

FINAL REPORT

On mission undertaken January 3rd to February 19th 2001

EAST TIMOR RICE FIELDS – RAT CONTROL TRAINING PROGRAM

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&

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Executive Summary

The Objective of this mission was to rapidly facilitate changes in farm practices that will minimise crop losses due to rodents in East Timor. Five (5) three-day workshops were conducted across East Timor and included participants from seven districts.

The selection of participants for the workshop was based on the following criteria:

- Be East Timorese currently or potentially employed in the agricultural extension field either with UNTAET, ETTA, MOBILE BRIGADE or an NGO.
- Be well known at the sub-district or village level and have the respect of local farmers.
- Be prepared to actively promote the strategy to local farmers.

In all 72 participants took part in the workshops from a total of 7 districts.

Knowledge of sound management strategies for rodents in East Timor was found to be low amongst participants, with a heavy reliance on time consuming mortality dependent control strategies. This situation has been addressed and a network of trained personnel, that are confident in the management strategies developed during phase one of the project, now exists. The challenge this network now faces is implementing a sustained extension campaign in an operating climate of poor job security with little or no resource allocation specifically for rodent management. This is an issue that must be tackled by administrators if crop losses from rodents in East Timor are to be minimised.

This second phase of the project confirmed the findings of the previous mission on rats in East Timor conducted in November 2000. Rodent captures during trapping exercises were consistent with the results of phase one with *Rattus argentiventer* occurring in the greatest numbers in tall adjacent grasslands and heavily overgrown drainage lines. Furthermore local participants confirmed that the recommended management strategies developed during phase one of the project were achievable, and culturally acceptable for the agricultural production systems in East Timor.

Rat damage in some extensive cropping systems has escalated as a result of the disruptions to normal farming operations caused by political unrest. These elevated levels of rat damage should decline overtime as previously cultivated areas (presently overgrown weedy fallow) are brought back into production. This will cause a reduction in the proportion of favourable rat habitat within the production system and a reduction in the levels of damage experienced, provided management recommendations are followed and efforts are made to limit food and nesting sites for rats.

Extensive crop losses from rats are often viewed by local farmers as sporadic events, the result of a curse more than a consequence of resource availability for rats. Many of the rice production systems in East Timor were described by workshop participants as receiving intensive rat damage every 5-6 years, with minor and 'acceptable' damage in the years between. The subsistence lifestyle of many of East Timor's farming community may be a major contributing factor to the occurrence of these sporadic events. In many areas mixed cropping is practiced. Often the major crop is rice, with maize grown in adjacent areas. Maize value is often financially low to the local people, the incidence of 20% crop losses due to rats in one location in the Baucau district was deemed as acceptable, so long as enough remained to be taken home to eat. Often compensatory planting is undertaken as a means of addressing the losses and there is no real incentive for undertaking additional weed control in the lowly valued crop in most years.

This approach is fraught with danger when dealing with rodents that have the ability to rapidly take advantage of an abundance of resources. This system allows a continual base population of rats to remain viable within the farming system until such time as the environmental conditions are favorable for an acceleration in breeding intensity and a major growth in populations. This system also ensures that there is a population of rodents ready to colonise and damage rice crops as soon as the milky stage is reached.

The result of such strategies is a continual rodent presence which can cause sustained annual losses (possibly low in some years) of both maize and the more highly valued crop of rice, and "sporadic" outbreaks of rat populations in which crop losses are severe and food security at the village level becomes threatened. Incentives for undertaking additional weed control, be they financial in the form of creating new markets for excess food production, or a community based approach which diversifies the variety of foods produced should be developed for communities which are currently farming in the manner described above.

1.0 Introduction

The AusAid funded emergency response to rodents in East Timor is a composite of three distinct phases. They are:

1. Phase 1: Initial investigations (November 2000);
2. Phase 2: Workshop series (Jan-Feb2001);
3. Phase 3: Assessment of adoption rates(May-June 2001);

Figure one shows the framework, links, reporting phases and external assessment components of the work program for rodents in East Timor.

In November 2000 AusAid sponsored Phase One of an emergency investigation into rat damage to crops (primarily rice and maize) in East Timor. The investigations identified two species of rodents (*Rattus argentiventer* and *Rattus exulans*) responsible for the crop losses, and provided management recommendations aimed at minimising these losses. Intensive trapping of rice production systems in the Natarbora sub-district was undertaken, and over 30 sites in the regions of Barique, Manatuto, Viqueque, Manafahi and Lautem were inspected. These sites represented all types of crop systems common within East Timor (highland, upland, lowland, irrigated, rain-fed, single and double cropped systems).

Damage and rodent captures were related to the size and structural complexity of adjacent non-crop habitats. Visits to five districts and information gained on areas that historically report high rat damage confirmed that damage was restricted to systems in which the management of adjacent grasslands and in-crop weeds was poor. Well-maintained holdings in which adjacent grasslands and in-crop weeds were maintained by slashing/burning and/or grazing, received minimal crop damage.

A clear pattern emerged from the investigations in phase one of this project. Regardless of the cropping system (irrigated, non-irrigated) and the crop rotation (one or two rice crops per year), high damage potential was always associated with:

- adjacent unmanaged grasslands;
- small, scattered holdings surrounded by grasslands;
- larger holdings where on-farm weed management (that is, drains, bunds) was poor;
- new farmers from the highlands with little experience in lowland cropping systems (eg Dilor, Natarbora).

These correlations were reinforced by field visits to areas that historically report low damage. Visits to both large and small holdings that manage surrounding habitats by burning, slashing and burning or grazing, confirmed the association between adjacent managed habitats and low rodent damage. That is, regardless of the cropping system or the size of the holding, negligible damage occurs in areas where the actual paddies are considered just one compartment of the agricultural system and all components (eg paddies, roadside verges, fallow paddies, drains and bunds) are managed as part of the total system. The comparison not only held from district to district, but also within districts, with similar sized holdings just a few kilometres from each other experiencing different damage levels due to adjacent habitat management.

