



West Timor rural water supply – ten years on

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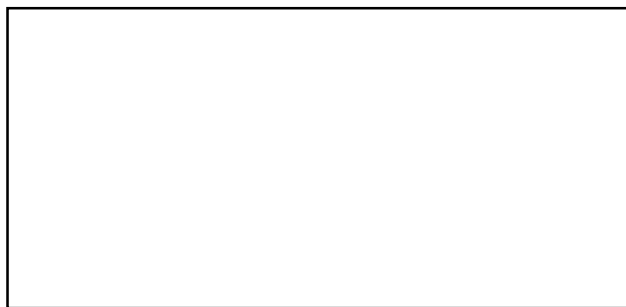


THE INDONESIAN EASTERN island of Timor (map 1 & 2) is subject to a number of natural phenomena that combine to cause great hardship for the inhabitants. Located off the north-west coast of Australia, Timor has prevailing dry south-east trade winds blowing from Australia which control the timing and strength of the rain-bearing north-west monsoon each wet season. This phenomenon produces an highly variable, often limited wet season that provides little security each year for the subsistence cropping rural people.

Geomorphologically, Timor is unlike most of the other 3000 islands of the Indonesian archipelago. Timor is not volcanic in origin having been raised 3000m “recently” (5 million years ago) from the sea floor by tectonic plate subduction. The resulting rugged land mass is a complex mix of marine sediments such as corals and clays that yield very poor quality soils and provide few sites suitable for finding and conserving ground water particularly in the

upland regions of the western end of the island. It is under these adverse conditions that the subsistence villagers who have the lowest per capita income in Indonesia, compete with their animals for limited water resources during the long hot dry season.

In 1982, the Australian International Development Assistance Bureau (AIDAB) with the Indonesian Government (GOI) working through an Australian Agricultural Consultant and the Livestock Department respectively began a two year pilot project to evaluate Australian dry land farming technology in these conditions. The key to this dry land farming system is the provision of year round water at or near the farming area, and one way this may be achieved is by the construction of small rainfed earth dams on catchments of sufficient size to fill the storage annually. It is estimated that over US\$30m is spent each year in Australia on rural small dam construction. This stored water is then piped to separate water tanks for people and



animals. As it is the woman's task in Timor to carry water twice daily often for great distances during the dry season, a new adjacent water supply would reduce the woman's task allowing time for other productive pursuits e.g. growing vegetables or weaving cloth, for which Timorese women are famous.

Nusa Tenggara Timur Pilot Livestock Project (NTTLP) – Besi Pae

3700 ha of sparsely populated land in upland central West Timor (map I) was selected as the project area because it lacked permanent water and offered a broad range of land systems to trial the fenced food crops, the upgraded grazing areas, and the dam systems.

To obtain more credible results the pilot project was extended to three years during which time 22 earth dam storages (bank section diagram 1) were constructed in a range of catchment, gully and soil types. This included three dams outside the project area to test different land systems. The short term results, while not providing a conclusive range of design parameters, provided general orders of annual runoff yield to catchment area, flood hydrographs for recorded rainfall, acceptable soil types that provided stable watertight embankments, and visible proof that earth dams could be built in this environment.

Successful earth dam construction is a function of a number of interacting parameters, with the embankment siting being the most critical. Siting depends on:

- Catchment area. This should be of sufficient size to yield a full storage each year, but not too large to cause spillway problems from high or extended flood flows.
- Suitable embankment material. Local availability of low porosity clay fill is essential
- Storage/excavation ratio. This is the volume of water stored to earth moved and should be as large as possible.
- Spillway site. Maximum spillway volumes and velocities need to be controlled to avoid environmental damage
- Location of storage to village. The particular user requirements must be taken into account.

In the design and construction phase, detail supervision was found to be extremely important. In addition the establishment of suitable running grasses on the bank and

spillway to inhibit soil erosion, and contour planting in the catchment using strongly rooted leguminous shrubs, were also essential.

At BesiPae where the boundaries of dam technology needed to be tested, dams were built at sites where the construction material was borderline, catchments were too small or too large, spillways difficult and some where the site was "just right".

The key sociological outputs were the need to consult with village groups to assess their water needs and the storage location. It was also imperative for sustainability of the system that the villagers were involved in and "owned" the storage despite the fact that the embankment would be mechanically constructed. Local labour was used extensively in the detailed work of laying the outlet and trickle pipes through the bank, planting of contour erosion control vegetation in the catchment and vegetative work on the spillway and the embankment. All this work enhanced the ownership, the on-going management, maintenance and ultimately the sustainability of the system. Towards the end of the Pilot phase, an extensive land systems analysis of the West Timorese landscape was carried out. This indicated suitable areas to the south of Soe in Kabupaten Timor Tengah Selatan (TTS) and areas surrounding Kefamananu in Timor Tengah Utara (TTU) (map1) would provide suitable sites for dam construction, food and fodder cropping, and cattle production.

The Nusa Tenggara Timur Integrated Area Development Project (NTTIADP)

The NTTIADP began in 1986 with the challenge of introducing and developing new technologies (most trialed at Besi Pae) in nine Government Departments and their agencies. These departments were Planning, Food crops, Livestock, Roads, Conservation regreening and checkdams, Village development, Land rehabilitation and conservation, and Water supply. Later, National level Planning and Coordination was added as the umbrella to the other departments.

