructuring Date(s) | Board Approved PDO Change | ISR Ratings at Restructuring | | Amount Disbursed at Restructuring in US$ millions | Reason for Restructuring & Key Changes Made |
|---|---|---|---|---|---|
| | | DO | IP | | |
| 08/31/2012 | | MS | MS | 1.69 | Extension of closing date by two months. |

## I. Disbursement Profile



# 0. Preface: Coordinated Programmatic Support for the Nile

## 0.1 Introduction

The project evaluated in this Implementation Completion and Results report (ICR) is one of twenty-nine projects funded by the Nile Basin Trust Fund (NBTF), which are all part of a much larger programmatic approach to support Nile cooperation. Because of the complementary and strategic nature of the projects, it would be incomplete to either evaluate the individual projects in isolation of the overall programmatic framework or fail to look at the role each NBTF project played in building Nile cooperation. This preface provides an overview of the coordinated partner support to the Nile countries through and in coordination with the NBTF, to provide background and context for the individual project ICR that follows.

The NBTF was created to support a trend of increasing cooperation in the Nile region. In 1995, the Nile governments established the Nile Council of Ministers of Water Resources (Nile-COM) and designed the Nile River Basin Action Plan, identifying 22 technical assistance projects which aimed to address economic development and equitable use of the Nile waters. In 1999, the Nile-COM adopted a long-term Shared Vision: *to achieve sustainable socio-economic development through equitable utilization of and benefit from, the common Nile Basin water resources*. More specifically, Nile Ministers adopted policy guidelines, "to develop the water resources of the Nile Basin in a sustainable and equitable way to ensure prosperity, security and peace for all its people; to ensure efficient water management and the optimal use of the resources; to ensure cooperation and joint action between the Nile Basin countries; to target poverty eradication and promote economic integration; and to ensure that the program results in a move from planning to action."

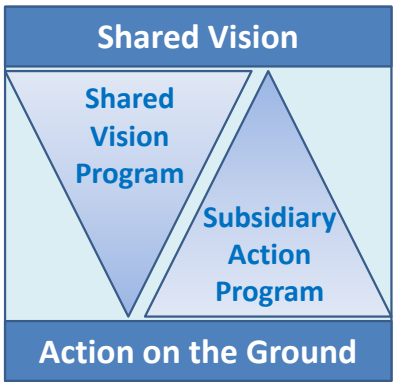



**Figure 1: Complementary Design of Early Nile Programs**

In order to advance these policy guidelines, the Nile-COM endorsed cooperation built around a Strategic Action Program with two complementary concepts: the need to enable a common basis to achieve the Shared Vision for the Nile Basin and the need to advance projects that benefited "the people and particularly the poor and disadvantaged in the Nile Basin." As a result, Nile-COM endorsed two programs: the Shared Vision Program (SVP) and the Subsidiary Action Program (see Figure 1). First, the Shared Vision Program was designed to build trust, confidence, and an enabling environment for the sustainable and equitable use of the Nile resources among water professionals and the public. Second, as articulated by Nile-COM, "a shared vision can only be legitimized by action on the ground," the Subsidiary Action Program (SAP), one for the Eastern Nile and one for the Equatorial Lakes, which focused on investment projects that addressed agricultural needs, environmental risks, energy, and river management. To implement these programs, the following year the Nile-COM ministers agreed to establish the Nile Basin Initiative (NBI) as a transitional institutional arrangement. At establishment, NBI's member states were Burundi, Democratic Republic of the Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda with Eritrea holding observer status. Membership is now ten countries with South Sudan joining in July 2012.

In 2001, the Nile Basin governments and international development partners convened for the International Consortium for Cooperation on the Nile (ICCON) in Geneva to discuss the Nile Shared Vision and the proposed programs, pledging US$140 million for their implementation. Based on the interest expressed by the Nile-COM and partners at ICCON, a multi-donor funding mechanism, the Nile Basin Trust Fund (NBTF), was established at the World Bank in 2003 with a consortium of ten international donors[1] to support the countries in their pursuit of the Shared Vision. Several donors also supported the NBI directly in coordination with the NBTF. With this considerable partnership, overall financial support to NBI has far exceeded the ICCON pledges.

Over the ten years, the NBTF supported twenty-eight completed NBI projects as part of the Shared Vision and Subsidiary Action Programs, and an Institutional Strengthening Project. The last set of projects closed at the end of 2012 (Table 1). To enable full disbursement of NBTF funds in support of NBI, partners to the NBTF agreed a two year extension of the fund until June 2015. An additional project, the Nile Cooperation for Results (NCORE) Project, was therefore approved in December 2012. The NCORE project is co-financed by the new Cooperation in International Waters in Africa (CIWA) Trust Fund managed by the World Bank.

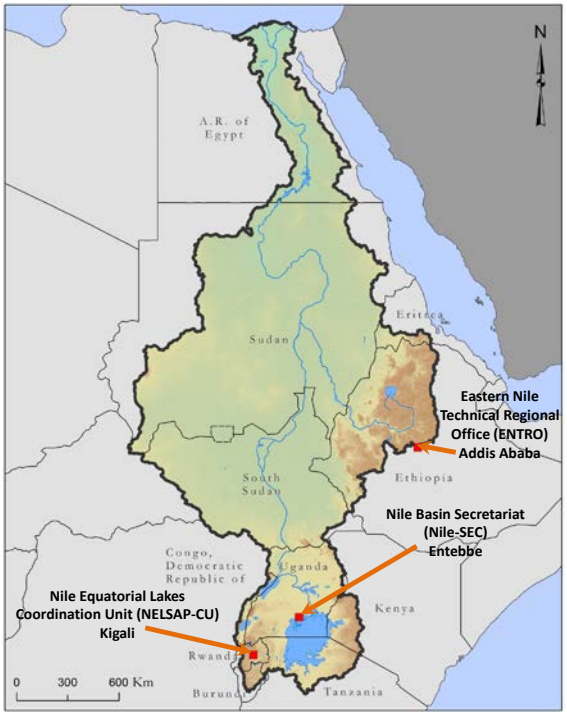



**Figure 2: NBI Centers**

### 0.2 NBTF Achievements to Date

The NBTF supported the Nile countries to **establish the NBI as a transitional institutional mechanism.** The NBI is the only regional water organization for all Nile Basin countries, aiming to operate as a catalyst for integrated growth, investment and risk management to achieve the Shared Vision. To carry out the Shared Vision and Subsidiary Action Programs, the three NBI Centers were formed; the NBI Secretariat in Entebbe, Uganda and two Subsidiary Action Program offices, the Eastern Nile Technical Regional Office in Addis Ababa, Ethiopia and the Nile Equatorial Lakes Subsidiary Action Program – Coordination Unit in Kigali, Rwanda (Figure 2).

[1] Contributors to the NBTF are: Canada, Denmark, European Commission, Finland, France, Netherlands, Norway, Sweden, United Kingdom and the World Bank. Partners providing bilateral financing include Germany, Sweden, and the African Development Bank. The United Nations Development Program and the United States are active in the development partnership and support efforts to increase Nile cooperation outside but in coordination with the NBTF partnership.

The governance structure is aligned with the basin-wide/sub-basin structure of the Nile Basin Initiative, (Figure 3). A Nile Council of Ministers and a Technical Advisory Committee (Nile-TAC) guides the basin-wide work of the NBI Secretariat (Nile-SEC). At the level of the Eastern Nile sub-basin, an Eastern Nile Council of Ministers (EN-COM) and an Eastern Nile Strategic Action Program Technical Committee (ENSAPT) provide governance oversight. In the Nile Equatorial Lakes sub-basin, the Nile Equatorial Lakes Council of Ministers (NEL-COM) and the Nile Equatorial Lakes Technical Advisory Committee (NEL-TAC) provide governance services.

Through the ten projects under the **Shared Vision Program (SVP)**, the NBI has improved collaboration within the Basin. The US$87 million Shared Vision Program was designed to build trust, strengthen capacity, and advance the enabling environment for investment in the Nile Basin. The program created networks and partnerships that brought people together across the Basin countries in various water-related sectors. According to a 2008 opinion poll, [2]the program created measurably greater levels of trust among such stakeholder categories as lawyers, media professionals and women leaders. Through work on joint projects on a range of critical issues, the SVP advanced a shared understanding of the need for regional engagement between the countries, including in water resource management, environment, wetlands, and regional power trade. The projects yielded a more organized knowledge base, a Decision Support System (DSS) and other tools to better understand, model and analyze the basin, an inventory of wetlands, plans for watershed management and regional power generation and transmission, studies of agricultural productivity and opportunities for water savings, and trained over 2,000 professionals.


**Figure 3: NBI Governance Structure**

The Shared Vision Program provided platforms to bring country officials together at the policy and the technical level. Based on these platforms, technical cooperation was strengthened thereby helping basin-wide processes and practices to be shared and consolidated. By establishing and managing a shared institution, and by collaborating on development projects and risk-management strategies, the Nile Basin countries established common principles, without which long-term cooperation would be difficult. Various project teams are in continuing contact across countries, through other NBI projects, or other initiatives. The NBI is also establishing an

[2] "Opinion Research with Key Stakeholders" conducted by the NBI, 2008. For more information, see World Bank report number "ICR 1493 – AFR," Annex 3.

integrated policy environment, including a suite of policies called the Nile Basin Sustainability Framework.

The NBI centers have improved the collation, analysis, and access to information relating to the Nile basin, including a procedures and norms for date and information sharing and exchange. The NBI has helped foster greater exchange not only on the river itself but on energy, agriculture and trade opportunities. NBI is a platform that can be used as a mechanism to notify each other of certain planned development projects using Nile waters.

Given its programmatic nature, the Shared Vision Program was reviewed by the World Bank in a Programmatic Implementation Completion and Results Report in June 2010[3]. The report reviewed the achievements of the seven thematic projects as well as the umbrella coordination project (Table 1). The Programmatic ICR found that the Outcomes, Bank performance and Grantee Performance were all moderately satisfactory, with the risk to development outcomes being rated as substantial.

While the outputs of many of the SVP projects were mainstreamed into other on-going initiatives, two SVP projects implemented second phases; the Regional Power Trade Project which produced a *Comprehensive Basin-wide Study of Power Development Options and Trade Opportunities: Proposed Development Options, Strategies and Investment Arrangements; and* the Water Resources Planning and Management Project extended the closing date until December 31, 2012 to complete the Nile Basin Decision Support System - this second phase of support has been reviewed in a new ICR.[4]

The **Subsidiary Action Program** helped identify and prepare investments of transboundary significance to improve the livelihoods of the basin's neediest populations and promote sustainable growth through improved watershed management, flood preparedness, agricultural improvement, power generation, and transmission. It also helped facilitate agreement among countries to move some investments forward – such as the regional Rusumo Falls Hydroelectric Project that is expected to make a significant contribution to access to power in Burundi, Rwanda, and Tanzania. The NBI facilitated US$919 million of investment projects currently under implementation, with a further US$1.584 billion under preparation (Table 2).

In addition, Subsidiary Action Program has helped the countries to consolidate their knowledge of the sub-basins and develop new tools and applications to help better identify and plan investments of regional significance. ENTRO and NELSAP-CU have provided studies and analysis to their member governments to improve planning and implementation of regional sustainable development projects. The NBI issues regional flood bulletins with hydrological forecasts for the Eastern Nile to assist national, regional and community authorities in predicting floods. University networks, especially in the Eastern Nile, have been strengthened through collaborative studies, internship programs, and workshops.

[3] World Bank report number "ICR 1493 – AFR"

[4] World Bank report number "ICR00002770"


**Figure 4: NBI Strategic Plan 2013-2017**

Implementation Completion and Results reports have been prepared for two Subsidiary Action Program Projects that closed in December, 2012, including the Regional Agricultural Trade and Productivity Project – Phase II[5] and the Eastern Nile Planning Model Project.[6] The results of these individual projects can be found in the individual ICRs.

The **Institutional Strengthening Project** (ISP) aimed to support the Nile Basin Initiative to strengthening the foundation for institutional sustainability, to enhance capacity, to harmonize corporate management, as well as to consolidate the gains of the SVP and SAPs. The project started in 2008 and closed in December 2012. Through ISP, the NBI clarified its core functions developed a five year Strategic Plan and a Financing Strategy to advance its sustainability. As a result of this work, the Nile governments committed to incrementally increase their direct financial contributions to the NBI to cover the core costs of the institution by 2017 (FY2018).

The NBI has also developed a suite of Strategic Plans for each Center and a consolidated concept note of projects for 2013 – 2017 which was presented to development partners in November 2011. The overarching Strategic Plan, (Figure 4) shows how the NBI's current work expands its original programmatic structure including the Shared Vision and Subsidiary Action Programs.

As part of implementing the new Strategic Plan and building on other projects, the NBI prepared the Nile Cooperation for Results (NCORE) Project. This project is supporting NBI activities in its three core functions of facilitating cooperation, water resource management, and water resource development.

The support provided through the ISP enabled results to be achieved across the NBI, including the twenty-one other SVP and SAP projects that were undertaken by the NBI during ISP implementation, as well as the subsequent work that was enabled by the ISP project. While a stand-alone ICR for the ISP project has been produced[7], the breadth of the ISP results can only truly be assessed when looking at the successes and lessons of the other NBI efforts as well.

[5] World Bank report number -- "ICR00002447"
[6] World Bank report number -- "ICR00002631"
[7] World Bank report number -- "ICR00002573"

### 0.3 Other Programmatic Evaluations

Given the historic nature of the approach of the Nile Ministers, as well as the lessons that can be learned for future transboundary efforts, the World Bank and the Development Partners have recently commissioned an Independent Evaluation of the Nile Basin Trust Fund. While the Independent Evaluation is still being finalized, it assessed that the NBTF was a highly appropriate mechanism for funding the NBI's Strategic Action Program, and that the portfolio of projects was relevant to the objectives of the NBI. It also highlighted areas needing further strengthening including sustainability and communications. The lessons learned from the Independent Evaluation will provide a valuable complement to the project level findings and lessons of the individual project ICRs.

### 0.4 Political track of activity

In parallel to the technical activities being undertaken through the NBI, and outside the support provided by the Nile Basin Trust Fund, the Nile governments undertook negotiations on the text of a water agreement on the Nile, the Cooperative Framework Agreement (CFA). This was opened for signature, with six Nile countries signing the agreement, although two opposed certain provisions. One country to date has ratified. Disagreements over the text of the document and process by which the document was opened for signature have affected the work of the NBI, with two countries freezing participation in NBI regional activities pending the clarification of aspects of the disagreement. While the political situation has lessened the impact of some of the technical activities undertaken by the NBI, the NBI has found ways to continue to advance cooperation and to provide technical assistance to continue to assist the Nile countries to assess transboundary issues associated with Nile water management and development.

### 0.5 Conclusion

International experience has demonstrated that building cooperation in large international river basins requires sustained engagement over many decades. For Nile Basin governments, shifting from a national orientation with limited collaboration to a regional approach was, and continues to be, a significant challenge. The Nile Basin countries with NBI support have made strides in sharing information, planning development programs and collaborating on investments. Today, the NBI has strengthened its institutional capacity, partnerships, and regional processes as well as its tools and procedures for cooperative water resources planning, development, and management in the Nile Basin – these will further evolve as institutional structures evolve over time. This ICR is an evaluation of one particular project as part of these overall inter-linked efforts to foster Nile cooperation and should be viewed in this context.

**Table 1. Nile Basin Trust Fund Project Portfolio**

| Project | Grant Agreement Signing Date | Grant Agreement Closing Date | Grant Amount[1] |
|---|---|---|---|
| **Shared Vision Program** | | | |
| SVP: Applied Training Project | 12-Feb-04 | 31-Dec-09 | 14.13 |
| SVP: Confidence Building and Stakeholder Involvement Project | 17-Mar-04 | 31-Dec-09 | 11.35 |
| SVP: Efficient Water Use for Agricultural Production | 16-Mar-05 | 30-Jun-09 | 4.12 |
| SVP: Nile Transboundary Environmental Action Project | 22-Apr-03 | 31-Dec-09 | 8.99 |
| SVP: Regional Power Trade Project | 1-Nov-04 | 30-Jun-09 | 5.76 |
| SVP: Additional Grant Financing Regional Power Trade Project - II | 16-Sep-09 | 31-Dec-11 | 4.56 |
| SVP: Socioeconomic Development and Benefit Sharing Project | 3-Feb-05 | 30-Jun-09 | 3.65 |
| SVP: Water Resources Planning and Management Project | 15-Oct-04 | 30-Apr-09 | 6.79 |
| SVP: Additional Grant Financing Water Res. Planning & Mgmt. - II | 31-Mar-09 | 31-Dec-12 | 17.22 |
| SVP: Shared Vision Program Coordination Project | 22-Apr-03 | 31-Dec-08 | 9.94 |
| *Shared Vision Program (subtotal)* | | | **86.51** |
| **Eastern Nile Subsidiary Action Program (ENSAP)** | | | |
| NBTF - ENSAP: Eastern Nile Watershed Management Project | 8-Nov-04 | 30-Jun-08 | 2.50 |
| ENTRO Grant for launching the Joint Multipurpose Program | 28-Sep-05 | 31-May-09 | 1.14 |
| NBTF Grant for Institutional Strengthening of the Eastern Nile Regional Technical Office (ENTRO) | 12-Oct-06 | 31-Dec-08 | 2.58 |
| EN Flood Preparedness and Early Warning Project - Phase 1 | 19-Jun-07 | 31-Dec-10 | 3.96 |
| EN Planning Model | 9-Sep-09 | 31-Dec-12 | 6.50 |
| EN Joint Multipurpose Program Identification Phase (JMP1) | 9-Sep-09 | 31-Dec-12 | 7.00 |
| *Eastern Nile Subsidiary Action Program (ENSAP) (sub-total)* | | | **23.68** |
| **Nile Equatorial Lakes Subsidiary Action Program (NELSAP)** | | | |
| NELSAP: Coordination Unit Project | 22-Apr-03 | 30-Jun-06 | 0.67 |
| NELSAP: NELSAP CU Institutional Strengthening and Scaling Up | 30-Jun-06 | 31-Dec-08 | 1.87 |
| NELSAP: Regional Rusumo Falls Hydroelectric and Multipurpose Project Preparation Grant | 24-Oct-06 | 31-Oct-12 | 7.72 |
| NELSAP: Agriculture and Trade | 29-Apr-08 | 30-Sep-09 | 0.60 |
| NELSAP: Additional Grant Financing Agriculture & Trade-II | 30-Nov-10 | 31-Dec-12 | 7.00 |
| NELSAP: Sio-Malaba-Malakasi RBM | 24-Sep-09 | 31-Dec-12 | 2.15 |
| NELSAP: Mara RBM | 24-Sep-09 | 31-Dec-12 | 2.15 |
| NELSAP: Kagera RBM | 17-Sep-09 | 31-Dec-12 | 3.77 |
| NELSAP: Power Program | 24-Apr-10 | 31-Dec-12 | 3.80 |
| NELSAP: Coordinated Water Resources Development Program | 4-Feb-10 | 31-Dec-12 | 4.90 |
| *Nile Equatorial Lakes Subsidiary Action Program (NELSAP) (sub-total)* | | | **34.63** |
| **Cross-Cutting** | | | |
| NBI Institutional Strengthening Project | 21-Oct-08 | 31-Dec-12 | 24.02 |
| NBI: Nile Basin Secretariat Support | 25-Jan-05 | 30-Jun-05 | .20 |
| NCORE: Nile Cooperation for Results | 26-Dec-12 | 31-Dec-14 | 13.80 |
| *Cross-cutting (subtotal)* | | | **38.02** |
| **Total - NBTF Grants** | | | **182.84** |

[1]Reflects amount granted to NBI for project purposes from NBTF. Actual amount disbursed by project is lower, in some cases.