A management program focusing on the removal of food and cover resources from non-crop habitats rather than using the application of rodenticides to control rodent numbers was recommended. This manipulative management will delay the onset of breeding by minimising the availability of high-energy food sources

that trigger breeding, and minimising the availability of nesting sites. Consequently the risk of crop colonisation and subsequent crop damage will be reduced. Management strategies should therefore focus on:

- Slashing and/or burning and/or grazing adjacent grasslands;
- Chipping and burning drainage channels;
- Spraying and/or chipping weedy fallows.

Habitat manipulation is a low technology, cost-effective, sustainable method of rodent control that is achievable in East Timor. Furthermore, the strategy takes a preventative approach rather than one that simply treats the symptoms of the problem. Unlike the use of rodenticides, habitat manipulation has no public health risk associated with its implementation, is low in cost and can be implemented with little external assistance. Farmers must be encouraged to engage in preventative rat control as opposed to relying on expensive chemical alternatives that, at best, provide only temporary benefit. Rodenticides are not a vaccine and will not serve as a sustainable alternative for subsistence farmers.

In January-February 2001 AusAid sponsored phase two of the emergency response to rodents in East Timor. This project was a follow up extension project with the major objectives being:

- Rapidly facilitate change in farming practices that will minimise crop losses to rats.
- Establish a network of extension agents, farmers, and village leaders that are confident in the principles of an ecologically based management program and are capable of promoting the principles to the farmers of East Timor.

The third and final phase of the program will focus on an assessment of program adoption and identification of adoption barriers and research priorities. This will be undertaken in May 2001 following the first of 2001's crop harvest.

2.0 Workshop Series

Phase two of the Project was conducted between the 3rd January and the 19th February 2001.

2.1 Participants

A series of five workshops on Integrated Management of rodents in agricultural systems in East Timor were undertaken. The objective of the workshops was to provide participants with both the understanding and operational skills necessary for them to explain the logic behind the strategy to local farmers and commence to bring about the change in practice required to minimise crop losses due to rodents.

On completion of training, participants obtained a level of understanding that will allow them to provide farmers with a detailed plan of the manipulations (and options) required to protect individual crops.

A three day intensive workshop was conducted in five locations (Manatuto, Same, Baucau, Viqueque, Maliana) throughout East Timor. Table 1 shows the number of participants trained and their district of residence.

Figure 1: Project framework, links, reporting phases and external assessment components of the AusAid Rodent Project in East Timor.

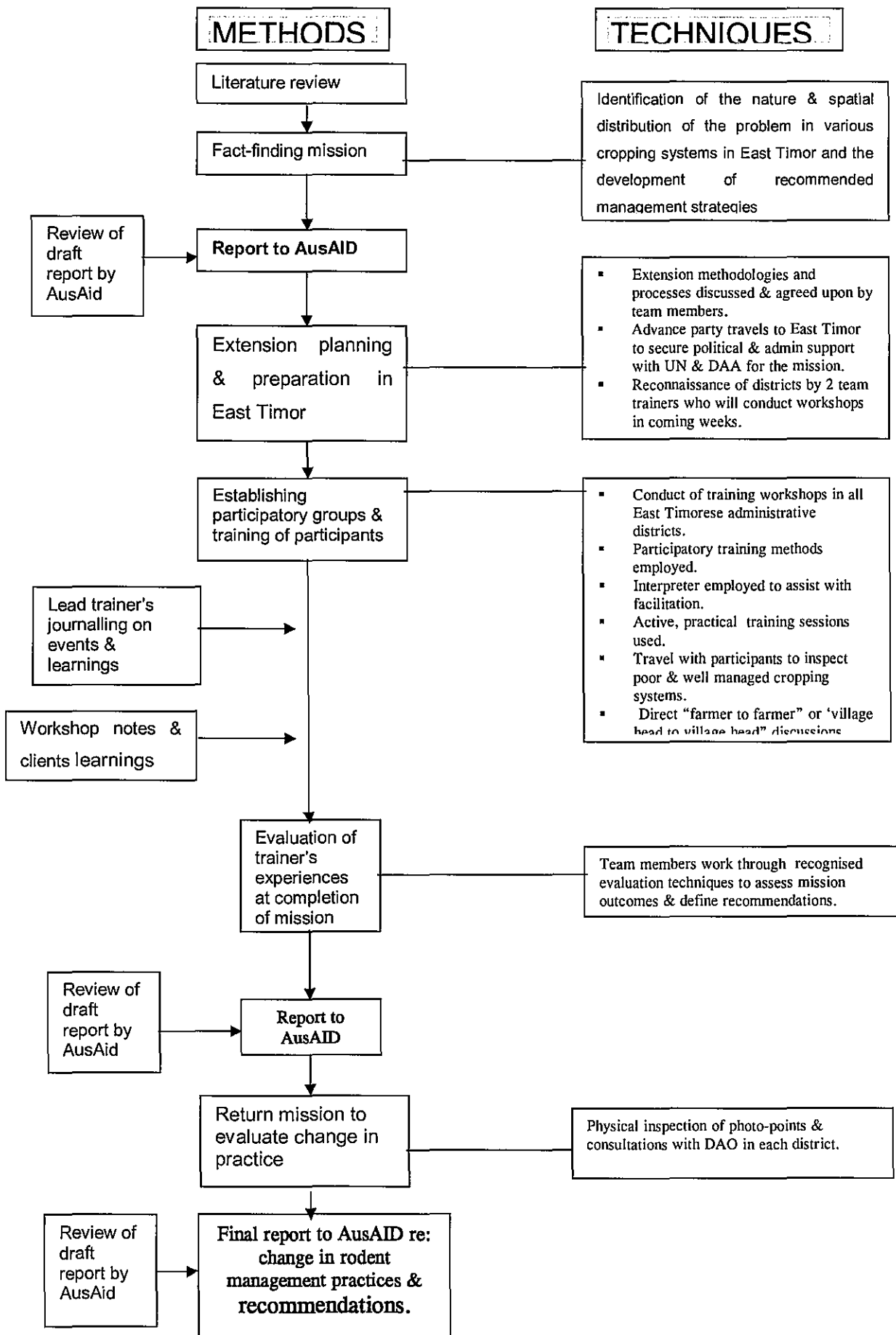


Table 1: Districts and number of participants trained

District	No of Participants
Manatuto	10
Manufahi	15
Dili (Atauro)	2
Lautem	8
Baucau	11
Viqueque	14
Bobonaro	12
TOTAL= 7	TOTAL= 72

Appropriate participants from each of the sub-districts gathered at a central location for the workshop (usually the District administrative centre). The selection of participants was based upon the following criteria:

- Be East Timorese currently or potentially employed in the agricultural extension field either with UNTAET, ETTA, Mobile Brigade, or an NGO.
- Be well known within the subdistrict and command respect from local farmers.
- Be prepared to actively promote the strategy to local farmers.