The aim was to raise the living standards of the rural poor by equipping government agencies with strategies to improve rural development and water supplies, to increase crop and livestock production and market access, reduce soil erosion and to develop planning capability. The initial project design was to undertake field activities in 75 villages in the two districts of Timor Tengah Utara (TTU) and Timor Tengah Selatan (TTS) with cooperation from the agencies for one year. The mid term review of the project reduced the number of participating villages to 40 with the agency connection increased to two years to achieve sustainable development activity. The project concluded in 1992.

In the water supply area, it was necessary to reconcile the ideas of the conservation regreening group and their construction of check dams with the water supply department (Pengairan) who were the large dam builders. The check dam system has a common design of a full height

concrete core as the impermeable barrier with steep hand or machine placed batters on either side. Spillways are formed with unreinforced concrete floors and masonry sides, and are often prone to failure. The check dam was designed to trap and prevent soil erosion, however these dams are very expensive to construct, and have been shown to have high seepage rates and thus fail to store water. This group had the responsibility in Indonesia for dams up to 10 metre bank height, and they were sceptical about the strength and durability of earth fill dams. On the other hand, Pengairan, part of the vast Public Works (PU) department, has responsibility for the design and building of large dams. They had the equipment and the expertise, but had not built small dams that required more than the usual supervision and attention to fine detail. These differences required significant attention by the /were always point of institutional difficulty right from the early pilot (BesiPae) period.

The aims of the project for the water supply sector were to train staff to plan, design and construct earth dams and water supply systems after considering all alternative water sources, and to involve the community in consultation of needs, siting and work before and during the construction phase. whilst, the sociological aspect of the program, arranging community involvement and consultation presented some problems, this input was vital if the recipients were to "own" and manage their water source. The village development department (BANGDES) under the planning department (BAPPEDA) were to assist in this community involvement.

While the district (Kabupaten) Pengiran staff understood the need for village involvement, eventually it was not possible to influence change at provincial and national level. Not all villagers viewed the presence of a dam in their village as a blessing, but rather another unwarranted imposition from the Central Government requiring their precious time spent on care and maintenance.

Finally, one objective of the dams program was the development and training of private contractors in small earth dam construction, in a similar arrangement for that of check dams construction. However, Pengairan staff undertook all the construction, as it transpired at the end of the project there were no private contractors with experience and capability to construct small earth dams.

Outcomes

The district TTS contains 9 sub-districts (kecamatan) covering 166 villages. The project design provided water to 45 villages across the 9 kecamatan. The district TTU contains 6 kecamatan covering 116 villages and the design in this case was for work in 30 villages across the 6 kecamatan. Eventually, after the redesign at the mid term review, where the operating time in the village was extended from one to two years, 56 dams were built to serve the villages. In the final year of the project, a program of rehabilitation of 16 dams was instigated as these dams

needed attention due to their unsuitable locations, poor site selection, poor workmanship and inadequate attention to erosion in the catchment.

Within the BesiPae project area, 195 families use the water resources while an additional 300-400 families outside the project benefit from the dams. Overall, the 10 year program impacted on 10,000 village families that represented 50,000 people. A survey after the conclusion of the project showed that project families earned more, had more cash and total income, than non project families, for example vegetables previously unavailable and almost unknown outside the large towns were now freely grown and marketed from the project areas to the passing trade.

A document prepared by BAPPEDA and endorsed by the Governor of the Province Nusa Tenggara Timur regarding the outcomes of this project, forms the process development model for the GOI in the Eastern Islands. There is no doubt that the GOI regards the project as successful in terms of providing sustainable benefits to upland areas and in terms of institutional development. A number of approaches developed by the project have been adopted as National and Provincial guidelines for planning and implementing rural development. The level of regard for the project outcomes could be gauged by the fact that a senior cabinet minister was involved in the project handover at National and Provincial level. Also the Dams Manual produced as the documented standard was adopted by Pengairan as a National Guideline for dam construction in Eastern Indonesia.

The provision of water supplies to villages was considered to be very successful technically, particularly after the direction was expanded to consider all forms of water resources including dams. However there are some difficulties with the maintenance of the storages as there was no provincial budgetary allowance to deal with the major problem of sedimentation. Pengiran is bound to annual physical targets for construction of new dams that take priority over maintenance, and Pengiran staff and plant operators are not experienced in dam maintenance and dam construction planning. A major program of small dam building was initiated after 1992 with over 270 planned for completion by mid 1998. Five internationally-funded large dams are also planned for private contractor construction in the province. The level of village "ownership" of the storages is insufficient in most cases to deal with more than the simplest issues. This suggests that more needs to be done at the Institutional Development level where the focus has been on improving government staff in theory and practical aspects of the technologies that were introduced in the program by field training and short courses.

Finally the program has shown that the check dams system was inappropriate in TTU and TTS and has ultimately been successful in getting the whole concept of check dams changed in the Province to multipurpose dams.

Conclusion

Historically, there has been a continual problem of water provision in Nusa Tenggara Timur but it now seems that small dam construction provides a workable solution. The BesiPae program, which began with a sectoral approach supported by appropriate technology through the Livestock Department, ended with the NTTIADP that ambitiously tried to tackle development constraints through institutional development over nine (9) government departments at community, district, provincial and even at national level. This trend was clearly shown in the

President's budget speech in 1994 (ref 3d) which indicated a shift to integrated or regional development confirming the approach in NTT.

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