**Table 2. Investments resulting from NBI projects that are currently (I) Under Implementation, (II) Under Preparation or (III) Pre-Investment/Identification**

| I. INVESTMENT PROJECTS UNDER IMPLEMENTATION | | | | |
|---|---|---|---|---|
| **Project Title** | **Total Cost (Million US$) (est.)** | **Secured Financing** | **Source(s) of Secured Financing** | **Target Start of Implementation (Calendar Year)** |
| **A. NBI Project Portfolio** | | | | |
| **NEL Regional Transmission Interconnection Projects** (agreed regionally, prepared regionally and nationally, implemented nationally) | 403 | 350 | AfDB, JICA, KFW, Netherlands | 2013 |
| **Watershed management Projects** (Reg., Egypt, Sudan; excluding US$40 million Ethiopia - Tana Beles) (agreed and prepared regionally, implemented nationally) | 52 | 35.4 | GEF, Finland, Egypt, Sudan | 2009 |
| **Lakes Edward and Albert Fisheries Project** (Uganda-DRC) | 170 | 40 | AfDB | 2011 |
| **Ethiopia Tana-Beles Integrated Water Resources Development** (implemented nationally, with some preparation by ENTRO) | 70 | 70 | IDA, Finland, Ethiopia, Communities | 2008 |
| **Ethiopia Irrigation & Drainage** (agreed regionally, prepared and implemented nationally) | 110 | 110 | IDA, Ethiopia | 2007 |
| **Ethiopia-Sudan Interconnection** (agreed regionally, prepared and implemented nationally with technical assistance from NBI) | 70 | 70 | IDA (for Ethiopia), Sudan, Ethiopia | 2008 |
| **EN Flood Preparedness and Early Warning-Phase 1** (agreed and prepared regionally, implemented regionally and nationally) | 4 | 4 | NBTF, EN countries | 2007 |
| **TOTAL - NBI Prepared or Regionally agreed** | **879** | **679.4** | | |
| **B. Selected NBI assisted projects** | | | | |
| **Lake Victoria Environmental Management Project - Phase 2 for Rwanda and Burundi** (prepared by NELSAP) | 40 | 40 | IDA, GEF, Sweden | 2011 |
| **TOTAL - NBI assisted projects** | **40** | **40** | | |
| **GRAND TOTAL- NBI prepared & assisted** | **919** | **719.4** | | |

| II. INVESTMENT PROJECTS UNDER PREPARATION | | | | |
|---|---|---|---|---|
| **Project Title** | **Total Cost (Million US$) (est.)** | **Secured Financing** | **Possible Source(s) of Financing** | **Target Start of Implementation (Calendar Year)** |
| **A. NBI Project Portfolio** | | | | |
| **Bugusera Integrated Water and Irrigation Project (Rwanda-Burundi)** | 50 | 0 | AfDB African Water Facility | 2013 |
| **EN Flood Preparedness and Early Warning - Phase 2** | 42 | 0 | | 2014 |
| **Regional Rusumo Falls Hydro-electric and Multipurpose Project** (Tanzania, Rwanda, Burundi) | 430 | 0 | IDA, AfDB, Netherlands (Pledged ) | 2014 |
| **Kagera Sub-Basin Small Multipurpose storage reservoirs and watershed management -** (Burundi, | 280 | 0 | ($13 million under | 2013 |

| II. INVESTMENT PROJECTS UNDER PREPARATION | | | | |
|---|---|---|---|---|
| **Project Title** | **Total Cost (Million US$) (est.)** | **Secured Financing** | **Possible Source(s) of Financing** | **Target Start of Implementation (Calendar Year)** |
| Rwanda, Tanzania, Uganda) | | | consideration from CIWA) | |
| **Sio Malaba Malakisi Sub-Basin** Small Multipurpose storage reservoirs and water shed management (includes Maira and Bulusambu Dam Projects) (Kenya, Uganda) | 115 | 0 | 62 – IDA (under consideration -Maira Dam project) | 2015 |
| **Mara Sub-Basin** Small Multipurpose storage reservoirs and water shed management (Tanzania, Kenya) | 90 | 0 | See note for Kagera above | 2015 |
| **Small Scale Irrigation** Investments in Tanzania (Prepared to pre-feasibility level through NEL Water Project) | 265 | 0 | Government of TZ is looking to secure financing internally | 2015 |
| **Power interconnection.** Iringa-Mbaya Transmission Line. | 200 | 0 | IDA, JICA and AfDB | 2015 |
| **Power interconnection.** Kenya-Tanzania Transmission Line. | 271 | 0 | Under discussion with several financiers | 2015 |
| **Power Interconnection.** Uganda (Nkenda) – Democratic Republic of Congo (Beni – Butembo – Bunia) Power Transmission Line Study Project (ongoing) | 165 | 0 | | |
| **B. Selected NBI Facilitated Projects** | | | | |
| **Egypt Irrigation & Drainage: (West Delta)** (agreed regionally through NBI, prepared and implemented nationally) | 213 | 0 | Egypt | |
| **Grand Total – NBI Projects Under Preparation** | 1,584 | 0 | | |

| III. TECHNICAL ASSISTANCE AND PRE-INVESTMENT ACTIVITIES TO IDENTIFY PROJECTS FOR POSSIBLE FUTURE PREPARATION AND FINANCING |
|---|
| Advancing the NEL Water Resources Development Project (TA) Identification and preparation of pre-investment projects for water resources development and management with regional significance. Over $200 million of investments under identification. Includes: -Lake Kyoga Development Strategy and Investment Plan ($170 m); Yala River Basin Development Strategy & Investment Plan ($639 m); Gucha-Migori Basin Development Strategy & Investment Plan ($857 m); Aswa Basin Development Strategy & Investment Plan ($728 m); and Lake Victoria basin in Tanzania ($359 m). |
| Baro-Akobo Multipurpose Project (Ethiopia, Sudan) US$ 3.5 million from AWF and NEPAD |
| Future investments which may emerge from the EN Planning Model US$ 6.5 million from NBTF; and Cooperative Regional Assessments in watershed management, irrigation and drainage, and power trade. |
| NEL Climate Adaptation Mainstreaming Project (TA) €400,000 from KfW |
| Regional Agriculture trade and Productivity Project US$ 7.7 million from NBTF. Irrigation sites under identification. Pre-feasibility Studies to be funded under NCORE. |
| Sudan Irrigation and Drainage (Upper Atbara, Sudan) |
| Future investments may also emerge from the multisectoral investment opportunities analysis in the Eastern Nile, being undertaken through the NCORE project |

# 1. Project Context, Development Objectives and Design

## 1.1 Context at Appraisal

***Sectoral context.*** Water has played, and continuous to play, a central role in the history and political economy of the Eastern Nile basin, and has shaped its socio-economic and environmental dimensions. The Eastern Nile basin constitutes over 60% of the Nile River Basin, covers approximately 1.7 million kilometers square ($km^2$), and comprises four sub-basins: the Baro-Akobo-Sobat and White Nile, the Abbay/Blue Nile, the Tekeze-Atbara-Setit, and the Main Nile from Khartoum to the Nile Delta (see Map). The Eastern Nile basin is an important shared resource linking Egypt, Ethiopia, and Sudan (pre-independence of South Sudan), and a small portion of Eritrea. The system offers substantial opportunities for investments to develop multi-purpose storage and hydropower, improve agricultural production and improve watershed management. However, tensions over these resources have been a major constraint to economic growth and opportunities for trade and regional integration.

The Eastern Nile region is home to about 154 million people, and is characterized by extreme poverty, rapid population growth, environmental degradation and political instability. Inadequate development and management of the water resources of the region have been a major constraint to economic growth and livelihood improvement in a region characterized by extreme poverty, political instability, rapid population growth, and environmental degradation. Poverty levels are still very high; in many parts of the Basin, access to basic water, sanitation, and power services is still very low, and the impacts of water-related diseases are high. Economic development is uneven and often dependent in many areas on the vagaries of climate (especially given the high degree of reliance of livelihoods in many parts of the basin on rainfed agriculture) and frequent floods and droughts undermine progress. Only a small percentage of the irrigation and hydropower potential has been developed. In existing agricultural areas, yields, crop intensities and irrigation efficiencies are low. Deforestation and land degradation are serious, contributing to low soil productivity and increased downstream sedimentation.

The region faces significant challenges in the future. Continued erosion in the highlands, salinization of the land and waters in the delta, susceptibility to floods and droughts, and inter-sectoral and inter-regional water conflicts threaten the livelihoods of many in the region and the trends are not encouraging. The infrastructure to manage climate variability (e.g. multi-purpose storage or large-scale watershed development) is very limited. Climate change threatens the region from the point of view of unknown changes in rainfall and streamflow timing and magnitude, increased crop water requirements, increased evaporation losses, and increased potential for saline water intrusion. Continuing unilateral development may result in benefits within each country but are often sub-optimal from a basin viewpoint, posing challenges of water infrastructure operational coordination, managing system losses, impacting flexibility, and potentially foreclosing future cooperative options. All this increases the risk that the region will not achieve the kinds of economic transformation that is required to make substantive poverty improvements in the entire basin.

The Eastern Nile also offers substantial opportunity for development. The system offers substantial opportunities for investments to develop hydropower, improve agricultural production, and mitigate floods and droughts. Meaningful cooperation is essential to both better take advantage of opportunities and to better face evolving challenges. The transboundary nature of the Eastern Nile offers a unique opportunity for cooperative development and management to realize the economic potential of the region by optimizing the development of its water resources

in a larger basin context to sustainably improve water productivity and manage evolving risks (e.g. floods, droughts, and climate change) that could spill-over to facilitate overall regional development and collaboration. Such cooperation would require shared knowledge, institutional capacity, and coordinated and well-analyzed investments.

At the time of conceptualization and preparation of the Eastern Nile Planning Model (ENPM) Project, the knowledge base of the Eastern Nile basin was fragmented and inconsistent, sharing of information was minimal (including in the public domain), and there was a lack of shared, modern, flexible analytical/modeling tools to envision various development scenarios and analyze their implications from economic, environmental and social viewpoints. There were no strong stakeholder forums (including among Universities) to use this information and analysis to systematically inform investment decisions on the Eastern Nile. This *status quo* was a major impediment to building consensus on cooperative investments in the basin and deciding where further studies were required. The ENPM Project was expected to address these issues by improving the knowledge base, develop a suite of analytical tools, and build capacity to explore evolving risks and opportunities in the basin.

***Regional strategy.*** Since the 1990s, Egypt, Ethiopia and Sudan have made significant strides in strengthening Eastern Nile cooperation. It started with the launch of the Eastern Nile Subsidiary Action Program (ENSAP) in 1999, within the framework of the Nile Basin Initiative (NBI). In launching ENSAP, the Eastern Nile Council of Ministers (ENCOM) agreed to ensure efficient water management and optimal use of resources, target poverty alleviation, and promote economic integration through cooperative investments. The first joint institution of the three countries – the Eastern Nile Regional Technical Office (ENTRO) – was established in 2002 to oversee the preparation of the Eastern Nile investment program.

During the mid-2000, considerable progress was being made in the preparation of the first group of ENSAP projects, called Integrated Development of Eastern Nile (IDEN), which included fast-track projects intended to demonstrate early benefits of cooperation, and multi-purpose track program and projects expected to be more complex and time-consuming in relation to pursuing separate national agendas. One of the fact-track projects – largely sectorally-focused, nationally implemented projects agreed in a regional context – identified as part of the original ENSAP investment portfolio to be critical to such cooperation was this ENPM Project (hereafter the Project). There was significant support from all Eastern Nile countries for the Project, including letters of commitment from Egypt, Ethiopia, and Sudan.

***High level Bank commitment.*** Since 1998, the World Bank had been intensively engaged with the countries of the Nile Basin under the NBI to promote cooperative development and management of the Nile River. It supported the NBI since its inception by facilitating cooperation and dialogue, coordinating donor contributions through a multi-donor Nile Basin Trust Fund (NBTF), promoting institutional development, and providing technical assistance and advisory services. At the request of ENCOM, the Bank played a leading role in the implementation of the Joint Multi-purpose Program (JMP) aiming at providing the analytical underpinnings to support investment planning of the Eastern Nile. For the three recipient countries, Egypt, Ethiopia and Sudan (pre-independence of South Sudan), the Project was consistent with the high level of Bank commitment to promote cooperative development and management of the Nile and the objective set in Country Assistance Strategies (CAS) and Country Water Resources Assistance Strategies (CWRAS) of providing a framework to analyze and prepare future cooperative investments in the Eastern Nile.

***Rationale for Bank involvement.*** The ENPM Project was considered to be a critical input to the objectives of the NBI and the work of the World Bank. Support for the Project would promote the objectives of the CASs and CWRASs of the Eastern Nile countries and would provide a framework for cooperative dialogue and planning of future regional investments. The Project would also help the Bank to tap its expertise in international river basins and in such knowledge-driven decision-support processes to assist the Eastern Nile countries in realizing a higher level of cooperation. Experience in other international river basins had also indicated the need to strengthen the collation, organization, analysis, dissemination, and use of basin information to build a shared awareness of key evolving issues in the Basin, and to better inform future cooperative investments. It was expected that such an activity would also help ENTRO integrate a decade of detailed studies and strengthen its knowledge and analytical services to the region.

**1.2 Original Project Development Objectives (PDO) and Key Indicators (*as approved*)**

The development objective of the Project, according to both the Project Appraisal Document (PAD) and the Grant Agreement, was that ***countries in the Eastern Nile operationalize an improved decision support modeling framework to identify water-related investments and evaluate them in a regional context.***

To track progress towards achieving the above mentioned development objective, the following key outcome indicators were proposed during the course of Project preparation, as reflected in the PAD Results Framework and Monitoring (Annex 3):

- Number of projects in Eastern Nile for which investment strategies are based on the ENPM analysis;
- Number of regional and national meetings facilitated by ENPM outputs; and
- Number of senior professionals in regional/national institutions using ENPM [products].

Key intermediate indicators, as reflected in the main text of the PAD, were also agreed:

- Development of a shared interactive Eastern Nile Knowledge Base and dissemination of a State of the Eastern Nile Report;
- Development of modeling tools to systematically evaluate Eastern Nile investments in a regional context, examining economic, environmental and social aspects as allowed by available data;
- Strong institutions at regional and national levels (in Egypt, Ethiopia and Sudan) with adequate capacity and partners (e.g., University Outreach Centers) to be a focal point for knowledge and analysis on water investments on the Eastern Nile; and
- Collaboration with the Nile Decision Support System (DSS).

**1.3 Revised PDO (as approved by original approving authority) and Key Indicators, and reasons/justification**

*Not Revised.*

**1.4 Main Beneficiaries**

Although the PAD does not explicitly define the expected Project beneficiaries, it is safe to say that the primary intended beneficiaries of the Project were the NBI (including ENTRO itself, ENCOM, the ENSAP Team, and the NBI Secretariat through Nile DSS synergy), who would

benefit from the efforts to strengthen Eastern Nile interaction and cooperation; the national-level governments, and universities from Egypt, Ethiopia and Sudan (pre-independence of South Sudan), who would have a lot to gain from increased knowledge, sharing of information and analytical tools, capacity building and training; and in general, the 154 million people living in the Eastern Nile basin, civil society organizations, and donor community, who would significantly benefit from the joint management of risks of water-related impacts (in particular floods, droughts and climate change) and the joint development of productive opportunities (in particular optimization of power and irrigation development and watershed management).

**1.5 Original Components (***as approved***)**

The Project components were based on the ENPM framework (developed by an international consulting firm) with inputs from a regional working group conformed by Eastern Nile riparian representatives. As designed, the Project included the following complementary components:

***Component A: Knowledge Base Development.*** This component's primary objective was to develop the knowledge base for the Eastern Nile to provide a shared, synoptic view of the Eastern Nile basin, including its opportunities and risks as viewed from an economic, environmental and social perspective. It was expected that the baseline data would be organized systematically in a Geographic Information System (GIS) platform with an associated web portal, and that an effective use would be made of modern datasets from satellite remote sensing and other global/regional datasets.

***Component B: Modeling System.*** This component's objective was to develop the ENPM modeling system to include a suite of simulation, optimization and multi-criteria analytical tools. It was expected that the models would build on a water systems "spine" using tools developed by the Nile Basin DSS to help analyze the economic, environmental and social aspects of proposed investments in a water resources systems framework and to evaluate alternative scenarios of the future. It was also expected that the tools developed would draw upon and contribute to the knowledge base developed under Component A, and would be flexible enough to adapt to changing needs and increasing information availability.

***Component C: Institutional and Human Capacity Building.*** This Component was to support a structured stakeholder process to ensure that the systems developed are driven by multi-sectoral stakeholder demand and appropriate to support decision-making. It was expected that the proposed ENPM Project (developed in collaboration with the Nile DSS) and associated training would strengthen ENTRO as a strong knowledge-driven regional institution, as well as improve the capacity of national institutions, reducing the current disparity in national capacity for such activities. Networking with academia and other international river basins were to be pursued to improve cross-fertilization of ideas and sustainability.

**1.6 Revised Components**

*Not revised.*

**1.7 Other significant changes**

***Revision of implementation arrangements at Mid-Term Review (MTR).*** The implementation modality for the development of the regionally shared modeling systems was changed during the MTR from using a large consultancy firm to support the development of the ENPM systems to in-house development at ENTRO. This change was necessary given the deterioration in the regional cooperation environment related to the Cooperative Framework Agreement and the consequent

problems faced by ENTRO (after two countries froze their participation in the NBI) to obtain approval from ENCOM to proceed with the signing of the large consultancy contract and the limited time then remaining to deliver on the requested scope of work. Under the new implementation modality ("Plan B"), substantial emphasis was given to the use of young professionals from the riparian universities and ministries through the implementation of an internship program, university partnerships, specialized smaller firm and individual consultancies (including in-house consultants) for the development of key Project products. This change provided an opportunity to further build technical capacity within ENTRO and create of a community of Eastern Nile modelers linked to Eastern Nile universities.

***Extension of the closing date.*** The Project was extended by two months from the original closing date of October 30, 2012 to December 31, 2012 to allow for orderly closure of the Project activities after a delayed start, to align with the Nile DSS closing, and to ensure continuity of ENTRO activities with a new project (Nile Cooperation for Results Project) that was being prepared to start at the beginning of 2013.

***Inclusion of South Sudan.*** In July 2011, during the course of Project implementation, South Sudan was declared a sovereign state. South Sudan was then treated as another Project beneficiary.

***Reduction in Project cost.*** At appraisal, the Project cost and NBTF grant were US$7.1 million and US$6.5 million, respectively, and at closure they were US$4.65 and US$4.35 million, as a result of the change in implementation modality mentioned above. The undisbursed grant were not lost for work on the NBI as this was returned to the NBTF, including to partially finance the subsequent Nile Cooperation for Results (NCORE) Project.

***Changes in the use of the grant proceeds.*** There were changes in the use of grant proceeds. Grant proceeds originally allocated for the large consultancy were reallocated for smaller consultancies, goods and equipment/workshops and training. Since a single category was stated in the Grant Agreement, this did not require any reallocation.

## 2. Key Factors Affecting Implementation and Outcomes

### 2.1 Project Preparation, Design and Quality at Entry

***Lessons of earlier operations were taken into account.*** Lessons learned from earlier activities on the Nile Basin and other major international basins were incorporated in Project design. First, strong emphasis was placed on the development of knowledge base and analytical capacity - good information and analysis was considered essential for good investment planning. Second, information sharing among riparian countries, which commenced before Project implementation with the development of the Eastern Nile One-System Inventory, was considered as the first step towards analytical work and riparian cooperation. Third, there was significant attention to the participation of all riparian countries in the development of useful knowledge products and analytical tools. And finally, the capacity of the Project management team was considered critical to ensuring the development of useful products. An international workshop organized during Project preparation to learn from other relevant projects and initiatives on transboundary river basin also helped shaping Project design. An international consulting firm was engaged to help prepare the project design document.

***Preparation adopted a participatory process.*** During the course of Project preparation, special attention was devoted to engaging stakeholders to ensure their adequate input into Project design. Stakeholder participation was initiated through a multi-sectoral regional working group that guided Project design and preparation. There was substantial commitment to the project from Egypt, Ethiopia, and Sudan, with letters of commitment, and also competing demands from different riparians to have the regional coordination for this Project based in their country - that was finally resolved with ENTRO and Bank facilitation.

***Key risks were assessed.*** While the political risk was adequately recognized and discussed in the PAD, no mitigating measure was identified to address the risk arising from the challenges of the Nile Basin cooperation, which unfortunately materialized one year into Project implementation – refer to Section 2.2. With the freeze in Egypt and Sudan participating in the regular governance activities of the NBI, ENTRO was unable to perform its regular activities and processes smoothly and efficiently. Despite several calls of ENTRO, a meeting of the ENCOM's members to approve the contract to engage the primary consulting firm to support the development of the regionally shared modeling systems never took place. The flexible Project design (discussed below), although not explicitly acknowledged in the risk section of the PAD, made it possible for ENTRO to proceed with the immediate tasks and embark on the "Plan B" to achieve the planned project objective and enhance technical capacity-building even in a difficult cooperation environment. Apart from the political risk, which was rated substantial, the other identified risks were rated moderate, and adequate mitigation measures to address them were provided.

***Simplicity and flexibility were embedded in Project design.*** The simplicity in Project design helped ENTRO keep a focus on implementation of Project activities. The flexibility embedded in Project design was a critical factor to maintain its relevance. The Project was identified as one of ENSAP fast-track project back in 2005 to act as a precursor of other NBI projects in the Eastern Nile basin. There was a long delay between Project identification and appraisal because of the difficulty in getting agreement among the riparian countries on the location of ENTRO's ENPM Coordination Office. In the meantime, other NBI projects (e.g. the Nile DSS, led by the former ENPM Regional Coordinator) moved forward and carried out some of the knowledge base and modeling activities that were supposed to be made available under the Project. This overlap between the originally envisaged activities under Components A and B of the Project and those undertaken by other projects was analyzed during the MTR and changes were introduced in the original scope of activities under each component. The simple and flexible design allowed accommodating the changes while staying focused on the PDO.

***Opportunities to build technical capacity within ENTRO and promote gender balance were not sufficiently explored during preparation.*** Most of ENTRO's previous activities for a decade and World Bank experience in other such projects relied on trying to procure large consultancies to undertake such tasks. This was also consistent with the Nile DSS approach and ENTRO's procurement and technical capacity at preparation. However, with the benefit of hindsight, an alternative "Plan B" approach seems to have been so appropriate that the Bank may have wanted to have explore such an option right from the beginning - to build technical capacity within ENTRO right from the start, rather than rely on a single large consulting contract to provide implementation support to ENTRO. The difficulty in completing the procurement process of the largest consultancy services under the Project, which led to the adoption of "Plan B", was indeed a blessing in disguise. With regard to gender balance, opportunities to promote gender equity among ENTRO professional staff were also not explored. During the course of Project preparation and implementation, professional positions at ENTRO (recruited with intense competition from among the region's professionals) were mostly filled by men. ENTRO did eventually make special efforts to recruit more women as part of the internship program.

## 2.2 Implementation

### Factors that contributed to success

***Focus on results*.** The focus-on-results approach adopted throughout implementation by ENTRO and the World Bank team was important for encouraging adaptive management while focused on end objectives. The feedback offered by the large number of riparian stakeholders that participated in the MTR workshops provided opportunities for modifying implementation modality in a pragmatic manner to reflect the prevailing realities in the region and meet the PDO. The focus-on-results attitude of key stakeholders participating in the Project helped the project achieve concrete outcomes at closing.

***Restructuring of ENTRO's institutional structure.*** This was also a key factor that greatly contributed to the success of the Project. The 2010 strengthening of the Water Resources Planning Unit at ENTRO with highly technically qualified staff resulted in a paradigm shift in ENTRO's *modus operandi* moving away from relying heavily on external parties to deliver its outputs to building in-house capacity to produce its analytical tools and knowledge products. Apart from allowing institutionalizing the Project's activities within the ENTRO's Water Resources Planning Unit, this shift also allowed senior staff at ENTRO to move away from heavy work load associated with contract management to focus more on the development of technical content.

***Solid technical capacity, continuity and strong commitment of key Project management staff, both on ENTRO and the Bank.*** The solid technical skills of the Head of ENTRO's Water Resources Planning Unit, the Regional Project Coordinators, and the Bank Task Team Leader, their continuity, their strong commitment towards the Project, and their deep appreciation for developing local capacity created mutual understanding and trust, which facilitated timely resolution of implementation problems.