Participants were finalised after discussions with the UNTAET District Agricultural Officer, ETTA staff, and in some cases the District Administrator. The make up of the participants was such that it represented the agricultural community at all levels from farmer to village chiefs, extension staff (UNTAET, ETTA, CNRT and NGO's), and administrative personnel. Table 2 shows a breakdown of the number of participants by profession. Appendix 1 shows a full listing of all participants, the subdistrict they represent, and their profession.

Table 2: Breakdown of participants by profession.

Profession	No of Participants
Farmer	40
Village Chiefs	5
Mobile Brigade	4
NGO Extension Off.	7
DAA Extension Off.	9
District Ag Officer	4
Philippino Army	3

2.2 Workshop Process

The workshop series was based on the following concepts:

- The process was participatory and focussed on community development;
- The process was strongly centered on practical adult learning principles;
- The process aimed to maximise dialogue between trainers and participants;
- The program was supported by influential organisations and personnel within each district.

Benchmarking sessions were conducted in a group situation to identify current practices, and deficiencies in the local knowledge base. It was clear from this process that few of the workshop participants had received any previous training

on rodent control during Indonesian times, and that the majority of control techniques were reactionary and based on methods which attempted to increase mortality rates of the population.

A survey of participants on the Baucau/Lautem workshop showed that very few of the participants had received any prior training in rat management. 70% of participants had never had any training on rat management, 17% had had some experience with the use of rodenticides, and 12% had received some training on IPM of rodents during Indonesian times. These figures are representative of participants at all 5 workshops.

Appendix 2 lists rodent control strategies that have previously been used or are still in use in East Timor as identified by the 72 participants of the workshop series. This listing does not identify the extent of the practice temporally or spatially, it merely lists all recorded practices.

2.3 Workshop content

Basic biology, habitat preferences, behaviour of the two pest species, and the relationship between these factors and damage levels were discussed and any deficiencies in the knowledge base were addressed. The recommended management strategies were explained as outlined in the report on phase one of the report.

This information was then re-inforced by field visits to rat-affected areas, and well managed areas where practical exercises were conducted and discussions were held with local farmers. Discussion with farmers revolved around the strategies used locally to manage rats, the specifics of implementing the program, the timing of implementation and level of damage received. Management strategies at both the effected area and well-managed systems were compared and beneficial practices were emphasised.

2.4 Trapping exercises

Trapping exercises were undertaken in all five workshops. The use of trapping exercises served two main purposes. Participants were able to familiarise themselves with the species of rats and see first hand the habitat types utilised by these species. It was a valuable tool in reinforcing the information covered in the more formal components of the workshop.

The trapping component of the workshops was well received by the local participants. It was carefully explained that the use of traps in the workshop was not an attempt to control rats. The use of traps to inflict mortality on a population of rats in an agricultural system is time consuming and requires extensive labour inputs, usually for no significant benefit. The use of traps is a valuable tool for monitoring the impact of management practices. Trapping exercises are also a valuable tool for helping farmers grasp the concept of habitat preferences of pests and to help them prioritise a work program to manage the pest.

Trapping results are presented in table 3. The results obtained confirmed the findings of phase one of the project with the highest capture rates recorded in adjacent grasslands and heavily overgrown drainage systems. All captures were *Rattus argentiventer*, suggesting that this species is the major pest species of rice fields in East Timor, as is the case through most of the south east Asian region. Autopsy revealed a pregnancy rate of 14% in mature females.

Table 3: Capture results from trapping exercises during workshops.

District	Adjacent Grassland	Very weedy drain	Moderately weedy drain	Weedy Fallow	Clean Fallow	Crop
Manufahi	*	4/20	1/20	0/20	0/20	*
Baucau	3/20	1/20	*	3/20	0/20	1/20 maize
Viqueque	*	2/20	*	0/40	*	*
Bobonaro	*	3/20	*	*	*	*
Average/ 20 traps	3/20	2.75/20	1/20	0.75/20	0/20	1/20
Captures at each habitat/20 traps	35%	32%	12%	9%	0%	12%

* -Habitat types not present therefore no trapping data at this site.

Note: Trapping results from weedy fallow must be interpreted cautiously as the Manufahi and Viqueque trapping nights were conducted in paddies which were beginning to flood.

Trapping was undertaken at Laleia during the Manatuto workshop however traps were stolen overnight, therefore no trapping data available. The stealing of traps occurred at several sites throughout the workshop series. This also occurred on the first night of trapping during phase one. It is likely that trap losses through theft would be minimised if fieldwork were undertaken at a regular site. The highly mobile nature of this project meant that it was not always possible to brief all of the local people (non-participants) with the objectives of the project, and trap losses were inevitable.

2.5 Construction of traps for use as a monitoring tool and explaining management concepts.

Rat traps are a rare commodity in East Timor and it is unlikely in the short term that that is likely to change. Thai Batt soldiers stationed at Baucau recently held a recycling competition and two of the entries were rat traps. One was constructed from an empty water bottle, a small piece of wire, some bamboo, and rubber bands, and the second from bamboo. All of these materials are cheap and readily available in all locations throughout East Timor. Participants were asked to form groups of three or four people, they were provided with a brief demonstration on how the traps worked, and were allowed a closer inspection of the trap. They were then asked to make a trap as a group.

