

Thailand Burma Border Consortium (TBBC)

**Environmental Impact Assessment:
Organisational, Program and Field Activities**

Final Report

By David Morgado

Bangkok, 23 March 2012

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1. Executive Summary

The Thailand Burma Border Consortium (TBBC) provides fuel for cooking, food and shelter material to over 140,000 refugees in nine Burmese refugee camps in Thailand. A rapid environmental impact assessment (EIA) of TBBC's program and activities was conducted by an external consultant in response to a request by one its donor agencies, Swedish International Development Agency (Sida). The assessment was carried out in line with Sida's *Guidelines for the Review of EIA - Humanitarian Assistance*. This report highlights the findings of the EIA and proposes a number of realistic recommendations for consideration by TBBC. These are summarized below.

Procurement and Logistics

Out of TBBC's activities, transportation has the most significant direct negative impact on the environment in terms of greenhouse gas and pollutant emissions.

The transportation of supplies is fully outsourced to the supplier but is closely monitored and evaluated by TBBC. Incorporation of environmental criteria for the selection, monitoring and evaluation of the supplier is recommended in order to raise awareness and support the adoption of better practice over time. Such criteria could include, for example, the average age of vehicle fleet used, prevalence of driver training, type of fuel used, route management, packing quality, legality of material source, tonne of material carried per km, etc. There is also an opportunity to optimize supply transport within a few camps, particularly for charcoal.

The transport of staff to and from the refugee camps is efficiently managed and planned on a monthly basis by staff in the TBBC headquarters and in each of the field offices.

Physical Planning

The location of the refugee camps and its physical planning is set by the Ministry of Interior from the Royal Thai Government. However, TBBC is responsible for the physical planning of the rented land used for the Community Agriculture and Nutrition (CAN) Programme and forestation activities as well as its supply storage warehouses.

The CAN Programme is based on a Low External Input Sustainable Agriculture approach applying environmental best practices - terrace planting, using natural pesticides, organic composting, effective utilization of available water and selecting most appropriate plants based on local conditions. In the selection of the sites for the CAN Programme and tree planting, it is important that TBBC continues to promote and apply CAN best practices, especially in Nu Po as it is located in the Umphang Wildlife Sanctuary.

In Nu Po camp, the CAN Programme is located next to a waste incinerator and an open air waste pit – at the time of assessment the pit was seen to contain potentially hazardous wastes such as lead batteries. Although TBBC is not responsible for waste management at the camps, this issue should be brought to the refugee camp committee to avoid contamination of local water resources (proximity of local pond) and food crops grown in the CAN allotments.

Generally, all TBBC's warehouses are of good quality, with concrete floors and zinc roofing which reduces adverse impacts of spills and contamination. Of all the warehouses visited, it is recommended that four charcoal warehouses in Site 1 and Umpiem be relocated due to potential flood and landslide risk respectively. In Mae La camp, a larger warehouse might be required to ensure adequate charcoal storage and minimize adverse impact of charcoal dust formation on the environment and refugee health.

Water and Sanitation

The management of water supply in quality and quantity and respective sanitation is not the direct responsibility of TBBC. However, TBBC utilizes the water supplied to the camp and its food and charcoal supplies are sources of waste in the camp. The cooking oil, fish paste, charcoal and the respective packaging provided by TBBC require close monitoring to minimize the potential negative impact on environment. For example, the general quality of the charcoal sacks is poor and should be improved. Furthermore, the charcoal sacks should be returned to the supplier for reuse, or be reused by refugees for storing charcoal only instead of erosion prevention.

Positively, TBBC's current practice minimizes potential adverse impacts – for example, plastic drums used for fish paste are reused by the supplier and include an inner plastic bag lining allowing for greater protection and reduction of odors. TBBC has opted to change cooking oil containers from plastic bottles to metal tins which has led to a reduction in plastic waste and in the number of leakages and which also allows reuse of these tins and is a source of income for the refugee camp committee. TBBC's Programme Guidelines provides rules for secondary use of cooking oil tins, which should be extended to other packaging material provided by TBBC, in particular charcoal sacks.

Food

TBBC provides refugees with a food basket containing rice, Asia Remix (fortified flour), salt, cooking oil, fish paste and yellow split peas. TBBC has full time nutrition experts and consults with international nutrition specialists on a regular basis. The food basket complies with United Nations World Food Program regulations.

Energy

The headquarters and field offices have good natural lighting, use energy efficient lighting and most electric appliances have Label 5 (highest electrical efficiency in the Thai market). TBBC also owns a small diesel generator managed by the refugee camp committee in Tham Hin. There is an opportunity for TBBC to improve its energy management to avoid unnecessary diesel consumption, respective noise and fuel emissions. In addition, TBBC should improve the diesel generator warehouse to match the construction quality of existing TBBC warehouses.

Forestry, Agriculture and Livestock

The high population density of the refugee camps leads to a significant pressure on forests and wildlife and respective carrying capacity of the surrounding ecosystem. TBBC supplies food, shelter and charcoal reducing this pressure considerably. In addition, TBBC supports agricultural and tree planting activities as well as local shelter production mitigating the environmental impact of the refugee camps (e.g. cement post project, mud bricks, bamboo water leaching and bamboo planting).

If funds are made available, TBBC should continue to extend its successful CAN and tree planting projects to other camps and explore opportunities for agro-forestry. TBBC should evaluate its on-going pilot projects and, if successful, extend these to other camps beyond Nu Po – particularly Umpiem and Tham Hin where the ecosystem's carrying capacity has been clearly exceeded. If possible, TBBC should also prioritize on planting local indigenous trees and bamboo instead of eucalyptus trees.

Chemical Effects

TBBC does not use any man-made fertilizers or pesticides in its activities. Rice fumigation using methyl bromide is applied by specialized staff in camps where rice is stored for a minimum of six/seven months. The fumigation process complies with United Nations World Food Program

requirements. TBBC should continue to monitor and report any spills from cooking oil, fish paste, charcoal and provide regular training to TBBC field staff and refugee staff at the warehouses.

People, Social Services and Education

TBBC provides regular training to TBBC field staff, camp committee, local Thai villagers and refugees for a number of activities and pilot projects that mitigate the adverse impact of the refugee camps on the environment. The key challenge for TBBC is the high turnover of refugee staff particularly volunteers. These volunteers are responsible for managing some of the warehouses tasks including cleaning, verifying correct unloading/loading process, etc. If possible, TBBC should ensure these volunteers are trained and if there is a regular turn-over of staff, TBBC should opt for part-time staff to ensure they are familiarized with TBBC's best practices.

TBBC should also consider including environmental reporting in the TBBC Programme Reports.