***Built-in flexibility in Project design*.** The fact that the Project activities and implementation arrangements were not over-specified in the grant agreement and the specification of only one disbursement category avoided over-burdening both Bank and ENTRO implementation team with administrative processes during the last year of implementation, and let them focus on delivering Project results.

***University partnerships and an innovative internship program increased ENTRO implementation capacity.*** During the MTR, ENTRO was keen on strengthening linkages with universities located in the Eastern Nile countries, in particular with the three universities with which ENTRO had already signed Memorandum of Understanding (MoU) during Project preparation. In spite of the prevailing regional cooperation tensions, Universities were very eager to work across borders, and the network of Universities involved with ENPM grew from the original 3 focal universities to include almost all the major universities in the region. A very innovative feature was the introduction of a competitive paid internship program at ENTRO for graduate students, young faculty, and ministry staff from all Eastern Nile countries (including South Sudan after it was formed) to be resident at ENTRO in batches for a period of about 3 months each. This allowed ENTRO to tap into creative youth talent and cutting-edge skills in the region, as well as offer them an opportunity to work together in teams across cultures and contribute to the ENPM products. This innovative internship program was a cost-effective and cost-efficient way to increase the capacity of ENTRO to deliver and disseminate the Project's knowledge and analytical products.

**Factors that caused implementation problems**

***Disagreements over the Nile Cooperative Framework Agreement (CFA)***. In mid-2010, disagreements related to a new water agreement for the Nile (the Cooperative Framework Agreement) led to a "freeze" in participation of two of the three Eastern Nile countries in official regional NBI activities, including this project[8]. This impacted negatively on all NBI activities – including this Project implementation. From mid-2010 onwards, ENTRO governance was not able to meet effectively, there was a low participation from riparian country officials in Project activities, hiring of country-based staff was delayed, and official representation in regional workshops was very limited. Despite the difficult political situation, ENTRO was able to flexibly sustain the Project activities, and in early 2012, the Project was able to rapidly scale-up implementation in its final year after instituting the changes agreed during the MTR.

***Overlapping with other NBI projects.*** As indicated earlier, due to long delay between identification and appraisal, and then due to the slow start-up, other NBI projects moved forward and carried out some of the knowledge base and modeling activities that were supposed to be made available under the Project, often with different development philosophies and objectives. Considerable time and effort were devoted to avoid duplication and improve synergy with the Nile DSS. This in turn caused constantly revisions of the scope of work under the primary consultancy, which impacted negatively on implementation.

***ENTRO fiduciary capacity.*** The project implementation was also hampered by ENTRO's procurement capacity as their limited procurement staff were supporting several major procurements in several ENTRO projects. Some final procurements related to satellite imagery could not materialize in this context.

**2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization**

***M&E design.*** The M&E framework of the Project was based on the Results Framework and Monitoring included in Annex 3 of the PAD. The M&E framework provided a list of outcome indicators to measure achievement of the PDO as well as intermediate indicators and output indicators to measure progress on each of the components. It also called for the use of questionnaires and surveys (including on-line/web-surveys) to obtain regular stakeholder feedback on Project's progress and impacts as well as on Project activities. In general, the M&E framework provided practical guidance for carrying out M&E of the Project and for measuring progress towards achievement of PDO.

***M&E implementation.*** ENTRO was responsible for the M&E of the Project. A dedicated ENTRO M&E Officer was responsible throughout Project implementation of tracking Project results and feeding the ENTRO's results-based work planning, budgeting and reporting system. Monthly, quarterly and annual reports were prepared focusing on results and financial resources utilization. In addition, MTR and Project Completion Report (PCR) were prepared. M&E was rated between Moderately Satisfactory and Satisfactory throughout Project implementation. Upgrading during the final stage of Project implementation was due to notable improvements in

[8] While there was a "freeze" in participation, the countries did not officially withdraw from the NBI or from ENTRO.

the quality of the reports. While the M&E system was in general good to monitor Project progress, more could have been done in terms of getting feedback from stakeholders to gauge Project implementation, assessing effectiveness of training and workshops and gathering information from NBI institutions on the use of Project products. Stakeholder opinion surveys were planned to be conducted but there were delays in their execution given the completion of most products only near project closing.

***M&E utilization.*** The M&E system was used by ENTRO management, ENTRO Project Team, and the Bank Project Team to track Project implementation and results. While monthly progress reports were disseminated within ENTRO for internal Project management, quarterly and annual progress reports were also disseminated to all key stakeholders, including ENCOM and ENSAP Team, for the purpose of information, accountability and learning. The Project was covered by the NBI's ENSAP's dedicated website (http://nilebasin.org/newentro/ ) linked at a later stage to ENTRO's new website (http://entroportal.nilebasin.org/ ), which was developed under the Project and disseminated Project activities and outputs.

### 2.4 Safeguard and Fiduciary Compliance

***Safeguards.*** The Project triggered the Environmental Assessment OP 4.01 safeguard policy and was categorized as Environmental Assessment (EA) category C because neither environmental nor social impacts were expected from the technical assistance activities to be supported by it. Nonetheless, the PAD acknowledges that a Strategy for Addressing Environmental and Social Safeguards (SAESS) was developed under the NBI Institutional Strengthening Project in 2008, which would be applicable to all technical assistance projects that fall under NBI, including this Project. Environmental compliance was monitored as part of the regular supervision missions, and was rated satisfactory in Implementation Status and Results (ISRs) through the Project's period. Guidance on stakeholder consultation including in the SAESS were adopted to engage stakeholders during the development of database and modeling tools. The assembled data and developed tools would allow conducting meaningful stakeholder consultations and participatory planning in the future.

***Financial management.*** Financial management compliance has been rated Moderately Satisfactory in ISRs throughout the Project period. The financial management system, including accounting, reporting and auditing arrangements, was in general adequate and satisfactory to the Bank. Quarterly Interim Financial Reports (IFRs) were submitted timely and were acceptable to the Bank. The Project benefitted from a stable, adequate and well-trained financial management staff in ENTRO. During early Project implementation, a problem was encountered with the transfer of advance funds to national office to support country-based activities. This issue was resolved immediately after notifying that all activities of the national offices with exception of the operating costs needed to be centrally funded by ENTRO. Internal controls, however, remained a challenge throughout Project implementation. Annual financial audited statements and associated management letters were submitted for the periods 2010/2011 and 2011/2012 and had unqualified opinions. The final audit of the Project financial statements for the period 2012/2013 will be submitted in November 2013 together with the first audit of NCORE project. The rating was a reflection of the low disbursement rate and low budget execution due to the initial delays with the primary consultancy contract. Budget execution was affected by the regional freeze of Project activities. Out of the NBTF grant amount of US$6.5 million, the Project was able to utilize US$4.32 million (66%). In retrospective, the slow disbursement delay should not have influenced financial management rating.

***Procurement.*** Procurement compliance has been rated Moderately Satisfactory in ISRs throughout the Project period. In general, procurement was acceptable to the Bank. The procurement plan was in place from Project start, and was subject to various updates to accommodate delays with main consultancy contract and reflect consultancy needs arising from the new implementation modality agreed at MTR. ENTRO procurement staff was familiar with Bank procurement procedures and was stable throughout implementation. Procurement processes were organized following agreed procedures. The main consultancy service selection process was completed after considerable delays, but the contract could not be concluded for reasons related to the freeze of NBI activities, as well as changes in the scope of work. The Bank provided its no-objection to ENTRO's request to proceed with the cancelation of the process, which was cleared by the Regional Procurement Advisor's Office after 6 months. Two post-reviews were conducted.. The Project would have benefitted from additional procurement support at ENTRO to speed up some of the procedures, particularly during the last year of Project implementation.

**2.5 Post-completion Operation/Next Phase**

**Sustaining institutional capacity supported by the Project**

As acknowledged in the PCR prepared by ENTRO, although the Eastern Nile region has a long history of institutions working on various aspects of water resources development and management, at the start of the Project, there was little in the way of a comprehensive knowledge base for the Eastern Nile basin, and extremely limited information in the public domain. Calibrated modeling toolsets that allow users to explore a range of development and management issues that the Eastern Nile basin faced were not available in the public domain. There were no effective partnerships among or across universities in each Eastern Nile country to work together on water-related issues of regional interest. Although ENTRO had overseen many major consultancies related to land and water management, its in-house capacity to organize, use, and analyze information on Eastern Nile was very weak. The use of modern information technology (IT) tools was limited and the ENTRO website provided little useful information. Eastern Nile countries did not really look to ENTRO to provide the knowledge base and modeling services they needed, especially to support decisions on water-related investments from a regional perspective.

By mainstreaming Project activities within its institutional structure, ENTRO has been able to develop an extensive in-house knowledge base and analytical skills. In addition, with financial support from the Project, ENTRO has improved its IT hardware and software, acquired datasets and books, improved communication and internet access, and re-organized its office space to better serve its functions.

As indicated by key stakeholders interviewed by the ICR team and corroborated by the findings of the stakeholder survey conducted after Project closure, there has been a dramatic change in ENTRO's capacity to develop and use knowledge and analytical products to support improved planning and management of water resources in the Eastern Nile. The extensive knowledge base developed has also improved the effectiveness and sustainability of previous technical assistance projects aiming at improving the knowledge base and planning. The modeling and visualization tools developed are being used by ENTRO to analyze a wide range of development, management, and climate scenarios in a multi-sectoral context.

According to the feedback obtained during the course of Project implementation and after Project closure, the Project has also facilitated strong partnerships with academic institutions in the Eastern Nile countries that have helped establish better professional networks within and across

countries, level the playing field, and improve research efficiency. This assessment was corroborated by the Heads of Water Resources Departments of Ethiopia and Egypt universities interviewed by the ICR team. They acknowledged that "this has been the first time face-to-face partnership between African universities" has been fostered for such an effort. The equipment, books, datasets, modeling tools, internship program, and capacity-building efforts should help both country government agencies and universities to develop a new cadre of professionals that are more cognizant of regional water resources development and management perspectives and can utilize the best available datasets and tools on a more level playing field. The new ENTRO web portal (expected to be scaled-up to the entire Nile Basin in the next year under the framework of the NCORE project) has innovative features to improve public access to information, tools, and knowledge products.

The knowledge base, knowledge products, and analytical tools developed with Project support have been a valuable source of reference information for country professionals, and have inspired and incentivized students that participated in the internship program to conduct inter-disciplinary research as well as masters/doctorate thesis on issues related to Eastern Nile challenges. The Project products are also expected to provide (and have already begun to provide) a valuable source of information to professional consultants engaged by the country and regional institutions to provide insights and advice on critical development challenges and proposed investments. For example, this includes enhanced support to Sudan and Ethiopia on flood forecasting, to the Tana and Beles Sub-basin organizations on knowledge products and basin planning, and modelling to improve existing dam operations and climate resilience.

The efforts made by ENTRO and its partners with the help of the Project should help improve the development of strong regional and country-level institutions and networks in the Eastern Nile that have improved access to comprehensive knowledge bases and analytical tools that leverage existing information and modern IT advances to improve regional cooperation. Thus, the sustainability of the institutional capacity supported by the Project is not a major concern.

**Progress made by the Project will be carried forward**

There are a number of current and future activities that are carrying or will carry forward the progress made under the Project. These include:

***Supporting progress under the recently launched NCORE project.*** After the set of NBTF projects in the Nile Basin came to a close in December 2012, the 3-year single NCORE project has been launched for all NBI institutions to support progress towards achievement of the NBTF projects' goals. In the case of ENTRO, the NCORE project will support activities that can benefit from, and build on, the achievements of the Project, namely refining the knowledge base and analytical tools, updating IT platforms, strengthening the web portal, improving the flood forecasting work, continuing the internship program and partnerships, enhancing the work on climate change, environmental and social aspects, dam safety, and developing additional demand-driven knowledge products and services. In addition, the NCORE project also proposes to expand some of the good-practice activities initiated under the Project to a basin-wide context. This would help ensure the short-term sustainability and enhancement of Project's activities, and contribute towards planning in the longer-term.

***Integrating Project's results in other initiatives.*** The work done with the support from the Project has already been integrated with other ongoing NBI activities. For example, the ENTRO worked closely with the Nile DSS team to co-locate and co-finance activities to improve the effectiveness and sustainability of both activities. ENTRO has also worked to help integrate

Project outputs into the Nile Information System and Knowledge Management activities, and also synergize with other activities financed by a number of other development partners, e.g., the Baro-Akobo-Sobat Multipurpose Development Project supported by the African Development Bank, other activities relating to knowledge management and GIS financed by GIZ, and several other proposed activities for the support of bilaterals such as the French, Swiss, and DFID.

Thus, even though the cooperation environment in the Eastern Nile continues to be very difficult and uncertain, the products and approaches developed by ENTRO for ENPM should not only help improve the cooperation environment through the desire for riparians to work together on such areas for mutual benefit, but also continue to prove useful irrespective of the shape or composition of the evolving cooperative institutions.

## 3. Assessment of Outcomes

### 3.1 Relevance of Objectives, Design and Implementation

***The Project's objective was highly relevant for the riparian countries.*** The development objective of the Project that countries in the Eastern Nile develop an improved decision support modeling framework to identify water-related investments and evaluate them in a regional context was consistent with the development objectives of Egypt, Ethiopia and Sudan (pre-independence of South Sudan), and their high level commitment to strengthen Eastern Nile cooperation. Shared knowledge base and appropriate analytical tools to better support decision making processes in the Eastern Nile were essential elements of such cooperation. The Project was also consistent with the needs perceived by the riparians and the commitment made by the Bank in its respective CASs and interim CWRASs of the Eastern Nile countries to provide a framework for cooperative dialogue, planning and preparation of future regional investments.

***The Project's design and implementation were also highly relevant.*** The Project design was technically sound and the three components were appropriately related to and consistent with the stated PDO. As indicated in Section 2.1, its design reflected the experience of several other international basins projects and programs. Preparation was carried out by the Bank in close cooperation with the three riparian countries and ENTRO. With relation to the relevance of implementation arrangements, the Project design called for mainstreaming of Project activities within ENTRO. Consistent with this, the Project's design should perhaps have put more emphasis on doing more in-house work, rather than on heavy reliance on a large consultancy. Implementation modality was modified at MTR along these lines. This change helped ENTRO staff to move away from a traditional role of being contract managers of large consultancies to actually doing most of the work themselves.

### 3.2 Achievement of Project Development Objectives

**Progress towards achievement of PDO**

To a significant extent, the Project achieved the PDO, as measured by the indicators defined at appraisal:

***Indicator 1: Number of projects in Eastern Nile for which investment strategies are based on the ENPM analysis.*** The target was to have at least one major joint multipurpose/national investments analyzed with Project's products. This target was surpassed at the end of Project

implementation. A range of joint multipurpose project options were analyzed using Project's tools. For example, many sizing and cascade versions of proposed Blue Nile mainstream dams were analyzed[9] using the tools developed under the Project. A number of investments of national significance were also analyzed in a regional context, wherever possible, related to irrigation, watershed management, and power systems to contribute to the development of investments strategies. ENTRO's products and services are being used by the Africa Development Bank for the appraisal of one of its projects. The Abbay Basin Authority and its branch offices of the Tana Sub-Basin Organization and the Beles Sub-Basin Organization are also using ENTRO's products to improve sub-basin planning and management and have signed an MOU with ENTRO in this regard with the Ethiopia Tana and Beles Integrated Water Resources Development Project. The Project has also helped shape the design of the activities proposed under the NCORE project.

***Indicator 2: Number of regional and national meetings facilitated by ENPM outputs.*** The target for this indicator was to have at least one regional meeting and one meeting at each of the riparian countries facilitated by Project's outputs. This target was also surpassed by the revised closing date. There have been a number of well-attended workshops organized at the regional level (4) and at the national levels in Egypt (3), Ethiopia (1) and Sudan (2) facilitated with the Project products. ENTRO plans to continue to use Project's products in future workshops and in engaging regional, country and development partner professionals.

***Indicator 3: Number of senior professionals in regional/national institutions using ENPM products***. The target for this indicator was that at least four regional level professionals and two professionals from each of the riparian countries were proficient in appropriate use of ENPM system tools. This indicator was also surpassed at Project's closing date. There are a number of professionals working in NBI institutions that are using Project's products. This includes the staff of the Water Resources Planning Unit at ENTRO, the 46 graduate students and young faculties involved in the internship program supported by the Project, faculty staff in key university in the Eastern Nile including Heads of the Water Resources Engineering Departments, and government professionals. In Sudan for example, the Ministry of Water regularly uses the flood forecasting supported under the project to make decisions during flood periods, and is also exploring the use of the RiverWare model to operate its Roseires dam. In Egypt, the Project's activities and products have created a new Eastern Nile modeling section in Cairo University, helped universities better network together and have influenced the design of the curricula of water resources management courses. In Ethiopia, the Project has improve the use of these tools for flood management and basin planning in the Tana and Beles sub-basins, and the Project's products have helped influence the design of a new program on transboundary water management has been introduced in the Institute of Water Resource.

**Progress towards key intermediate performance indicators**

The Project outcomes were also measured by four intermediate outcomes that assess achievements in the three components.

[9] As usual with World Bank financing of technical assistance, the inclusion and examination of ongoing and planned infrastructure in a study should in no way be construed as an endorsement of any particular infrastructure projects by the World Bank, nor by any of the parties involved with the project, other than where such projects have been specifically considered and expressly endorsed by the World Bank or any such parties, such as through an actual project financing.

***Achievements under Component 1 (Knowledge Base Development).*** Achievements under this component were captured through the following intermediate indicator: Development of a shared interactive Eastern Nile knowledge base and dissemination of a State of the Eastern Nile Report. By closure, the Project helped develop a wide range of knowledge base and products on the Eastern Nile. A wide range of multi-sectoral spatial layers were collated, computerized, quality enhanced, and organized into GIS layers (see Figure 5). Systematic geo-databases were developed for watershed management, power systems, and irrigation and drainage. Interactive toolkits were developed to provide easy access to thematic and sub-basin information (see Figure 6). An annotated bibliography was developed for key documents on the Eastern Nile. An Eastern Nile Atlas was developed to visualize the spatial diversity of the region. A State of the Eastern Nile Report was also developed to describe the history, context, and future opportunities and risks in the Eastern Nile. A modern interactive web portal was developed to provide enhanced access to the Eastern Nile knowledge base and knowledge products. This platform for regional cooperation provided by ENTRO is addressing the reluctance among Eastern Nile riparian countries to share data and knowledge.