Apart from the obvious objective that this activity achieved i.e teach local people to make a rat trap, it served two other important points. It emphasised the need for a cohesive team approach, comprised of people with a variety of skills, when implementing an effective rodent management program, and emphasised the need for flexibility and inventiveness. On many occasions the project team were asked how exactly should we control the grasses and weeds. Again this may sound like a simple question with an obvious answer, but the reality is that each and every farming community in East Timor has a unique resource base to draw upon when determining what specific technique they will use to control unwanted vegetation. Burning, slashing, and grazing will all control grasses, however if a village has only a few head of buffalo how do they get the most out of them for grass and weed control, and what technique do they use to manage the areas that cannot be grazed.

Flexibility and an ability to improvise new techniques are critical factors in the effectiveness of rat management in farming systems where resource availability is not always ensured.

2.6 Extension Material

Phase one of the project developed a short information/fact sheet on the problem of rats in East Timor rice fields. This information was being used as a part of the workshop series until it was pointed out by some of the local participants that the information in both the Tetun and Bahasa translations did not truly represent the original English version. It would be beneficial to 're-translate' the original document into Tetun and Bahasa Indonesian, to ensure that all of the information in the flyer represents the recommendations made in phase one of this project.

Additional extension material was developed by as a component of phase 2. This material takes the form of a series of cartoons which depicts the rat species responsible for crop losses, the behaviour and habitat preferences of the rats, and appropriate management strategies for minimising rat damage. Brochures were distributed to participants at the workshops and through NGO representatives. Some participants did not receive brochures because workshops were completed before the completion of printing. The brochures remain in storage in Dili and distribution will be completed during phase three.

2.7 Photographic reference points

Photographic reference points were established in five districts in East Timor where workshops were held. Latitude, longitude, and compass bearings for each of the 50 photopoints are presented in appendix 3. These photographic reference points will be used to objectively assess change in practice in East Timor during phase three of the project.

3.0 Learnings from the project

3.1 Storage areas

Post harvest losses of rice in storage areas is a significant problem in East Timor. It was not possible to determine the level of losses incurred however the inspection of several storage areas throughout the workshop series highlighted a number of problem areas.

Rice is stored at various locations throughout the production system and within the village environs. Traditional techniques for minimising accessibility to stored foods exist in East Timor in the form of "rat proof" storage poles. These consist of a pole approximately 6-8 feet high with a flat piece of metal or smooth wood that restricts rodent access by creating a barrier to climbing the pole. Despite the existence of this technology it is not being widely used, and it is doubtful that such a system would allow large quantities of produce to be stored.

Metal 44 gallon drums are in use in some areas and do provide a sound storage system however they are in short supply and many villages do not have access to sufficient numbers. Recommended techniques and designs of storage areas were covered as a part of the workshops. These techniques incorporate a similar design concept to the traditional techniques mentioned above, and if implemented should greatly reduce post harvest losses.

Post harvest losses due to rats have flow on effects with regards to localised rat populations and damage to crops in the field. This is especially the case where

storage facilities comprise woven bags stored on the ground in small huts within the cropping area. This situation ensures that rats have free and easy access to a high quality food source. This may provide sufficient food to maintain rat populations within the cropping system when alternative food sources are low. The consequences are an ever-ready population of rats waiting to take advantage of resource abundance when crops begin to mature.

3.2 Impediments to normal farm practice

Wide spread disruption of the rice production system in East Timor as a result of political turmoil, and in some cases destruction of irrigation capabilities, has led to major reductions in the area under cultivation during 1999,2000, and 2001. The consequence of this disruption is an expanded area of poorly managed, weedy fallow areas. Weedy fallow areas were identified as one of the most utilised habitat types for the two species of rodents that inflict the majority of crop losses during phase one of this project in November 2000. As a result many of the production systems in East Timor are at a greater risk of serious crop losses due to rodents. Capacity building projects currently underway in East Timor, whilst not directly aimed at reducing rat damage, will reduce the risk of crop losses from rats as these abandoned fallows are brought back into production, and are again subjected to weed management programs.

Farming areas that have not recorded high levels of rat damage may easily become prone to the effects of rats through either environmental or political disruption. An example of an environmental disruption exists in the District of Manatuto where heavy rains and flooding has caused extensive damage to the irrigation system. The reduced irrigation capacity has led to a reduced area being brought under production during the wet season crop of 2001. Discussions with local farmers and extension workers revealed that it was unlikely that much effort would go into the management of the abandoned paddies this season, stating that they would instead focus their efforts on the area that could be brought under cultivation.

Given that rodent pest species in East Timor favour the habitat types of tall adjacent grasslands and weedy fallows it is reasonable to assume that in situations where agricultural areas are abandoned and left unmanaged, the proportion of the crop lost through rat damage is likely to increase. The extent of this increase can not be easily predicted. Given that this situation mirrors the characteristics of the most at risk farming systems in East Timor, that on occasion report 100% crop losses from rats, then the potential for a massive surge in rat damage in what are traditionally relatively rat free areas exists.

3.3 Double cropped systems

In the district of Maliana villages farm an extensive rice production system nearby to the main settlement. One crop is planted early in the year in the wet season and incorporates the majority of cultivatable land as a commercial rice crop. The second crop is greatly reduced and is primarily grown as a subsistence crop providing food for the local people. This second crop was reported to receive much higher levels of losses from rats.

Further questioning of local participants from this area revealed that the approach taken to farming the second crop was much less intense and consequently created a mosaic of fallow and crop through out the system. Cropped areas were not grouped together, and were often surrounded by unmanaged fallow paddies. The result is an increased risk of crop damage due to an increase in the interface between managed crop areas and unmanaged weedy fallows that provide an excellent rat habitat.