2. Background and Objective

The Thailand Burma Border Consortium (TBBC) is a non-profit, non-governmental humanitarian relief and development agency. Upon request from the Swedish International Development Agency (Sida), a core funding agency, TBBC contracted an external consultant to conduct an environmental impact assessment (EIA) with the following three objectives:

1. Assess the impact that the current TBBC organizational, programme and operational activities have on the environment.
2. Produce a report that TBBC can use with its donors, and other stakeholders, in reporting on the environmental impact of its activities.
3. Highlight realistic recommendations that TBBC can implement to reduce any negative impacts on the environment.

3. Scope and Methodology

3.1 Methodology Overview

The EIA project was divided into five key phases:

- 1. Scoping** (meeting with TBBC Organizational Development Director)
 - a. Identification of TBBC's activities and study area
- 2. Literature and Data Review**
 - a. Project documents (e.g. progress reports)
 - b. Literature review (e.g. UNHCR)
 - c. Secondary geographic data (as relevant and if available)
 - i. Soil and land use maps
 - ii. Location of natural parks and wildlife sanctuaries
 - iii. Hydrography maps and water source points
- 3. Inception Report including Methodology, Questions and Checklist** based on eight key components as indicated in *Sida's Guidelines for the Review of EIA - Humanitarian Assistance*.
- 4. Field Audit and Environmental Impact Assessment** including interviews with TBBC field staff and other partner agencies.
- 5. Report Production and Submission including Recommendations and Pragmatic Action Plan for Mitigation Measures**

The EIA scope was defined based on an initial literature and data review, and an inception meeting at Thailand Burma Border Consortium (TBBC) on the 6th December 2011. The following section summarizes TBBC's key activities and the selected study area.

3.2 Organizational Structure

It is important to highlight the organizational structure of the refugee camps and the roles of multiple stakeholders/agencies. Each agency implements and is responsible for particular programs within the refugee camps such as:

- **Water and Sanitation** (e.g. Solidarites International, International Rescue Committee, American Refugee Committee).

- **Health** (e.g. Aide Medical International).
- **Education** (e.g. Adventist Development & Relief Agency, Catholic Office for Emergency Relief & Refugees, ZOA Refugee Care Netherlands).

These above agencies and TBBC work together with the refugee camp committee, allowing the refugees to participate in decision making, program design and implementation, ensuring their self-reliance. Other major international agencies working in the refugee camps include the United Nations High Commissioner for Refugees (UNHCR) and the International Organization for Migration (IOM).

The Committee for Coordination of Services to Displaced Persons in Thailand (CCSDPT) is the main agency responsible for coordinating all activities undertaken by the Non-Governmental Organizations (NGOs) and the UNHCR at the refugee camps. **Both these organizations are involved in the operation and management of the camps.** The CCSDPT works under the mandate of the Ministry of Interior and has a committee of NGOs of which TBBC is an executive member.

TBBC's programs are consistent with the CCSDPT/UNHCR Strategic Framework for Durable Solutions and are implemented through partnerships with refugee committees, community-based organizations and local groups.

3.3 TBBC's Activities

TBBC's daily activities are mainly related to the supply of **fuel for use in cooking stoves, food and shelter.**

The fuel and food related activities include:

- Food procurement and supply (e.g. transportation and distribution).
- Fuel supply for cooking stoves (e.g. charcoal).
- Fuel and food storage (e.g. warehouses).
- Local food production (e.g. Community Agriculture and Nutrition Programme – Box 1).
- Livestock support as part of TBBC's income generation program.
- Diesel generator for electricity.

Shelter related activities include:

- Procurement and supply of shelter material including construction and maintenance (e.g. bamboo, eucalyptus, grass/leaf thatch, plastic sheets and zinc panels).
- Provision of local shelter material such as bamboo and eucalyptus (e.g. land rented by TBBC for planting trees).

While carrying out a number of these activities, TBBC provides regular training and capacity building to refugees and local Thai communities.

Box 1 - Community Agriculture and Nutrition (CAN) Programme

Since 2002, TBBC is responsible for managing a successful and pioneering CAN Programme. Currently, the programme covers operates in five refugee camps - Nu Po, Umpiem, Mae La Oon, Mae Ra Ma Luang and Mae La. It is based on Low External Input Sustainable Agriculture applying environmental best practices - terrace planting, using natural pesticides, organic composting, effective utilization of available water and selecting most appropriate plants based on local conditions. The objective is to build community self-reliance in agriculture and nutrition, and to improve overall availability and access to nutritious foods in order to enhance refugee household nutrition and income.

Under this project, TBBC provides seeds, seedlings, trees, tools and fencing and regular training and capacity building (4 to 5 times per year with three to five days practical training). Training is also given to neighboring Thai villages for shared benefits and community integration. In the last 10 years, TBBC estimates training over 10,000 refugees under the CAN Programme.

Depending on the camps, refugees can use land rented by TBBC or, if space is not available, opt for growing vegetables and trees in their household gardens. TBBC has also initiated a seed saving initiative to support full self-reliance. According to TBBC's Program Report - January to June 2011, 22% of all households in the five camps (excluding boarding houses) received seeds and are cultivating gardens inside and outside the camps. The only critical challenges are space availability within the camps for agriculture practices and funding limitations to be able to implement the CAN Programme in all camps.

The CAN Programme falls under the TBBC Development Programme and is supported by an Agricultural Specialist and four Agricultural Officers. An educational film entitled "Ma Doh Ma Ka" is shown in the camps to raise awareness on the CAN Programme and its benefits. In addition, the detailed CAN handbook, written by David Saw Wah and translated into four languages (Burmese, English, Karen and Thai), shares knowledge and experience on agricultural and environmental best practices. These materials are comprehensive and well-illustrated. Catholic Office for Emergency Relief and Refugees (COERR) and ZOA also support agriculture projects in most camps.



Figure 1 – CAN Programme at Umpiem refugee camp

3.4 Defining the Scope and Methodology

The EIA focused on five of the eight components specified by Sida¹, which are highlighted in **bold** below:

- 1. Procurement and Logistics**
2. Physical Planning
3. Water and Sanitation
- 4. Food**
- 5. Energy**
- 6. Forestry, Agriculture and Livestock**
7. Chemical Effects
- 8. People, Social Services and Education**

The remaining 3 components are not directly related to TBBC's activities or are outside TBBC's full control (i.e. these are managed by CCSDPT, refugee committee and other agencies – e.g. waste management, water and sanitation). However, these 3 components have been covered in this report to a lesser extent and the recommendations provided to TBBC reflect these limitations.

