

WATER RESOURCES

PLANNING and MANAGEMENT



coba
GROUP

ENGINEERING AND ENVIRONMENTAL CONSULTANTS



PRESENTATION

COBA is a multinational and multidisciplinary group of Engineering and Environmental Consultants, founded in 1962.

The Group provides engineering consultancy services ranging from basic and planning studies, technical, environmental and economic feasibility studies, design and construction design as well as project management and works supervision, to operation follow-up and behaviour monitoring.

The Group has offices/subsidiaries in three continents and experience in more than fifty countries and encompasses several companies in accordance with functional specializations or geographical areas.

The competences acquired along the last six decades, together with the state-of-the-art employee expertise, the stability of its permanent staff and the comprehensive international experience allow to find out the best solutions for the full satisfaction of public and private Clients' needs and expectations.

During its existence, the Group has participated together with public authorities or private developers, in the feasibility of multidimensional projects, some of them being structuring projects and with major impacts on the improvement of peoples' life conditions in the several countries where it worked.

At present, the Group has a wide number of competences and technical areas that allow the composition of multidisciplinary teams who share knowledge and experiences in the execution of projects.

WATER SECTOR - ORIGIN AND EVOLUTION

COBA's experience in water sector dates back to its establishment in 1962. The former water projects were associated with water storage (dams) and later to the study of water resources for water supply systems (for public and irrigation and industrial purposes) and water resources planning and management of national and multinational river basins.

Thus, Hydraulics, Hydrology and Water Resources Planning are key disciplines of COBA activity for above 55 years. These disciplines are concentrated on the Water and Energy Department with a permanent staff of above 25 hydraulic engineers, planners and environmental specialists.

Along these years, the water resources are assuming an increasing importance worldwide to satisfy the industry and population needs and to reduce poverty, mostly in the poorest zones of the globe, as well as to manage a more and more scarce resource.

Therefore, water resources and their sharing between countries have been assuming a role of the utmost importance worldwide, being an issue that deserves in-depth discussions and meetings between national and regional organizations and the relevant world organizations and teams of experts.

COBA has been tailoring its means to offer services in the specific areas that associated with new conditions requirements, participating, nowadays, in studies of water economics, climate changes, water quality preservation, ecological systems preservation, water systems modeling, Geographic Information Systems and providing technical assistance to governments and organizations for water resources planning and management.

FIELDS OF ACTIVITY

HYDRAULIC UNDERTAKINGS

Concrete, Earth-fill and Rock-fill Dams. Weirs and Reservoirs Water Conveyance Systems. Hydraulic Structures.

POWER GENERATION AND TRANSMISSION

Hydroelectric Power Plants. Photovoltaic power plants and wind farms. Small Hydropower Plants. Power Plants Rehabilitation and Modernization. Substations High Voltage Transmission Lines. Cooling Water Systems for Thermoelectric Plants.

WATER SUPPLY AND WASTEWATER SYSTEMS

Catchment, Transport and Distribution of Potable Water. Water Treatment Plants. Drainage Systems. Wastewater Treatment Stations. Pumping Stations.

AGRICULTURES AND RURAL DEVELOPMENT

Irrigation and Drainage Systems. Rural Roads. Production Systems. Mapping and Basic Information.

TRANSPORTATION INFRASTRUCTURES

Roads and highways. Railways. Passenger and Freight Railway Stations. Metro and Light Rail. Airports. Bridges and other engineering structures.

ENVIRONMENT

Environmental Impact Assessment. Environmental Management, Monitoring and Auditing. Pollution Control. Landscaping. Land Management. Recovery of Degraded Areas. Waste Landfills.

GEOTECHNICAL STRUCTURES

Tunnels and Caverns. Slopes in Fill and Cut Section. Special Foundations Breakwaters. Embankment Works.

MARITIME AND FLUVIAL WORKS

Wharfs. River Training. Quay Rehabilitation. Flood and Flow Control.

MINING INDUSTRY

Environmental Studies. Design of Tailings Dams and Related Structures. Safety Assessment of Tailings Dams. Design Review of Tailings Dam Closure. Operations Maintenance and Monitoring Manual for Tailings Dams. Risk Analysis. Mine Closure Plan. Training.

BUILDINGS

Residential and Services Buildings. Industrial Buildings. Steel and Mixed Industrial Structures. Rehabilitation and Restoration of Ancient Buildings.

CARTOGRAPHY AND CADASTRE

Geographic Information Systems (GIS). Digital Cartography. Thematic Cartography. Thematic Cadastres. Land Acquisition.

SAFETY CONTROL AND REHABILITATION

Expertise, Monitoring. Inspection and Reinforcement of Dams and Transportation Infrastructures. Works Instrumentation. Project Maintenance and Operation.