Ideally farmers in this situation could work collectively to plant one continuous area under rice, and implement an aggressive weed and grass management program on bund walls and drainage channels within the cropped area. Some of the better managed rice production systems in East Timor work on such an arrangement. This grass and weed control program should be extended as far as local resources will allow into the adjacent fallow paddies that surround the cropped area. Livestock within the system should be concentrated in the adjacent fallow areas by fencing or tethering, and additional hand slashing and

burning should be conducted regularly. It is vital that an unfavourable rat habitat (i.e. low in food resources and low in nesting sites and cover) be created between crop and the adjacent unmanaged areas that harbour rats.

The situation described above closely resembles the problem faced by many farmers in East Timor that are farming small isolated areas surrounded by tall grasslands. This type of system will face constant colonisation pressure that could lead to a total crop loss (as has been described in the smallholdings of Natarbora and Lacluta) as a result of rats.

3.4 Issues associated with the DAA: Employment tenure of staff, and absence of sustained extension programs

In each of the workshops participants were questioned in relation to how the information gained from this training could be passed on to the wider community. The responses obtained highlighted two major barriers to the continued extension of information.

The first was related to a lack of job security. Many of the participants were employed on short-term contracts and many of the participants were approaching the expiry of their contracts. Without job security it is unlikely that the challenge of extending the recommended management strategies for rats in East Timor will be pursued with any great vigour.

The second and perhaps most significant barrier was the lack of a sustained extension campaign on rats. No government programs were in place to provide resources for implementing an extension campaign focused on improving the capacity of farmers to manage rodent populations. This is not a unique situation for East Timor, nor is it unique to developing countries. Leirs *et al* describe a common approach to rat management adopted by governments as being seen to be active at a time of crisis, and as populations and problems subside, so to does the political will to address the real issues which produce such a crisis.

A major exception to this case exists in the form of the NGO's. One example is a program that has been put in place in the Manatuto and Lautem Districts. Having accepted invitations to have staff and local farmers trained during the workshop series, a follow up program was put in place by Care International to ensure a rapid and practical dissemination of the recommended management strategy. This follow up program has involved smaller scale workshops and meetings with farmers conducted by Care staff that attended the workshop series. In addition to conducting training for local farmers Care has established demonstration sites and has been assisting in the provision of resources to improve the capacity of the local population to manage the extensive non-crop areas adjacent to the rice production systems.

The future of rodent management in East Timor lies in the hands of the current administrators (UNTAET, ETTA), future governments, NGO's, and local staff. This project has provided clear and achievable management recommendations that are cost effective and sustainable. Additionally it has established a local network of trained personnel that are confident in these management strategies. All players need to be aware that the potential for major crop losses from rats exists in many areas of East Timor, and that if resources are not allocated to a coordinated and structured program, then the equivalent resources may well be wasted in a time of crisis, and food security for subsistence farmers will be threatened.

3.5 Motivation for improved rodent management

Throughout the workshop series we came across a number of situations where villages were implementing a mixed cropping system. In many of these cases the area under rice was substantial and it was obvious from the work that we observed that the labour inputs into this crop were significant. Often however the adjacent crop was a lowly valued crop.

Severe crop losses from rats are often viewed by local farmers as sporadic events, more a result of a curse than of the availability of resources for rats. Many of the rice production systems in East Timor were described by workshop participants as receiving intensive rat damage every 5-6 years, with minor and 'acceptable' damage in the years between. The subsistence lifestyle of many of East Timor's farming community may be a major contributing factor to the occurrence of these sporadic events. In many areas mixed cropping is practiced. Often the major crop is rice and maize is grown in adjacent areas. Maize value is often financially low to the local people, the incidence of 20% crop losses due to rats in one location in the Baucau district was deemed as acceptable, so long as enough remained to be taken home to eat. Often compensatory planting is undertaken as a means of addressing the losses.

This approach is fraught with danger when dealing with rodents that have the ability to rapidly take advantage of an abundance of resources. This system allows a continual base population of rats to remain viable within the farming system until such time as the environmental conditions are favourable for an acceleration in breeding intensity and a major growth in populations. This system also ensures that there is a population of rodents ready to colonise and damage rice crops as soon as the milky stage is reached. The result of such strategies is a continual rodent presence which can cause sustained annual losses (possibly low in some years) of both maize and the more highly valued crop of rice, and "sporadic" outbreaks of rat populations in which crop losses are severe and food security at the village level becomes threatened.

The challenge in improving the management of rats in cropped areas where these practices are in place relies on a balance of science, extension, and community development. There must be an incentive for local people to undertake additional labour to maintain a clean, weed free system. The incentives must provide an improvement in the standard of living if widespread adoption of the practices is to be achieved.

There are two alternative approaches to generating an incentive for extra labour input in East Timor farming systems. The first relies on extensive changes to the way crops are managed post harvest with respects to market availability. The second relates to providing villages with a diversity of food that they can expect to be available as a result of their increased efforts.

During a visit to the extensive rice producing area of Uatolari in the District of Viqueque it was found that local villages were having difficulty selling their excess production. Their explanation for this was that as a result of East Timor's political turmoil the majority of buyers had abandoned their operations in East Timor. The villages also believed that the importation of cheaper rice was seriously effecting their capability to market their rice within East Timor. The end result of this breakdown in the system is that excess rice is being used to feed pigs in the local area, and it would appear that it is no longer as highly a valued commodity as it was previously.

The devaluation of the rice crop in the Uatolari area has the potential to lead to complacency with regards to crop production in this area, and in a way it mirrors the situation in other districts where there is little perceived benefit arising from maintaining a vigilant weed and grass control campaign in surrounding areas. If a high standard of crop production with regards to minimising losses to rats is to be achieved in East Timor, then local producers must be guaranteed market access, and a means of benefiting from any additional labour undertaken to ensure rat populations remain low year after year.