In Thailand, TBBC is active in a total of nine refugee camps (Figure 2). As these share similarities in location and structure (and therefore in the main categories of environmental impacts), five camps were selected and audited in January 2012 on the following basis:

- **Ban Mai Nai Soi (Site 1)** – This camp is located near several water streams and susceptible to potential flooding and landslides. It shares many similarities with remote Site 2 which is crossed by a river and subject to regular flooding and landslides.
- **Mae La** – This is the largest refugee camp in Thailand with about 48,000 refugees and likely to present significant long-term impacts.
- **Nu Po** – This refugee camp is situated in the Umphang Wildlife Sanctuary and expected to present significant environmental impacts.
- **Tham Hin** – This refugee camp has a different organizational structure and commercial activities due to proximity to Bangkok when compared to all the other refugee camps.
- **Umpiem Mai** – The camp is located in the proximities of the Umphang Wildlife Sanctuary and expected to present significant environmental impacts.

The visit/audit enabled a clear overview of TBBC's activities in the refugee camps and how these activities reflect on the local environment. For the visits/audits, the basic methodology and key questions for each component are included in Annex I, including list of key people interviewed. A general checklist supported the visits/audits to the refugee camps and is included in Annex II.

Though the EIA presented here focuses particularly on the operational phase of activities, where construction or decommissioning phases of any activities are undertaken by TBBC, these have been included in the assessment.

¹ Sida's Guidelines for the Review of Environmental Impact Assessment - Humanitarian Assistance

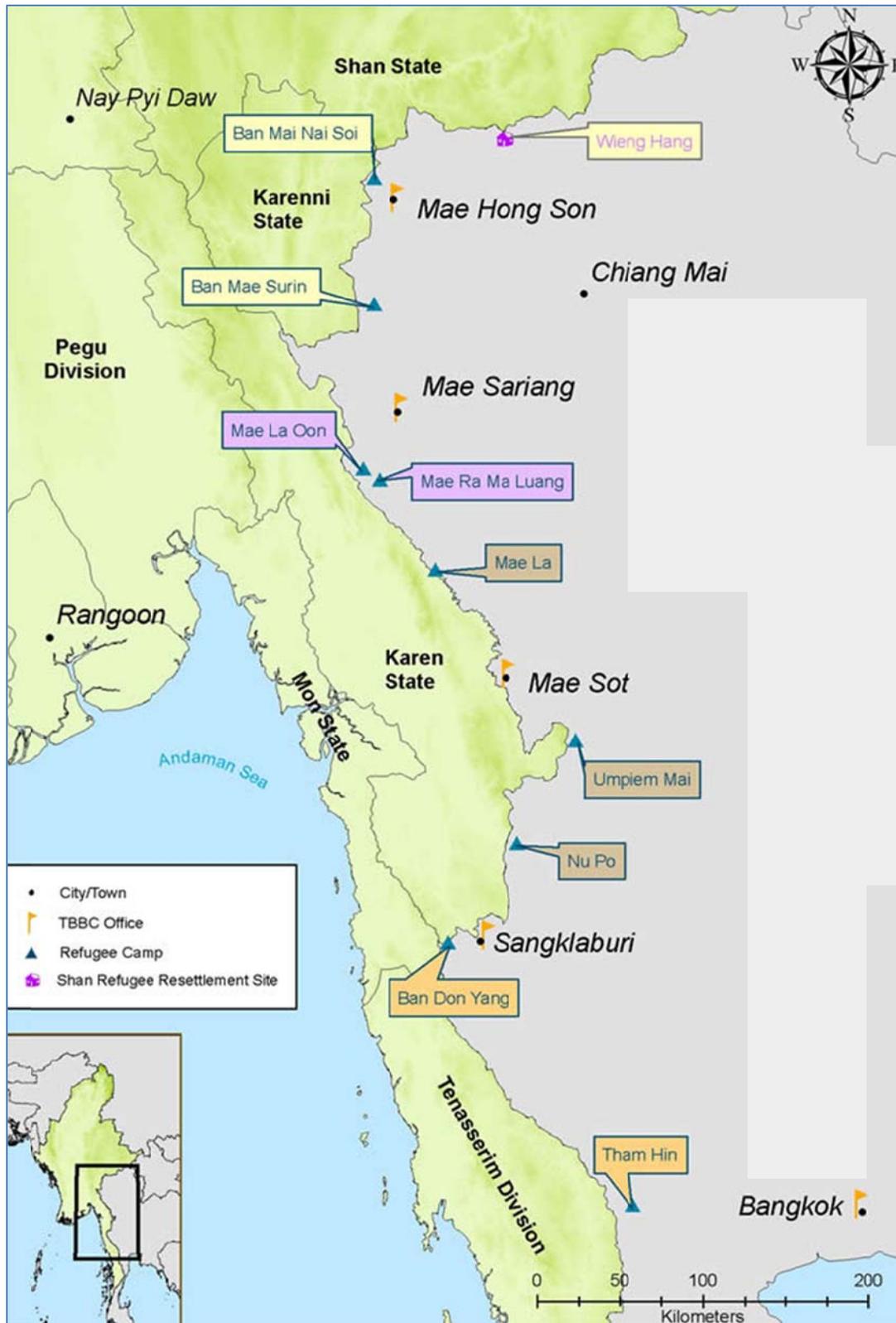


Figure 2 – Location of the nine refugee camps in which TBBC operates in Thailand (TBBC, 2012)

4. Environmental Impact Assessment

4.1 Assessment of Procurement and Logistics

4.1.1 Understanding the procurement process

The assessment of the procurement and logistics covers all TBBC's transport activities including staff transport to and from the refugee camps. As previously mentioned, TBBC provides the refugee camps with several food, shelter and non-food items such as:

- Charcoal including packaging.
- Bamboo, eucalyptus, grass and leaf thatch, plastic sheets and zinc panels.
- Rice, Asia Remix (fortified flour), salt, soya bean cooking oil, fish paste, yellow split peas, including packaging and plastic containers.

The charcoal and shelter material are sourced locally from Thailand as well as some food items like the fortified flour, cooking oil and fish paste. The remaining food items are typically sourced outside of Thailand, from countries such as Australia. The raw materials for charcoal production are often sourced from Cambodia and Lao People's Democratic Republic. Local sourcing of food (i.e. from within the country) would mean a significant reduction in transportation and related greenhouse gas emissions. However, according to TBBC, it is not always possible to source all food items at competitive prices and large quantities from Thailand alone.

The quantities supplied to each camp depend primarily on the refugee camp preferences, population characteristics and age groups. The items that require close monitoring due to their potential adverse impacts on the local environment are cooking oil, fish paste and charcoal and their respective packaging. Their impacts will be assessed in the **Water and Sanitation** section.