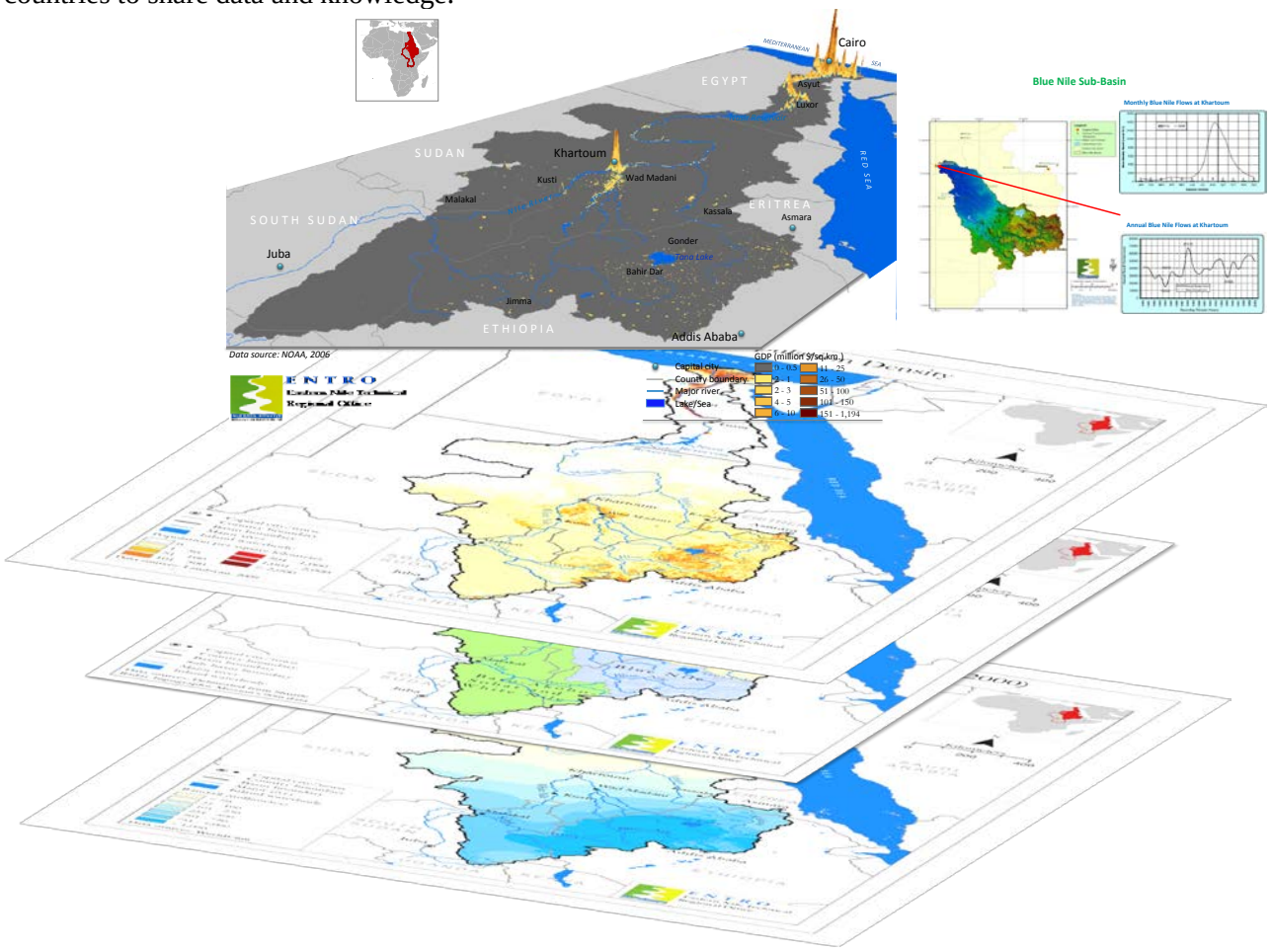



**Figure 5: EN datasets were organized and visualized under ENPM**

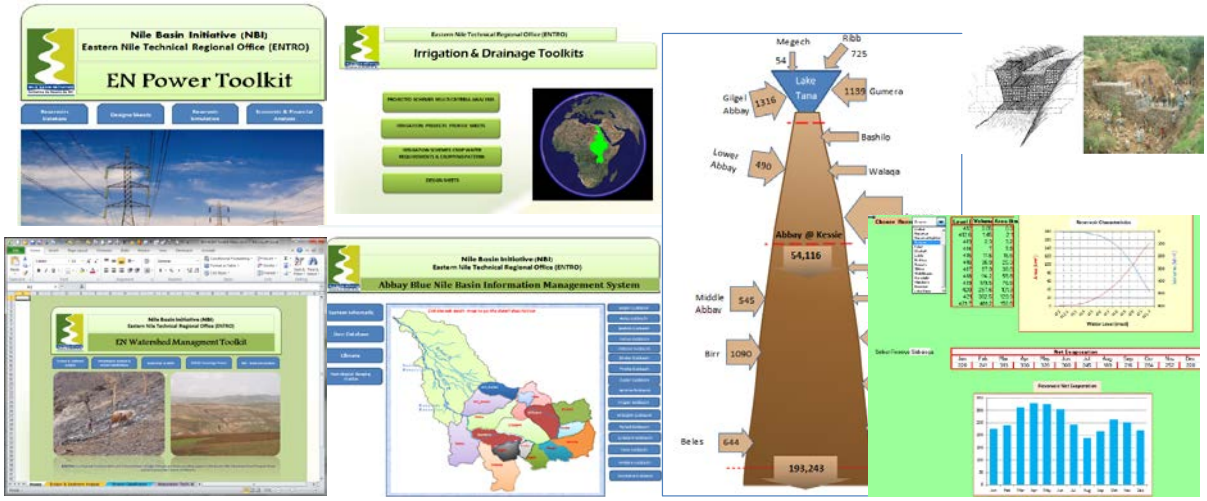



**Figure 6: Examples of Interactive Toolkits developed under ENPM**

***Achievements under Component 2 (Modeling System).*** Achievements under this component were measured through the following intermediate indicator: Development of modeling tools to systematically evaluate Eastern Nile investments in a regional context, examining economic, environmental, and social aspects as allowed by available data. By closure, several modeling tools were developed to provide analytical insights into the resource management and investment options in the Eastern Nile. This included simulation, optimization, and multi-criteria tools to examine proposed water investments in a multi-sectoral regional context (see Figure 7). A range of reputed modeling tools were used to support analysis on the Eastern Nile – including Soil and Water Assessment Tool (SWAT), the Hydrologic Engineering Center (HEC) suite, River Basin Simulation Model (RIBASIM), RiverWare, Mike Basin, and the Nile DSS framework. Efforts were made to integrate economic, environmental, and social aspects in spite of the significant limitations of the available data. The impacts of investments on sensitive downstream areas were examined for varied scenarios of sizing, phasing, filling and operational strategies. Optimization tools were developed to examine options to maximize the net benefits of basin development and management. Flood forecasting tools were improved to help countries provide early warning to vulnerable residents of flood-prone areas. Climate change analysis was conducted using a range of the best available Global Circulation Model (GCM) outputs. Tools were developed and targeted studies undertaken to improve the consideration of economic, environmental, and social aspects. It is expected that such tools will continue to be refined in the future – immediate follow-up work to refine the knowledge base and analytical tools and further encouragement for adoption will be supported by the recently-launched NCORE project.

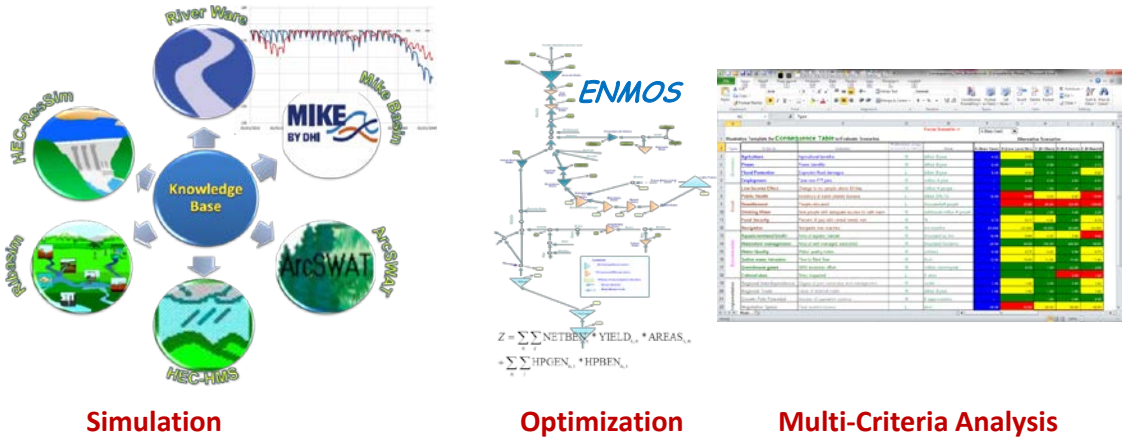



**Figure 7: Examples of Models Used in ENPM**

***Achievements under Component 3 (Institutional and Human Capacity Building).*** Achievements under this component were measured by two intermediate indicators: Strong institutions at regional and national levels (in Egypt, Ethiopia, and Sudan) with adequate capacity and partners (e.g. University Outreach Centers) to be a focal point for knowledge and analysis on water investments on the Eastern Nile; and collaboration with the Nile DSS.

With regard to the first intermediate indicator, at the regional-level, the Project has helped transform ENTRO into a credible center to provide regional knowledge and analytical services. ENTRO now has the enabling skills, knowledge base, modeling tools, networks, partnerships, and outreach mechanisms to be able to engage a wide variety of stakeholders to help them make better informed decisions on issues and options that have regional significance. ENTRO's credibility as a provider of knowledge and analysis services has also improved tremendously. A few indicators of this improvement are as follows. ENTRO's services were used by the African Development Bank in the preparation of a project on the Baro-Akobo-Sobat. South Sudan, who is facing unique challenges in building capacity after several years of conflict, is currently looking for ENTRO to help build its capacity on water resources management. Both the Tana Sub-Basin Organization and the Beles Sub-Basin Organization are also using ENTRO's services to improve sub-basin planning and management. At the national-level, the Project has had mixed success. It has helped developed excellent partnerships with universities in the Eastern Nile countries, helping universities to establish better professional networks both within and across countries, and to partner with a number of ENTRO activities, including training and workshops (see Figure 8). The internship program established has been pioneering, helping a new generation of potential water professionals and leaders to acquire new skills, develop new regional collaborations, and contribute multi-sectoral perspectives to enhance ENTRO's knowledge and analytical services (see Figure 9). The Project has also helped improve national government capacity through provision of equipment and training; however, their full participation (especially in the case of Egypt and Sudan) has been severely constrained by their freeze in participation in NBI activities.


**Figure 8: Examples of Training and Workshops**

**Figure 9: Example of ENTRO Interns**

With regard to the second intermediate indicator, a key concern during preparation was to maximize the synergy between the overall Nile Basin analytical activities (particularly the Nile DSS activity of the Water Resources Planning and Management project implemented by the Nile Secretariat) and the Project implemented by ENTRO. Cooperation was very limited initially (e.g. limited to sharing knowledge bases, co-locating activities in-country, and helping on each other's procurements) due to each project implementing a number of activities with separate multi-country teams as planned on a very tight timeframe. However, as the Project's activities really picked up especially towards the closure, there was much more robust and meaningful collaboration. This included co-financing key consultancies related to software development for additional Nile DSS features, adapters for additional models to be added to the Nile DSS framework, IT equipment and software to Eastern Nile countries, synergizing remote sensing procurement, and synergy in training and capacity building. This has also helped the Nile Secretariat and ENTRO to better agree on future knowledge, analysis, and partnership needs under the new NCORE project.

### 3.3 Efficiency

The PAD indicates that the Project would contribute to the overall success of the ENSAP by generating the necessary shared knowledge base and modeling tools and frameworks. Economic benefits to be derived from the Project in the form of comprehensive information base, capacity building and training, analytical tools, and stakeholder involvement, were found to be difficult to quantify in monetary terms. Indeed, a cost-benefit analysis is not well suited to assess the impacts of technical assistance and capacity building operations such as this operation due to the problems in the quantification of intangibles and issues of attribution. The benefits of the Project, however,

include a number of economic, social and environmental gains and include both tangible and intangible outcomes:

- Improving ease of access to critical information buried normally in difficulty-to access reports through well-organized knowledge base and interactive knowledge products and web portal,
- Developing a variety of models for analyzing a number of different themes and scenarios, to help make more informed decisions even on controversial investments.
- Improving university collaboration within and across countries
- Developing a new generation of water professionals (e.g. interns) in the region who have built strong friendships across countries, and appreciate each other's' viewpoints in a regional context. For example, Universities in Egypt informed the ICR team that many of their ENTRO interns returned from their short 3-month internships with a desire to do their masters' or doctoral theses on regional issues relating to the Nile Basin.
- Improving information and tools in the public domain to help improve further analysis and decision-support on the basin
- Cutting the costs for future analyses – for example, during contract renegotiations with a large consultancy (eventually cancelled), ENTRO managed to negotiate down the cost by US$1 million just because they could now provide the information in-house instead of through a task in the Consultancy.
- Improving ENTRO's credibility to provide knowledge and analytical services in the Eastern Nile region. The ENPM Project has helped ENTRO build better on previous work and rival any basin entity in Africa at least in terms of a well-organized detailed knowledge base, wealth of knowledge products, an impressive range of analytical tools, and helping foster a talented network of water professionals.

With regard to the cost-effectiveness of the Project, the PAD indicated that the Project costs compare favorably to the initial phases of similar decision support systems in other parts of the world and were expected to be well worth the investment given its expected impacts on designing and selecting investment scenarios expected to cost billions of US dollars.

The Project achieved high efficiency since it was able to meet (or even surpass) targets by the closing date with considerable cost savings in the amount of US$2.45 million (estimated project cost at appraisal was US$7.10 million and actual Project cost at closure was US$4.60 million) through the use of smaller consultancy contracts and the implementation of the internship program. Even if the overall costs incurred by the Bank during preparation and supervision are taken into account, the significant outputs listed in Annex 2, were obtained at a relative modest costs of US$5.31 million.

### 3.4 Justification of Overall Outcome Rating

***Rating: Satisfactory***

The outcome of the ENPM Project is rated satisfactory based on its significant achievements, high relevance, the satisfactory rating given to its efficacy, and since it achieved the intended development objective by the closing date.

### 3.5 Overarching Themes, Other Outcomes and Impacts

#### (a) Poverty Impacts, Gender Aspects and Social Development

The Project activities created limited opportunities for employment, income generation, and poverty reduction. However, it is expected that potential follow-up investments in the Eastern Nile would provide greater opportunities for increased employment, which in turn would have positive impacts on poverty reduction.

#### (b) Institutional Change/Strengthening

As indicated in Section 2.5, the long-term capacity and institutional development included the improvement of the knowledge base and analytical capacity at ENTRO and Eastern Nile countries and the strengthening of networks among Eastern Nile universities. The internship program has helped young water professionals in the region to network with each other and to contribute new perspectives to old and evolving challenges. All these will contribute to riparian countries to envision alternative development scenarios; assess their economic, environmental and social impacts from a regional perspective; and make informed decisions over the use of the Eastern Nile.

#### (c) Other Unintended Outcomes and Impacts (positive or negative)

The Project has resulted in several unintended impacts. ENTRO has become more interested in building in-house capacity, networking young professionals in the region, putting more information in the public domain, and develop a more service orientation to its clients. The information base quality and insights have improved significantly as many public-domain and commercial models have been used together. ENTRO has been able to attract attention for collaboration from many agencies – e.g. MOUs have been already signed with UNESCO-IHE and the Ethiopia Tana and Beles Integrated Water Resources Development Project and the Abbay Basin Authority and several Universities. A delegation from Malawi recently visited ENTRO and wishes to have follow-up collaboration as they embark on basin planning exercises in the Shire basin. Technical papers are being submitted in journals based on the ENPM tools and the knowledge base and tools are better informing debates on development paradigms. Universities have indicated that they have stronger networks not only across countries but also within countries as a result of the ENPM workshops and internship programs. The internship programs are now intensely competitive as compared to early batches.

Although the Project intended to support basic activities relating to information and analytical tools and capacity development, it is now easier to see the role its activities could have in addressing the larger critical information, institutional, and investment issues that the countries of the Eastern Nile face in the pursuit of their shared goals of socio-economic development and environmental and natural resources management. As indicated in the PCR prepared by ENTRO, the work initiated under the Project has contributed to address most of these critical challenges, as shown in Table 3.

**Table 3: ENPM Role in Addressing Eastern Nile Challenges**

| EN Challenge | How the ENPM Project has Helped Address the Challenge |
|---|---|
| Fragmented and incomplete knowledge base | • A comprehensive knowledge base has been developed for the first time on the Eastern Nile Basin, which has already proved invaluable to support a number of different modeling and other analytical efforts to provide insights into other key challenges that the basin faces.<br>• Knowledge products developed allow visualization of available knowledge base in an interactive manner, provide improved access to basic information on the Eastern Nile, and improve communication to a wide range of stakeholders interested in the Eastern Nile.<br>• Internship program involving graduate students and young faculty in the key universities of the Eastern Nile has contributed to develop more systematic knowledge base and to disseminate and use such knowledge.<br>• ENTRO web portal has enhanced public access and use of the knowledge base and products created with the support of ENPM. |
| Lack of shared understanding of the opportunities and risks to address poverty and economic growth issues in the Eastern Nile | • Significant knowledge base information and tools have been developed to analyze the overall economic aspects of various investment and climate scenarios.<br>• Various system models developed have been used for Eastern Nile scenario analysis, including consideration of different sizing, combinations, and phasing of dams on the Blue Nile, use of a range of projections of future climate, etc. and identification of key parameters of regional interest (e.g. hydropower generation, low and high season flows, levels in downstream dams including the Aswan, etc.)<br>• Eastern Nile Atlas and State of the Basin Report provide development context and identify the opportunities and risks faced by the region, including climate risks.<br>• Toolkits developed help address specific opportunities and challenges (e.g. related to watershed management, power development and trade, agriculture, etc.) |
| High erosion in upland areas | • Spatial information collated allows for systematic erosion analysis for the Eastern Nile.<br>• Sediment contribution of various tributaries has been estimated.<br>• Watershed management toolkit provides information for watershed management professionals to plan watershed management strategies and interventions. |
| Poor agricultural productivity | • Comprehensive knowledge base developed is useful for understanding the needs and potentials in agricultural development, since it provides easy access to comprehensive and comparable information on existing and proposed irrigation systems in the basin.<br>• Modeling work carried out has improved the consideration of agricultural aspects including irrigation development, trade-offs with hydropower generation, upstream-downstream linkages, deficit management and climate change, in an integrated systems and basin context.<br>• Special studies on the role of groundwater near the Lake Tana area and in Sudan also shed light on the potential for groundwater and conjunctive use in the Eastern Nile; the multi-criteria analysis in Gezira focused on interesting institutional issues relating to Water Users Associations (WUAs), and the fisheries development study in the Egyptian delta focused on the relationship between water quality and fisheries productivity. |
| Poor electricity access | • Knowledge base developed allows for easy access to synoptic information related to power sector opportunities and challenges.<br>• Modeling work carried out provides insights into the consideration of power development in an integrated basin setting and regional system impactions and shed more light on the environmental and social implications (e.g. related to flood and recession agriculture downstream).<br>• Supported regional forums have helped disseminate the power-related information, tools, and insights |

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| Inadequate water storage | • Knowledge base developed and toolkits provide detailed information on the locations, characteristics and power generation details of all existing and proposed systems in the Eastern Nile.<br>• Various options of new dam developments have been examined from a project viewpoint and from a larger systems perspective.<br>• Support for JMP has helped explore critical issues related to the implications of Blue Nile large dams and cascade development on system parameters of riparian interest.<br>• Special study on dam safety emphasizes the need for dam safety considerations in a national and regional context (one of the focus areas for the new NBI NCORE project).<br>• Groundwater-related special studies and work on watershed management also indicate the role of other types of extensive smaller-scale water storage in improving system storage. |
| Insufficient consideration of the triple bottom line (economic, environmental, social) implications of water-related investments | • Comprehensive knowledge base collated includes economic, environmental, and social aspects: in economics, costs and benefits of various investments, embedded economic/financial information such as crop prices and cost adjustment tools in the toolkits developed, innovative spatial information such as new high-resolution gridded GDP estimates, economic benefits of flood management, land use impacts in different flood zones, analysis of trade-offs; in environment, information and toolkits on wetlands, protected areas, erosion/sedimentation, flood, etc.; and in social, information related to resettlement implications of various water investments, population distribution (including new high-resolution datasets), and indicators related to poverty.<br>• Training and capacity-building aspects of Project helped improve awareness of the existing knowledge base and tools of relevance.<br>• Internship pool was also diversified to include young professionals examining economic, social, and environmental aspects.<br>• Special studies also contributed to examining issues relating to water quality, water user association institutional development, dam safety, etc.<br>• Support provided to Universities relate to a wide variety of themes relevant to the triple bottom line and should help many waves of future students in accessing updated information and tools on these aspects.<br>• ENTRO website and knowledge products should also help improve the public access to a more comprehensive set of information that others can build upon and improve. |
| High vulnerability to climate risks | • Extensive knowledge base relating to historical climate and scenarios of future climate that is available, which has been very helpful to better integrate climate considerations into the modelling work.<br>• Work on shorter-term climate risks has focussed on improving the use of weather forecasts, conversion to hydrologic forecasts, flood forecasting, and development of downstream hydrologic models. Use of public-domain real-time and quasi-real time earth observation/ satellite-based knowledge products was enhanced.<br>• Work on longer-term climate risks related to climate change exacerbating existing high climate variability and other on-going changes has been undertaken by consideration of various modelling scenarios.<br>• Special study on sea-level rise in the Egyptian Delta provides insights into the implications of seal-level rise scenarios on a particularly vulnerable area in Egypt.<br>• Knowledge output on Eastern Nile in a changing climate summarizes the existing and evolving climate risks in the basin. |
| Need for stronger regional and country institutions | • ENTRO now has access to probably the best available knowledge base on the Eastern Nile and a range of analytical tools to be able to provide demand-driven insights into various scenarios of the future.<br>• ENTRO uses the information and tools to better inform its dialogue with country and regional institutions, including its governance. |

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| | • Knowledge base, knowledge products, and analytical tools developed are valuable source of reference information for country professionals.<br>• Work related to regional forums and training has involved several government professionals in the Eastern Nile countries.<br>• Access to and networking among talented professionals in the universities of the region has improved and helped build lasting relationships both among themselves as well as with ENTRO at the regional level.<br>• Introduction of the internship program at ENTRO has been useful not only to develop a range of high-quality knowledge products but also improved interactions across young professionals from different Eastern Nile countries working together for a common goal, improved awareness-building of the next generation of professionals and possibly policy-makers on the regional context of Eastern Nile water resources opportunities and challenges.<br>• Website developed is intended to facilitate public outreach and public access to basic information, tools, and knowledge products related to the Eastern Nile; and has the potential to provide a wide range of interested groups with improved access to relevant information and insights on the Eastern Nile opportunities and risks.<br>• Project helped improve development of strong regional and country-level institutions in the Eastern Nile that have improved access to comprehensive knowledge bases and analytical tools that leverage existing information and modern IT advances to improve regional cooperation for realizing the region's full potential and manage evolving risks. |
| Need to understand the rationale for enhanced regional cooperation | • A critical pre-requisite to understanding why countries need to look at the regional context even for large country-based existing or proposed investments is the development of a comprehensive knowledge base and analytical tools.<br>• ENTRO in a unique position to provide knowledge services in examining various scenarios of cooperation. Such analysis driven by facts and not perceptions alone are useful to clear the cobwebs of long-held misconceptions and myths in the region and use the power of analysis with the best available information to help riparian decision makers develop a shared understanding of the risks and opportunities in the Eastern Nile.<br>• More immediate needs for regional cooperation can also be examined by the work that Project helped facilitate – e.g. to improve forecasting of weather and associated hydrology, flood and drought management, and balancing multiple demands in operation of the growing portfolio of significant water infrastructure in the Eastern Nile.<br>• Institutional development at regional, country governments, and academia supported by Project are critical to change entrenched mindsets, improve public access to information, and help shape a new range of collaborative, creative solutions to old and evolving problems of the region. |

### 3.6 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

The PCR prepared by ENTRO summarizes the feedback received from Project implementation partners and users of Project products on three dimensions: knowledge base, analytical tools and stakeholder partnerships. This summary is presented in Annex 5. The feedback received indicates that the Project was able to meet its objective and stakeholders using the products and services provided by ENTRO were very satisfied.

A qualitative assessment of the impacts of this Project and the First Joint Multi-purpose Program Identification (JMP1-ID) project was gathered though a survey conducted at the NCORE project launch workshop involving approximately 40 participants. Findings of this survey are also

presented in Annex 5. The main conclusions of the qualitative assessment in relation to the ENPM Project are summarized below.

***Achievement of PDO.*** The evaluation found the Project had been able to achieve its development objective. The survey asked participants how strongly they agreed with the statement that the Project has met its objectives: 28% gave a "strongly agree" response, 38% gave an "agree" response and 28% gave an "average" response. Only three respondents indicated that the development objective was not met, and five did not know.

***Contribution of recent activities carried out by ENTRO.*** In relation to the recent activities conducted by ENTRO, the evaluation found the majority of interviewed stakeholders were satisfied with ENTRO's contribution towards the goal of NBI. Participants were asked to express their agreement with the contribution of the recent activities carried out by ENTRO (with the support from the Project and the JMP1-ID project) to address key challenges in the Eastern Nile: 95% gave an "average" or better response to the contribution to develop a common vision for the Eastern Nile, 98% to build capacity for basin-wide development and management and more efficient use of Eastern Nile resources, 93% to increase awareness about Eastern Nile issues and the need to jointly develop and use the common resources of the Eastern Nile for the benefit of all, 95% to generate knowledge products and modeling tools for better development and management of Eastern Nile resources, 98% to strengthen the capacity of ENTRO to provide technical knowledge helpdesk services to other regional and national institutions, and 88% to strengthen the capacity of ENTRO to facilitate regional-scale land and water investments.