PROJECT MANAGEMENT AND CONSTRUCTION SUPERVISION

Project Management. Cost Management. Site Supervision. Quality Assurance/Quality Control.

NATIONAL WATER PLAN | Angola

Client: Ministério de Energia e Águas (MINEA) - Instituto Nacional dos Recursos Hídricos (INARH)

Date: 2012 / 2015

Studies undertaken in consortium

DESCRIPTION:

The National Water Plan (NWP) contemplates the existing situation in the country and the diagnosis of the major problems and potentialities on a short, mid and long-term basis.

Besides the physical, economic and social characterization of the water sector, the NWP focuses especially on:

- Characterization of water resources (surface and groundwater), as far as quantity and quality are concerned;
- Identification and quantification of water uses (urban water supply, industry, irrigation, hydropower, environment, etc.);
- Execution of the water balance of water availabilities vs. water demands;
- Identification and characterization, in space and time, of the principal problems, namely floods, droughts, pollution, etc., as well as current and potential conflicts that may arise pertaining to water use;
- Definition of a short-term physical and financial programme.

Water balance was established based on existing information pertaining to water availabilities and water consumption economic, social and environmental pressure. This water balance has been made for the region / watershed as well as for several river sections, thus enabling to identify the most critical areas.

Emphasis is placed on the assessment of geographical areas in which water problems assume a particularly relevant socioeconomic and strategic relevance, namely regarding its potential for hydropower generation (more wet watersheds) and in regions where water conflicts use are expected to arise (drier watersheds).

The results of the National Water Plan have been presented under the form of a multi-criteria matrix, enabling to prioritize sustained technical interventions, with a suitable degree of safety, and to establish a physical and financial programme for a 25 year-project horizon



HIGH HYDROELECTRIC POTENTIAL PORTUGUESE NATIONAL PROGRAM OF DAMS Portugal

Client: REN (Rede Elétrica Nacional)

Date: 2001/2004

Studies undertaken in consortium

The purpose of the NPDHHP was to identify and define priorities for investments in large hydroelectric developments in the project horizon 2007-2020.

The proposal regarding the developments to be implemented resulted from the Strategic Environmental Assessment (SEA) of 4 large strategic options established within the scope of the NPDHHP (National Program of Dams with High Hydroelectrical Potential).

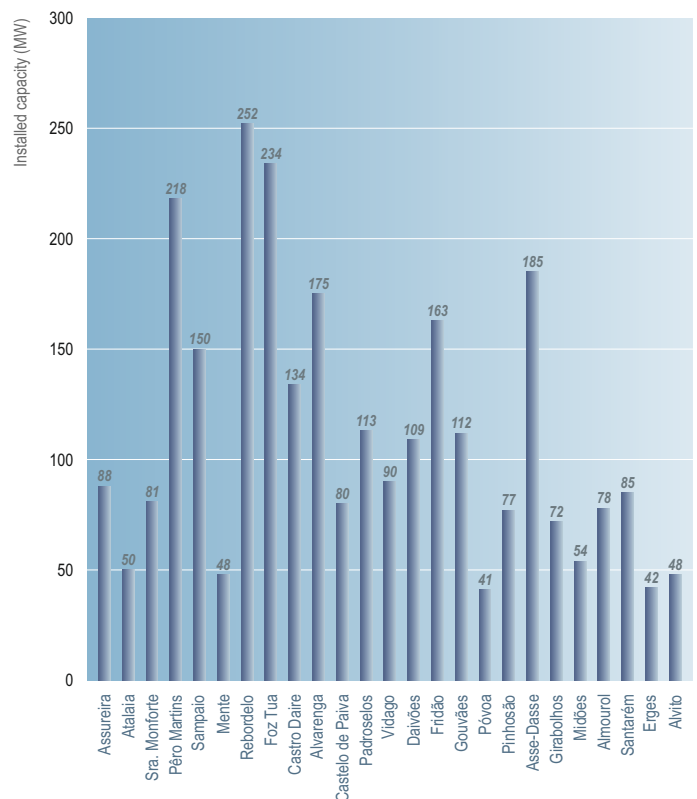
The selected developments are of great interest regarding power generation, optimization of the watershed resources, their potential to meet with other uses as well as their best technical, economic, social and environmental conditions that enable them to be implemented on a short to a medium term.

The 10 selected developments able to meet the installed capacity established for the 2020 horizon are: Almourol, Alvito, Daivões, Foz Tua, Fridão, Girabolhos, Gouvães, Padroselos, Pinhosão and Vidago which are expected to generate a total installed capacity of approximately 1100 MW, generating 1630 GWh/year on an average hydrologic year.