The TBBC procurement and logistics managers post an annual/bi-annual tender for supplies. The suppliers selected are responsible for all transportation to the refugee camps. Depending on the camp location and road access condition throughout the year, the supplies are delivered on monthly or six/seven month basis (e.g. Mae La On and Mae Ra Ma Luang). The types of trucks utilized by suppliers include ten-wheel trucks (e.g. capacity of 400 x 50 kg rice sacks), six wheelers, and 4x4 drive pick-up trucks depending on road access and location of refugee camp.

TBBC maintains detailed supplier evaluations including sample testing by third party, and a tendering committee of procurement and program staff that select the best contracts based on best value for money. The criteria taken into account for selection includes: price, product quality, production capacity, reputation and proven ability to meet delivery schedules, experience in delivering humanitarian assistance, and knowledge of local working conditions. This means that suppliers who perform less than satisfactorily on previous contracts may not be awarded a future contract even if their price is the lowest. In this evaluation process, there is a clear opportunity for TBBC to include environmental criteria in the selection of the supplier (see section 4.1.5).

4.1.2 Transportation of Staff

All TBBC's offices, including headquarters have a monthly chart with all the staff names and daily travel arrangements to ensure efficient transport management (Figure 3). In addition, TBBC headquarter has one full time staff responsible for managing staff transportation to and from the refugee camps. For each refugee camp, there is one field staff responsible for coordinating local staff transportation. Based on the visit/audit to the camps, it was evident that all staff transportation is efficiently managed to reduce unnecessary travel duplication.



Figure 3 – Staff monthly plan at TBBC’s Umphang office (left) and TBBC headquarters in Bangkok (right)

Furthermore, the Bangkok staff use the google calendar application to coordinate work and transportation with other TBBC field offices. About 3 to 5 people travel to each camp on a bimonthly basis from Bangkok headquarters. Except for Tham Hin and Ban Don Yang, all staff transport from Bangkok involves domestic flights. Frequent travel to the camps is required to ensure effective operation of TBBC’s activities by field staff.

Previously the Mae Sot office was responsible for three camps – Mae La, Umpiem and Nu Po – particularly as Mae Sot office to Nu Po camp represents almost a 5 hour drive. TBBC has reduced travel time and transportation by opening an office in Umphang which is much closer to Umpiem and Nu Po camps (1h30min drive). Therefore the impact of staff transportation and respective emissions has been successfully minimized. The vehicles used by field staff are modern and well maintained Toyota Hilux 3.0 Diesel pickup trucks, which are well suited for the road conditions, daily use and transport of staff and materials (Figure 4).



Figure 4 – TBBC field staff vehicles

4.1.3 Transportation of supplies to and from the refugee camps

TBBC supplies a very large amount of items on a regular basis to nine refugee camps with over 140,000 refugees. The impact of transportation in terms of greenhouse gas and pollutant emissions is

probably the largest direct negative impact from TBBC's activities². The logistics and procurement of supplies is complex and challenging, and TBBC's efforts to organize and plan their logistics helps to reduce this impact. For example, for rice supply alone, approximately 25 ten-wheel trucks are required per month for a population of approximately 48,000 people in Mae La, the largest refugee camp. Upon visiting the camps, it was evident that the space available at the camps does not allow for larger warehouses which would reduce monthly transport.

In Mae La, local pick-up trucks deliver shelter materials such as leaf thatch for rooftops. Ban Mai Nai Soi (Site 1) is the only camp where food supplies are delivered by local pick-up trucks. In this camp, the local suppliers are neighboring Thai villagers that live near the refugee camp and their engagement ensures integration of the local community, income, and more importantly, authorization for use of the local roads. However, it does mean an additional step in transportation, loading/unloading and use of pick-up trucks instead of larger trucks (Figure 5). The loading/unloading of charcoal can lead to a decrease in product quality although quality is controlled by a third party. In some cases, this means charcoal packages are rejected and returned to supplier. Overall, the benefits to the community outweigh the environmental considerations but with adequate training from suppliers these issues could be minimized. TBBC should continue to monitor this process closely to ensure adequate training and to optimize the loading/unloading process. Furthermore, if possible, TBBC should request the supplier to setup an external warehouse so that unloading/loading can be managed more efficiently with minimum time constraints for delivery.

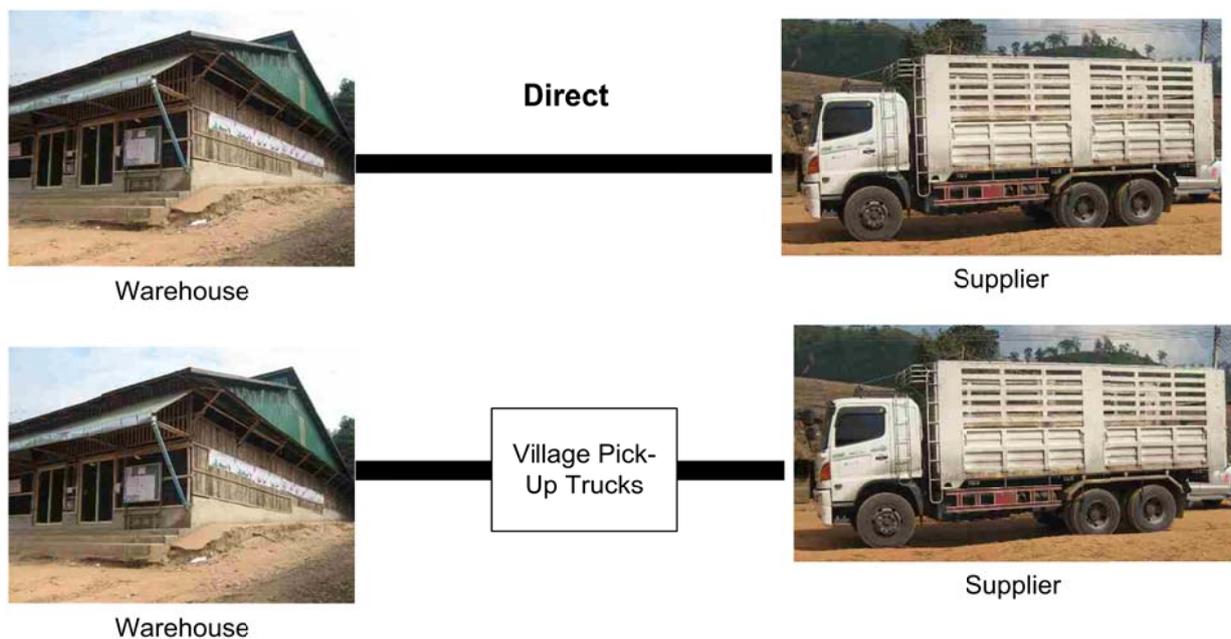


Figure 5 – Transportation of supplies directly or via local villagers

Generally, most of TBBC's warehouses are located in strategic locations to minimize refugee movement and the need to carry heavy supplies over lengthy and steep distances (the only exception is Umpiem where local motorbikes are used for transportation). However, in the Ban Mai Nai Soi (Site 1 camp) there is an opportunity for TBBC to combine two small charcoal warehouses closer to one of the main warehouses to minimize transportation within this camp. This is especially important as the roads are on stream beds and the charcoal warehouses are located close to a small river which is subject to frequent flash floods in the rainy season. The location of these warehouses is covered in more detail in the **Physical Planning** section.