***Assessment of products and services delivered by ENTRO.*** In relation to the products and services delivered by ENTRO, the evaluation found the majority of interviewed stakeholders were satisfied. Participants were also asked to assess the products and services delivered by ENTRO: 95% gave an "average" or better response to the comprehensive knowledge base and knowledge products of the Eastern Nile (e.g., systematic geo-database; watershed management, power and irrigation interactive thematic toolkits; interactive sub-basin toolkits; ENTRO web portal; Eastern Nile Atlas and Eastern Nile State of the Basin Report), 95% to the public domain modeling tools (e.g., soil and water analysis model of the Eastern Nile, Hydrological Engineering Center Reservoir System Simulation (HEC-ResSiM) Eastern Nile system simulation model), 95% to the commercial modeling tools (Riverware model of the Blue Nile, RIBASIM of the Abay-Blue Nile, and MIKE-BASIN model of the Nile Basin), 95% to the internship program supported by the Project, 95% to the Project national and regional capacity building activities (including workshops, training and IT support), and 88% to informing regional dialogue on strategic water resources, planning, development and management. Respondents also provided concrete recommendations to enhance the quality of the products and services, namely, to update database and model inputs, and review model results; to communicate the reliability of model results; to establish a policy for sharing knowledge products and analytical tools; to make the models more affordable; to include all Eastern Nile universities in the follow-up internship program and expand it to also cover other institutions; and to disseminate further the modeling products through technical training sessions.

***Long-lasting benefits.*** The evaluation found a strong belief among interviewed stakeholders that the Eastern Nile institutions will benefit from the Project. Participants responded that the Eastern Nile institutions will benefit from the various products and services delivered under the Project: 61% gave a "strongly agree" response, 34% gave an "agree" response and 5% gave an "average" response.

## 4. Assessment of Risk to Development Outcome

***Rating: Moderate***

There have been a number of achievements of the Project in establishing a comprehensive knowledge base, developing a number of analytical tools, and reaching out to interested stakeholders. These achievements have helped strengthen ENTRO's role as a regional knowledge services provider, as well as helped make information become available in the public domain for other professionals to build upon. While most of the Project's activities were designed and implemented keeping in mind sustainability considerations, there are a few issues that need to be considered to ensure the sustainability of the Project outcomes over the long-term. Given the recently launching of NCORE project, there is a good reason to hope that ENTRO's enhanced capacity will be sustained in the mid-term.

At present, ENTRO has the best available comprehensive knowledge base assembled on the Eastern Nile. However, if the knowledge base is not continuously updated to reflect stakeholder feedback, demands placed on ENTRO's knowledge and analytical services as well as additional reports and datasets that are created and/or developed for the Eastern Nile, then, the knowledge base would become obsolete and irrelevant. ENTRO has to have the necessary technical staff/skills/partnerships to keep the knowledge base updated.

Similarly, the set of analytical tools developed at ENTRO to address the various issues that are critical to the Eastern Nile will need to be continuously updated to reflect the rapidly-evolving set of modern tools. In order to do this, ENTRO has to have the necessary staffing and skills to stay on top of the new developments in water-related models and build additional partnerships with relevant regional organizations as well as with other basin organizations.

Similarly, efforts to implement the IT strategy and policy that lays out a vision for a sustainable information technology framework at ENTRO need to continue so ENTRO is able to adapt to the rapidly changing IT world. In order to do that, ENTRO needs to have the adequate skills and financial resources to make the needed investments in videoconferencing to improve interaction within NBI institutions and development partners and be able to conduct effective distance learning.

Given the limited participation of Eastern Nile country government professionals during Project implementation (due to the status of regional cooperation), ENTRO needs to enhance interaction with country government professionals to ensure that they have access, use, and contribute to refinement of the knowledge base and analytical tools developed. The sustainability of this project's activities are also enhanced by the partnerships developed among Universities and young professionals in the region, and these would also need to be further nurtured.

In order to sustain outcomes, ENTRO would require continued financing, which has to be done in a difficult regional environment. Such financing would need to come from the NBI/ENTRO member states as well as development partners. The Nile Council of Ministers decided in July, 2012 to emphasize member country commitment to maintain minimum functionality of the NBI. There would be a need for additional country commitment to finance their Government agencies to better interact with ENTRO to use the Project outputs. Universities have been excellent partners on the Project and it is expected that their work on the networks they have developed will actually help them access additional resources to build on the Project work. While the NCORE Project will extent support to ENTRO during the next three years, there will be a need to evolve a strategy to ensure ENTRO's financial sustainability after this project comes to an end.

## 5. Assessment of Bank and Grantee Performance

### 5.1 Bank Performance

#### (a) Bank Performance in Ensuring Quality at Entry

***Rating: Moderately Satisfactory***

The Bank performance during preparation of the Project is rated moderately satisfactory. The Bank team had expertise and experience in preparing the Project and had a very good relationship with the NBI institutions. The Bank knowledge on major international basins and previous operations in the Nile Basin were well used to shape the design of this operation. The Bank team put to good use lessons learned regarding Project's design simplicity and flexibility. As noted in Sections 2.3 and 3.1, the Bank team did a good job in identifying key Project components, which were fully aligned with the PDO, and the key elements of the M&E framework. The challenges in the Eastern Nile basin were well understood by the Bank team.

A key Project design weakness was the heavy reliance placed on the large consultancy contract to develop most of the knowledge products and deliver the technical assistance. To reflect on the priority need in capacity building, more emphasis would have been given on the use of short-term advisors or consultants to assist ENTRO in the delivery of in-house products. Given the initial limited management capacity within ENTRO to manage a different modality to deliver the technical assistance through so many consultants, the Bank team was constrained to pursue a large consultancy. The restructuring that took place at ENTRO during early phase of Project implementation and the strengthening of its leadership provided the enabling environment to adopt a different implementation modality. Of course, in retrospect, it may have been more desirable for ENTRO to be equipped with the right leadership and coordination skills from the start. Similarly, it may have been desirable (even though difficult in the governance environment of ENTRO) to have the proposed primary ENPM consultant selected, and strong ENPM user networks in place prior to project implementation to facilitate a smooth start.

#### (b) Quality of Supervision

***Rating: Satisfactory***

The Bank performance in supervision is rated satisfactory. The Bank supervision missions were regular, instrumental in identifying critical problems, and according to the interviewed ENTRO staff, added value. Missions were all led by the same Task Team Leader, who was involved in the conceptualization and preparation of the Project. Supervision missions were also effective as learning tools because mission members made strong efforts to undertake training at ENTRO and disseminate knowledge, and representatives from various institutions participating in missions were also able to take back new insights and lessons learned. The Bank team worked very closely and effectively with ENTRO counterparts and showed flexibility in modifying implementation modality at MTR to adjust to the changing political situation. This was critical for achieving results. Bank team members located in Addis Ababa also added value to the overall management of the Project. Proximity to ENTRO allowed closer monitoring and intensive on-the-ground implementation support, and also helped create trust.

When Project implementation was lagging, the Bank team identified alternative financial sources (including a grant from the Integrated Land, Water and Climate Trust Fund in the amount of US$500,000) to hire selective expertise to support ENTRO's efforts to compensate for the lack of progress with the technical assistance activities to be supported by the Project. The Bank team also mobilized support from the Bank Africa Spatial Help Desk to build the capacity of ENTRO staff and interns in using modern global datasets, earth observation and climate products, and a range of innovative visualization and interactive tools and knowledge products.

One shortcoming in supervision not attributed to the Bank team but to the Bank system in general, was the slow response (6 months for the Regional Procurement Advisor's Office clearance) to ENTRO's request to cancel the procurement process for the selection of the main consultancy.

Another shortcoming during supervision not attributed to the Bank team but to the Bank management was the inability to extend the Project beyond December 2012 when a large portion of the grant was still undisbursed, particularly when the NBTF's closing date was extended until end-2014. One year extension would have allowed strengthening and consolidating the Project's achievements with the available funds. Bank management decided to close all NBI projects by December 2012.

**(c) Justification of Rating for Overall Bank Performance**

***Rating: Satisfactory***

The overall performance of the Bank is assessed as satisfactory. The Bank team had a large role in supporting ENTRO in turning the Project around and making it a success. The limitation observed in the quality at entry caused some delays in implementation but had marginal impacts on the achievement of the PDO.

**5.2 Grantee Performance**

**(a) Government Performance**

***Rating: Moderately Satisfactory***

In this particular Project, the "Government" should be understood to include the ENTRO, the recipient of the NBTF grant, and the Eastern Nile countries represented through the ENCOM. The combined performance of the ENTRO and the ENCON is rated moderately satisfactory.

The performance of ENTRO during preparation and implementation as described in section 5.2 (b) is rated satisfactory. The significant improvements in its technical capacity and the mainstreaming of Project activities within its own structure are testaments to the commitment that the ENTRO afforded to this Project.

The performance of the ENCOM during preparation is rated moderately unsatisfactory. While water ministries staff from Egypt, Ethiopia, and Sudan provided inputs into the design of the Project, and were effective in mobilizing stakeholders to shape Project design, their lack of consensus on the location of the regional coordination for the Project caused Project preparation to stall for almost two years. Their performance during implementation is also rated moderately unsatisfactory, namely because of the freeze of the participation of Egypt and Sudan in NBI activities that limited government official participation in key ENPM Project activities. It also resulted in a considerable delay in implementation, which as indicated in section 2.1 was a blessing in disguise as new knowledge networks emerged and ENTRO's internal capacity was strengthened. This also impacted on the ability of two out of the three riparian countries to fulfill their counterpart funds obligations. During the implementation period, Ethiopia was the only country to meet its annual contribution to ENTRO.

**(b) Implementing Agency or Agencies Performance**

***Rating: Satisfactory***

The implementing agency for this Project was ENTRO. The performance of ENTRO responsible for the Project is rated satisfactory during preparation and implementation. ENTRO, with the support from the Eastern Nile universities were fully committed to the Project from the conceptualization stage, and were instrumentals in its successful implementation. At the design stage, ENTRO had conceived the Project to be implemented through a semi-integrated project implementation unit, partially using its existing structures. The reorganization that took place in ENTRO during the early phase of implementation improved considerably the performance of the Project by institutionalizing Project activities within its evolving structure and by putting excellent technical experts from its Water Planning Unit in charge of the Project. ENTRO focused its activities towards achieving the PDO and played a very active role in coming out with an alternative implementation modality to provide technical support. ENTRO also strived to maintain a balanced composition within its internship program by involving interns from each of the riparian countries including South Sudan.

A few shortcomings were noted in the M&E system. Although ENTRO had the capacity to implement the M&E system as originally designed, no much was done in terms of obtaining regular feedback from Project's beneficiaries on Project products and services to gauge implementation.

**(c) Justification of Rating for Overall Grantee Performance**

***Rating: Moderately Satisfactory***

The overall performance of the Grantee is assessed as moderately satisfactory. Despite the shortcomings presented in section 5.2 (a), ENTRO provided unconditional and high quality leadership and its performance was remarkable. The adjustments on the implementation modality introduced after the MTR allowed ENTRO to partially make up for delayed implementation of Project activities, delivered on commitments, and achieved overall outcomes by closure.

## 6. Lessons Learned

The ENPM Project design and implementation experiences have resulted in a wealth of experiences that could be useful not only for future work in the Nile Basin but in other river basins across the world. Some of these (as corroborated in the PCR) are indicated below:

**What Worked Well?**

***Flexible Design:*** One of the key lessons that this project illustrated was the need to have a project design that focus on end goals and not be too rigid in the implementation modalities to achieve these. For example, although regional tensions and the environment for cooperation grew difficult during project implementation, it was possible to achieve the project objectives, key indicators, and even surpass most of the indicator targets in the results framework. This was done through adaptive management where ENTRO worked with the Bank to change implementation arrangements from the reliance on a large consultancy to doing more in-house work.

***"Plan B" can sometimes be better than "Plan A":*** When the ENTRO governance was not able to meet for over 2 years to approve the large planned consultancy under the original plan ("Plan A"), the choice was clear – either to close the project or try another implementation modality. A "Plan B" was developed to try and achieve the project goals through an alternate implementation modality of in-house consultants, interns, university partnerships, and specialized smaller firm consultancies. In the end, it turned out that this new plan was probably much better than the previous plan as it helped ENTRO professionals to move from being contract managers of a large consultancy to actually doing most of the work in-house. It also helped build much stronger links with academia, and develop a wider range or knowledge products. It also helped ENPM to become better institutionalized within ENTRO and contribute better to other ENTRO activities (e.g. related to flood forecasting and the Joint Multipurpose Program).

***Working Closer with Academia:*** A key lesson learned has been that, in complex river basins with largely entrenched government positions, it is critical to broaden the stakeholder pool for engagement. For a knowledge-driven project such as the ENPM, it was always useful to involve academia. The ENPM project had proposed to have close working relationships with one focal University in each of the three target Eastern Nile countries (Addis Ababa University, Khartoum University, and Cairo University). After initial interactions with these universities and gauging their strong interest in working together on technical issues relating to the Eastern Nile, ENTRO decided to expand this network to include all the key technical universities in the Eastern Nile countries through these three focal universities. This has resulted in unexpected benefits in the form of improved interaction of technical Universities within the Eastern Nile countries, as well as drawing from a wide pool of candidates for ENTRO internships. The internship program initiated by ENPM Project has been extremely useful both to help the interns acquire new skills, regional perspectives, and collaboration, as well as to help ENTRO develop a wide range of knowledge and modeling products and better disseminate ENPM Project outputs. Based on this experience, the NBI has decided to expand such academic partnerships and internships to all the countries of the Nile Basin in future activities.

***Focus on the Public Domain:*** Often, such projects support the development of high-quality multi-sectoral knowledge bases, modeling tools, and technical reports. However, these often remain accessible only by a select few, and new researchers and technical specialists have to often start from scratch. Also, it is quite surprising that even in complex river basins such as the Nile with entrenched political positions, so little information and insights even on basic critical issues and options relating to the basin are easily accessible to the general public. ENTRO used the ENPM Project framework to develop versions of key datasets, interactive knowledge products, reports, and modeling tools that could be shared in the public domain. This has been facilitated by the web portal, university partnerships, internships, and workshops. This should help not only provide the general public with access to the best available data, tools, and insights on the basin, but also help current and future researchers to improve the quality of these products and build further on this work.

***One Model or Several?*** A key decision that has to be made when embarking on the analysis of a basin as complex as the Eastern Nile is to decide which modeling framework should be utilized. One school of thought is to use only one model to avoid the situation if different models give different results. This is often useful in the case of using one shared operational tool (e.g. forecasting, systems simulation) or for allocations for legal purposes in a mature cooperation setting. However, in this case, ENTRO decided to use multiple models given the fact that the issues being analyzed were very varied in the Eastern Nile (e.g. erosion management, flood forecasting, irrigation systems, power systems, reservoir filling and operations, wetland management, climate change, etc.) and no one model was available to address all these issues

satisfactorily. This allowed ENTRO to use different reputed models for the ENPM Project and use the results to cross-verify results; although there was little real difference in basic model outputs (as the laws of physics have to always be met given that they utilize the same knowledge base for setup and calibration), this allowed for the use of specialized "fit-for-purpose" tools, improve partnerships with academia and technical interns (who worked on a range of tools), and be ready to explore new tools being created in a rapidly-evolving marketplace. The ENPM Project also helped the Nile DSS to build adapters for additional models to expand the repertoire of models that could be used with the overall Nile DSS framework.

***Variety in Knowledge Products:*** For effective communication of complex issues in the Eastern Nile and change entrenched mindsets, it is critical that information be communicated in customized ways to target different stakeholders. A lesson in the ENPM implementation is to try to develop a range of knowledge products to help better interface with each stakeholder group. For example, the project helped ENTRO develop products for a non-technical audience to quickly grasp key issues and options (e.g. the Eastern Nile Atlas, the Eastern Nile State of the Basin Report, and the Eastern Nile in a Changing Climate). Interactive visualization products were also developed to help different types of stakeholders interact at their pace and per their interest (e.g. the interactive One System Inventory, an Interactive Web Portal, animation and interactive PDF products, etc.). For those more technically inclined, a range of innovative knowledge products were developed that could be used both with and without specialized software (e.g. GIS datasets, Google Earth overlays, interactive spreadsheet toolkits, calibrated models, multi-criteria and other modeling results visualization tools, etc.).

**What Could Have Been Done Better?**

***Project Readiness:*** The initial slow start of the project could be attributed to many reasons that provide many lessons in hindsight. One is to have ENTRO work closely with the Bank to have major procurements (e.g. the primary ENPM consultancy) ready with the necessary clearances on both sides (e.g. from ENTRO governance) well in advance of project start. Another is to improve the links with potential users of the ENPM systems even before project start.

***Engaging Potential Partners Early:*** It is often difficult to effectively engage potential users of knowledge and analytical systems without something to show initially. If early efforts are done to pilot the knowledge base and tools, it would be easier to attract a range of potential users and keep them engaged throughout the process. For example, in this Project, after initial discussions displaying the work ENTRO had done in-house, it was easier to attract interest from Universities and other knowledge partners. Synergy was also explored with overall NBI through discussions, coordination, and co-financing of activities of the ENPM with the Nile DSS, even though each was being implemented in tight timeframes by different groups. In the future, ENTRO could also use the project outputs to build better relationships with Non-governmental and Civil Society Organizations (perhaps through federations such as the Nile Basin Discourse) and also with other Research Networks that exist in the Basin. This will help ensure enhanced dissemination for more informed dialogue, as well as feedback and suggestions for future work by ENTRO on knowledge and analytical products. Efforts also need to be made to improve interactions with government agencies where there is interest and to stimulate interest where not. Efforts could also be made to use such projects to build national capacity more directly where required and requested (e.g. there could be opportunities especially in countries such as South Sudan in this regard).

***Need for a Programmatic Approach:*** Given that the work related to development of multi-sectoral knowledge bases, analytical tools, and stakeholder frameworks to support planning and management of water resources in areas like the Eastern Nile will never be completed, there is a need to conceive and implement such activities in a longer-term programmatic framework. The ENPM was conceived as a three year project, in which most of the work ended up being done primarily in the final project year given the governance issues that plagued its implementation. At the end of the project, it is now really at a stage where many of the activities could be (and need to be) scaled up, building on the new credibility and capacity that ENTRO has in providing knowledge and analytical services. These could include more direct helpdesk support to country governments, an expanded internship program and university linkages, a systematic annual modeling forum, training workshops and distance learning programs, partnerships with other basins and global knowledge providers, web portal enhancement, developing shared hydromet visualization platforms, addressing additional critical areas on the Eastern Nile (e.g. seasonal forecasting, wetland management, developing additional datasets including primary data collection to support triple-bottom line analysis), more effective use of evolving IT advances (e.g. improved use of earth observation products, cloud computing, mobile apps, newer modeling suites, videoconferencing), scholarships, study tours, and developing a new generation of knowledge products customized to different stakeholders. Very few of these have been included in the next NBI project (NCORE) and there is still substantial need for financing to maintain ENTRO's momentum in these activities to provide enhanced services to its stakeholders and not lose its in-house skills. All this calls for a more flexible, longer-term programmatic framework to conduct such knowledge and analytical capacity building activities.

## 7. Comments on Issues Raised by Grantee/Implementing Agencies/Donors

**(a) Grantee/Implementing agencies**
*n/a*

**(b) Cofinanciers/Donors**
*n/a*

**(c) Other partners and stakeholders**
*n/a*

## Annex 1. Project Costs and Financing

**(a) Project Cost by Component (in US$ Million equivalent)**

| Components | Appraisal Estimate (US$ millions) | Actual/Latest Estimate (US$ millions) | Percentage of Appraisal |
|---|---|---|---|
| 1. Knowledge Base Development | 4.65 | 1.05 | 64% |
| 2. Modeling System Development | | 1.92 | |
| 3. Institutional and Human Capacity Strengthening | 2.19 | 1.68 | 77% |
| **Total Baseline Cost** | 6.84 | 4.65 | 68% |
| Physical and Price Contingencies | 0.26 | - | 0% |
| **Total Project Costs** | 7.10 | 4.65 | 65% |

**(b) Financing**

| Source of Funds | Appraisal Estimate (US$ millions) | Actual/Latest Estimate (US$ millions) | Percentage of Appraisal |
|---|---|---|---|
| Counterpart Funds | 0.60 | 0.30 | 50% |
| Nile Basin Trust Fund | 6.50 | 4.35 | 67% |
| Total | 7.10 | 4.65 | 66% |

## Annex 2. Outputs by Component

**Component A: Information Management and System Development (Actual cost US$1.05 million or 23% of total Project cost)**

***Development of ENTRO Database.*** The ENTRO database has been developed to handle both spatial and non-spatial datasets collected and compiled from different ENSAP projects. The central database has two separate databases (spatial and non-spatial), which are logically linked. It can also import datasets from the Nile DSS. The spatial database has been built using enterprise spatial database engine technology for systematically organizing and handling bio-physical/environmental and, socio-economic datasets of the Eastern Nile. The non-spatial database is developed to organize and store time-series hydro-meteorological, characteristic and parameter datasets, which are logically linked to the spatial datasets. Data series and applications that feed into ENTRO web portal such as web mapping and time series model data manager are stored in this database. It is expected that these datasets will be enhanced and improved in quality over time depending on evolving analysis needs.