At the end of the NPDHHP implementation, in 2020, the total hydroelectric installed capacity in large developments in Portugal shall be of approximately 7 000 MW, reaching more than 9 000 MW taking into account the current power strengthenings.

The Environmental Assessment Studies were developed according to critical factors identified in the environmental and sustainability factors, as well as to relevant strategic reference framework to the program: climate changes, biodiversity, natural and cultural resources, natural and technological resources, human development and competitiveness.

The Environmental Assessment enabled to conclude that Option D Energy, Socio-economic and Environmental points of view is the one that, in global terms, mostly contributes to achieving the strategic goals regarding the critical factors and that less conflict to these.



The studies carried out analysed 25 hydroelectric developments with installed capacities above 30 MW.

Development	Watershed	River	Type	Watershed area (km ²)	Reservoir capacity (hm ³)	Installed capacity (MW)	Power generated (GWh/year)
Foz Tua	Douro	Tua	Reversible	3 822	310	234	340
Fridão	Douro	Tâmega	-	2 630	195	163	299
Padroselos	Douro	Beça/Tâmega	Reversible	315	147	113	102
Gouvães	Douro	Torno/Tâmega	Reversible	100	13	112	153
Daivões	Douro	Tâmega	Reversible	1 984	66	109	148
Vidago	Douro	Tâmega	Reversible	1 557	96	90	114
Almourol	Tejo	Tejo	-	67 323	20	78	209
Pinhosão	Vouga	Vouga	Reversible	401	68	77	106
Girabolhos	Mondego	Mondego	Reversible	980	143	72	99
Alvito	Tejo	Ocreza	-	968	209	48	62
TOTAL					1 266	1 096	1 632

GOVE HYDROPOWER DEVELOPMENT | Angola

Client: GABHIC - Gabinete para Administração da Bacia Hidrográfica do Rio Cunene

Date: Detailed Design: November 2002 / July 2005

Final Design, Technical Assistance and Construction Supervision: May 2008 / December 2012

Studies undertaken in consortium

DESCRIPTION:

The Gove dam is located in the Province of Huambo, some 120 km south of the town of Huambo.

Its main purpose was the Cunene river flow regulation to increase the power generation in the international reach of Cunene river and to create conditions, in combination with Calueque dam, to transfer flows to Namibia.

A detailed hydrological study has been carried out of the whole Cunene basin and the simulation of water flow propagation in the Cunene river in order to comply with the international agreement between Namibia and Angola, regarding the minimum flow in Ruacanã power station and the water transfer to the region of Ovamboland in Namibia.

The Gove dam, built in 1975, was subject to sabotage actions (in 1986 and 1990) that endangered its exploitation.

In the former design, a powerplant was planned to be incorporated in the dam and it was now integrated in the project.

Dam:

The Gove dam site covers an area of 4 667 km² and the reservoir, with the NWL at (1590,00), has a storage capacity of 2547 x 106 m³.

The Gove dam has a homogeneous embankment cross-section and a rockfill toe. The maximum height above the foundation is 58 m and the crest length is 1 112 m. The dam volume is 4 x 106 m³.

Rehabilitation actions: dam rehabilitation nearby the left abutment; foundation treatment for strengthening of the cut-off structure; treatment of longitudinal and drainage galleries to minimize the seepage; protection of downstream rockfill face to prevent the serious evolution of erosion and the migration of fill fines; dam external drainage; drainage pumping system and drainage at the toe of dam; dam heightening in 1 m; dam monitoring plan; remedial actions in the water intake and in the bottom outlet; repair and strengthening of the initial protection of the outlet channel affected by erosion; control and prevention of the serious evolution of gully; improvement of the dam left abutment ring road and the Operators building area, as well as the aircraft facilities.

A new power station has been designed and constructed with a capacity of 60 MW as well as a substation.



FIRST NATIONAL WATER RESOURCES DEVELOPMENT PROJECT. BUILDING BLOCK 4. | Mozambique

Client: Direcção Nacional de Águas (D.N.A.). (National Water Directorate)

Date: 2003/2004

Studies undertaken in consortium; funded by the World Bank

DESCRIPTION:

These studies are part of the First National Water Resources Development Project and were developed in two phases:

