

### 3.3

#### **Technical Aspects and Best Practices Leading to Sustainable Rural Landuse Intensification**

EIA and CIA should lead to informed decisions on whether or not to proceed with a particular infrastructural project in favour of another, or at least to choose the option that ensures minimal disruption of the livelihood of the community at large in both current and trans-generational scenarios. In reality however, all too often investment in civil works and the design and layout of structures are more influenced by short-term political and financial agendas, than by longer-term environmental social and ecological considerations. It would seem wiser then for EIA and CIA to concentrate more on mitigating the emergence of worst-case scenarios or, at least, managing and mitigating their impacts if they cannot be prevented. For this reason, in Part 2 above, the various catchments comprising the Nam Theun 2 HPP Impact Zones have been described in terms of their component "landuse management" tracts, as an aid to classifying the various impacts and to planning and quantifying their management and mitigation and attributing the relevant costs to the relevant stakeholders.

A large number, perhaps the majority, of irrigation schemes in Thailand and Lao PDR are of inefficient design and have been poorly maintained and managed. Rather than further expansion into marginal lands, it would be much more economical to upgrade existing irrigation systems and to upgrade managerial capacity.

The main aspects to be considered in irrigation development are: 1) civil works design & layout, 2) sophistication of operation & maintenance, 3) cropping regimes, and 4) power source (in the case of pumping schemes). Apart from access to water sources, the main factors limiting the further expansion of irrigation in the Mekong Basin are topography and soil characteristics such as porosity and (potential) salinity. Agricultural land that is beyond the reach of irrigation water supply can also be sustainably developed for rainfed agricultural production. Again, technical inputs are required whose successful implementation demands the application of **Best Practices** to a chain of processes. These are outlined below.

### 3.3.1 *Data-gathering & Monitoring*

To be of maximum utility in the planning and monitoring of irrigation and other land development measures, the quite comprehensive socio-economic, topographic, landuse and infrastructural data already compiled by the MRC needs to be restructured into a geo-referenced framework built on Basic Statistical Units (BSU: village territories in rural areas, urban and suburban blocks in towns). The watershed classification maps require enhancement in the form of present landuse, slope and native ecotype overlays (GIS layers), based on interpretation of both ancient and recent aerial photography.

The MRC database relies on information received from each member country for planning the expansion and upgrading of irrigation systems; this database still requires some enhancement. While the locations of irrigation headworks are pinpointed and hectareage provided for irrigated area and sometimes for potential expansion, there is no indication of the technical sophistication of each irrigation system, or of irrigation efficiency. There is no cross-link to the associated village territorial data, so it is not possible to determine how far local subsistence needs are catered for, nor the capacity of the irrigated or irrigable areas to cater for increased population pressure. These data deficiencies could be overcome by technical inspection in the field, combined with a definition of village territorial boundaries, aided by aerial photo interpretation. It is doubtful if data to this level of sophistication is on hand at the provincial and district irrigation service offices.

Data on pinpointed irrigation schemes is partially incomplete. Particular attention needs to be given to recording conveyance and distribution efficiency plus the agricultural and ecological suitability of lands identified for irrigation expansion. Usually the most effective construction and operational monitoring is that carried out by project beneficiaries themselves, once they are familiarised with construction and operational plans and given the appropriate training. Status indicators should be chosen to be geo-referenced and provide for, *inter alia*, monitoring of crop, animal and wood fibre production, water runoff and quality, soil loss and atmospheric emissions emanating from each LMU. Population density and the status of institutional organisation and community services are also important aspects to be tracked.

According to Table I - 1, there exists considerable potential for expanding Basin irrigated areas both in the wet and dry season. What needs to be ascertained however, is how much of this potential expansion could be into flood reticulation wetlands (with adverse effects on the fishery) or onto soils of high porosity or low fertility (including salinity risk).

### 3.3.2 *Design of Civil Works*

The long-term public interest will best be served when civil works are designed for longevity, upgradability and ease of maintenance.

#### Irrigation Systems

*Headworks:* Should be designed to withstand at least the 100-year flood without damage and be equipped with de-sedimentation devices. Pumps, when fitted should be electrically powered wherever possible using motors with a high power factor rating thus economising on electricity consumption.