An alternative to incentives based on a direct financial benefit is to encourage activities in the non-crop areas that will provide a diversity of food crops to the subsistence level farmers. The ideal situation would enhance grass and weed control, not involve extensive labour inputs, offer an addition or improvement in the village diet, and be operational on a sustainable basis. This approach is particularly important for those sub-districts where the production systems consist of small scattered holdings surrounded by extensive grasslands (e.g. Same, Nartabora Viqueque). These small-scattered holdings are at the greatest risk of regular high levels of rat damage which, and in many cases the incorporation of livestock into the production system was negligible. Alternatives to livestock include the establishment of fruit bearing trees that will shade out grasses (although not provide an alternative food source for rats) or perhaps timber plots that could be used as fuel or for future sale as a cash item. The selection of alternatives would need to be investigated to ensure that a resource base for rats was not being established.

3.6 Non-rodent pest management issues in East Timor Rice

The issue of insect damage resulting from *Leptocorisa sp* was raised at several farms where field inspections were conducted. There appear to be at least two species of *Leptocorisa* in East Timor, with one participant from the DAA identifying one of the species as *Leptocorisa acuta*. The team did not contain any members with entomological skills and the identification of the genus and species should be confirmed by an entomologist with taxonomic skills.

The *leptocorisa* genus is a sap sucking insect (stinkbug) which is a pest of many rice producing areas of South East Asia and Papua New Guinea. The management strategies recommended for rats in East Timor fits closely with recommended strategies for *Leptocorisa* management (Sands pers.com).

Leptocorisa sp are predominantly hosted by grasses, sedges, and annual weeds that are often prolific in poorly managed fallow blocks and adjacent unmanaged grasslands. An integrated approach for *leptocorisa sp* consists of managing both the cropped area and adjacent non-crop areas. Flowering grasses, sedges, and annual weeds provide the food source which can initiate breeding (Sands 1977).

Bund walls, drainage/irrigation channels and fallows should be maintained weed free. A buffer of well mown/slashed/grazed land of at least 30 metres should be maintained around the crop. *Leptocorisa acuta* is a poor flier, usually moving 10 metres or less each flight, and "hopping" from host plant to host plant. The establishment of an unfavourable habitat which the insect must move through is a great deterrent to crop colonisation (Sands pers.com).

An area worthy of closer investigation with regards to the multi beneficial aspects of weed control in crop and adjacent grasslands for both rat and insect management exists in the rice producing areas of East Timor's northern coastal areas. Located between Manatuto and Baucau are several extensive production systems with varying levels of weed control both in crop and in adjacent non-crop

areas. Observations in the field and discussions with local farmers found that this area also experiences varying levels of both rat and *Leptocorisa sp* damage despite the relatively close spatial distribution of the systems.

4.0 Situation report on the main rice growing areas of Oecussi district East Timor.

4.1 Situation

As an adjunct to phase one of the project the team were asked to make an inspection of the rice growing areas of the Oecussi district (the East Timorese enclave located along the northern coastline of West Timor). AusAID and East Timorese DAA and UN Agriculture officials were unsure of the rodent risks facing this district and wanted the team to assess the damage risk by rodents to rice crops in this district.

The inspection was carried out on the 5th of January 2001.

4.2 Findings

Both the principal irrigated rice growing areas of Oecussi and smaller less intensive rain-fed systems located on the thin flat coastal margins of district were inspected. The systems are based on a single rice crop per year with a long fallow period through the dry months. Little rice is grown in the highlands, maize and cassava are the dominant crops in highland areas.

Rodent damage is historically low in nearly all locations inspected which may be attributed to three main factors:

1. The strong prevalence of livestock, namely Banteng cattle and to lesser extents water buffalo and goats in the farming systems. Oecussi is recognised as the cattle district of East Timor, with estimated a cattle population of over 20000 head. The integration of livestock in these systems provides effective weed management in fallows and areas adjacent to rice crops. This restricts the potential food resources and harborage locations for rodents that might threaten crops. There is also a strong culture of fencing in Oecussi, which assists greatly in managing this stock across the cropping areas.
2. The dominance of heavy cracking clay soils also serves to make the irrigation areas a less than favorable habitat for the likes of the ricefield rat (*Rattus argentiventer*). This rat would find burrowing in these conditions a difficult task in the dry, and during the wet season the clay soils would not provide for congenial, dry nest sites.
3. In Oecussi this is a consistent practice of burning of the refuse/and trash from rice threshing areas in the fields so to deny rats that might be in the crop a carry-over food resource through the fallow period.

4.3 Conclusions

Rodent damage is historically low and can be expected to remain that way if the current practices continue to be implemented.

4.4 Acknowledgements

The team would like to extend thanks to Mr Edward Reece (Political Officer with the UN) for his assistance in arranging transport, acting as a guide and securing accommodation during our visit.

5.0 Conclusions

This project has successfully established a network of personnel trained in IPM of rodents in East Timor. The network comprises people from all levels of the agricultural sector including farmers, village leaders, government extension officers, NGO extension officers, and administrators. The program has also identified key issues with regards to improving rodent management at a policy and administrative level, and identified further management issues at the farm level.

The recommended management strategy will provide significant control of rodent populations in East Timor provided it is implemented. The rate of change toward best practice even through well resourced extension programs in developed countries is low. (Rates of adoption of around 30 % are regarded as very good). DAA staff and ultimately farmers could benefit from using contemporary participatory extension and training techniques to better facilitate change.

Wide spread implementation of the strategy will ultimately come down to the political will of the future administrators of East Timor, and their ability to fund a sustained work program on rodents. There is without doubt a demonstrable need for capacity building for rodent management in agricultural crops in East Timor. This would need to consider both research and extension elements in its composition and implementation.

6.0 Acknowledgments

We would like to take this opportunity to thank those people that showed a keen interest in the work we undertook in East Timor during January and February 2001.

Firstly to the many UN and ETTA staff (too many to list) that helped us to identify appropriate participants, venues, and accommodation during our project, without your help we would not have achieved such a high participation rate.

The late Thomas Correia of Vermasse who freely offered his time to meet and talk with participants on several occasions, and allowed us to utilise his farm as an example of a well managed system. We are very sorry to hear of his recent death.

The many Australian members of CIVPOL that offered advice, help, and accommodation on many occasions.