PHASE 1 - Inventory and Resources Assessment

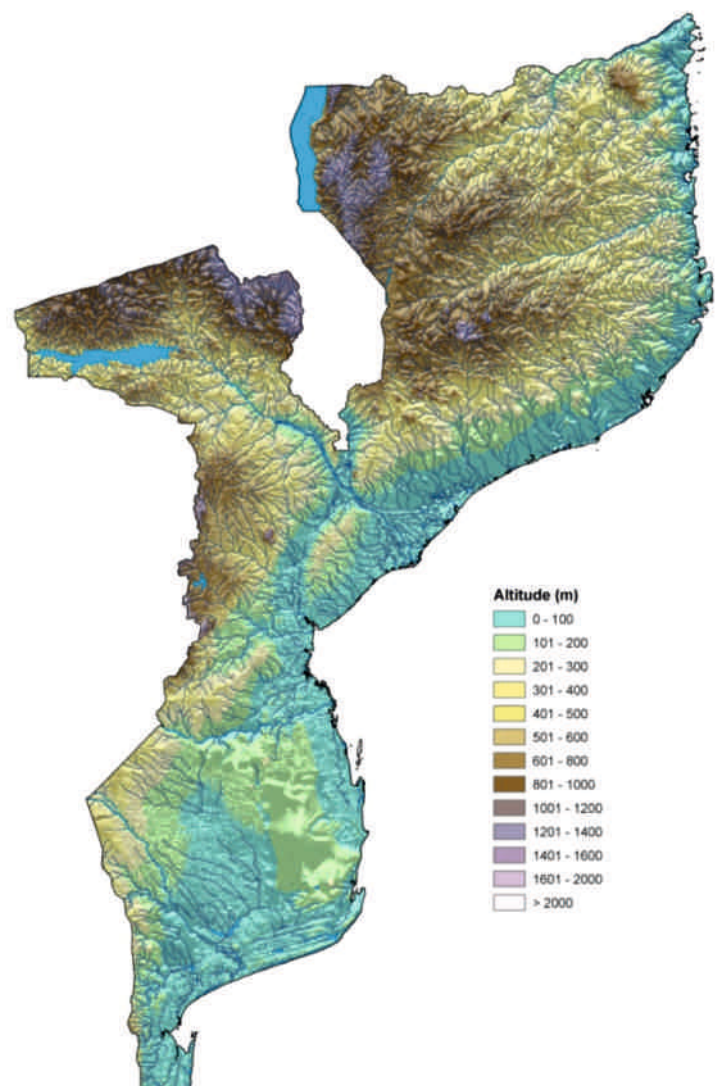
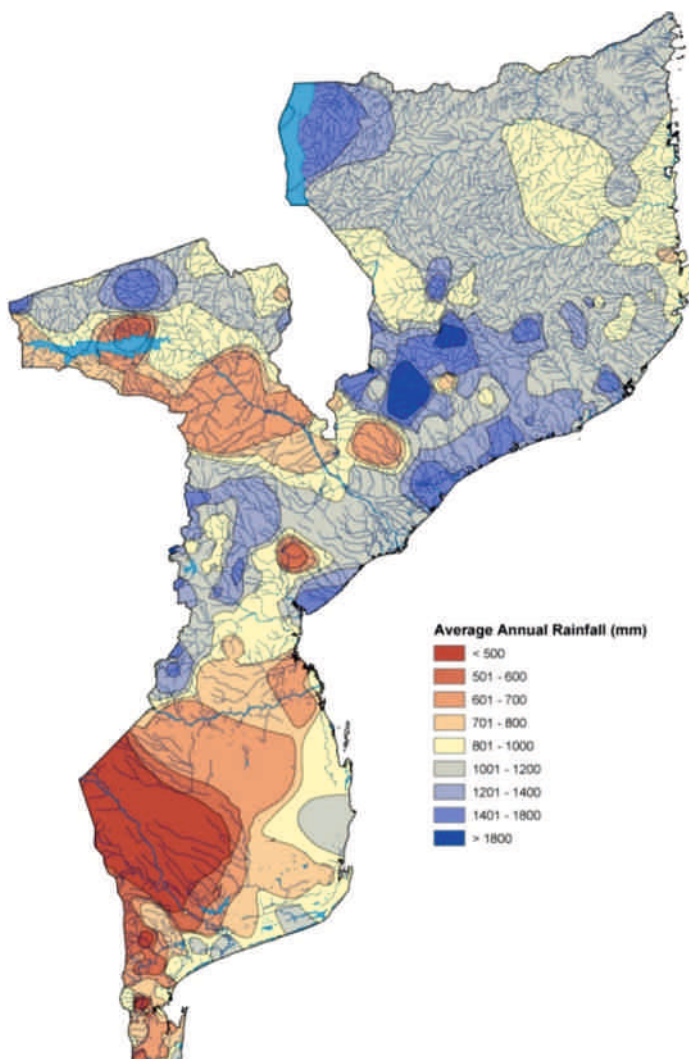
PHASE 2 – Strategy definition

In the first phase a general characterization of Mozambique with regard the water resources uses was made. This characterization included an overall analysis of the country in terms of demography, morphology, climate, hydrology, as well as an assessment of institutional framework associated with water resources. Analytical and planning tools most appropriate to the needs of Mozambique were defined and an assessment of the Mozambican water resources exploitation and the associate existing problems was made.