***Development of ENTRO Web Portal.*** ENTRO's web portal has been developed to help organize, store and disseminate information and knowledge products related to the socio-economic and environmental conditions of the Eastern Nile. It is categorized into an internal portal (Intranet), running in a server hosted at ENTRO's physical premises (Addis Ababa, Ethiopia), and external web portal, constituting a subset of the internal portal's content. The portal has interactive web interfaces which enable users to navigate through ENTRO's available resources and download its wide range of data, documents and maps. The web portal manages documents, images, videos, maps and other application files using a database management system. In general, the web portal serves as a repository for knowledge bases developed under different ENTRO projects and collected from other projects in an organized fashion, and as an interface for accessing these knowledge bases. The tools also allow users to produce maps based on global time-series, remotely sensed weather data from NASA and other such public domain sources. The portal is also comprised of a resources center that enable users to search and download data, information and knowledge products such as project based factsheets, posters, documents, images, maps, MS Excel based toolkits, and others. The toolkits available through the portal are interactive and allow users to extract sub-basin level information, focusing in on a singular aspect or more of the social characteristics, environmental conditions, economic features and institutional aspects of the Eastern Nile region, based on the user's preference.

***Development of Remote Sensing Analytical tools and Products.*** Remote sensing products at ENTRO are derived from publicly available global datasets; e.g., Moderate-resolution Imaging Spectroradiometer (MODIS), land cover, and Normalized Difference Vegetation Index (NDVI) time series. The land cover classification scheme is based on the global International Geosphere Biosphere Program (IGBP) and produced at 0.5 kilometer pixel resolution. Land cover classes are assigned by processing the 32-day spectral database using decision tree and artificial neural network classifiers trained by ground data. ENTRO remote sensing data will be used as background for mapping, and analysis related to: land cover data and land cover change information (including changes in urbanization, cropped areas, desertification, forest cover, etc.), NDVI, evapotranspiration, Nile morphology and change at certain reaches, change detection of parks, agricultural encroachments to forest land, erosion assessment using remote sensing data, and satellite altimetry for lake level heights, changes in wetlands, as well as rainfall estimation, flood extent estimation.

***Geospatial System Development.*** ENTRO has organized spatial data into systematic geodatabases, including an extensive set of metadata for existing spatial datasets, support for development of customized mapping products (Eastern Nile Atlas), spatial analysis and spatial products (e.g. animations, interactive PDFs). Metadata of the Eastern Nile is available for the following parameters: administration, climate, geology, hydrography, land cover, soils, demographics, economy, health, education, irrigation, dams and hydropower plants, power interconnection, transport and communication. Data was collected from public domain datasets, country level feasibility studies and master plans, Cooperative Regional Assessments (CRA) conducted by ENTRO as well as other ENTRO studies and documents.

***Thematic Toolkits.*** ENTRO has developed a number of technical thematic toolkits to collate available information and provide analytical tools in an easy-to-use interactive setting that does not need special software and uses advanced Microsoft Excel functionality. It is expected that these toolkits would be refined and evolve over time as they are used. These toolkits include:

- Watershed Management Toolkit: This toolkit builds on earlier ENTRO work on watershed management cooperative regional assessment and includes available information on erosion and sedimentation in the Eastern Nile, schematics of sediment contribution of various tributaries, as well as a roster of watershed management measures and their implications.
- Power Toolkit: This toolkit builds on the extensive work carried out under the Power Trade CRA and includes information on power demand trends, power supply options in the Eastern Nile, detailed available information for each major existing and proposed hydropower site, and tools to support analysis of power systems.
- Irrigation Toolkit: This toolkit builds on the work of the Irrigation and Drainage CRA and includes detailed information on all existing and proposed irrigated agriculture areas, cropping patterns, and tools for economic and technical analysis of irrigation investments

***Sub-Basin Toolkits.*** ENTRO has developed a number of technical sub-basin toolkits to collate available information and provide analytical tools in an easy-to-use interactive setting that does not need special software and uses advanced Microsoft Excel functionality. It is expected that these toolkits would be refined and evolve over time as they are used. These toolkits include:

- Blue Nile Toolkit: This toolkit integrates key existing information on the Blue Nile (Abbay) sub-basin and includes clickable schematics of the basin with key information related to its basin characteristics, hydrology, and water structures.
- Baro-Akobo-Sobat Toolkit: This toolkit integrates key existing information on the Baro-Akobo-Sobat sub-basin and includes clickable schematics of the basin with key information related to its basin characteristics, hydrology, and water structures.
- Tekeze Toolkit: This toolkit integrates key existing information on the Tekeze sub-basin and includes clickable schematics of the basin with key information related to its basin characteristics, hydrology, water structures, and other features.
- Main Nile Toolkit: This toolkit integrates key existing information on the Main Nile sub-basin and includes clickable schematics of the basin with key information related to its basin characteristics, hydrology, water structures and other features.

***Knowledge Products.*** A brief description of the key knowledge products developed by the Project is provided below**:**

- Eastern Nile Atlas: This Atlas provides a snapshot of the Eastern Nile, its climate, resources, and environment, social and economic characteristics. The Atlas aims to strengthen the Eastern Nile knowledge base and promote better understanding of shared resources. It also strives to enhance resource planning tools and analysis by reconciling maps of the sub-basin with pertinent information. By increasing the understanding of climate, resources, environment, social and economic characteristics of the Eastern Nile, policy makers would be in the position of making informed decisions about the future use of shared resources and increasing public domain data about the Eastern Nile.

- Eastern Nile State of the Basin Report: The Eastern Nile State of the Basin Report is a non-technical document that provides strategic overview of the Eastern Nile key issues. The report focuses on the big development challenges in the Eastern Nile basin, and addresses the transboundary water resources development and management issues from the view of promoting and facilitating economic growth, reducing poverty and food in-security; and enhancing social wellbeing. The report represents a compilation of existing knowledge that looks at historical water management and development, current practices and looks ahead at the water development opportunities and potentials and the main obstacles to these possibilities.

- Eastern Nile in a Changing Climate Report: This report addresses climate risks in the Eastern Nile. It encompasses a review of historical climate risks in the Eastern Nile, examination of future climate change scenarios, their implications and coping strategies to improve climate resilience

***User Manuals***. Several user manuals were developed under the Project, including the following: SWAT, River Ware, RIBASIM, Mike Basin, Nile-DSS, Web Portal, and Eastern Nile Multi-purpose Optimization System (ENMOS).

***Special Studies.*** Several special technical studies were initiated under the Project, and were implemented by academia and professionals of Eastern Nile universities (Addis Ababa University, Khartoum University, and Cairo University). Each university investigated two issues that were of significance at a national level. The following areas of research were addressed through these special studies:

- Nile Delta Flooding due to Sea Level Rise (SLR) (Cairo University): The study investigated scenarios for SLR in the Nile Delta to better understand the associated impacts on existing coastal systems, infrastructure and property, and to identify high risk areas that are prone to high impact. An inundation model was developed using GIS that accounts for connectivity with the sea or lakes. The main input to the inundation model is a Digital Elevation Model (DEM). In the study, topographic maps of scale 1:25,000 were digitized together with the surveying of key features using GPS levelling to produce the data required for the DEM. Key features included the international road and the road along the Salam canal. The impact of SLR was assessed by producing maps for the inundated areas from a 0.5 m, 1.0 m, 1.5 m, 2.0 m and 2.5 m SLR. The study showed that initially the water will mainly enter the low areas from the coastal lakes (Manzala and Burrullus). The embankment surrounding the Salam canal would protect the areas behind it till a level of about 1 m. This

embankment is mostly at a level of 2 m and thus it could be possible to increase the level for the lower parts of this embankment to act as a dike. The Burrullus Lake however, does not include any embankment surrounding it and thus such an embankment could be considered.

- Impacts of Fish Aquaculture Production on Water Quality in the Northern Nile Delta (Cairo University)**:** The overall objective of the study was to develop a model for the assessment of impacts of aquaculture production on receiving water bodies for different operational scenarios. A mathematical material flow analysis model using a spread sheet was developed to predict the generated pollutants from fish aquaculture production for different scenarios (run-through or recirculating system). The model is based on a mass balance approach. Input parameters were the pond volume, inflow, initial water quality, filter outflow water quality, water quality of the pond, feeding pattern and quantity, and stocking density. The analysis calculated nutrient loads due to fish digestion and respiration, fish yield, and output water discharged to the lakes for the two scenarios (conventional and proposed).

- Dam Break Analysis for Proposed Cascade of Dams on the Blue Nile (Addis Ababa University): This study analysed impacts of dam breach in the Blue Nile cascade using appropriate modelling tools, focusing on three dams: Grand Ethiopian Renaissance, Roseires and Sennar dams in the Blue Nile sub-basin. This analysis augments knowledge gaps identified through the JMP1-ID project, which aims to understand the impacts on the Abay/Blue Nile catchment of reservoir construction for hydropower and other development purposes. The study used a one dimensional hydraulic model based on Hydrological Engineering Center River Analysis System (HEC-RAS) software to simulate dam break inundation. For each dam, the model determined breach size and discharge, routing of the breach discharge downstream, and determines flood depths at possible hazard sites. The study conducted a literature review to determine the most suitable equations for determining breach size and its parameters, breach formation and progression, peak breach outflow discharge, water-elevation discharge relationship, flood routing and available GIS-based topographic maps. This study derived a very preliminary estimate of the area of flooding, depth and velocity in flood plain but noted that findings become grossly unreliable as the cross section extension in the study was based on 90 m resolution DEM since no other survey measurement was possible under the scope of study.

- Surface-Groundwater Resources Evaluation and Water Balance for Conjunctive Use in the Tana-Beles (Addis Ababa University)**:** The main objective of the study was to estimate the groundwater hydrology of the sub-basins and to assess potential conjunctive use of surface and groundwater. The results of the exercise produced three-dimensional values of hydraulic conductivity for seven distinct zones within the region, based on their geological properties and flow regimes, as well as classification of these zones in terms of their aquifer productivity. The study also determined recharge patterns of the aquifer, from rainfall, percolation to the water table from rivers, lakes, ponds, and through localized recharge. The study found that two major aquifer systems exist in the catchment. A regional flow system occurs in the larger fractured rock aquifer of the tertiary and quaternary volcanics. The second aquifer system occurs in the unconsolidated sediments that have in-filled the valleys by alluvial processes. Groundwater levels in the unconsolidated aquifers show seasonal variation and response to river levels with high levels in the wet winter and low levels in the summer. The fractured aquifer is hydraulically connected to the

surface water bodies via a continuous saturated zone. Primarily, the major rivers in Tana-Beles sub-basin gain water from the aquifer, however, this relationship can vary temporally and spatially and will depend on the relative river and groundwater levels. As the aquifers are connected to the river network, the authors recommend that these aquifers be better managed.

- Investigation of the Upstream Interventions on the Groundwater - Surface Water Interaction in the Blue Nile Region in Sudan (Khartoum University). The study investigated the impacts of the upstream interventions on the interaction between the Blue Nile aquifer and the Blue Nile River and its tributaries. The study found that the Blue Nile constitutes the primary recharge source for the Blue Nile Basin aquifer, and that current abstraction rates from the aquifer are almost recovered by this total annual recharge. While the study found that upstream development plans (e.g., Grand Ethiopian Renaissance Dam) do not appear to have any significant impact on groundwater recharge, on the other hand, increasing abstractions by 50% will not be recovered by recharge from the river resulting in a reduction in groundwater storage.

- Multi-Criteria Assessment of Productivity, Water Use and Farm Income as Influenced by Institutional Changes in the Gezira Scheme (Khartoum University)**:** The main objective of the study was to describe the existing situation of institutional reform and investigate its contribution in improving water productivity, income generation and poverty reduction in the Gezira Scheme. Specific objectives were envisaged to determine the cropping patterns and productivity of crops in Gezira Scheme after the formation of the WUAs, to specify the necessary steps required to ensure that WUAs have a role to play in poverty reduction, and to develop a Multi-Criteria Analysis (MCA) tool with relevant criteria and indicators to describe the performance of Gezira Scheme under the WUAs. The study showed that the livelihood of the Managil group has improved as member were able to best understand the advantages of the institutional changes and explored new cash crops of their own choice. The Managil group is also situated such that it receives its irrigation water supply from the first control structure on the main canal. The Southern group was ranked fourth as it was unable to use the opportunity rendered by the freedom of choice of crops, and was not involved in the WUAs formation and unaware of their functions. The study recommends that in the future, institutional changes be discussed thoroughly with all farmers so that they understand the impacts of changes on their livelihoods.

***IT Strategy and Policy.*** This strategy, developed with ENPM support, lays out a vision for a sustainable information technology framework. Many of these achievements need to be sustained by ensuring that ENTRO has adequate financing and staffing to adapting to the rapidly changing IT world. This includes updating software versions, hardware, web portal, possible use of cloud storage and processing, and building mobile apps to take advantage of the new wave of smartphone and tablet popularity. This also includes investing in videoconferencing (currently limited by Government of Ethiopia restrictions) to improve interactions within NBI, with partners, and as an enabling mechanism for effective distance learning.

**Component B: Modeling System Development (Actual cost US$1.92 million or 41% of total Project cost)**

The Project has supported the development of a range of modeling systems to examine issues of interest for the Eastern Nile. This included a focus on different types of models that could characterize different parts of the Eastern Nile system to provide the required insights, and included models that could examine:

- Hydrological schematics for each of the major Eastern Nile sub-basins with associated information.
- Water Balance SWAT model for the Eastern Nile basin was developed to examine changes in water cycle interactions (e.g. evapo-transpiration, infiltration, runoff, "green" and "blue" water, etc.) with changes in afforestation, rainfed and irrigated cropping pattern changes, urbanization, other land use changes, hydrology, existing and new reservoir operating rules, etc.
- Water Systems Planning (simulating a river basin/sub-basin - e.g. turning on/off various reservoir options, changing operating rules/filling strategies, varying demands such as agricultural/irrigation including recession agriculture, hydropower, industrial, environmental flows, etc.)
- Optimization Model for Eastern Nile using public domain/low cost tools (e.g. Excel, General Algebraic Modeling System (GAMS) as used in ENMOS): This included the formulation of optimization problems (with appropriate objectives, constraints and decision variables) – e.g. to maximize net benefits of water resources development and management under resource, technology, policy, environmental/social/budget constraints; optimizing coordinated reservoir operating rules, with functional specifications.
- Enhancements of Flood Forecasting Systems at Egypt, Ethiopia, and Sudan. Flood mapping (based on work done under the Eastern Nile Flood Preparedness and Early Warning System Projects I&II) to estimate inundated areas and approximate damage costs (including implication for recession agriculture and groundwater) for different precipitation/flow regimes.
- Climate Change Analysis to analyze historical climate variability in Nile Basin and analyzing climate change scenarios in Nile Basin (with specific focus on Eastern Nile Basin and to assess the vulnerability of Eastern Nile water system to climate risks; identify and evaluate climate change mitigation and adaptation opportunities in the Eastern Nile system.

***Operationalization of Flood Early Warning Systems (in Ethiopia and Sudan).*** The tools developed under ENTRO's flood management activities have built upon work undertaken by a previous ENTRO project (Flood Preparedness and Early Warning that closed in December 2010). In Sudan, ENTRO strengthened existing Flood and Early Warning System (FEWS) and in Ethiopia supported its establishment and operationalization. These tools allow for the production of spatial maps, daily rainfall forecasts, and daily flood hazard maps for flood prone areas in the Eastern Nile. The tools are used to develop flood preparedness emergency action plans and for the purpose of evacuation and early warning program. In addition to daily forecasts that are primarily shared with National Forecast Centers, weekly flood bulletins are produced and shared with a wider range of stakeholders including Ministries, Relief Agencies, Non-Government Organizations (NGOs), Meteorological departments, research centers and international agencies interested in the Eastern Nile Flood Season Monitoring activities. Scale up of flood risk mapping

to cover flood-prone areas in Gambella, Ethiopia was carried out. To generate these maps: (a) data was collected and validated based on field surveys to produce terrain models; (b) DEM for the Gambella floodplains was developed; (c) Stochastic and Hydrologic frequency analysis was carried out to determine flood quintile under different return periods; (d) HEC-RAS hydraulic model was configured to determine flood depths and velocities; and (e) Flood hazards maps were produced using ARC-GIS and Hec-GeoRAS Interface in Arc GIS.

***Modeling Tools.*** Several models were developed under the Project:

- Soil and Water Analysis Tool (SWAT): This popular public-domain tool was used to develop a calibrated model using public domain datasets for the entire Nile Basin with a focus on Eastern Nile scenarios. This model was developed with inputs from international experts (e.g. from the CEGIS, Bangladesh, and the primary ArcSWAT developer from Texas A&M) as well as regional and national experts (including universities). This model has also been used to analyze several development and climate change scenarios.
- RIBASIM**:** ENTRO worked with Deltares (developers of RIBASIM) to use this tool to develop a calibrated water systems model for the Eastern Nile. This water systems model was used to analyze scenarios of changing water demands (e.g. municipal, industrial, and agricultural based on country master plans) and scenarios of water infrastructure (e.g. new dams) and climate in an integrated manner.
- RiverWare: ENTRO worked with an international consultant with extensive experience in using RiverWare, developed by the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) and used as the primary model for managing the Colorado Basin. This system simulation model was used to analyze a number of scenarios, particularly related to Blue Nile mainstem projects with different filling and operating rules and their impact downstream (e.g. on Aswan levels and hydropower generation).
- HEC Suite: ENTRO used the set of free modeling tools developed by the Hydrologic Engineering Center of the US Army Corps of Engineers. This included the development of Eastern Nile system simulation models using HEC-ResSiM to explore the impacts of building water infrastructure on the system hydrology. In addition, Hydrological Engineering Center Hydrological Modeling System (HEC-HMS) and HEC-RAS were also used for the work related to flood forecasting in the Eastern Nile.
- Nile DSS Platform and Mike Basin: ENTRO also worked closely with the NBI Secretariat to improve synergy between the ENPM Project and Nile DSS activities. This included the use of the Nile DSS framework and the use of the Mike Basin modeling system that was initially linked to the Nile DSS. This included support for the use of the Mike Basin modeling platform as part of the JMP1-ID project activities of ENTRO.
- Eastern Nile Multi-Purpose Optimization System (ENMOS): ENTRO also developed an optimization system that allows for selecting the optimal values for key decision variables (e.g. reservoir releases, cropping patterns, etc.) in order to maximize or minimize selected objectives (e.g. maximizing net benefits in the basin) subject to constraints (e.g. related to water, irrigated areas, budgets, physical infrastructure limitations, etc.). This model, developed by ENTRO professionals, with the support of World Bank and University College of London specialists, uses GAMS optimization software linked to an Excel Interface for inputs and outputs.

**Component C: Institutional Capacity Strengthening (Actual cost US$1.68 or 36% of total Project cost)**

***National Networks (Government and academia).*** The national networks have primarily been facilitated by academia. The Project has had good success in building university partnerships across the Eastern Nile universities. This has expanded from the initial set of 3 selected universities to include: in Egypt, Cairo University, Ain Shams University, Assuit University, Alexandria University, and South Valley University; in Ethiopia, Addis Ababa University, Arbaminch University, Bahir Dar University; Ministry of Water and Energy- Flood Forecast Center; in Sudan, Khartoum University, Gezira University, Sudan University for Science and Technology, Ministry of Electricity and Water Resources-Hydraulic Research Station; and in South Sudan, South Sudan University. These universities have met regularly with Project facilitation and some have also been engaged to conduct special studies building on their comparative advantage in different technical areas of specialization.

***Internship Program.*** ENTRO's internship program was established in December 2011, and involved several advanced graduate students and young faculty from the partner universities and governments. Participants included specialists not only in water resources, but also those working on economic, environmental and other aspects in three continuous batches since the program's institution: Batch-1, 9 interns (3 each from Egypt, Ethiopia, and Sudan); Batch-2, 12 interns (4 each from Egypt, Ethiopia, and Sudan); and Batch-3, 22 interns (from Egypt, Ethiopia, Sudan, and South Sudan). These interns had been resident at ENTRO office in Addis Ababa for about 3-4 months each. Some of the interns in previous batches had also been engaged to guide interns in subsequent batches. The interns had regular meetings and presentations and also participated in relevant technical trainings.

***Trainings and study tours.*** Many professionals were trained through formal training events and study tours. These included:

- Decision-makers: The Project was able to reach out 10 decision makers in the region: ENCOM (3 ministers), ENSAPT (3 senior professional decision makers), and the Heads of the Civil Engineering Departments of Cairo University, Addis Ababa University, Khartoum University, and Gezira University (4 highly recognized professors).
- Senior Professionals: The Project managed to secure the involvement of about 8 senior water-related professionals in the three countries**.**
- Young professionals: The Project focused on developing a large cadre of younger professionals (many possibly future senior professionals and decision makers) to create and effectively use the knowledge base, modeling tools, and knowledge products on a variety of issues of regional concern. A total of 46 interns participated in several informal training processes facilitated by the Project.
- Specialized training: Trainings were conducted on the following software: SWAT (1), RiverWare (2), RIBASIM (2), GIS (1), Remote Sensing (1) and Interactive Spatial Knowledge Products (1).
- Study tours: Study tours were organized back-to-back with each of the regional workshops and included visits to watershed management efforts in Bahir Dar, water supply installations in Mekele, high-productivity agriculture in the West Delta in Egypt, and other areas of regional interest.

***Workshops***. The following workshops were organized and supported by the Project: at the regional level, January 2010 in Nazareth (Project Launch workshop), October 2011 in Addis Ababa (University Partnerships), September 2012 in Mekele (Project products), August 2012 in Cairo (GIS Training), October 2012 in Addis Ababa (SWAT Training), November 2012 in Addis Ababa (RIBASIM Training), and December 2012 in Juba-South Sudan (Final Regional Project workshop); and the national level including regional participation, March 2012 in Bahir Dar, Ethiopia (with Addis Ababa University) , May 2012 in Khartoum, Sudan (with Khartoum University), May 2012 in Cairo, Egypt (SWAT modeling workshop organized by World Bank and MWRI), July 2012 in Alexandria, Egypt (with Cairo University), November 2012 in Khartoum, Sudan (with Khartoum University), and December 2012 in Cairo, Egypt (with Cairo University – International Forum of Scientific Research focused on the Nile).