Members of AusBatt at Baucau for access to facilities and accommodation during our stay there.

ThaiBatt at Baucau and Viqueque for their friendly assistance with accommodation, transport, catering for both ourselves and the local participants.

A special thankyou for the demonstration and translation services during the rat trap making session.

PorBatt at Same for assistance with accommodation and catering during our visit to Same.

Margaret Rollings for her work translating the captions for the cartoons.

7.0 References

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Appendix 1: List of participants names, subdistrict and profession (district by district)

1) Manatuto

NAME (Naran)	SUB-DISTRICT (Sub-Distrito)	PROFESSION (Profisuan)
Domingos Capualho	Manatuto	Mobile Brigade
Jose Sako	Manatuto	Farmer
Eugenio Oliveira	Laclo	Farmer
Antonio Siriako	Laleia	Farmer
Helder Santos	Manatuto	CARE Ext. Officer
Vicent Soares	Manatuto	Farmer
Tomys Soares	Laclubar	Farmer
Norberto Jnachan	Phil BATT (Alpha Co)	Major Sargent
Hermie Limun	Phil BATT (Alpha Co)	Technical Sargent
Hernani Montero	Phil BATT (Alpha Co)	Technical Sargent

2) Same/Auturo Island

NAME (Naran)	SUB-DISTRICT (Sub-Distrito)	PROFESSION (Profisuan)
Hermenegiloo Pereira	Betano	Farmer
Luis Da Costa Amaral	Same/Hato udo	Farmer
Airelio dos Santos Marques	Manufahi	Farmer
Kakiaho De Jesus Kasujo	Fatu-berliu	Farmer
Andre Seres	Fatu-berliu	Farmer
Mufeed Seeman	Same	District Agric. Officer
Carlito Soares Maria	Dili/Atauro	Farmer
Jose Pereira	Dili/Atauro	Farmer
Alcino Jarmento	Same	Farmer
Americo A Brito	Dili	DAA/ETTA Ext. Officer
Julio Branco	Same	Farmer
Francisco da Silva	Same	Farmer
Manuel A Fernandes	Same	Farmer
Silverio Tilman	Same	Mobile Brigade
Joel A dos Santos	Ainaro/Hato udo	Farmer
Horacio Tilman	Same	Farmer
Anito Brandao	Alas/Manufahi	Farmer

3)Baucau/Lautem Workshop

NAME (Naran)	SUB-DISTRICT (Sub-Distrito)	PROFESSION (Profisuan)
Afonso Ribeiro	Venilale	Farmer
Virgilio P Sawador	Baguia	Farmer
Francisco Ximenes	Laga	Farmer
Vicente Matos Belo	Baucau	Laho Foundation
Alfredo De Oliveira	Luro	Farmer
Tito Fernandes	Los Palos	Farmer
V. De Jesus	Lautem	Farmer
Bazilio Da Costa	Lautem	CARE Los Palos
Joho Da Costa	Lautem	DAA/ Agric. Coordinator
Juvencio Magno	Illiomar	Farmer
Egas Dos Santos	Tutuala	Farmer
Eduardo Dos Reis Belo	Vermasse	Farmer
Hipolito De Jesus	Los Palos	ETTA/Ext. Officer
Afonso Jose Foria	Vermasse	Farmer
Antonio Belo	Quelical	Farmer
Januario Ximenes	Baucau	Farmer
Aleixo Gusmio	Baucau	Farmer
Pascoal A Belo	Baucau	CRS Extension Officer
Francisco Oama	Baucau	Mobile Brigade
Durga Shrestha	Baucau	Acting Agricultural Affairs Officer

4)Viqueque Workshop.

NAME (Naran)	SUB-DISTRICT (Sub-Distrito)	PROFESSION (Profisuan)
Jose Francisco	Viqueque	Farmer
Evaristo De Saviana	Viqueque	Village Chief
Domingos Celestino	Ossu	Village Chief
Carlos Pinto	Viqueque	DAA Ext. Officer
Al Brasil	Viqueque	Mobile Brigade
Moises Pinto	Viqueque	Timor Aid
Antonio Thomas Soares	Viqueque	DAA Language Assistant
Francis T Kibalya	Viqueque	UNTAET DAO
Manuel Lopes	Uatolari	Farmer
Pascoal Martins	Lacluta	Farmer
Aderito de Amaral	Lacluta	Farmer
Laurenco Soares	Lacluta	Secretarial Chief
Diago Xavier	Lacluta	Farmer
Luis Mesquita	Lacluta	Farmer

5)Maliana Workshop

NAME (Naran)	SUB-DISTRICT (Sub-Distrito)	PROFESSION (Profisuan)
Celestino Soares	Bobanaro	World Vision
Cesar Da Silva	Bobanaro	Farmer
Vasco Pacheco	Balibo	CNRT
Pedro Gonsales	Maliana	Village Chief
Zeferino Soares	Kailako	Village Chief
Alcino Mau Liso	Maliana	DAA Ext. Officer
Longuinhos Joao	Maliana	DAA Ext. Officer
Manuel Oliveira	Maliana	World Vision
Duarte Lelo	Maliana	CNRT
Raul Borges	Maliana	DAA Ext. Officer
Justino Soares	Maliana	DAA Ext. Officer
Francisco Cab	Maliana	World Vision
Niazi Sharafat	Maliana	District Agricultural Officer

Appendix 2: List of methods used to control of rats in East Timor as generated by the 72 participants

