METSI A SEKHALA (fast water) – METSI A PHALLANG BUTLE (slow water):
FIELD STUDIES IN SUSTAINABLE DEVELOPMENT – LESOTHO CASE STUDY

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Abstract
The Faculty of Built Environment and Engineering comprises some nineteen disciplines and sub-disciplines representing the breadth of professions currently operating with the field of urban development. As such it provides a fertile environment in which to promote trans-disciplinary opportunities to engage students in "exciting new combinations and applications of teaching and research" (Betts 2004). A core theme for encouraging these new engagements is "sustainable living" which requires effective teamwork from a wide cross section of disciplines if complex problems are to be solved. One initiative aimed at achieving this objective is the introduction of an Elective in Field Studies in Sustainable Development. The first Field Studies under this Elective took eighteen undergraduate and postgraduate students from across the Faculty to work on a negotiated community project in partnership with community members in the small village of Morija in Lesotho, southern Africa. Morija sits centrally within the lowlands of Lesotho which are highly degraded through severe gully erosion caused by overgrazing, over-cultivation and poor soil conservation practices. This is producing what Hoffman and Ashwell (cited in Clarke 2002, 201) call "ecological refugees", the poverty stricken rural population "being forced to leave their desiccated areas and move to the urban centres" or commute to the capital Maseru or move into South Africa for work. The project delivered a community self-help strategy to assist them to rehabilitate one such gully passing through the heart of Morija in a way that will harvest hitherto wasted stormwater runoff and restore stored soil moisture by raising local water tables. It is intended that the harvested water will be available for irrigation of domestic crop production to increase community food security.

1.0 INTRODUCTION: THE LESOTHO CONTEXT

Lesotho (formerly Basutoland) is a landlocked independent kingdom within South Africa (Figure 1). It contains the dominant watershed in South Africa. The headwaters of the Orange River and its major tributary, the Caledon, rise in the Drakensberg and Maloti Mountains of Lesotho less than 500km from the Indian Ocean and flow some 2000km west across South Africa to the Atlantic Ocean. Jacks & Whyte (1939, 272) and Clarke (2002, 133) note that South Africa's principal source of water is in effect controlled by Lesotho and that water is of great importance in a sub-continent marked by its scarcity.

Brokered by South Africa and funded by the World Bank, the Lesotho Government has completed the giant Katse Dam as part of the Lesotho Highlands Water Project (LHWP) being constructed in these headwaters to export water to South Africa and increase Lesotho's export income (Go2africa 2004). The generation of hydroelectricity is a by-product of the project. The Mohale Dam, the second major dam in the Lesotho Highlands Water Project, has also been constructed.

The LHWP has had a mixed reception from various commentators and from the people of Lesotho and, apart from its boost to Lesotho's income most seem to be negative. Clarke (2002, 136 suggest that it "*serves as an example of how the world's dwindling water can become a catalyst for civil and international conflict*". Clarke (2002, 137) and Bond (2002, 143) refer to the effect the construction of the Katse Dam has already had on more than 20 000 Besotho people and the overall loss of 11 000 hectares of grazing land to the project in a country already critically short of farmland. Lesotho is one of the world's poorest countries in economic terms. It has a very small manufacturing base and its major export has been labour in South Africa. Its scarce arable land is severely degraded by sheet and gully erosion (Murray *et al* 1998, 593). Bond (2002, 143) notes that the country's stock of arable land has been reduced to just 9% of its area (circa 2 700 hectares) and that this has occurred through the combination of loss of grazing and arable lands to the LHWP and the severe erosion of the Lesotho lowlands. Rock (1994) quotes estimates of some 29% of the rural population who do not have access to land for food production. Clarke (2002, 140) highlights the internal importance of land and water to the Lesotho people through reference to villagers, whose traditional water supplies have

disappeared, being accused of stealing South Africa's water if they fetch water from the LWHP dams. The combination of these factors places an imperative on rehabilitation of land and water systems in the remaining farmlands and the maximising of their production capacity as a sustainable system.