**Annex 3. Economic and Financial Analysis**
*(including assumptions in the analysis)*

*N/A*

## Annex 4. Grant Preparation and Implementation Support/Supervision Processes

### (a) Task Team Members

| Names | Title | Unit | Responsibility/ Specialty |
|---|---|---|---|
| **Lending/Grant Preparation** | | | |
| Nagaraja Rao Harshadeep | Senior Environmental Specialist | SASDI | TTL |
| E.V. Jagannathan | Senior Water Resources Engineer | AFTWR | Co-TTL |
| Barbara Miller | Lead Water Resources Specialist | AFTWR | Cluster Leader |
| Winston Yu | Water Resources Specialist | SASDA | Economics |
| Roxanne Hakim | Senior Anthropologist | AFTS2 | Social |
| Tafesse Freminatos Abrham | Senior Financial Management Specialist | AFTFM | Financial Management |
| Richard Olowo | Senior Procurement Specialist | AFTPC | Procurement |
| Evarist Baimu | Counsel | LEGAF | Legal |
| Daryl Fields | Senior Hydropower Specialist | ETWWA | Decision Support |
| Astrid Hillers | Senior Environmental Specialist | ENV | Environment |
| Zaure Schwade | Operations Analyst | AFTWR | Operational Support |
| Duncan Burrell | Operations Analyst | OPCFC | Operational Support |
| Mikael A Ketsela | Operations Analyst | AFTWR | Operational Support |
| Eileen Rose Burke | Operations Analyst | AFTWR | Operational Support |
| Thembi Kumapley | Team Assistant | AFTWR | Team support |
| Lakech Tsegaye | Team Assistant | AFCE3 | Team support |
| **Supervision/Implementation Completion Report (ICR)** | | | |
| Nagaraja Rao Harshadeep | Senior Environmental Specialist | AFTEN/ AFTN1 | TTL |
| Rita Cestti | Sr. Rural Development Specialist | OPSOR | ICR Lead Author |
| Habab Taifour | Young Professional | YPP | Water Resources |
| E. V. Jagannathan | Consultant | SASDA | Water Resources |
| Barbara A. Miller | Lead Water Resource Management (Retired) | AFTWR | Water Resources |
| Eileen Rose Burke | Senior Water Resources Management Specialist | AFTN2 | Operational Assessment / Nile Coordination |
| Binyam Bedelu | Procurement Specialist | AFTPE | Procurement |
| Richard Olowo | Lead Procurement Specialist | AFTPE | Procurement |
| Thembi Kumapley | Program Assistant | AFTWR | Team support |
| Dawit Tadesse | Program Assistant | AFTN2 | Team support |

| | | | |
|---|---|---|---|
| Lillian Brenda Namutebi | Consultant | AFTME | Financial Management |
| Mulat Negash Tegegn | Consultant | AFTFM | Financial Management |
| Walter A. Garvey | Consultant | AFTN2 | Water Resources Management |
| Tafesse Freminatos Abrham | Consultant | AFTFM | Financial Management |
| Jonathan David Pavluk | Senior Counsel | LEGAM | Legal |
| Hrishikesh Prakash Patel | Consultant | AFTN1 | GIA and Knowledge Products |
| Lauriane Cayet | Consultant | AFTEN | Spatial Information Systems |
| Fernanda Zermoglio | Consultant | MNSWA | Climate Change |
| Jorge Jose Escurra | Consultant | SASDI | Water Resources Modeler |
| Sirein Awadalla | Consultant | AFTN2 | Water Resources/ Research |

**(b) Staff Time and Cost**

| Stage of Project Cycle | Staff Time and Cost (Bank Budget Only) | |
|---|---|---|
| | No. of Staff Week | US$ Thousands (including travel and consultant costs) |
| **Lending** | | |
| FY07 | 3.5 | 17.29 |
| FY08 | 1.3 | 17.20 |
| FY09 | 1.2 | 12.67 |
| FY10 | 0.0 | 0.00 |
| **Total:** | 6.0 | 47.16 |
| **Supervision/ICR** | | |
| FY10 | 0.0 | 0.00 |
| FY11 | 0.0 | 0.00 |
| FY12 | 0.0 | 24.14 |
| FY13 | 0.0 | 0.00 |
| **Total:** | 0.0 | 24.14 |

## Annex 5. Beneficiary Survey Results

### Feedback Obtained During Project Implementation

During the course of Project implementation, ENTRO obtained feedback from stakeholders on Project's activities and outputs. Below is a compilation of the feedback received group in three areas: knowledge base, analytical tools and stakeholder partnerships.

***Knowledge Base***

- Good innovative products to base shared trust
- Very important for planning and management
- Extensive database, requires quality check
- Developed knowledge is at satisfactory level, needs more integration
- To some extent, collected data fill the issue of data scarcity
- Sharing data is still not clear, more refinement is also needed
- Young scientists have acquired knowledge essential for the challenge of data scarcity they used to face
- All countries should take real steps for sharing data
- Focus on climate change data is needed
- Project's developed knowledge base added a lot to general public awareness among Eastern Nile countries

***Analytical Tools***

- Useful and beneficial.
- Probably the latest tools ever available
- Tools are now ready for professors to use, update, and teach
- Analytical tools are quite good
- Developed tools provide insights on water issues in the region
- Need to propose comparative assessment among outputs of different tools
- ENTRO data has found the path for utilization
- Very important for the decision makers for impact assessment
- Important tools for the better management of the Eastern Nile basin
- Efforts are needed to compare different model results
- Final versions of models shall be provided to the universities

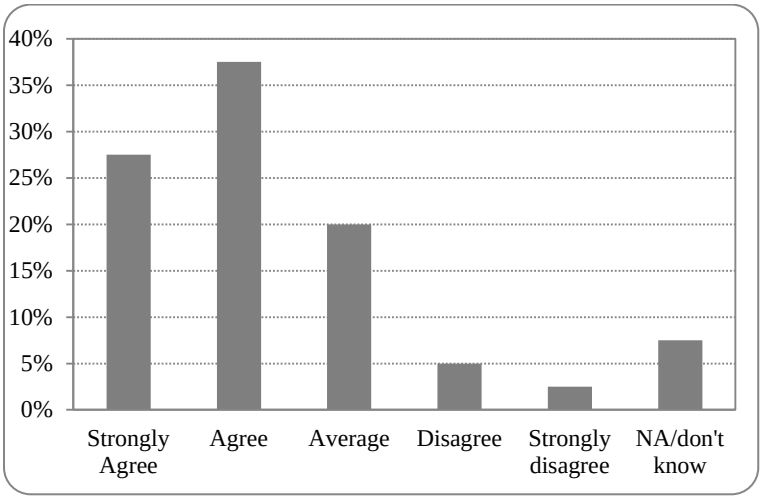
***Stakeholder Partnerships***

- Effective structure for sharing information for the welfare of the region
- Promising Eastern Nile network of both junior and senior academia
- Quite satisfactory, it might be good to have media outlet
- Active participation is clearly noted
- Inputs from indigenous and farmers is still needed
- Established network requires engagement of other stakeholders groups
- Stakeholder selection is successful
- End products have to be shared with users
- Project established a real partnership among Eastern Nile universities that needs to be sustained

**Feedback Obtained After Project Closure**

During the NCORE workshop launch, which took place in March 2013, ENTRO conducted a survey among workshop participants to obtain their feedback on several aspects of the Project and the JMP1-ID project. A total of 40 participants responded to the survey representing Egypt (4), Ethiopia (14), South Sudan (3), Sudan (13) and others (6). The survey did not pretend to be representative of the diverse institutions that participated in or benefited from either project or both projects, or the stakeholders in the Eastern Nile basin. It is considered however a good mechanism to gather input from stakeholders on important aspects of the Project implementation.

When asked to indicate how close the objective of the Project has been met, 85% responded with an average or better answer.




When asked to indicate their level of agreement or disagreement with the performance of the Project activities, the great majority responded with an average or better answer with regard to: knowledge base and knowledge products (95%), public domain tools (95%), internship program (95%), national and regional capacity building activities (95%), commercial modeling tools (95%), and informing regional dialogue activities (89%) – see table below.

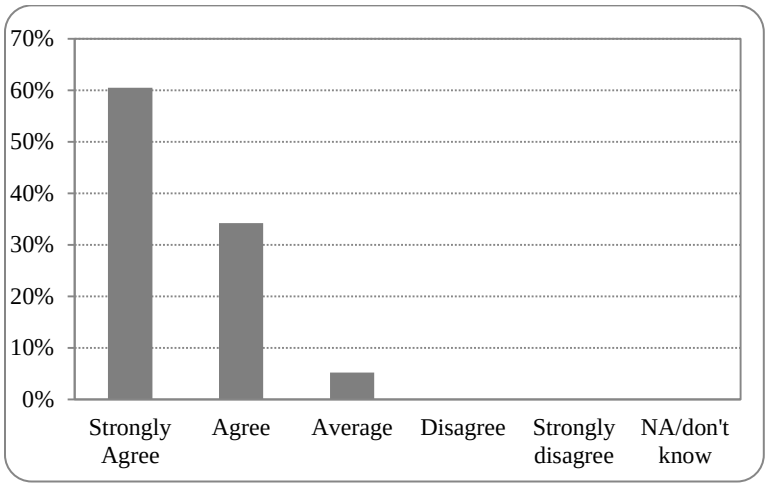
| ENPM Project Activities | Percentage of Respondents Who Reported … | | | | | |
|---|---|---|---|---|---|---|
| | Strongly Agree | Agree | Average | Disagree | Strongly disagree | NA/don't know |
| Knowledge base and knowledge products | 50% | 37% | 8% | 0% | 5% | 0% |
| Public domain modeling tools | 32% | 37% | 26% | 0% | 5% | 0% |
| Commercial modeling tools | 24% | 42% | 29% | 0% | 5% | 0% |
| Internship program | 62% | 22% | 11% | 3% | 3% | 0% |
| National and regional capacity building | 35% | 49% | 11% | 3% | 3% | 0% |
| Informing regional dialogue on strategic water resource planning, development and management | 35% | 30% | 24% | 3% | 5% | 3% |

When asked to indicate their level of agreement or disagreement with the contribution of ENTRO recent activities (including those supported under the ENPM Project and the JMP-1 ID Project), the great majority responded with an average or better answer with regard to: developing a

common vision for Eastern Nile (95%), built capacity for basin wide development and management and more efficient use of Eastern Nile resources (98%), increased awareness about Eastern Nile issues and the need to jointly develop and use the common resources of the Eastern Nile for the benefit of all (93%), generated knowledge products and modeling tools for better development and management of Eastern Nile resources (95%), strengthen the capacity of ENTRO to provide technical knowledge helpdesk services to other regional and national institutions (98%), and strengthen the capacity of ENTRO to facilitate regional-scale land and water investments (88%) – see table below.

| ENTRO's Activity Contribution | Percentage of Respondents Who Reported … | | | | | |
|---|---|---|---|---|---|---|
| | Strongly Agree | Agree | Average | Disagree | Strongly disagree | NA/don't know |
| Developing a common vision for Eastern Nile | 48% | 40% | 8% | 0% | 5% | 0% |
| Built capacity for basin wide development and management and more efficient use of Eastern Nile resources | 45% | 48% | 5% | 0% | 3% | 0% |
| Increased awareness about Eastern Nile issues and the need to jointly develop and use the common resources of the Eastern Nile for the benefit of all | 43% | 43% | 8% | 5% | 3% | 0% |
| Generated knowledge products and modeling tools for better development and management of Eastern Nile resources | 58% | 35% | 3% | 0% | 5% | 0% |
| Strengthen the capacity of ENTRO to provide technical knowledge helpdesk services to other regional and national institutions | 34% | 44% | 20% | 0% | 2% | 0% |
| Strengthen the capacity at ENTRO to facilitate regional-scale land and water investments | 25% | 43% | 20% | 0% | 5% | 8% |

When asked to indicate their level of agreement or disagreement on whether the Eastern Nile institutions would benefit from the various products and services delivered by the Project, 100% responded with an average or better answer.



## Annex 6. Summary of Grantee's ICR and Comments on Draft ICR

*The Project has basically met its deliverables. All activities have been implemented to produce the outputs as planned, and sometimes even much beyond plans, even though implementation modalities were adapted as required. Not only ENTRO, but also the three Eastern Nile universities, through their relevant professionals, have built significant experience in and exposure to the knowledge base and analytical tools required to prepare, design, reach consensus on, implement, and monitor complex, multisectoral, transboundary water resources development projects. This helped build capacity in a context in which none of the three Eastern Nile universities have previously ever embarked upon in a coordinated manner. Lessons of experience in the institutional, technical, and planning domain have been acquired, which goes a long way into building a strong regional network of modelers and planners. The internship program and developed analytical tools are indications of the right steps in this direction. Project implementation has been supported by and done in collaboration with the relevant professors, researchers, academia and other relevant stakeholders in the three countries. The World Bank has provided invaluable support from the very inception to implementation. As indicated in the next section, ENTRO also strongly believes that the Project results are sustainable, especially with enhanced support of the Eastern Nile countries and development partners.*

**Context**

The ENPM Project was identified as one of ENTRO's "fast track" in 2005 to act as a precursor for basin-wide activities and provide ENTRO with in-house analytical and knowledge foundation to support other activities such as irrigation and drainage, power trade and flood management. It was intended to strengthen the knowledge, modeling, and stakeholder interaction capacity of regional and national institutions to plan for water resources investments in a regional context, with appropriate regard to economic, environmental and social aspects. The Project was to be an essential building block to stimulate cooperative investments in the region. Not only was the Project the result of cooperation, but it was thought to be able to further cement this cooperation through regional projects and the consideration of national projects in a regional context. This was essential to ensure that scarce financial resources are used effectively and that the region can take advantage of transformational opportunities that Nile cooperation provides.

A key development during Project conceptualization was that a Cooperative Framework Agreement (CFA) was being negotiated across countries. A Nile Basin Decision Support System (DSS) was being conceived as an integrating modeling framework for countries to use across the basin and the Project was actually initially intended to precede and inform the Nile DSS work in the Eastern Nile. The preparation of the Project was stalled for almost two years as the Eastern Nile countries could not reach agreement on the location of the regional coordination of the Project. The increasing tensions and frustrations relating to lack of agreement on the CFA also added to the delays in Project preparation and implementation, but underlined the need for a comprehensive knowledge base, modeling tools, and technical networks to develop a common understanding of the issues and options for regional cooperation.

**Development Objective**

The development objective of the Project was that countries in the Eastern Nile operationalize an improved decision support modeling framework to identify water-related investments and evaluate them in a regional context. This development objective was met.

At the start of the Project, there was little in the way of a comprehensive knowledge base for the Eastern Nile basin, and extremely limited information in the public domain. There was no available modeling toolsets in the public domain calibrated for the basin to allow for exploration of the range of development and management issues that the basin faced. There were no effective partnerships among or across universities in each Eastern Nile country to work together on water-related issues of regional interest. At a regional-level, although ENTRO had overseen many major consultancies related to land and water management, its in-house capacity to organize, use, and analyze the information was very weak. The use of modern IT tools was limited and ENTRO website provided little useful information. Countries did not really look to ENTRO to provide the knowledge and modeling services they needed, especially to support decisions on water-related investments keeping in mind the regional context. As a result of Project implementation, there has been a dramatic change in ENTRO's capacity to develop and use knowledge and analytical products to support improved planning and management of water resources in the Eastern Nile.

The extensive knowledge base developed has also improved the effectiveness and sustainability of previous investments to improve the knowledge base and planning. Modeling and visualization tools developed have been useful to analyze a wide range of development, management, and climate scenarios in a multi-sectoral context. The Project has facilitated strong partnerships with academic institutions in the Eastern Nile, which have helped improve research efficiency and targeting. The equipment, books, datasets, modeling tools, internship program, and capacity-building efforts would help both government agencies and universities to develop a new cadre of professionals that are more cognizant of regional water resources perspectives and can utilize the best available datasets and tools on a more level footing. ENTRO has a new web portal (expected to be scaled-up to the entire Nile Basin in the next year) with innovative features to improve public access to information, tools, and knowledge products. All this has placed the region in a much better position to work cooperatively on water resources development and management and better understand the regional implications of proposed water-related investments so that more informed decisions can be made.

**Performance Indicators**

Performance indicators agreed at negotiations were also all met.

***Development of a shared interactive Eastern Nile Knowledge Base and dissemination of a State of the Eastern Nile Report were satisfactorily accomplished.*** The Project helped develop a wide range of knowledge base and products on the Eastern Nile. A wide range of multi-sectoral spatial layers were collated, computerized, quality checked, and organized into GIS layers collated into systematic geodatabases were developed for watershed management, power systems, and irrigation and drainage. Interactive toolkits were developed to provide easy access to thematic and sub-basin information. A modern interactive web portal was developed to provide enhanced access to the Eastern Nile knowledge base and knowledge products. An Eastern Nile Atlas was developed to visualize the spatial diversity of the region. A State of the Eastern Nile Report was developed to describe the history, context, and future opportunities and risks in the Eastern Nile.

***Development of modeling tools to systematically evaluate Eastern Nile investments in a regional context, examining economic, environmental, and social aspects as allowed by available data was satisfactorily accomplished.*** A suite of modeling tools was developed to provide analytical insights into the resource management and investment options in the Eastern Nile. This included simulation, optimization, and multi-criteria tools to examine proposed water investments in a multi-sectoral regional context. A range of reputed modeling tools were used to support analysis on the Eastern Nile – including SWAT, the HEC suite, RIBASIM, RiverWare,

Mike Basin, and the Nile DSS framework. Efforts were made to integrate economic, environmental, and social aspects in spite of the significant limitations of the available data. The impacts of investments on sensitive downstream areas were examined for varied scenarios of sizing, phasing, filling and operational strategies. Optimization tools were developed to examine options to maximize the net benefits of basin development and management. Flood forecasting tools were improved to help countries provide early warning to vulnerable residents of flood-prone areas. Climate change analysis was conducted using a range of the best available GCM outputs.

***Strong institutions at Regional and National levels (in Egypt, Ethiopia, and Sudan) with adequate capacity and partners (e.g. University Outreach Centers) to be a focal point for knowledge and analysis on water investments on the Eastern Nile was accomplished with mixed results.*** At regional-level, the Project has helped transform ENTRO into a credible center to provide regional knowledge and analytical services. ENTRO now has the enabling skills, knowledge base, modeling tools, networks, partnerships, and outreach mechanisms to be able to engage a wide variety of stakeholders to help them make more informed decisions on issues and options that have regional significance. The Project work has also benefitted other NBI activities (e.g. Nile DSS) and has helped shape the next generation of projects (e.g. NCORE) for the NBI. At national-level, the Project has had mixed success. It has helped developed excellent partnerships with universities in the Eastern Nile countries, helping universities to establish better professional networks both within and across countries, and to partner with a number of ENTRO activities. The internship program established has been pioneering, helping a new generation of potential water professionals and leaders to acquire new skills, develop new regional collaborations, and contribute multi-sectoral perspectives to enhance ENTRO's knowledge and analytical services. The Project has also helped improve national government capacity through provision of equipment and training; however, this has been severely constrained by the current status of regional cooperation on the EN.

***Collaboration with the Nile DSS was satisfactorily accomplished.*** A key concern during Project preparation was to maximize the synergy with other Nile Basin analytical activities (particularly the Nile DDSS under the Water Resources Planning and Management project implemented by the Nile Secretariat). This was very limited initially – each project was concentrated in implementing its activities on a very tight timeframe. However, as the Project activities started to pick up, especially during the third year of implementation, there was a much more robust and meaningful collaboration. This included co-financing key consultancies related to software development for additional Nile DSS features, adapters for additional models to be added to the Nile DSS framework, IT equipment and software to Eastern Nile countries, and co-organizing training workshops. This has also helped the NBI Secretariat and ENTRO to better agree on future knowledge, analysis, and partnership needs under the new NCORE project.

**Activities and Outputs by Components**

***Component 1 - Knowledge Base Development:*** A knowledge base was expected to be developed to provide a shared, synoptic view of the Eastern Nile basins, including its opportunities and risks as viewed from an economic, environmental and social perspective. Baseline data were to be organized systematically in a GIS platform with an associated web portal, and modern datasets from satellite remote sensing and other global/regional datasets were to be effectively used. The following is a list of the main activities conducted during the course of Project implementation and their respective outputs:

- Design and develop centralized database: A broad range of data sets was collated from several sources to develop a comprehensive knowledge base for the Eastern Nile. Organized spatial/GIS datasets in the form of geodatabases were developed at ENTRO for watershed, joint multipurpose project investments, power, irrigation and drainage, and flood management.
- Design and develop data management interface: A number of innovative spreadsheet tools were developed at ENTRO to provide easy access to critical thematic and issue-specific datasets (e.g. related to erosion/sedimentation, water resources, water infrastructure, irrigation, etc.). GIS systems were developed to use the geodatabases developed for the spatial knowledge base; and modern interfaces (e.g. web-based, offline interactive) were developed to visualize the data in the knowledge base.
- Develop data analysis tools: A number of knowledge products (e.g. overlays, animations, detailed spatial analysis) were developed to provide support to ENTRO activities. A number of interactive tools were also developed to provide thematic support.
- Establish quality control procedures: In establishing well-structured centralized geodatabases, there was significant effort in ensuring that the data from different sources were reconciled, harmonized, and formatted in a common framework
- Knowledge products, training and outreach: A number of knowledge products were developed, including the Updated Eastern Nile One System Inventory, the Eastern Nile Atlas, the State of the Eastern Nile Basin Report, the Eastern Nile under a Changing Climate Report, input datasets for a range of models, and a number of datasets and interactive tools.

***Component 2 - Modeling System:*** The ENPM modeling system was expected to be developed to include a suite of simulation, optimization and multi-criteria analytical tools. The models were to be built on a water systems "spine" using tools developed by the Nile Basin DSS to help analyze the economic, environmental and social aspects of proposed investments in a water resources systems framework, and to evaluate alternative scenarios of the future. The tools to be developed were to be draw upon and contribute to the Knowledge Base to be developed under Component 1, and were to be flexible to adapt to changing needs and increasing information availability. The following is a list of the main activities conducted during the course of ENPM Project implementation and their respective outputs:

- Identify modeling/decision support system framework: ENTRO explored the evolving needs in terms of modeling systems and pursued those that were useful for its ongoing activities (e.g. related to watershed management, climate risk management, irrigation systems, power systems, and water infrastructure development). A review of a range of available models (including the Nile Basin DSS) was undertaken and then ENTRO pursued those most suited tools to support decision making.
- Fine-tune an apply basin simulation system: Several simulation models were developed including the Nile Basin DSS, SWAT, RiverWare, RIBASIM, and HEC tools (including HEC-ResSiM, HEC-RAS, HEC-HMS).
- Develop and implement basin optimization system: Two basin optimization models were developed: ENMOS and RiverWare.
- Develop multi-criteria analytical tools: Basic multi-criteria analysis tools were used under the special studies.
- Define and develop standard system output: Scenario visualization tools, web-facilitated tools and individual modeling tools to explore scenarios were developed. Similarly, adapters to Nile DSS framework were developed to facilitate visualization of outputs.