- Maintain the area surrounding rice paddies clean of grasses and weeds.
- Maintain the rice paddies and bund walls clean of grasses and weeds.
- During the rice production process, the paddies are flooded prior to planting and this drowns the rats out of their burrows.
- During the flooding period, the fruit from a palm tree is crushed and added to the water in the fields and drainage lines. This seems to irritate the rats and they move on.
- The leaf off a stinging tree can also be mashed up and added to the water. This irritates the rats skin and they either move away or fight each other.
- Some areas have had occasional access to rodenticides- Klerat, Racumin.
- A traditional poison can be mashed up into a paste using the bark off a tree.
- Fumigate the rat burrows with a pump and smoke. The rat dies in the burrow and other rats wont move in because they are scared.
- Dig up rat burrows during the day and catch rats as they run out.
- Villages actively hunt rats using dogs and cats.
- Hunt rats with bow and arrow.
- Keep a number of cats around the field and rice storage areas.
- Produce glue boards with food in the middle to catch rats.
- Produce a number of bamboo rat traps although the trigger mechanism is manual and therefore one person is required for each trap.
- Some bamboo traps have a trigger so strong it squashes the rat.
- Some areas use a trap barrier system utilising bamboo, a hessian sack and clear plastic. Food is placed on one side of the plastic and the rat has to enter the bamboo tube to get to the food. The sack is placed on the end of the bamboo.
- Lengths of bamboo can be hollowed out and placed in the field. Overnight the rat enters the bamboo and stays. The bamboo traps are collected in the morning and the rats have to be killed.
- Catch any available rats in the field and attach small bells to their necks. Once released in the field the bells scare other rats away.
- Catch male rats, castrate them and release them back into the field. It is believed that the rat becomes angry and chases and kills other rats.
- Catch the biggest male rat from the storage area, remove one testicle, replace it with a bean and the sow the rat up again. Once it has healed, it is released into the field

where the bean will swell and cause irritation. This angers the rat and it kills other rats. Other rats stay away from the storage area when they see what happens to them.

- A male rat is caught, castrated and placed in a small wooden box. A small boat and sail are made. The village gets together and a celebration/ceremony takes place around the box. The rat is then placed into the boat and it is sailed out to sea.
- Place alternative food sources (fish etc) around the perimeter of the field to attract rats away from the rice itself.

Appendix 3: Location of Photographic Reference Points in East Timor Rice Fields

Table 1: Photographic reference points for the District of Manatuto, Sub District Lacro, Village/Area Licone

Photo Points	Bearings (°)	G.P.S
1	20	8°33'31.4"(S) 125°54'44.4"(E)
2	10	8°33'31.4"(S) 125°54'44.4"(E)
3	0	8°33'31.4"(S) 125°54'44.4"(E)
4	350	8°33'31.4"(S) 125°54'44.4"(E)
5	10	8°33'31.4"(S) 125°54'44.4"(E)
6	5	8°33'31.4"(S) 125°54'44.4"(E)
7	0	8°33'31.4"(S) 125°54'44.4"(E)
8	330	8°33'31.4"(S) 125°54'44.4"(E)
9	330	8°33'31.4"(S) 125°54'44.4"(E)
10	340	8°33'31.4"(S) 125°54'44.4"(E)

Table 2: Photographic reference points for the District of Manufahi, Sub-district Same, Village/Area Betano

Photo Points	Bearings	G.P.S
1	40	9°08'57.8"(S) 125°41'19.6"(E)
2	350	9°08'57.8"(S) 125°41'19.6"(E)
3	270	9°08'57.8"(S) 125°41'19.6"(E)
4	40	9°08'57.9"(S) 125°41'20.1"(E)
5	0	9°08'57.9"(S) 125°41'20.1"(E)
6	270	9°08'57.9"(S) 125°41'20.1"(E)
7	300	9°08'57.9"(S) 125°41'20.1"(E)
8	30	9°08'57.6"(S) 125°41'21.8"(E)
9	270	9°08'57.6"(S) 125°41'21.8"(E)
10	300	9°08'57.6"(S) 125°41'21.8"(E)

Table 3: Photographic reference points for the District of Baucau, Sub District Vermasse, Village/Area Lae Luba.

Photo Points	Bearings (°)	G.P.S
1	210	8°34'28"(S) 126°20'35.2"(E)
2	210	8°34'28"(S) 126°20'35.2"(E)
3	270	8°34'28"(S) 126°20'35.2"(E)
4	330	8°34'28"(S) 126°20'35.2"(E)
5	150	8°34'28"(S) 126°20'35.2"(E)
6	40	8°34'28"(S) 126°20'35.2"(E)
7	185	8°34'27.4"(S) 126°20'35.8"(E)
8	270	8°34'27.4"(S) 126°20'35.8"(E)
9	270	8°34'27.4"(S) 126°20'35.8"(E)
10	185	8°34'27.4"(S) 126°20'35.8"(E)

Table 4: Photographic reference points for the District of Viqueque, Sub-district Lacluta, Village/Area Umatolu.

Photo Points	Bearings (°)	G.P.S
1	140	8°52'51.8"(S) 126°12'56.5"(E)
2	160	8°52'51.8"(S) 126°12'56.5"(E)
3	190	8°52'51.8"(S) 126°12'56.5"(E)
4	270	8°52'51.8"(S) 126°12'56.5"(E)
5	300	8°52'51.8"(S) 126°12'56.5"(E)
6	350	8°52'51.8"(S) 126°12'56.5"(E)
7	330	8°52'51.8"(S) 126°12'56.5"(E)
8	42	8°52'51.8"(S) 126°12'56.5"(E)
9	86	8°52'51.8"(S) 126°12'56.5"(E)
10	102	8°52'51.8"(S) 126°12'56.5"(E)

Table 5: Reference points for Photos, Bobonaro District, Maliana Sub District, Village Area Tunu Bibi.

Photo Points	Bearings (°)	G.P.S
1	115	8°59'16.5"(S) 125°12'30.1"(E)
2	125	8°59'16.5"(S) 125°12'30.1"(E)
3	160	8°59'16.5"(S) 125°12'30.1"(E)
4	180	8°59'16.5"(S) 125°12'30.1"(E)
5	190	8°59'16.5"(S) 125°12'30.1"(E)
6	220	8°59'16.5"(S) 125°12'30.1"(E)
7	240	8°59'16.5"(S) 125°12'30.1"(E)
8	260	8°59'16.5"(S) 125°12'30.1"(E)
9	290	8°59'16.5"(S) 125°12'30.1"(E)
10	40	8°59'16.5"(S) 125°12'30.1"(E)