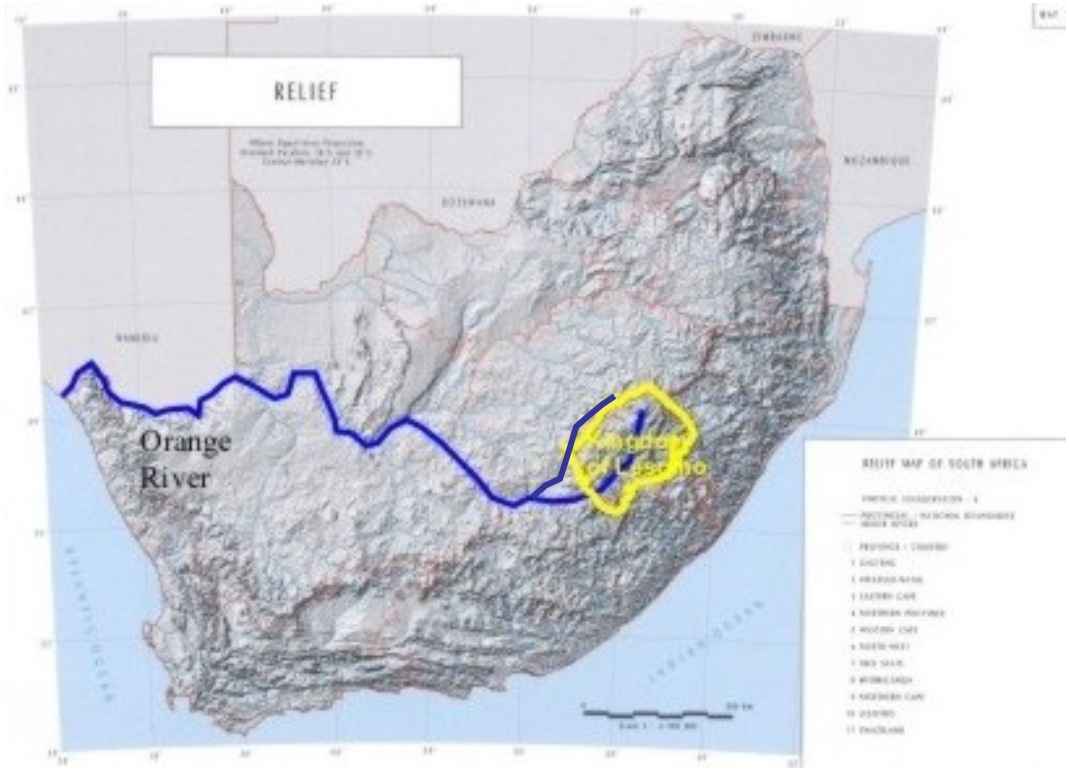

Figure 1 – Locality Map (adapted from: van Riet *et al* 1997)

2.0 GULLY (DONGA) EROSION IN LESOTHO

Soil erosion is evident throughout Lesotho (Rock 1994). It is particularly severe in its lowlands which share the sandstone geology of the South African Karoo. These sandstones produce deep duplex soils that are highly susceptible to erosion by the high intensity summer storms that provide 85% of Lesotho's rainfall between October and March. Rock (1994) attributes the onset of today's serious soil erosion problems to the displacement of native hunters and gatherers by the cropping and herding Bantu at the beginning of the 19th century. Increasing population and the consequential increase in pressure of grazing and cropping on the lowland veld has removed the scant protection afforded by the grassland cover and, in the absence of any coordinated attempt to control runoff, has resulted in extensive gully erosion.

Reference is made to early 20th century accounts and photographic evidence in the 1920s of severe erosion in the then British Protectorate of Basutoland. Jacks & Whyte (1939, 273) include a photograph of a gully, locally called a donga, in excess of 14 feet (4.2m) deep. Dongas in excess of 20m deep, having cut through the deep duplex soils down to the sandstone bedrock, are not uncommon in the contemporary Lesotho landscape (Figure 2). A 1988 Natural Resources Inventory estimated an annual loss of 40 million tonnes of soil from the Lesotho range and croplands (Rock 1994).
Hidden costs of this land degradation include:

- lowering of water tables to such a degree that the stored moisture potential of agricultural soils following the summer wet season is negated and food security is becoming a major issue;
- cessation of flow from most of the once frequent hillside springs welling from the sandstone strata thus denying this source of potable water supplies to impoverished villagers; and
- destruction of the vast majority of the country's lowland riverine ecosystems (Figure 3).