In the second phase a strategic definition was made of actions to be undertaken at short, medium and long terms in the areas of water supply (urban and irrigation), sanitation, flood control and protection against dryness, environmental flows and knowledge of the available water resources, namely of the international rivers. A program for immediate actions was defined and an estimation of the investments for a 20-year horizon was made.

Within the studies, a systematic inventory was made of the available climatic and hydrological data, on which thematic maps of major parameters covering the entire country were based.

The results achieved were presented and discussed in three Workshops held in the city of de Maputo, jointly with the other consultants and in the presence of the different organizations and entities involved in the water resources sector.



CALIBRATION OF THE HYDROLOGICAL MODEL VIC AND ELABORATION OF A DIF FOR THE LOWER ZAMBEZE REGION | Mozambique

Client: Direcção Nacional de Promoção do Desenvolvimento Rural (DNPDR) and Administração Regional de Águas (ARA-Zambeze)

Date: 2012 / 2013, Financed by The Global Environment Facility (GEF) and by the World Bank. Studies undertaken in association

DESCRIPTION:

The purpose of the study is to assess the impacts in the hydrological regime of different land use and land cover scenarios. The study area embraces the Chemba, Maringué and Caia districts in the Sofala Province, Mutarara in the Tete Province and Morrumbala and Mopeia in the Zambeze Province.

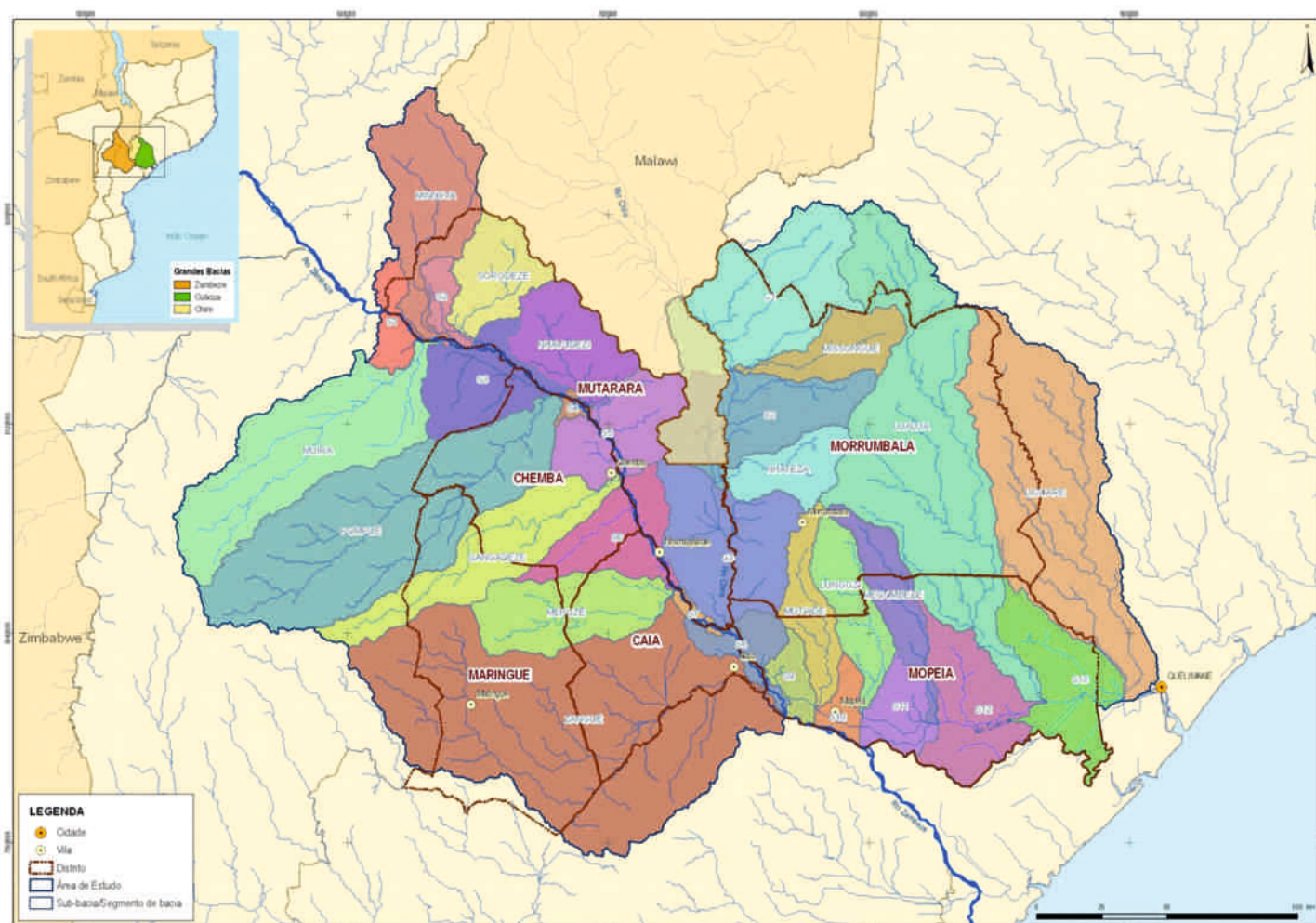
The main function of the study is to calibrate and apply the VIC Hydrological Model (Variable Infiltration Capacity) created by the University of Washington and develop a DIF (Dynamic Information Framework) Data Base, for input and output of the model's data.