² As transportation is outsourced to the supplier it was not possible to quantify the exact amount of greenhouse gas emissions resulting from transportation to and from the refugee camps.

4.1.4 Sourcing of fuel, shelter material and food

The production of local shelter material and food is a unique opportunity for TBBC to enhance self-reliance, complement TBBC's supplies and reduce transportation emissions. This is already in place in refugee camps such as Site 2 (for leaf thatch only), Tham Hin (plantation just commenced last year), Umpiem and Nu Po camp under TBBC's CAN Programme and tree plantation projects. However, due to the high population density of the camps, limited space available and proximity to forest areas/wildlife sanctuaries, these projects are seen as more of a complement to the existing supply and to enhance food diversity rather than reduce transportation and supply.

Preference should be given to suppliers that provide material from sustainably managed forest or farmed trees or bamboo plantations. Sourcing shelter material from unknown sources should be avoided. TBBC is already undertaking pilot projects for local production of shelter material including bamboo and eucalyptus to support self-reliance and complement TBBC's shelter supply. These are covered in more detail in the section on **Forestry, Agriculture and Livestock**.

During the visits to the camps, the quality of the charcoal sacks was seen to be poor and field staff has reported this to TBBC headquarters and to the supplier. Good quality packaging will ensure minimal loss of charcoal and charcoal dust during travel and at the warehouse, and will therefore reduce potential adverse impact on soil, air and water quality (See Box 3 for more details). TBBC should ensure poor packaging is reflected on the supplier evaluation and improved in the next supply. On the positive side, some refugees use the charcoal dust and waste water from rice to produce charcoal balls in the dry season (Figure 6). When used for cooking, this charcoal is short lasting and has lower calorific value than normal charcoal. However, it reduces need for additional charcoal, minimizes charcoal dust waste and its potential adverse impact on the environment. The production of charcoal balls should continue to be supported and promoted within the refugee community particularly in the dry season. This could be easily promoted by TBBC at public forums.



Figure 6 – Charcoal balls made of charcoal dust and waste rice water

4.1.5 Procurement Process

The responsibility of ensuring efficient transportation lies with TBBC's suppliers. It is logical to assume that suppliers will use the most efficient routes possible to maximize profits, however this is not always the case. As the cost of transport is often passed on to the client and takes into account the cost of fuel, typically there is no direct incentive for a supplier to optimize the efficiency of logistics. As a result there is a clear opportunity for TBBC to include environmental criteria when selecting the

supplier. This has been substantiated through interviews with TBBC staff and a review of the TBBC procurement manual. Such criteria could include:

For Selection:

- The selection process should positively weigh those suppliers who have taken measures to **optimize the planning of routes** and ensuring efficient transportation. TBBC should request evidence from supplier on mechanisms used to ensure effective planning.
- **Average age of fleet used** - An old fleet (e.g. 20 years) might represent higher emissions and lower fuel economy (excluding carbon life cycle analysis). The selection process should benefit suppliers with modern and well maintained fleets rather than those that use older or poorly maintained fleets.
- **Driver training** – Some fleet companies provide training to drivers on eco-driving, driver handling and safety, and preventative maintenance (e.g. tyre pressure monitoring). These best practices can make a significant difference in fuel economy savings.
- **Type of fuel used** – Depending on local availability, some trucks use fuel blended with bioethanol or biodiesel resulting in lower emissions. The selection process should benefit suppliers using alternative fuels.
- **Packaging quality** – It is essential to avoid any spills during transport and loading/unloading phases. A good package will also ensure the product quality is sustained by the supplier. This is particularly relevant for the charcoal, cooking oil and fish paste due to their characteristics and potential adverse impact on environment.
- **Source of charcoal and shelter material from legal sources:** If possible, TBBC should ensure the shelter materials and by-products used for producing the charcoal are from legal sources (as specified by Thai law). If possible, the supplier should provide a note on the source of the material and implementing an informal chain of custody system (for verification of origin).

Monitoring:

- **Tonne per Kilometer** – this indicator can be used by TBBC to find out the most efficient suppliers and identify any differences throughout the year. The fuel spent indicator could be included in standard delivery forms also known in TBBC as Good Received Notes.
- **State of vehicle:** The field staff usually verifies the state of the supplies and can also evaluate the vehicle condition and any issues should be reported to TBBC.
- **State of packaging** – already monitored at TBBC and included in the overall evaluation of supplier.

The key challenge in using the criteria above is the limited number of suppliers (limited alternatives) and low number of road transport companies willing to access remote or isolated camps. However, the use of these criteria raises awareness of such issues in suppliers, and over time supports the adoption of better practice.

4.1.6 Efficient Cooking Stoves – Reducing demand and transportation of charcoal

Efficient cooking stoves complemented with basic training are one step of ensuring efficient use of charcoal for cooking and water heating (Figure 7). Until 2007, TBBC provided efficient cooking stoves to refugee camps to Mae Ra Ma Luang, Mae La Oon, Mae La, Nu Po and Umpiemi Mai camps. According to TBBC, “it was originally hoped that all camps would become self-sufficient but this has proved unfeasible at least in the short term”. By 2009, a survey indicated that already 80% of households in all camps had a functioning fuel-efficient cooking stove.

Due to insufficient funding, TBBC has opted to discontinue the provision of efficient cooking stoves to the remaining 20% of households and prioritize on food, fuel and shelter supplies. If funds are made available in the future, TBBC should evaluate the charcoal cost and quantity savings resulting from use of efficient cooking stoves (including new efficient cooking stoves – **Rocket Cooking Stove** which is sold for 200 THB in Nu Po camp) compared to other methods (cost-benefit analysis). This will help determine if the cost of the efficient cooking stove offsets the charcoal cost to supply that quantity for all households.

Further, if the savings are considerable, TBBC should provide efficient cooking stoves primarily to refugee camps with no surrounding forests (e.g. Umpiem and Tham Hin) and then to camps in forest areas where there is high usage of wood fuel (e.g. Site 1). The Adventist Development and Relief Agency (ADRA)-led project is currently exploring local production of efficient cooking stoves that could be potentially purchased by TBBC following evaluation.

