

ENVIRONMENTAL SERVICES

Shaping our world



Issues

Water resources projects are inevitably associated with biophysical and socio-economic impacts.

Lahmeyer International employs a range of specialists to assess all these impacts, which can vary widely according to the type of project involved.

These specialists work alongside the firm's engineering staff so that results of assessing the impacts of project options become part of the decision-making process when selecting options for implementation.

Together, these teams work to enhance the positive and minimise or mitigate any negative impacts arising from project implementation, as well as striving to ensure that development benefits are shared equitably among legitimate stakeholders.

Ongoing climate change is posing an increasingly greater challenge in water resources projects. Aspects such as changing river flows and changes in magnitude and frequency of extreme hydrological events such as droughts and floods have to be considered.

Planning for social and environmental management and monitoring, including where appropriate human settlement aspects, are integral parts of the services provided. Preparation of high quality plans helps to ensure that projects are developed in a sustainable manner.

Dams

- Energy, irrigation, flood control tourism, fisheries, navigation
- Public consultation
- Up- and downstream hydrological and biological systems
- Resettlement planning
- Sedimentation and erosion
- Cultural heritage, indigenous people



Irrigation & Drainage

- Farm output & income generation
- Water management and water quality
- Soil fertility
- Disease vector management
- Land take: forest, pasture & natural habitat changes



Flood Control

- Definition of flooded areas and effects of flooding
- Socio-economic considerations
- Mitigation measures



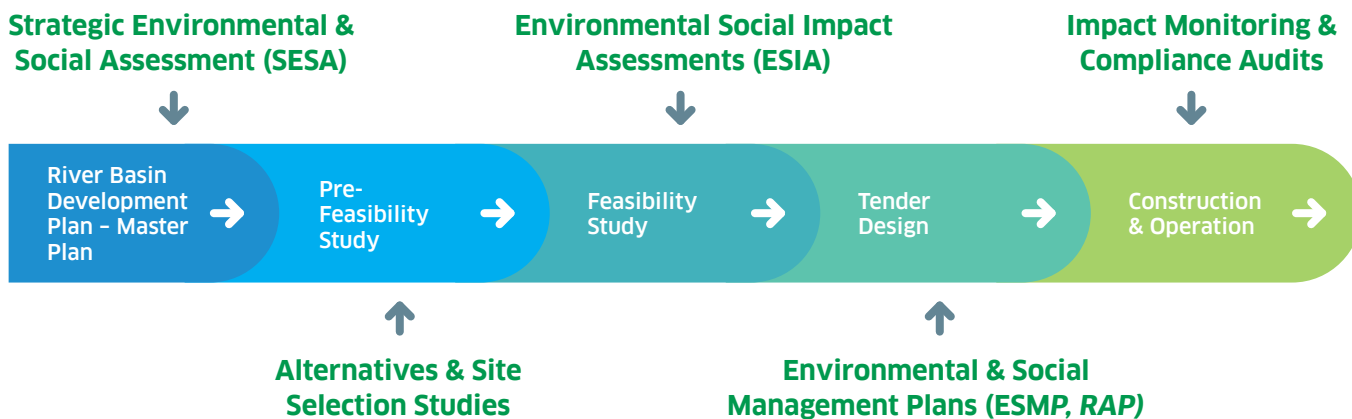
Water Supply

- Socio-economic considerations
- Gender aspects
- Water quality
- Health impacts
- Ecological aspects



Tools

Environmental and Social Planning Instruments in Relation to Project Planning Phases



Experience has shown that early consideration of the environmental and social aspects of large infrastructure projects is crucial to the sustainability of the final product. These aspects therefore play a vital role at every stage of project development.

Typically, infrastructure projects develop from an initial concept through reconnaissance, pre-feasibility, and feasibility or due diligence studies towards design, implementation, commissioning and operation and maintenance (O&M). Various environmental planning tools accompany the technical planning cycle.

At the reconnaissance or Masterplanning stage, a Strategic Environmental and Social Assessment (SESA) is carried out.

SESA is a high-level assessment aimed at identifying national/ regional strategic priorities for development, taking account of environmental, social and economic concerns. It includes cumulative impacts and remains focussed on major issues. It will guide policy decisions on options for water, land and energy development.

The SESA is followed by the investigation of alternatives and site selection studies that should be undertaken at Pre-Feasibility Study Stage. More specific and detailed studies needed at Feasibility Study stage are then presented in an Environmental and Social Impact Assessment report.

Before implementation begins, Environmental and Social Management Plans should be prepared, which will include a Resettlement or Settlement Action Plan in cases where human habitation is affected.

During construction and operation of the Project, regular monitoring, both of the progress of implementing mitigation measures and of their effectiveness, is undertaken to ensure that the objectives of the Environmental and Social Management Plans are being achieved.

In practice, there is, of course, an iterative element to the various stages so that, for example, the E&S Management Plans will need to be updated regularly in order to take account of feedback obtained from monitoring audits.



Methods

Remote Sensing

Remote Sensing is a powerful tool for gathering project data, and includes the use of satellite imagery, aerial photography and laser measurements. Output format includes thematic maps, which can be designed to display key information from chosen sectors.

Geographical Information Systems (GIS)

The use of GIS allows the interrogation of spatial databases of information and the display of the results in map format.