Figure 2 – examples of severe donga erosion, Morija and environs.

The following list summarizes an important range of factors that need to be considered in relation to the donga issue (adapted from Rock 1994):

- field studies of the time estimated that 80% of gullies were still actively growing;
- dongas usually originate from runoff concentrations in denuded rangelands and then cut through croplands in the lower parts of the catchment;
- the dongas grow laterally and reduce valuable cropland area;
- growth rates are exacerbated by increased water velocities once the downward erosion reaches bedrock;
- donga erosion results in massive loss of topsoil and soil nutrients;
- the donga environment is either dry and barren or conduits of high velocity runoff preventing restoration of soil moisture reserves for cropping and thus result in the production of badlands;
- although dongas are clearly visible and the impacts of equally insidious sheet and minor rill erosion which will ultimately lead to more gully erosion often goes unnoticed;
- previous soil conservation efforts was placed on terracing croplands, establishment of drains and grassed waterways and little attention was given to rehabilitation works; and
- a major obstacle to management and rehabilitation is the culturally complex system of land tenure where land is either communally owned or allocated to individuals by the local chief.

Observations made by the author indicated that examples of effective soil conservation practices were at best isolated. Anecdotal evidence suggests that this observation is typical of the whole of the lowlands region. An excursion into the central highlands where the duplex soils were replaced by more erosion resistant and fertile volcanic soils showed a much higher incidence of soil conservation practices.

Figure 3 – river ecosystem destroyed by silting,

3. 0 FIELD STUDIES IN SUSTAINABLE DEVELOPMENT

3.1. QUT and the Lesotho Case Study

The Faculty of Built Environment and Engineering at QUT comprises some nineteen disciplines and sub-disciplines representing the breadth of professions currently operating with the field of urban development. As such it provides a fertile environment in which to promote trans-disciplinary opportunities to engage students in "*exciting new combinations and applications of teaching and research*" (Betts 2004). A core theme for encouraging these new engagements is "sustainable living" which requires effective teamwork from a wide cross section of disciplines if complex problems are to be solved. One initiative aimed at achieving this objective is the introduction of an elective, *Field Studies in Sustainable Development*.

The elective provides the opportunity for students, in Year 2 or above from all of the disciplines in the Faculty, to undertake a program of study through direct immersion in a host community in a developing country. It has a core focus on issues of sustainable development in environments that are outside the core experiences of study in participants' chosen disciplines. It requires engagement with very different cultural beliefs and practices and the collaborative exploration of alternative technologies and development ideologies appropriate to the cultural context. The unit involves exploration of relevant theory and practice in the built environment and engineering fields guided by the research and practice experience of multi-disciplinary staff and other specialists. In this context the elective also supports QUT's learning and teaching goal of encouraging the acquisition of a broader, more general education in a global context.

The first of these field studies was conducted in November and December 2004. Following a series of introductory seminars at QUT and a fourteen day cultural, economic and environmental awareness raising program in South Africa, eighteen undergraduate and postgraduate students from across the Faculty worked for a further eight days on a negotiated community project in partnership with community members in the small village of Morija in Lesotho.

3.2 The community project

Pre-planning for the field studies included consultation with Morijan stakeholders as to the nature of appropriate projects the students might involve themselves with. To this end a list of potential projects were prepared by participating academic staff and canvassed through community leaders in Morija. This consultation process was coordinated in Morija by Mr Stephen Gill, Curator of the Morija Museum and Archives. Strong support by the Chief of Morija, Mr Ranthomeng Mapete, and the Department of Forestry and Land Reclamation in the Lesotho Government led to adoption of a single project to be undertaken by the students working with interested local citizens.

The village of Morija sits on a north-facing slope between the escarpment of Makhoarane Plateau and the extremely degraded Legato River. A number of drainage lines flow down from the plateau to the river and two pass through Morija. Severe gully erosion dating back to the 19th century has resulted in one of these drainage lines, Koapeng Stream, becoming a badly degraded gully filled with weeds and urban rubbish. Investigation of ways and means to rehabilitate and manage this gully to restore the system to a healthy environment was adopted as the central project (Figure 4).