Finally, TBBC should provide basic training in the efficient use of charcoal and over time consider reducing charcoal ratio of 8.0 kg per person per month to minimize impact on environment from transportation as well as from charcoal dust. Exception should be made to vulnerable groups and refugee camps where the carrying capacity³ has been exceeded – i.e. Tham Hin and Umpiem.



Figure 7 – Efficient cooking stove in a household

4.1.7 Assessment of Procurement and Logistics

Good Practices by TBBC in Procurement and Logistics:

- Successful management of complex transport logistics to nine refugee camps with 140,000 people.
- Staff monthly plan and dedicated person for efficient staff transport management.
- Full-time staff and field staff responsible for procurement and monitoring supply to the refugee camps.
- Charcoal packages with more than 15% charcoal dust are rejected and returned to supplier.
- Local production of shelter material and food (CAN Programme).

³ The ability of a given ecosystem in sustaining the population size that depends on it while maintaining its productivity and adaptability.

- Setup of Umphang office reducing staff transportation to Umpiem and Nu Po refugee camps.
- Almost all charcoal warehouses are separate from food supply warehouses.

Key Recommendations for Procurement and Logistics:

- Ensure the TBBC procurement manual includes environmental criteria for selection, monitoring and evaluation of supplier.
- Ensure supplier continues to provide training to staff and sub-contracted staff covering adequate loading and unloading, particularly to avoid charcoal breakage.
- Continue to explore optimization of warehouse location to minimize supply transport within the camps with least impact for the refugees. For example, the small charcoal warehouses in Site 1 could potentially be located close to the Main Warehouse N. 3 which already supplies all the other items.
- Ensure the packaging for charcoal is of good quality to avoid breakage and adverse impact of coal dust on soil, air and water quality.

4.2 Assessment of Physical Planning

4.2.1 Understanding the physical planning

The location of the refugee camps is determined by the Ministry of Interior from the Royal Thai Government. The government's expectation is that these camps will be temporary. Consequently, environmental aspects are not considered in the selection of the site and respective area required. This leads to multiple issues such as overcrowding and the location of camps within protected wildlife areas, on steep slopes or in river beds which are susceptible to regular or extreme weather events and natural disasters. The fact that the camps are seen as temporary also limits the application of a number of potential mitigation measures (e.g. use of concrete instead of wood for poles) and the selection and location of TBBC warehouses and their characteristics.

4.2.2 Physical Planning of CAN Programme and Forestation Activities

TBBC is responsible for the physical planning of the rented land used for the CAN Programme and tree planting. According to the soil map of Thailand, generally, all the refugee camps are located in steep land, made up of acid to intermediate rocks, with mainly red-yellow podzolic soils with occasional limestone outcrops. Podzols are relatively sandy with little or no vegetation which means that these are easily susceptible to landslides and erosion. Generally, podzols are also poor in nutrients and therefore organic material and composting will be important for the CAN Programme to increase the fertility of the soil under intensive usage (Nu Po camp is exception).

In the selection of sites for the CAN Programme and tree planting, it is important that TBBC continues to apply CAN best practices (see Box 1), especially in the case of Nu Po as it is located in a wildlife sanctuary. The best practices should also be extended to the tree planting activities and, if possible, managed by CAN staff (additional staff might be required).

The CAN Programme location should also be carefully evaluated based on the existing surrounding environment, especially in forested areas. For example, in Nu Po camp, the CAN Programme is located next to an open air waste pit and waste incinerator. Although the management of waste is not the responsibility of TBBC, this issue should be brought to the refugee camp committee to avoid contamination of local water resources (proximity of local pond) and food chain. During the visit, it was noticeable that the open air waste pit had small AA batteries which contain hazardous heavy metals such as lead. The level of contamination at this stage is unclear without further tests on soil, water and food chain.

4.2.3 Physical Planning of warehouses

Generally, all TBBC's warehouses are of good quality (see Box 2) and located in relatively safe areas in terms of flood and landslide risk. For example, the warehouses have concrete floors and are covered with zinc roof which reduces potential adverse impact of spills and contamination from charcoal, fish paste and cooking oil. Of all the warehouses visited, only four prompt minor actions from TBBC in Site 1 (3) and Umpiem (1). It was observed that TBBC has been responsive to such issues in the past. For example, in Mae Surin, TBBC raised the floor of a charcoal warehouse because it was located on the river bank and regularly flooded during rainy season.

Box 2 – Characteristics of TBBC's Warehouses

TBBC constructs, maintains and manages all its warehouses in the camps according to international standards established by the United Nations World Food Program. The application of these standards is adapted to suit local conditions in the camps, human resource capacity and geographic/topographic issues. Earlier versions of the camp warehouses were constructed of eucalyptus wood, bamboo and thatched roofs, and were built over a floor of compacted earth. However, government officials have allowed for more durable materials to be used in community buildings, such as medical clinics, schools and warehouses, including the use of cement for floors and corrugated iron/zinc roofing. Currently, TBBC uses three different designs in the construction of warehouses in the camps:

- The **'hybrid design'** of eucalyptus wood and bamboo in combination with a cement slab or raised/woven bamboo floor on wooden or cement posts and with a corrugated iron roof, complete with fibreglass skylights. This design is the most commonly used in camps. The 'hybrid-design' can be constructed using existing building skills within the camp population but use large amounts of bamboo and require constant maintenance.
- **Mobile Storage Units (MSU):** MSU's come in 2 versions; soft-walled or hard-walled. The soft-walled version is best suited to emergency situations, whereas the hard-walled version is best suited to protracted situations. TBBC currently has two hard-walled warehouses installed in Mae La (Figure 8) and Umpiem Mai. These warehouses are 'mobile', in that they are based on a modular, metal frame which can be constructed in a short space of time in any location which has a level surface.

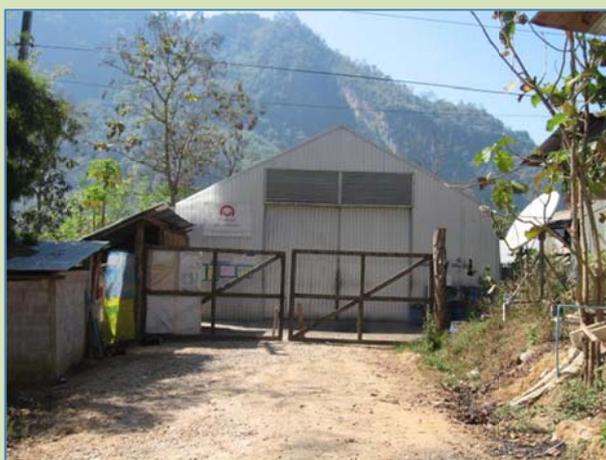


Figure 8 – MSU type storage at Mae La camp (used for supplementary needs)

- **Mud-brick warehouses:** Currently, mud-brick warehouses exist in only three camps: Nu Po, Mae Ra Ma Luang and Mae La Oon. Mud-brick construction was chosen because materials are readily available around the camps and community members receive training in construction techniques contributing to their acceptance by beneficiaries. Mud-brick warehouse construction also offers good in-camp livelihood opportunities.

