

# SUSTAINABLE RIVER BASIN DEVELOPMENT

*Shaping our world*





## Sustainable River Basin Development

Tractebel's recent and ongoing experience of river basin studies and integrated river basin development projects includes:

- Water Resources Management for the Pyanj River Basin (Tajikistan, 2017-current)
- Mahaweli Water Security Investment Program (Sri Lanka, 2016-current)
- Irrigation Master Plan Preparation through Integrated River Basin Planning (Nepal, 2016-current)
- Songwe River Basin Development Programme (Malawi/Tanzania, 2013–2015)
- Agricultural Development Plan for the Lower Nzoia River (Kenya, 2013–2014)
- Development Plan for Upper Atbara Irrigation (Sudan, 2012)
- Genale-Dawa River Basin Integrated Resources Development Master Plan (Ethiopia, 2003–2007)
- Integrated Development of Nile Basin – 1,000 km downstream Blue and White Nile confluence (Sudan, 2000–2009)
- Development and Implementation of a River Basin Planning Approach and Model (Turkey, 2003)
- Valle de Sula Priority Works for High Risk Zones (Honduras, 2001–2004)
- Moragahakanda Development Project (Sri Lanka, 2000–2002)
- Caspian Sea Environment Program (Central Asia and Caucasus, 1998–2000)
- Upper Volga River Basin Environmental Program (Russia, 1996–1997)
- The Kayanga and Koliba Rivers (Guinea-Bissao, Guinea and Senegal, 1993–1995)

Nation-wide inventories and planning studies have also been undertaken for the development of water and land resources in a range of countries, including: Armenia, Burundi, Ecuador, Guatemala, Kenya, Laos, Malawi, Morocco, Nicaragua, Pakistan, Peru, Sierra Leone, Somalia, Sri Lanka, Sudan, Zambia and Zimbabwe.



*Irrigation diversion weir on the Mahaweli River, Sri Lanka*



*Access to clean water is a major problem in many parts of the world, Sudan*

# The Process of Sustainable River Basin Development

## Problem Awareness

Demographic and utilisation trends lead to the awareness that, unless action is taken, a disparity will develop between quantity and quality of river basin resources, and the needs of the population and their environment.

## Resources and Needs Inventory

Physical data are captured using field survey and remote sensing techniques. Legal, social, institutional and management information is processed. Needs are identified and projected.

A prime consideration is the identification of the stakeholders, and the determination of their needs and aspirations. Their participation and the building of consensus in conceiving, planning and implementing projects is a pre-condition for success.

## Development Objectives

Development objectives may include better land and water use, adequate energy and food supply, improved health and education standards and protection of the environment.

## Implementation

Coordinated implementation of projects and measures involves time and budget control, equitable cost recovery, monitoring of resources, demand management appropriate to supply reliability, suitable operation and allocation procedures, and the evaluation of future needs for further developments, including climate risk management.

## Action Plan Formulation

The pros and cons of the most attractive scenarios are presented and evaluated together with decision makers. Coordinated resources planning and management procedures are devised. Compromises often need to be made among competing interest groups before formulating and adopting the final action plan. Adaptive planning accounts for uncertainties, especially in terms of future climate variability.

## Scenario Analysis

This step aims at the evaluation of possible scenarios for river basin development.

Standard tools include GIS and digital terrain models, hydrological and hydraulic investigations, groundwater simulations, water and air quality modeling, integrated resources planning, conjunctive surface/groundwater use, system modelling, cost/benefit analysis, impact assessments and various visualisation techniques.



## Scan for Potential Actions • Alternative or selected multi-disciplinary development measures may include:

### Social:

- nutrition and health care
- community development
- vocational training
- gender mainstreaming
- family planning
- culture preservation

### Land use:

- farming systems
- erosion control
- mining
- forestry
- recreation
- nature reserves
- industrial and residential zoning

### Physical:

- irrigation, drainage
- flood control
- water supply
- power facilities
- rail, river, road, air transport
- agro-processing
- industry
- waste management

### Institutional/legal:

- river basin authorities
- local government
- water user groups
- non-governmental organisations
- private developers
- water rights
- international obligations
- public consultation

### Financial:

- financing
- funds allocation
- pricing
- cost recovery
- taxation

## What is Sustainable River Basin Development?

Sustainable River Basin Development is the integrated, long-term planned development and management of a river basin's water and other resources, to ensure their continued renewability.

This requires a process covering detailed assessment of available resources and existing infrastructure, analysis of present and projected demands, identification of constraints to development, determination of real costs and benefits of alternative actions, and evaluation of institutional capabilities and legal frameworks.

Objectives, policies and strategies are then formulated for short, medium and long term development of the basin's resources, with

specific regard to local conditions and regional requirements.

Prioritisation of selected interventions results from analysis of planned actions for conformity with agreed selection criteria.

Successful implementation of the development plan requires appropriate legislative and regulatory frameworks, use of objective-oriented funding and cost recovery principles, effective monitoring and competent cross-sectoral management.

Potential transboundary impacts and conflicting interests can be solved by a joint planning approach and sharing of benefits of the neighbouring countries.

Sustainable River Basin Development therefore spans a broad spectrum of disciplinary boundaries, covering agriculture, engineering, economics, the environment and a wide range of social, institutional and management sciences.



*Water controlling terrace system for rice cultivation, Nepal*



*Water abstraction for agricultural use through Aflaj irrigation system, Oman*



## Why Sustainable River Basin Development?

Increasing demographic pressure on land and water resources has placed river basins under stress worldwide. Inappropriate land use practices have led to land degradation and consequent loss of economically useful areas. Dam construction for hydropower generation and water supply has involved the inundation of large areas of forest and agricultural land, and in some cases led to involuntary resettlement of populations.

Dikes and levees for flood protection have aggravated flooding problems downstream. Although irrigation development of agricultural areas has increased food production, it has sometimes also brought about increases in waterlogging and soil salinity, contamination of surface and ground waters with pesticides and

fertilizer residuals, and the spread of waterborne diseases.

Furthermore, the demand for potable and industrial water in growing urban and industrial centres has led to water scarcities, high costs of new water supplies, and increasing threats to ground and surface water resources from inadequate municipal waste and effluent disposal facilities. Climate change will add more pressure on water resources in many areas with fluctuations in water availability and water quality.

Prevention and mitigation of such problems requires cross-sectoral and long-term planning and management efforts to ensure Sustainable River Basin Development.



*River regulated by a dam, Oman*



*River catchment, Nigeria*

## We are Tractebel

Tractebel provides a full range of engineering and advisory services throughout the life cycle of its clients' projects, including design and project management. As one of the world's leading engineering and advisory companies and with more than 150 years of experience, it's our mission to actively shape the world of tomorrow. With about 5,000 experts and presence in more than 70 countries, we are able to offer our customers multidisciplinary solutions in energy, water and urban.

Since December 2014, Tractebel Engineering GmbH (former Lahmeyer International) belongs to Tractebel and thus is part of the international ENGIE group headquartered in Paris. Tractebel (Brussels, Belgium) and Tractebel Engineering GmbH (Bad Vilbel near Frankfurt, Germany) cooperate on numerous international projects as one company.

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