Figure 4 – the Village of Morija and Koapeng Stream

The group consulted with a wide cross section of the community as a precursor to engaging with problem solving. The lack of a reliable supply of affordable water and its impact on food security rapidly emerged as a major issue for the villagers. Morija has a reticulated treated water supply sourced from a series of bores. Distribution to the wider village is via a series of locked public standpipes scattered through the village. A large number of villagers cannot afford the rental of a key

to access this water. In a small valley above the village there is a daily ritual of villagers, mostly women and children, patiently filling containers of water, transported by wheelbarrow, from a small trickle that is all that is left of once good supplies of spring water. Given these factors, and the strategic location of the gully, the group adopted additional objectives to maximise the potential benefits of rehabilitation to the community including improved access to water and increased food security opportunities and to set the project up as an exemplar for wider rehabilitation efforts.

Two other important factors that were to influence the way in which the project progressed also emerged. The first was the discovery that many villagers had the skills, knowledge and experience to implement a range of potential technologies that might be applied to land rehabilitation. These people were invited to participate in the project work and quickly became essential members of the team. The second factor was that, while there was wide recognition that land degradation was increasingly reducing food production potentials and quality of life, the struggle of day to day survival produced an all pervading attitude that nothing would be done to fix it unless the villagers were paid for their labour.

3.3 Learning about appropriate technologies

Parallel with the community consultation, the group also investigated local examples of appropriate technologies, good land management practices and the successful rehabilitation of degraded systems in order to better understand potential technologies that respected the cultural context. This also recognised the lesson that had been learned many years earlier in Australia's Landcare program, that change in attitudes to land management is best achieved through peer leadership, the so-called "bottom up" approach.

A number of notable exemplars were identified (Figure 5):
(a) Keyhole gardens are ingenious raised garden beds built around a small cage of sticks into which household waste, urine and grey water is recycled as a liquid fertiliser to provide the nutrients to support continuous vegetable production for a household.
(b) Ferro-cement rainwater tanks for collecting roof water, constructed with reusable formwork and materials supplied by an aid agency, and built with community cooperative labour.
(c) Small earth dams constructed across the head of gullies from which water was gravity fed to a greenhouse (pictured) and a house garden and a stock enclosure in another example.
(d) A variety of drop structures (stone, sand bags, old tyres, gabions) built across smaller gullies to trap silt and rebuild gully floors combined with **revegetation** of gully margins.

Two notable examples of use of techniques (d) were examined at the rural resort of Malealea. Dating back to the mid 1980s these were initiated as part of the Matelile Rural Development Project funded by German aid (Rock 1994). One of these, Mufada, was so successful in restoring and protecting both the eroded valley and its water table that a continuous supply of good quality spring water, gravity fed to lower valley fields, was producing sufficient food and nursery stock to provide a steady income to its second generation landowner family (Figure 6). Although only an hour drive from Morija, none of our villager participants had ever seen Malealea. Taking them with us totally changed the dynamics of the rest of the project as their excitement in seeing for themselves an alternative future became palpable.

3.4 Project outcomes

The deadline for delivering a significant impact was set for just six days into the project. The group was invited to present the key concepts to a scheduled Village Assembly to be held in a natural amphitheatre in front of the village chief's house. A great deal of energy was devoted to finding a communication strategy to get the attention of the assembly and hold it through the presentation. Inspiration came through two sketches done by landscape architecture student, Jane Hulme. One showed a desiccated landscape split by a deep and jagged gully emanating from an opening in the mountain escarpment. The other depicted a verdant and productive hillside irrigated from a vegetated valley containing a series of small pondages stepping down the slope from the same opening in the escarpment. These were captioned, in the Sesotho language, *Metsi a sekala (fast water) and Metsi a phallang butle (slow water)* respectively and became the opening gambit in the student presentation delivered in English and translated into Sesotho with the aid of an interpreter (Figure 7).