As shown in Figure 9, this charcoal warehouse is located on top of a small water stream and is made completely of bamboo with zinc roof top. The floor is equally made of bamboo leading to regular dust seeping into the water stream and two surrounding houses. If possible, the location of this warehouse should be reconsidered by TBBC despite the limited space available in the area.



**Figure 9 – Charcoal warehouse with bamboo floor on top of water stream
(Site 1 – Ban Mai Nai Soi)**

Figure 10 and 11, shows two other charcoal warehouses (number 3 and 4) in Site 1 located near a water stream and potentially subjected to flash floods. Figure 10, already shows that the water stream is slowly encroaching into the warehouse building and fence. As warehouses 3 and 4 only supply charcoal, they could be relocated to the Main Warehouse N. 3 which already supplies all the other items.



Figure 10 – Charcoal warehouse near water stream (Site 1 – Ban Mai Nai Soi)



Figure 11 – Charcoal warehouse near water stream (Site 1 – Ban Mai Nai Soi)

The physical planning of warehouses, also involves ensuring the correct size of the warehouse based on the number of people supplied in the area. In Mae La, the challenge is significant due to the high population density. In one of the charcoal warehouses, at least 15 sacks (20 kg) were stored on top of each other (Figure 12) throughout the whole warehouse. Although the charcoal briquettes are fairly resistant, the resulting weight pressure on the lowermost sacks is considerable. This might lead to higher percentage of dust content leading to additional waste and unnecessary adverse impact on air, water and soil quality. If possible, TBBC should explore at least doubling the size of this warehouse to minimize dust formation.



Figure 12 – Charcoal stacking at Mae La camp due to limited space available

The risk of landslide (30%-50% slopes), tree/rock fall, floods and fire are high in some of the refugee camps. The potential disaster risk for each camp was assessed by UNHCR in 2007 and published in the *Disaster Risk Management in Refugee Camps along The Thailand – Myanmar Border*. Though it is not TBBC's direct responsibility to ensure safety mechanisms are in place at each camp, TBBC

should identify location of high risk when conducting the annual survey for shelter material requirements, and report these to the camp committee. This should be the case of the charcoal warehouse in Umpiem camp which is at risk of collapsing (Figure 13). If building a new warehouse or house, best practices to minimize landslides should be applied such as terrace construction, horizontal bamboo barriers and vegetation/tree plantation surrounding the house to reduce soil erosion from heavy rain and respective water-run off. This helps avoid environmental issues resulting from flooding, landslide/erosion, tree and rock fall.



Figure 13 – Charcoal warehouse in Umpiem camp in risk of collapsing due to landslide

In addition, all charcoal warehouses should be fully covered to reduce adverse impact on air quality to the neighboring houses and ecosystem, especially during distribution, and unloading/loading. The only exception was one charcoal warehouse in Mae La camp (Figure 14). In addition, all charcoal distribution should be managed inside a closed environment and not outside the warehouse.



Figure 14 – Charcoal warehouse in Mae La camp with wired fencing for wall cover

4.2.4 Assessment of Physical Planning

Good Practices by TBBC in Physical Planning

- Environmental practices applied in physical planning of CAN Programme and tree planting.
- Good quality construction of TBBC's warehouses.

Key Recommendations for Physical Planning

- If possible, TBBC should avoid warehouse location in areas with high risk of flooding, landslides and tree/rock falling. If not possible to relocate the warehouse, continue to monitor and evaluate the conditions surrounding the warehouse and risk level.
- Ensure warehouses, particularly charcoal warehouses have adequate wall cover to avoid degradation of air and water quality in the camp (one charcoal warehouse in Mae La had wired fencing only).
- Site 1 has a charcoal warehouse with bamboo floor and wall. This warehouse should be dismantled and the charcoal supplies should be relocated to adequate warehouse nearby, if possible. In addition, charcoal warehouse 3 and 4 are located near a water stream potentially prone to flash floods and should be relocated to a location near Main Warehouse 3 minimizing any impact on refugees.
- Nu Po's CAN Programme is located near waste incinerator and open air waste pit containing batteries. TBBC should evaluate resulting contamination of vegetables, soil and water and report situation to refugee camp committee for relocation of open waste pit.
- All charcoal should be managed inside a closed environment and not outside the warehouse to avoid charcoal dust in the refugee camps with potential adverse impact on air and water quality. An appropriate area for distribution might need to be considered by TBBC.

4.3 Assessment of Water and Sanitation

4.3.1 Understanding water and sanitation at the refugee camps

The management of water supply in quality and quantity and respective sanitation is not the direct responsibility of TBBC. TBBC uses water supplied by the camp in the warehouse, agricultural and forestry projects. These use minimal amounts of water and are not foreseen as a risk to water availability and quality in the camps in the dry season. The agricultural projects use natural fertilizer and composting with effective water use. Water is also used to clean warehouses and this should be carefully carried out by TBBC to avoid unnecessary impact on water quality, particularly when cleaning fish paste and cooking oil spills. Charcoal dust from the warehouse should be reused for production of charcoal balls as shown in Figure 6.

TBBC's food packages and containers and livestock provided under TBBC's income generation program are also sources of waste in the camp. The refugee camp committee is responsible for distributing the food packages within the camp and selling it outside the camp for income. The fish paste plastic drum is reused by the supplier and includes an inner plastic bag lining allowing for greater protection and reduction of odors. It also reduces the probability of potential spills during transportation and unloading/loading.

Box 3 - Information on the Potential Negative Impact of Cooking Oil, Fish Paste and Charcoal on the Environment

Cooking or vegetable oils share similar characteristics as mineral oils (e.g. gasoline or kerosene). Cooking oil is insoluble in water and degradation can be slow (reduces rate of microbial degradation) depending on the quantity, the local conditions and climate. For example, cold water

temperature means the fatty acids will coalesce and sediment forming grease which interferes with biological life. A significant spill or regular spills can have an adverse impact on water quality and subsequently vegetation, living organisms and human population living downstream as well as refugees using local surface or ground water. One litre of oil can contaminate several million liters of water.