*Distribution canal networks:* Should be elevated sufficiently to command by gravity all those lands within reach that are suitable for irrigation. The canal network should be equipped to meter water independently by volumetric measurement to each farm holding. Canals should be aquaducted and culverted to allow for free passage of floods and fish. They should not be lined unless absolutely necessitated by scarcity of compactable natural construction materials. Weep-holes should be fitted to prevent lifting by groundwater back-pressure when the canal is empty.

*Drainage Network:* Should be adequate to allow each farmer to cultivate whichever dry season crop he chooses and whenever he chooses, without being flooded by the irrigation practices of his neighbours.

*Electrical Connections:* Switchboard wiring should be termite-proofed and motors should be protected from burnout by circuit breakers responding to excess current, excess voltage and phase-out conditions. Single-phase tapplings of the 3-phase transmission line serving the pumps should be disciplined so as to ensure an adequate voltage balance between each of the three phases.

*On-Farm Works:* Paddy field bunding should be continuous and aligned on the contour to allow of convenient and efficient water distribution and drainage and to ease access of cultivation and transportation equipment.

#### Access Roads

Farm, forest and plantation access roads should be designed with ease of labour-intensive maintenance in mind. Cross-sections should be high-crowned and wherever possible gradients should be less than 10% and adequately dimensioned drains and culverts installed to minimise erosion. Cuts and fill should be protected by phosphatically fertilised creeping vegetation.

#### Soil Conservation Works

Soil conservation earthworks should be designed to protect all sloping arable, grazing and plantation lands from erosion damage. Designs should cater for slopes between 5% and 12.5% being contour-bunded (average horizontal interval 8 metres) and slopes between 12.5% and 25% being terraced (maximum vertical interval 1 metre). Designs should envisage vegetative protection for both bunds and risers.

Fuller details are provided in the following reports, which were prepared for the Theun-Hinboun Power Company:

1. Installation, Operation and Maintenance of Streambank Garden/Orchard Water Supply Systems for the Theun-Hinboun Power Company Impacted Villages. EcoLao, Vientiane, April 2003 (EcoLao 2003).

2: Extension Strategy for Promulgation of Organic/Conservation Farming in the Catchment of the Nam Theun-Hinboun Hydropower Project Headpond (EcoLao 2003).

### 3.3.3 *Public Consultation & "Informed" Choice*

The public consultation approaches employed in Western countries with infrastructural development and associated resettlement mitigation or compensation need to be adapted to meet the cultural conditions pertaining in the rural areas of the Mekong Basin. Wholly "informed" choice concerning future livelihood and location options requires much more than information alone to be supplied to the indigenous communities, who have little appreciation or experience of alternative landuse systems. Proactive "Hands On" demonstration in the villages of livelihood alternatives is required. Truly informed choice comes, not from information and consultation alone but from hearing, seeing, touching and doing. PRA methodologies may be useful once the development measures are budgeted and in process, but the initial steps in public consultation should follow the POCA (Participatory Opportunities and Constraints Analysis) methodology. This has been applied in the preparation of the project proposals for the ADB-supported 'Sustainable Agro-Forestry Systems for Livelihood Enhancement of Rural Poor' (Nam Ha Poverty Alleviation Project) (ADRA 2003).

### 3.3.4 *Water Resources Infrastructure Operation & Maintenance*

#### Hydropower Schemes

Operating hydropower reservoirs with a view to maximising electricity production is not always in the best interests of the downstream irrigators. Operating rules may need to be modified to allow for precautionary releases from reservoirs when floods threaten, ensuring that downstream rice crops are submerged for no longer than three days at a time. Bypass releases may be required at times when generators are shut down if these coincide with periods of peak irrigation demand. The turbinated water discharge regime embodying gradual fluctuations in downstream water levels causes far less stream bank erosion than does a daily peaking regime.

Within the Nakai District headquarters town of Oudomsouk, twenty or more houses and shops will need to be relocated to make way for a reservoir saddle dam. The farming and gardening needs of the labourers and low-paid government officials to be relocated should not be overlooked when finalising the overall RAP.

#### Irrigation Schemes

Apart from charging for the volume of all irrigation water supplied (including a contribution to the cost of maintenance and repair of civil works) Water User Groups need to be educated in scheduling the times and amounts of irrigation water to be applied to each type of crop for gaining best advantage from the water supplied. Full details are available in the numerous technical manuals published by the Food and Agriculture Organisation of the United Nations. Some of these, however, may not yet have been adequately translated into local languages for use in farmer training sessions.