Figure 5 – examples of appropriate technologies

Figure 6 – restored spring and resultant farm production

Figure 7 – *Fast Water – Slow Water*

Two further drawings, also captioned in the Sesotho language, followed to complete the presentation. The first depicted a series of cartoon like sketches illustrating how the existing community capacities could be harnessed to adapt appropriate technologies to convert the existing degraded landscape to a more stable and productive future. The second illustrated how the rehabilitation could be broken into four successive stages to keep the magnitude of the task conceptually achievable in the minds of the villagers (Figure 8). This strategy proved a resounding success. Following a lively question and answer session the Assembly resolved to seek the necessary progressive funding to carry out the work and promised that, if QUT were to return in two years, the structural work would be substantially completed.

Figure 8 – presentation drawings to supplement the *Fast Water – Slow Water* concept

The follow up to the assembly was to prepare a series of simple "how to" drawings and instructions that fleshed out the detail of the required interventions outlined in the staging strategy. With the now even more enthusiastic help of local members of the team each drawing was tested in terms of its ability to effectively communicate to lay people in the village (Figure 9 includes a selection of these). All of this material has since been processed into a printed report and distributed to key stakeholders and local aid agencies in Lesotho to give them the guidance they need to carry out the work.

Figure 9a – where and how to stop the head of the gully from growing further uphill

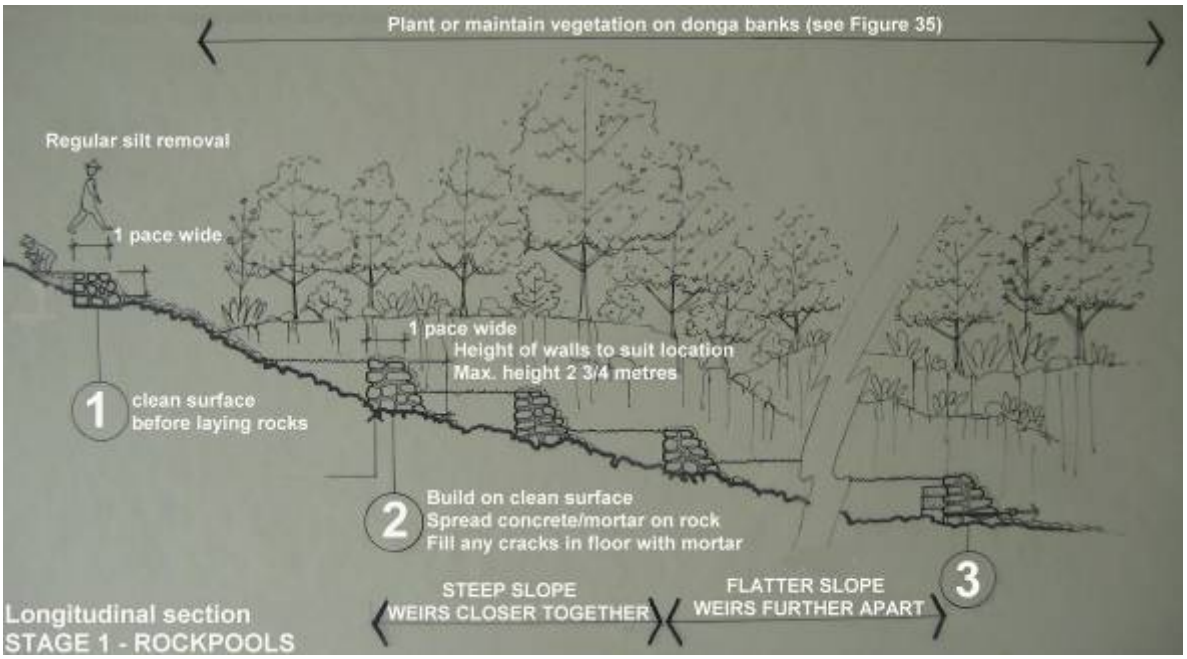

Figure 9b – strategy to intercept silt above the donga and to build a series of small weirs to store water for irrigation of home gardens