***Component 3 - Institutional and Human Capacity Building:*** The ENPM was expected to support a structured stakeholder process to ensure that the systems developed would be driven by multi-sectoral stakeholder demand and appropriate to support decision-making. It was expected that the Project activities and training would strengthen ENTRO as a strong knowledge-driven regional institution, as well as improve the capacity of national institutions, reducing the current disparity in national capacity for such activities. Networking with academia and other international river basins was also expected to be pursued to improve cross-fertilization of ideas and sustainability. The following is a list of the main activities conducted during the course of Project implementation and their respective outputs:

- Facilitate structured stakeholder interaction: At regional level, the Project organized, facilitated, or provided inputs to a variety of forums – NBI Forums, Regional Working Groups, as well as a set of technical ENPM Project workshops in Eastern Nile countries. At the country level, the Project facilitated access to data, tools, and networking among professionals in countries; however, the work directly with ministries and policy makers was more limited during implementation due to the prevailing Eastern Nile country relationship issues. University networking was enhanced under the Project for all Eastern Nile universities. An innovative set of internships was established with all key universities in the Eastern Nile in order to both contribute to Project's product development and to more effective dissemination by investing in young faculty and graduate students from Eastern Nile universities.
- Establish and develop ENPM institutional setting/ structures: The Project activities were mainstreamed within ENTRO and did not remain just as a separate project to be implemented by ENTRO. The revised focus on in-house capacity helped convert ENTRO staff to become more hands-on with the knowledge base and models being developed and make ENTRO a center of excellence on the knowledge and analytical aspects of the Eastern Nile. The Project helped develop a community of modelers working on the Eastern Nile and provide them support in the form of data, tools, and networking.
- Strengthen institutional and human capacity: The Project helped facilitate significant training and capacity building. Within ENTRO, the Project supported IT equipment, internet, data, tools, professional development. At the level of regional institutions, the Project helped provide inputs to shape future NBI activities; support to NB DSS activities. Eastern Nile government institutions were provided with vehicles, some enabling IT and furniture. Eastern Nile universities were supported for IT hardware/software and related furniture, and books.
- Strengthen data availability, accessibility, and quality: The Project was able to develop a first set of organized datasets, tools, and reports in the public domain, improved data quality and harmonization in geodatabases, modernized ENTRO website to improve online access to and visualization of Eastern Nile knowledge base and tools.

**Key Challenges Faced and Changes Made During Implementation**

There were a number of challenges that were faced by ENTRO – many of these were resolved without major Project restructuring as the design of the Project allowed for flexibility in implementation modalities to achieve the development objective and key outputs. The key challenges that were encountered and the resulting changes made as a part of adaptive management by ENTRO in consultation with the Bank during implementation were the following:

***Inadequate availability of critical data/information.*** The knowledge base and analytical capacity to be developed under ENPM were underpinned by the availability of critical datasets and information on proposed investments. Access to these often remained a challenge during implementation. During preparation, activities such as collation of masterplans, the CRAs, the One System Inventory, and others really helped bring much of the relevant available information into ENTRO. In addition, during implementation, modern high-resolution global data sources, including those based on earth observation, were extensively tapped. University partnerships and internships were used to fill critical knowledge gaps.

***Lack of ENTRO governance consent to primary Project's consultancy.*** A large consultancy contract to provide implementation support for the Project was under competitive procurement process for many months; however, ENTRO could never get its governance to clear this large consultancy as required as its governance had not met for almost two years during a particularly tense phase related to the CFA. When it was clear that the selected Consultant would not have sufficient time to deliver the proposed outputs even if recruited, and given little prospect for an ENCOM meeting, ENTRO worked with the Bank to modify implementation arrangements. Even though the development objective, components, and result indicators remained the same, implementation modalities were drastically changed to allow ENTRO to use in-house expertise supported by small consultancies to deliver the products. More systematic university partnerships were also developed and an extensive internship program was initiated. In many ways, this "Plan B" was considered to be more effective than "Plan A" in terms of building in-house capacity and bringing a diversity of expertise and outreach opportunities to ENTRO and academia.

***Inadequate mainstreaming of Project within ENTRO*** During preparation, ENTRO had considered Project to be one of its many projects to be implemented almost like separate project implementation units within ENTRO. Early in implementation, ENTRO reorganized itself the need to institutionalize all its "projects" into its evolving structure. The ENPM was one of the primary activities under the newly established Water Planning Unit. During implementation, as the Project helped produce credible knowledge bases, analytical tools, and drew on academic professionals, ENTRO increasingly worked to ensure that all Project's activities were also relevant to its other major units and programs.

***Inadequate synergy with Nile DSS.*** The Nile DSS work being undertaken by the Nile Secretariat needed to be synergized with the Project activities being undertaken by ENTRO. During preparation, and also during early implementation, areas of synergy were identified among the Nile DSS and the Project activities, but there were problems to operationalize them as the Nile DSS work packages got underway, and the Project primary consultancy was stalled. After the "Plan B" was agreed, the synergy improved significantly, and towards the end of the two projects, the Project was co-financing and co-organizing joint activities with the Nile DSS.

***Tight implementation timeframe.*** The Project was to close on October 30, 2012 providing a tight timeframe given the late start for "Plan B".As per ENTRO's request, the Bank provided no-objection to extending the Project by two more months till the end of CY2012 to allow for a more orderly closure of Project activities and improved synergy with the Nile DSS.

**Benefits of the Project**

The work done under ENPM is critical especially for the NBI institutions at the regional-level and also critical for each of the Eastern Nile countries as summarized below.

**Regional-Level:**

***ENTRO:***

The ENPM project has been instrumental in providing ENTRO with the enabling knowledge base, modelling tools, and professional networks and institutional capacity in order to better serve its member countries in their efforts to better develop, manage, and utilize the shared waters of the Nile Basin. This includes a comprehensive and well-organized knowledge base, including spatial information organized into thematic geodatabases. This has also enabled ENTRO to more effectively utilize past studies that it has conducted (e.g. the Cooperative Regional Assessments) as well as other available global, regional, and national information. The quality management and organization of the knowledge base has also made it possible to visualize this information in many different forms for publications and presentations (e.g. charts, maps, animations), develop input datasets as required for a wide variety of modelling tools, and develop a range of thematic and sub-basin toolkits. A range of models has also been developed using the available knowledge base to test a variety of development and climate scenarios. ENTRO has also built strong relationships with regional academic institutions and young modelling professionals through the internship programs. This has enabled ENTRO to develop credibility as a knowledge institution that has good access to knowledge, tools, and expertise on critical issues facing the Eastern Nile and be in a position of being a centre of excellence to provide knowledge and analytical helpdesk services to the region. The ENPM project has also helped ENTRO to fulfil its mandate on its other activities as shown in the table below:

| ENTRO Activity | Support from ENPM |
|---|---|
| **Cooperative Regional Assessments** (Power Trade, Watershed Management, Irrigation and Drainage) | Improving the effectiveness and sustainability of these studies through organization of data from these studies into systematic geodatabases and development of toolkits and other knowledge products building on this work. |
| **Joint Multipurpose Program** | Support for use of knowledge base and modelling tools developed, and ENTRO professionals trained under the ENPM project. In particular, to explore the implications of new dams and cascade options on the Blue Nile on flooding, storage levels and hydropower generation downstream (at Roseires and Sennar in Sudan and at Aswan in Egypt), and on the recession agriculture along the Blue and Main Nile. |
| **Flood Preparedness and Early Warning Project** | The ENPM project has supported the refinement and updating of models used in the FPEW project, improved the development of linked hydrologic models (e.g. near Lake Tana and in Sudan) to improve hydrologic forecasts, improved the use of satellite earth observation data products, and supported the continued flood forecasting products issued during flood season by ENTRO. |
| **EN Watershed Project** | Comprehensive datasets have been developed relating to topography, land use, population distribution, agriculture, soils, climate, etc. to improve understanding of watersheds in the basin. Erosion modelling has been done with the support of models such as SWAT. A detailed watershed management toolkit has been developed to provide easy access to a comprehensive set of data and visualizations on erosion, sedimentation, and watershed management practices. |
| **Overall** | The ENPM work has also proved useful overall for corporate reporting, ENCOM/ENSAPT, NileCOM/NileTAC meetings, building partnerships with universities and global knowledge institutions and professionals, and to support interactions with development partners. |

***Other NBI**:*
The ENPM project has also provided benefits to other NBI institutions. This includes support to activities of the NBI Secretariat under the Water Resources Planning and Management Project – primarily the Nile DSS (e.g. through sharing datasets, co-financing of software development, hardware provision to National Ministries of Water in Egypt, Ethiopia, and Sudan, and training programs/workshops). The ENPM work has also influenced the design of the NCORE project aimed at strengthening all NBI institutions starting 2013.

**Country-Level:**
The ENPM project has provided a number of country-level benefits to Egypt, Ethiopia, and Sudan as indicated below:

- National Government Agencies: The ENPM project has supported the provision of equipment (IT hardware, software, and modelling tools – both for ENPM and Nile DSS, vehicles) and training to the Water Ministries. This has helped improve the links among government water professionals in various Eastern Nile countries and with the NBI, as well as allow for transfer of knowledge bases, modelling tools, and analytical techniques to enhance modernization of water management in the Eastern Nile countries.
- Universities: The ENPM project has built strong relationships with key technical Universities in the Eastern Nile countries. This has helped universities undertake demand-driven research (e.g. special studies) to respond to critical problems in the Eastern Nile, as well as improve partnerships within the universities (e.g. via the Focal Coordination Units in one university in each country). They have also been able to provide some of their best students and young faculty to work with ENTRO as interns and benefit from, and contribute to, the development of a shared knowledge base and analytical tools. The knowledge base and modelling tools should also help support future research at these Universities. The ENPM Project has also supported the universities with IT hardware, related furniture, software, datasets, and books to support current and future generations of students working on issues of analytical relevance to the Eastern Nile.
- General Public: The project has made special efforts to improve the availability of quality information in the public domain to demystify and improve understanding of complex, and often controversial, issues in the Eastern Nile ranging from construction of large dams on the Blue Nile to the additional challenges that climate change may bring to the region. The new ENTRO website (to be expanded Basin-wide under the NCORE project) provides improved access to public domain data, supports easy visualization of complex spatial information (e.g. through the Eastern Nile Atlas and online mapping), provides easy to read summaries of the Eastern Nile (e.g. through the State of the Eastern Nile Report), and provides access to tools so others can build upon this work. The internship program and workshops have also helped improve awareness of the need to consider national investments in a regional context, as well as build a community of modellers in the Eastern Nile.
- South Sudan: South Sudan was declared an independent country in 2012 and was recently admitted as an NBI member country. This new country has weak institutions and universities (recovering from decades of civil war) and extremely low capacity in meeting its challenge to develop and manage its water resources for the benefit of its largely very poor population. With the support of ENPM, ENTRO has begun the process of supporting this newest African nation by supporting interns from Juba University. At ENTRO's invitation and facilitation, the water-related ministries in South Sudan have also begun to participate in technical workshops to showcase and train participants in ENPM products.

**Sustainability**

Many of these activities were designed and developed keeping in mind sustainability considerations but there remains much to be done. There are a number of technical, financial, and institutional issues that need to be considered while exploring the sustainability of the Project activities.

***Technical.*** The technical challenges include the following:

- Knowledge Base: The Project has actually helped improve the sustainability of previous NBI and other efforts in building the best available knowledge base related to the region's water resources planning and management. This includes the CRA completed for power trade, watershed management, and irrigation and drainage as well as information from a number of Master Plans and other studies were carefully collated, computerized, and organized into systematic geodatabases. A number of other datasets were also collated. This has helped ensure that much of the work conducted previously with expensive consultancies and stakeholder inputs were collated into a flexible knowledge platform. However, this knowledge platform will need to be continually updated to reflect stakeholder feedback, demands placed on ENTRO's knowledge and analytical services, as well as additional reports and datasets as they are created/updated (incl. from available global/earth observation, regional, and local datasets and research products). The knowledge platform developed at ENTRO can serve as a repository of updated knowledge on the Eastern Nile to improve the use and sustainability of future activities that add to the knowledge base or draw from it. In order to do this, ENTRO has to ensure that it has the necessary technical staff/skills/partnerships to keep the knowledge base updated. Also, more work is required to update the knowledge base, particularly on environmental, social, and economic aspects where more systematic, comprehensive, primary data would need to be generated.
- Analytical Tools*:* When the Project was being conceived, there was much debate about whether only one modeling platform should be pursued or flexibility should be maintained on the choice of modeling platform. At the end, given the lack of an integrated modeling platform that could help answer the varied questions that the region was trying to explore, ENTRO decided to use the best tools available or that could be built/customized to address the various issues that are critical to the Eastern Nile. This included use of the Nile DSS platform as well the development of a number of "as required" toolkits and models that were fit-for-purpose in analyzing watershed management, irrigated agriculture, power systems, flood forecasting, groundwater, dam failures, among other themes. This approach could make use of the comparative advantages of different state-of-the-art specialized models available today. The Project also co-financed activities with Nile Sec to build adapters in the Nile DSS to expand the suite of models that could interface with the Nile DSS platform. All this aids sustainability as it avoids over-reliance on one tool or set of tools, and can benefit from several innovative and creative approaches to addressing critical development and management problems related to the Eastern Nile. This also allows the use of several modeling tools that build on the information in a common knowledge platform to help cross-check and develop new insights on results. This also allows for expanding the elements of university partnerships as different faculty and students in Eastern Nile universities are familiar with different modeling tools. ENTRO will need to ensure that it has the necessary staffing and skills to stay on top of the new developments in water-related models and build additional partnerships to explore the use of a rapidly-evolving set of modern tools.

- Information Technology: The Project has managed to leverage advances in modern software and hardware to develop a range of appropriate mechanisms to analyze and access data and information to generate knowledge products and services. Software applications includes the development of a state-of-the-art Web Portal, a range of interactive knowledge products including the use of innovative interactive spreadsheets, interactive PDFs, animations, offline and online GIS platforms, remote sensing analyses, and presentations. Hardware advances facilitated by the Project include the use of modern PCs, upgrading the server network, dramatically improving internet access speeds, and piloting the use of modern Tablets (iPADs). The Project also helped support the development of ENTRO's IT strategy and policy that lays out a vision for a sustainable information technology framework. Many of these achievements need to be sustained by ensuring that ENTRO has adequate financing and staffing to adapting to the rapidly changing IT world. This includes updating software versions, hardware, web portal, possible use of the cloud for storage and processing, and building mobile apps to take advantage of the new wave of smartphone and tablet popularity. This also includes investing in videoconferencing (currently limited by Government of Ethiopia restrictions) to improve interactions within NBI, with partners, and as an enabling mechanism for effective distance learning.

***Institutional.*** The most critical issue related to sustainability of the Project activities relates to institutional issues. In many regional forums (e.g. the Strategic Dialogue between NBI and its Development Partners), participants recognize that commitment to cooperation the only way to ensure sustainability of benefits from the shared Nile Basin water resources and that NBI is the most appropriate platform to take the agenda forward. However, there remain many unresolved issues to get a basin-wide cooperative framework and move to a comprehensive Nile Basin Commission. There is also some concern among Eastern Nile partners states regarding some of the large unilateral investments proposed. This situation results in some uncertainty on the future structure, staffing, funding, and mandates of the NBI institutions such as ENTRO. This will also have significant implications for the sustainability of the Project achievements. It should be noted that if the current capacity of regional institutions to provide such knowledge and analytical services is diminished or eliminated, it will probably take many years to rebuild the capacity and networks required to provide such services again.

The ENPM outputs in terms of the knowledge base, knowledge products, analytical/modeling tools, and stakeholder networks (e.g. university networks and the Eastern Nile modeling community) are of use not only to ENTRO to support its various evolving activities, but also the overall NBI. There are also a number of analytical activities related to the use of several different modeling suites, innovative flood forecasting tools, and interactive thematic/sub-basin toolkits that can be adapted to work on the rest of the Nile Basin (especially the Lake Victoria/NEL region). In this respect, it will be critical for NBI Secretariat, Nile Equatorial Lakes Subsidiary Action Program, and Lake Victoria Basin Commission to benefit from such work. ENTRO also needs to explore ways to better engage other relevant regional organizations (e.g. RECs, Regional Climate Centers, Regional Training Centers) as well as build partnerships with other basin organizations. In particular, it would be useful to strengthen the networking with NGOs and/or Civil Society Organizations (CSOs) forums such as the Nile Basin Discourse and research forums that can benefit from, and contribute to, improving public access and user feedback for the knowledge and analytical products initiated by the ENPM Project.

The role of Eastern Nile country government professionals has been more limited (due to the status of regional cooperation) and needs enhancing in the years ahead. The Project (directly and in partnership with Nile DSS) provided limited support to government agencies in terms of

equipment and operating costs. Some government professionals have also participated in regional forums and internship programs financed by the Project. There is a need for much more enhanced interaction of ENTRO with country government professionals to ensure that they can access, use, and contribute to refinement of the knowledge base and analytical tools developed.

One of the highlights of the ENPM Project has been the excellent partnerships with Eastern Nile universities that have been useful both to academia and ENTRO. It has helped universities to organize themselves within each country to help contribute to regional issues. For example, although the ENPM Project started with working with only one university in each country, this network rapidly expanded to include all other main universities in the region. Project has helped foster these relationships by organizing joint meetings to allow university expert faculty to comment on work being undertaken in Project, and to facilitate meetings of modeling specialists within each country. Special studies have been financed by the project to build on the comparative advantages of each university to address critical knowledge gaps in the Eastern Nile. An innovative internship program has been established in ENTRO (so far 3 batches of about 13 interns each have been resident in ENTRO for about 3-4 months each learning regional perspectives of various thematic issues and contributing to the development of knowledge products). This work with academia contributes to the overall sustainability of the Project as now there are a group of interested professionals that will be able to access, use, and build upon the Project's products to undertake targeted research and provide advice to governments as required. This work with academia will benefit from sustained financing especially to continue the internship program, special studies, regional workshops, and new innovations such as modeling/app development competitions and hackathons that could inspire the next generation of creative thinkers to contribute to resolving what seem like intractable problems today related to water resources development and management in the Eastern Nile.

ENTRO will need to also continue to expand its general communication – the new web portal should help in this regard, but additional activities will need to be undertaken related to development of newsletters, updating of email and hardcopy distribution lists, and ways to solicit and act upon feedback from users of Project's products.

***Financial.*** The activities undertaken by ENTRO under the Project would need to be sustained from a technical and institutional perspective as indicated above. However, all these activities (e.g. hardware/software/website upgrades, staffing, partnerships, internships, targeted studies, workshops and training, communications and outreach, etc.) would require continued financing. This also has to be done in a difficult regional cooperation environment. Given the utility of sustaining the Project activities to promote better-informed regional cooperation, such financing would need to come from the NBI/ENTRO member states as well as development partners. The NILECOM decided in July, 2012 to emphasize member country commitment to maintain minimum functionality of the NBI. There would be a need for additional country commitment to finance their government agencies to better interact with ENTRO to use the Project outputs. Universities have been excellent partners on the Project and it is expected that their work done and networks developed will actually help them access additional resources to build on the Project work. Development partners have also expressed willingness to continued support to the NBI programs and projects in the October, 2012 Nile Basin Strategic Dialogue. For example, the design of the Nile Cooperation for Results (NCORE) project financed by the Nile Basin Trust Fund and the Cooperation for International Waters in Africa (CIWA) Trust Funds managed by the World Bank and implemented by the three NBI institutions (NBI Secretariat, ENTRO, and Nile Equatorial Lakes Subsidiary Action Program) has a number of elements that sustain the achievements of the Project.

## Annex 7. Comments of Cofinanciers and Other Partners/Stakeholders

*n/a*

## Annex 8. List of Supporting Documents

The key ENPM Project Documents in the Project Files include:

- ENPM International Workshop Presentations
- ENPM Project Concept Note
- ENPM Project Information Document
- ENPM Project Integrated Safeguards Data sheet
- ENPM Project Preparation Consultant Report
- ENPM Project Implementation Plan
- ENPM Project Completion Report

### ENPM Products

- ENTRO Knowledge Base Overview
- ENTRO new Portal
- Eastern Nile Atlas
- Eastern Nile State of the Basin Report
- Eastern Nile in a Changing Climate
- ENPM Project Overview Factsheet
- Factsheets for all key ENPM activities

**Other Related Documents**

- NBI Overview
- Eastern Nile One-System Inventory (hydrologic, environmental and socio-economic data)
- EN Watershed Management Cooperative Regional Assessment (CRA) Report
- Reports of the Flood Preparedness and Early Warning Project
- Reports of Eastern Nile Regional Power Trade Study
- EN Irrigation and Drainage Cooperative Regional Assessment (CRA) Report
- Other ENSAPT Project Documents

**MAP**

# ARAB REP. OF EGYPT, ETHIOPIA, SOUTH SUDAN AND SUDAN

# EASTERN NILE PLANNING MODEL (ENPM) PROJECT

NILE RIVER SUB-BASIN BOUNDARIES
NILE RIVER BASIN BOUNDARY
WETLAND/GRASSY MARSH
CATARACTS
CITIES
NATIONAL CAPITALS
MAIN ROADS

Main Nile Basin
Tekeze-Atbara-Setit Sub-Basin
Baro-Akobo-Sobat and White Nile Sub-Basin
Blue Nile Sub-Basin

Area of main map

*This map was produced by the Map Design Unit of The World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.*

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