The VIC model was essentially developed to integrate the Climatic Models of Global Circulation, used in the study of climate change scenarios in the land part of the hydrological cycle. The principal input data are meteorological data, especially data pertaining to rainfall, temperature and wind. Due to the characteristics of the model and due to the insufficient data from the meteorological networks, data gathered from sensors based on satellites was used.

Land Use, Land Cover and the Soils in the area under study were studied in depth, since these comprise fundamental components for application of the model.

Upon its calibration, the VIC model shall be applied to alternative scenarios of land use and vegetation cover. The sustainability of land exploitation shall be verified.

The study includes training of ARA-Zambeze staff and the know-how transfer regarding the VIC model and the DIF data base for future use of the model in other scenarios.



FLOOD RECOVERY PROGRAMME IN THE GAZA PROVINCE | Mozambique

Cliente: European Union

Date: 2000/2004

DESCRIPTION:

An EC financed Technical Assistance Program to the Government of Mozambique has started in September 2000 with the purpose of rehabilitating the urban infrastructures of the towns of XaiXai and Chokwé that were seriously damaged by the heavy floods occurred by the end of 1999 and early 2000. This is a 18 million Euro programme.

The technical assistance support program was materialized through

- mobilization, in the two first years and half, of a resident team composed of three members, a Team Leader appointed by COBA and two Deputy Team Leaders appointed by the other companies of the consortium; during the last one year and half the Technical Assistance has been exclusively provided by COBA;

- support of short and mean term missions composed of experts in the different concerned areas, namely the water supply, the waste and pluvial waters, flood protection, urban roads and streets;
- mobilization of construction supervision experts for short and mean term missions.

The objective of the Technical Assistance was to identify the interventions to be carried out, prepare studies & tendering procedures, assist the client in evaluating proposals and awarding contracts, as well as to coordinate the execution of works. The works were inaugurated in October and December 2004, in Chokwe and Xai-Xai, respectively.



MANAGEMENT PLANS OF THE WATERSHEDS IN THE PIAUÍ STATE | Brazil

PHASE I - Diagnosis

Client: UNESCO – Brazil Delegation

Date: 2005 / 2006

Funded by the World Bank (Project AE Nº 4310 / BR)

PHASE II - Study of Alternative Solutions and Definition of a Pilot Project

PHASE III - Feasibility Study of the Selected Alternative for the Conveyance Structure and Preliminary Design of Pilot Project Structures

Client: IICA – IICA – Interamerican Institute for Cooperation on Agriculture

Date: 2006 / 2008

Funded by the World Bank (Project AE Nº 4310 / BR)

DESCRIPTION:

The Piauí state has a total area of 252 378 km². It is the third largest north-eastern State with a population of about 2 850 000 inhabitants.