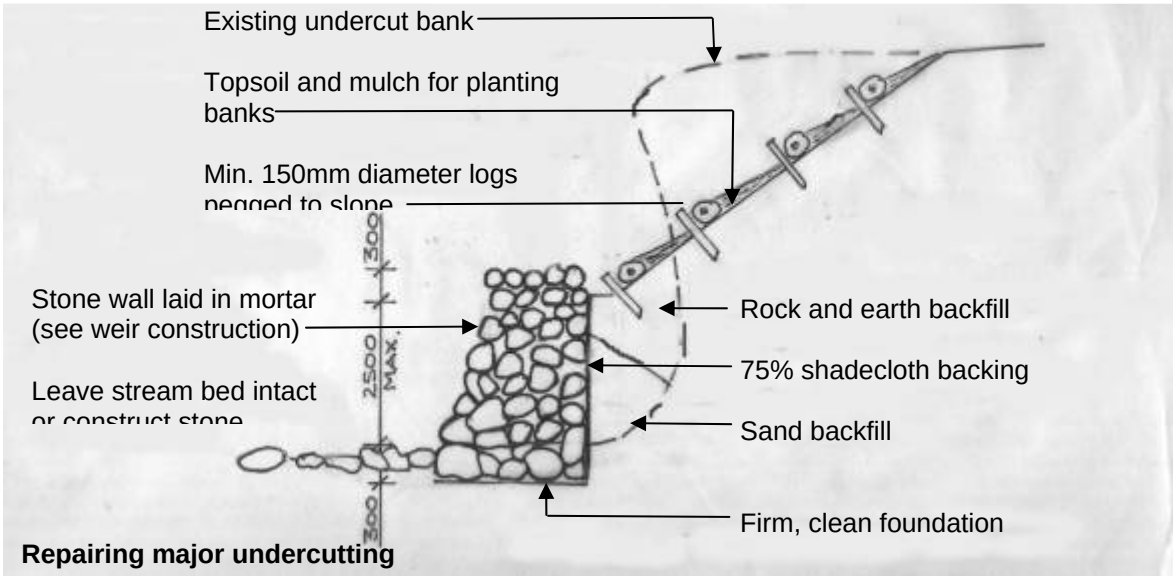

Figure 9c – repairing an undercut bank in the donga.

4.0 Evaluation of the effectiveness of the Field Studies

At the conclusion of the field trip the students were asked to return a simple questionnaire that asked them to identify the best aspects of their experiences and to suggest any improvements that might be considered in future offerings of the Elective. Analysis of the responses showed that there was a general appreciation of the wider exposure to different socio-cultural, political and environmental contexts in terms of what constitutes sustainable development and seeing different technical issues and solutions in practice. One student particularly valued *the strong emphasis on sustainability that (ran) through this field trip and utilising knowledge acquired to relate to the situation in Lesotho*. Another emphasised *broadening perceptions and expanding consideration for those less fortunate (as well as*) *experiencing different views from each discipline and how thought processes come through*.

Suggested areas for improvement frequently urged increased opportunities for greater direct immersion into the dominant cultures of South Africa as part of the awareness raising program. While recognising that this represented a willingness by students to learn even more, the interesting question regarding acceptable levels of risk that supervising staff need to carry in ensuring the wellbeing and safety of the group at large must be considered. A second area for improvement noted the need for a greater emphasis on the history of the countries to be visited in pre-departure seminars. Since most cultures are a direct product of their histories this point is well taken. The broad message from the feedback has endorsed the field studies as a highly valued learning experience by all participants including the six students who asked the author to fail them so they could do it again.

5.0 References

Betts, M., White paper – the founding principles of the new faculty, Faculty of Built Environment and Engineering, Queensland University of Technology, Brisbane, Australia. 2004.

Bond, Patrick, *Unsustainable South Africa: Environment, Development and Social Protest*, Pietermaritzburg, South Africa, University of Natal Press. 2002, p 143.

Clarke, James, *Coming Back to Earth: South Africa's Changing Environment*, Houghton, South Africa, Jacana (Pty) Ltd., 2002.

Go2africa at http://www.go2africa.com/lesotho/Lesotho/katse%2Ddam/ (accessed 24/04/2004).

Jacks, G.V. & Whyte, R.O., *The Rape of the Earth: a World Survey of Soil Erosion*, London, Faber and Faber Ltd. 1939, p 272

Milbrath, Lester W., *Envisioning a Sustainable Society: learning our way out*, Albany, NY, State University of New York Press, 1989, p xi.

Rock, Florian, The Mafeteng Development Project: evaluation of bund and donga (gully) rehabilitation in the Matelile region, Lesotho Government, Morija, Morija Printing Works, 1994.