Bio-Physical Field Surveys

Experienced local and international specialists investigate a range of relevant bio-physical parameters, such as

- Hydrological and meteorological data
- Geology and soils
- Flora and fauna
- Cultural and Archaeological heritage

Participation and Consultation

Consultation is essential for public awareness and gaining acceptance of infrastructure projects. For many types of projects, public participation during design and planning plays a key role in ensuring functionality and sustainability.

Social Field Surveys

Field surveys play a key role in gathering basic socio-economic and project-specific information.

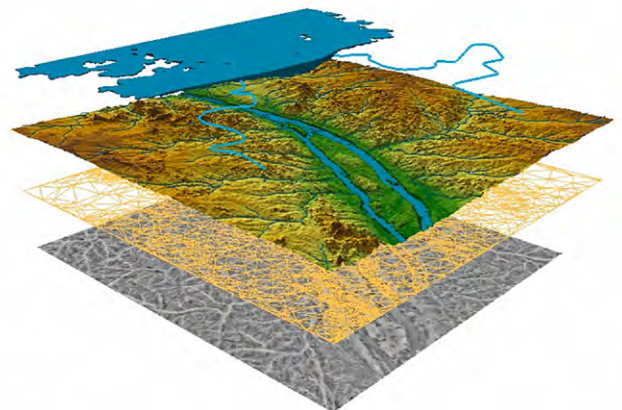
The situation of Project Affected People (PAP) should not be worse after project implementation than before; if this is likely appropriate compensation and mitigation measures have to be agreed. Contact with PAPs is therefore fostered throughout the project period to represent and protect their interests throughout the decision-making process.

Risk Analysis

Risk analysis defines human and material damage potential in order to ascertain priorities and to help decide on design parameters that will be adopted.

Modelling

Modelling is often a vital tool for scenario planning as well as contributing to the analysis of risks. Hydraulic analyses and runoff simulations are among the many forms of modelling used in predicting project impacts under a range of conditions. Key issues can include erosion and sedimentation, water quality, and environmental flows.



Applications

Within a study area of 15,000 km² in Eastern Sudan, the **Kenana and Rahad II Irrigation Projects** investigated options for new irrigation developments on the more than 1 million ha of irrigable soils which are commandable from the Roseires Dam.

The concept for development aimed at a wide distribution of irrigation water, generating a mixed land use pattern of irrigated and non-irrigated areas, which would allow the continued utilization of the area by nomadic herdsman and the conservation of biodiversity in the protected forests and Dinder National Park.

The concept envisaged to attract large scale agricultural investors to the schemes, while also providing sufficient areas for irrigated smallholder farms to improve the social-economic situation of the local population.

All planning stages were accompanied by environmental and social studies in a step-wise approach, starting with broad screening and scoping studies, a full-scale Environmental and Social Impact Assessment (ESIA),

and the Environmental Management Plan (EMP) and Settlement Plan (SP).

The **Songwe River Basin** covers about 4,200 km² in Malawi and Tanzania. A multi-purpose Development Programme for the basin was designed, including dams and hydropower plants, irrigation schemes, river stabilization, water-related social infrastructure, and institutional development including formation of a river basin organization.

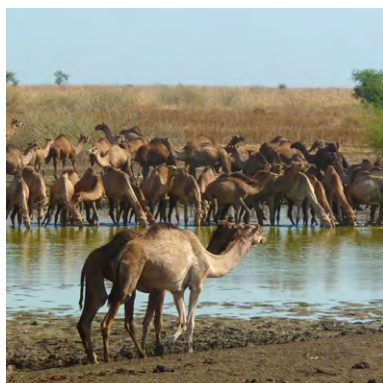
Extensive stakeholder consultations led to the development of a Shared Vision 2050 for the basin, and generated broad support among the residents. A basin-wide Strategic Environmental and Social Assessment (SESA) investigated the cumulative impacts of the full range of potential investments.

Subsequent project-specific studies provided Environmental and Social Impact Assessments (ESIA), mitigation and management plans (ESMP); as well as Resettlement Action Plans (RAP), where resettlement could not be avoided.

The Environmental Information Management System (EIMS) is a key tool for improving the environmental performance during implementation of the **Naga Hammadi Barrage Project**, some 360 km downstream from Aswan on the River Nile, Arab Republic of Egypt.

The **Upper Tamakoshi Hydroelectric Project** lies in Nepal at the base of the Higher Himalaya, about 100 km northeast of Kathmandu and 8 km south of the Chinese Tibetan border. The 309 MW high head run-of-river project exploits a gross head of 820 m over an 11 km stretch of the Tamakoshi river.

Environmental Management Action Plans (EMAP) and Land Acquisition, Compensation and Rehabilitation Plans (ACRP) for hydropower and transmission line components were prepared alongside with the detailed design, hydrology, sediment and glacial lake outburst flood (GLOF) studies. The project is currently under construction.



Lahmeyer – A Company of Tractebel

At the helm of the Energy Transition, Tractebel provides a full range of engineering and consulting services throughout the life cycle of its clients' projects, including design and project management. As one of the world's largest engineering consultancy companies and with more than 150 years of experience, it's our mission to actively shape the world of tomorrow. With about 4,500 experts and offices in 33 countries, we are able to offer our customers multidisciplinary solutions in energy, water and infrastructure.

Since December 2014, Lahmeyer belongs to Tractebel and thus is part of the international ENGIE group headquartered in Paris. Tractebel, which is based in Brussels, and Lahmeyer, which is based in Bad Vilbel near Frankfurt, cooperate on numerous international projects and keep growing closer as one company.

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