Before electrifying or otherwise upgrading the high-horsepower pump-irrigation systems for paddy fields along the Nam Hinboun, it will be advisable to investigate how far the irrigation requirements of the residents of the Hai-Hinboun Plain could be satisfied by gravity irrigation canals that followed the foothills adjoining the left and right bank flood plains of the Nam Hai respectively - the latter extended along the right bank of the Hinboun. These canals could be filled by pumping from the re-regulation pond, which would ensure a reserve supply of irrigation water for when the generators are not working. If extra turbines are to be added to the Power Station, then, by sacrificing one or two metres of head so that these turbines would discharge directly into the afore-mentioned irrigation canals (which

would need to be oversized) additional erosive discharge into the Nam Hai would be avoided.

### 3.3.5 *Tree Plantations*

A potentially important factor that will influence the forestry sector in the future is the development of tree plantations with fast growing species suitable for industrial use. BGA, a New Zealand-based funds management and investment company, currently has a plantation concession agreement covering 154,000 hectares in Bolikhamxay and Khammuan Provinces (Pak Kading and Hinboun Districts).

The main species planted are *Eucalyptus camaldulensis* (*Murray River Red Gum*) and *Acacia mangium*. The concession area is located between the Mekong and the mountain ranges extending from Pak Kading in the north to the mouth of the Hinboun River in the south. By no means will all of the concession area be available for corporate plantation estate, as the tract incorporates the territories of several villages who have been cajoled by government to release a portion of their shifting cultivation fallow land for the company's use, in return for wage labour opportunities and their own plantations with technical support, seedlings and markets organised by the company. There is, however, a need for parallel technical and financial support for the development of small irrigation systems on the numerous side streams traversing the concession area to compensate for former upland rice lands having been converted to tree plantations.

The ADB Industrial Tree Crops Loan espouses a similar pattern of nucleus estate and smallholder industrial tree plantation in other parts of Vientiane, Bolikhamxay and Khammuan Provinces. There would be great value in expanding this approach to the shifting cultivation villages in the catchments of the proposed hydropower projects in the Theun-Kading Basin, with the double aims of poverty alleviation and watershed protection. The land there is steeper than in the BGA concession area although soils are generally better; contour-bunding and roadside protection would need to be included in the plantation model

### 3.3.6 *Best Practices for Rainfed Agriculture, Grazing, Plantation, Forestry & Conservation*

These are briefly described below in Section 4.1.1, Five-Year Scenario (Year 2010).

Irrespective of whether the NT2-HPP proceeds, the agro-forestry and irrigation components of the NT2 RAP should be pursued. Rural roads should be upgraded and the rural electrification grid extended. All side streams should be gully-stopped and used as water sources for the electric powered irrigation of fruit trees, vegetables and supplementary dry season green forage for cattle and buffalo. These initiatives are long overdue:

Socio-economic surveys sponsored by NTEC in 1996 highlighted the depressed socio-economic situation of the Nakai Plateau residents.

The TH-HPP has been benefiting from runoff from the Nakai Plateau and the Nakai-Nam Theun NBCA catchments since 1998. A portion of its revenues should have been devoted since that time to promoting the welfare of the residents in this portion of its catchment. The GoL holds equity in both the Theun-Hinboun and the NT2-HPP ventures. Refunding of a portion of the agricultural and irrigation development costs to THPC could be arranged if, and when, the NT2-HPP comes on stream.

Because of the poverty situation of the villagers along the middle Nam Theun on the Nakai Plateau, there is a strong case for development of agro-forestry and

gully-stop irrigation in the "Resettlement Tract" before NT2 construction works commence.

The Resettlement Budget for Nam Theun 2 Reservoir Oustees is calculated at more than US \$20,000 per family over a 10-15 year period. Land development for sustainable agro-forestry based rural sedentarisation is estimated at about US \$4,000 over five years. It is considered reasonable to expect BOT hydropower developers to contribute an annual 1-2% of revenues for upgrading the livelihoods and thereby helping to preserve the integrity of the catchments, once revenue generation commences. It is however, difficult to expect company Boards of Directors to agree to increasing their up-front expenditure (and interest payments thereupon) by also investing in the development and stabilisation of catchment communities. The ultimate beneficiary of reducing soil erosion in the catchment and thereby slowing sedimentation of the Theun-Hinboun Headpond will be the government when it takes over the project completely after the expiration of the BOT period. A low-interest start-up loan to government, developer or joint venture from an international development bank is called for.