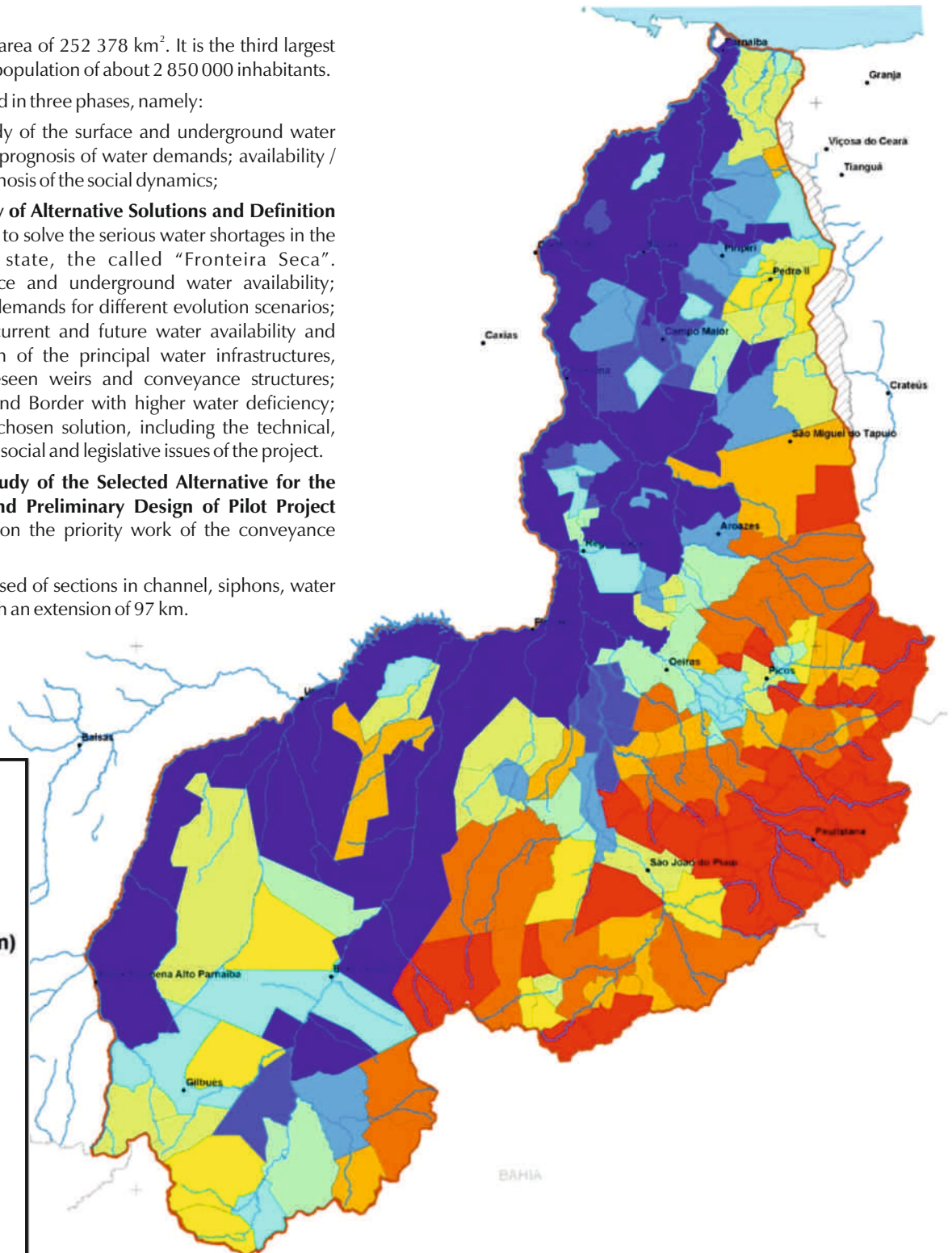
The studies were developed in three phases, namely:

Phase I - Diagnosis: Study of the surface and underground water availability; diagnosis and prognosis of water demands; availability / requirement balance; diagnosis of the social dynamics;

Phase II - Planning: Study of Alternative Solutions and Definition of a Pilot Project, in order to solve the serious water shortages in the poorest region of the state, the called “Fronteira Seca”. Characterization of surface and underground water availability; current and future water demands for different evolution scenarios; water balance between current and future water availability and demands; characterization of the principal water infrastructures, namely existing and foreseen weirs and conveyance structures; characterization of the Land Border with higher water deficiency; preliminary study of the chosen solution, including the technical, economic, environmental, social and legislative issues of the project.

Phase III – Feasibility Study of the Selected Alternative for the Conveyance Structure and Preliminary Design of Pilot Project infrastructures, focusing on the priority work of the conveyance structures.

The pilot project is composed of sections in channel, siphons, water conveyance structures, with an extension of 97 km.



WATER SUPPLY TO FORTALEZA | Brazil

Client: Secretaria dos Recursos Hídricos, Ceará (Water Resources Department, Ceará)**Definition of Alternatives and Detailed Design, Environmental Impact Assessment and Social Impact Studies:** 2000/03
Funded by the World Bank (within the PROGERIRH Programme)
Studies carried out in Association, COBA being the leader of the Consortium

DESCRIPTION:

The studies aimed at evaluating the water requirements and sources in the region of the metropolitan basins of Fortaleza, define alternatives to meet those requirements, select the most feasible alternative and prepare the respective Detailed Designs.

The water requirements in the project's influence area were estimated at about 600 million m³/year, both for human consumption and for feeding several irrigation projects. The population to supply in the project horizon (2030) was calculated at 5.000.000 inhabitants.

The Castanhão-Fortaleza Water Conveyance System encompasses 200 km long-conveyance structures and pumping stations for the transport of a maximum flow of 22 m³/s, from its source at the Castanhão Dam, to existing dams in the Metropolitan Region of Fortaleza. The studies accounted for several diversion structures along the conveyance system for human supply and irrigation as well as the Castanhão pumping station with a total capacity of 16 MW.



WATER RESOURCES MANAGEMENT PLAN OF THE GUADIANA WATERSHED | Portugal

Client: Instituto da Água (INAG)

Date: 1997 / 2000. Studies undertaken in association

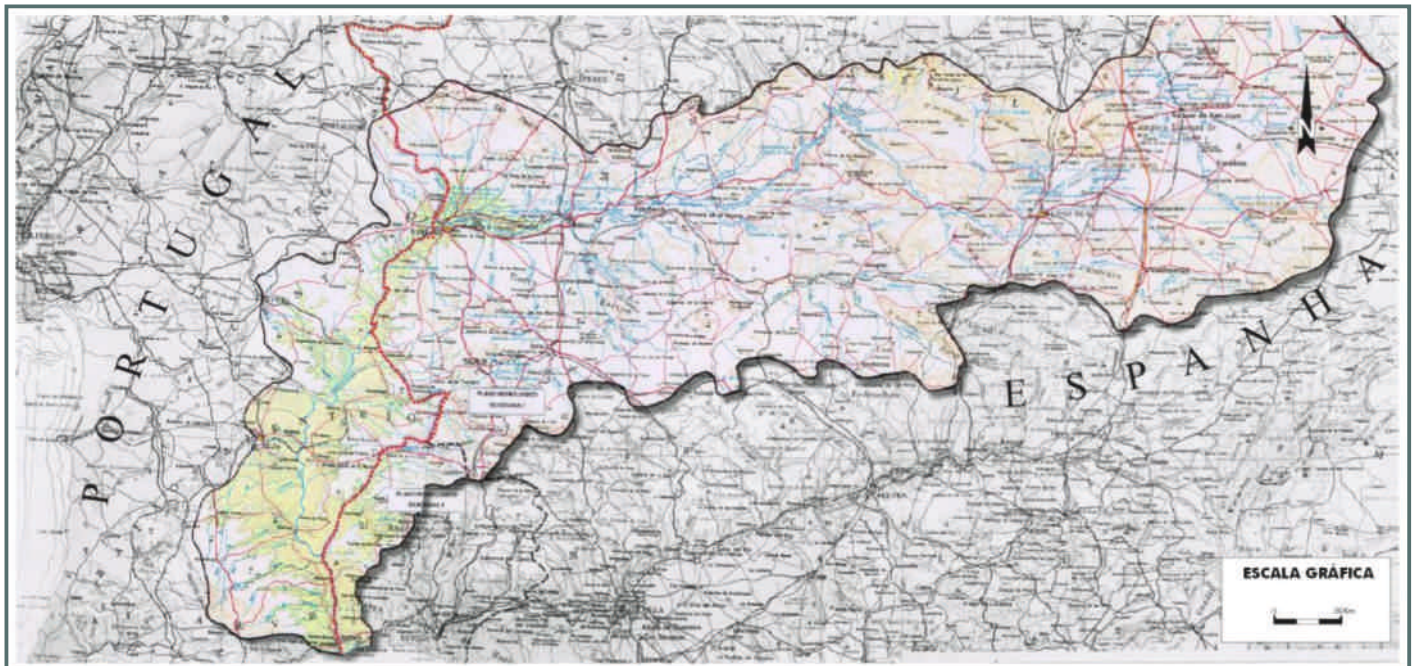
DESCRIPTION:

The plan covers an area of 11 500 km². It aimed at collecting and treating information regarding water resources, characterizing the situation, defining objectives and means and actions to reach them and establishing guidelines, rules and regulations for the Plan.

The studies comprised the summary of existing studies, the collection of new data and organization of all information in order to characterize the surface and underground water resources, quantitatively and qualitatively, the need and use of the water resources, the ecosystems and to prepare inventories and registers of hydraulic and basic sanitation infrastructures and patrimony, so as to provide all relevant information regarding the actual situation and recent evolution of the region.

From the identification of the visible potential and difficulties, alternative scenarios were developed, bearing in mind the maintenance of the natural environment and the physical, social and economic constraints of the region. The comparison of alternatives and the multi-criterion selection of the basic scenario aimed at the optimisation of the natural resources and involved a cost-benefit economic evaluation allowing, together with the investment studies and exploitation costs, the consideration of environmental costs as well as those that reflect the shortage of water resources.

To understand the physical and financial programming, rules and regulations were drawn up to establish, between others, the water use, the conciliation of the uses, the water and reservoir administration criterions, environmental protection and conservation guarantees and the economic framework for the construction of the new works.





 JULY | 2023



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