Fish paste can have a similar adverse impact on the environment as cooking oil. However, depending on the quantity, its degradation and impact on air and water quality could be substantially more significant. For example, the fish paste contains pieces of fish which are insoluble in water and natural degradation in the water would take time. As the fish solids break down, these will release colloidal and suspended fats and solids leading to an increase in the Biological Oxygen Demand (BOD)⁴ in the water.

The **charcoal** provided by TBBC is generally composed of waste from sawmills, bamboo and coconut by-products which have been heated in the absence of oxygen (pyrolysis). The resulting material is then compressed to increase calorific value and reduce dust. Charcoal is composed of about 90% carbon by weight, 5% water and 4-6% ash. By converting wood into charcoal approximately 60% of the original energy content is lost depending on the kiln and compression technique. The charcoal dust can represent a significant negative impact on water and air quality in the refugee camps, particularly in the dry season. When charcoal dust (particulates) enters a small stream, increases the suspended solids in the water making it turbid and may deposit a fine layer of sediment in the bed of the stream, both of which adversely affect aquatic life. In addition, it can potentially alter the characteristics of water (e.g. pH, increase in BOD, etc).

Assuming each charcoal sack has 5% charcoal dust (1 kg), over the whole year, this amounts to several tons of charcoal dust (particulate matter) in the refugee camps. Some of the dust is released in warehouses during unloading/loading and distribution. The charcoal balls produced in the camps reduce charcoal dust waste and respective risk to human and animal health. Regular and long-term exposure to charcoal dust (particulates) can have serious respiratory effects and damage lung tissue.

4.3.2 Water and Sanitation at the warehouses

One warehouse in Mae La has a hole in the wall to allow for cleaning operations. However the hole is next to the river. TBBC should opt to close this hole and investigate other ways of dealing with fish paste and cooking oil spills and respective cleaning with minimum impact on environment. TBBC warehouses already have concrete floors which typically absorb the cooking oil but fish paste spills are more difficult to manage. Nevertheless, all spills should be avoided and staff responsible for distribution should continue to be adequately trained. In most warehouses, during the visits, cooking oil spills were kept to a minimum.

4.3.3 TBBC waste management

The waste resulting from TBBC's activities such as food packaging, cooking oil tins and charcoal packaging is minimized as a result of reuse by refugees in the camp (Table 1). In addition, TBBC's Programme Guidelines provides rules for secondary use of cooking oil tins. TBBC should extend these rules to other packaging in particular charcoal sacks as indicated in Table 1.

⁴ Biological Oxygen Demand is the quantity of dissolved oxygen present that is needed by aerobic biological organisms in order to break down organic material present in a given water sample at certain temperature over a specific time period.

Table 1 – Summary of waste originated from TBBC’s activities, re-use given by refugee camp committee and ideal use

	Use given	Ideal use
Food Packages 	<ul style="list-style-type: none"> - Used for erosion or flood prevention, - Garbage bag, - Keeping clothes, - Sold outside the camp, - Used to carry materials such as wood and leaves, - Household planting 	<ul style="list-style-type: none"> - Used for erosion or flood prevention, - Garbage bag, - Used to carry materials such as wood and leaves, - Household planting
Charcoal Packages 	<ul style="list-style-type: none"> - Used for erosion or flood prevention, - Garbage bag, - Reuse for storing charcoal, 	<p>Preferably should be returned to supplier for reuse, or reused by refugees for storing charcoal. Should not be used for erosion or flood prevention as it contains charcoal dust. It should not be used for flood prevention.</p>
Cooking Oil tin (18 litre) 	<ul style="list-style-type: none"> - Tin used for construction material such as roof or wall, - Plant and water container, - Increase efficiency of cooking stove - Cupboards - Household dry food storage - Erosion prevention - Fire protection - Sold outside the camp, 	<ul style="list-style-type: none"> - Tin used for construction material such as roof or wall, - Plant and water container, - Increase efficiency of cooking stove - Cupboards - Household dry food storage - Fire protection <p>The cooking oil should not be used for erosion as it is not biodegradable.</p>
Fish Paste Drums (60 litre) 	<ul style="list-style-type: none"> -Returned to supplier for reuse 	<ul style="list-style-type: none"> - Return to supplier for reuse
Food Containers for Distribution 	<ul style="list-style-type: none"> - Reused by refugees 	<ul style="list-style-type: none"> - Reused by refugees

4.3.4 Assessment of water and sanitation

Good Practices by TBBC in Water and Sanitation

- The CAN Programme applies best practices for effective use of water.
- Previously the cooking oil was supplied in plastic bottles. TBBC has now opted for metal tins leading to a reduction in plastic waste, reduction in number of leakages and also allowing for reuse by refugees and source of income for the refugee camp committee.
- Use of reusable containers for food distribution.
- Reuse of food packages for erosion prevention and household planting.
- Fish paste plastic drum includes bag inside reducing probability of potential spills.

Recommendations for Water and Sanitation

- TBBC should investigate adequate ways of managing fish paste spills and avoiding contamination to nearby water resources. TBBC should continue monitoring and evaluating warehouse performance and regular training of TBBC field staff and more importantly volunteer refugee staff. For monitoring purposes, number of significant spills (e.g. more than 3 cooking oil tins) should be listed and used to evaluate performance of warehouses and staff.
- Charcoal sack and cooking oil tins should not be used for erosion or flood protection purposes.
- As mentioned in the procurement and logistics assessment, the charcoal package quality should be improved to minimize impact of charcoal dust on water quality.

4.4 Assessment of Food

TBBC provides refugees with a food basket containing rice, Asia Remix (fortified flour), salt, cooking oil, fish paste and yellow split peas. TBBC has full time nutrition experts and consults with international nutrition specialists on a regular basis. The food basket complies with United Nations World Food Program regulations.

TBBC's priority is to maintain a nutritionally balanced food basket, particularly for vulnerable groups. The refugee's traditional diet is typically based on a small variety vegetables and rice, making it a challenge to provide infants with essential minerals and vitamins. The Asia Remix contains 60% rice flour and 30% soya flour for cultural acceptance. It is the only food item that could be challenged as not being part of the refugee's traditional diet. Yet it is an essential vehicle of vitamins and minerals and is only provided to infants. According to TBBC's nutrition experts there is no other alternative vehicle to successfully provide these minerals and vitamins within the traditional diet.

Good Practices by TBBC in Food

- Full time nutritional expert at TBBC.
- Soya and rice flour blend in Asia Remix to be more culturally acceptable.
- Regular monitoring of food quality and refugee health.
- Food ration revised on annual basis to determine preferences and receive feedback. Each camp receives different quantities based on this feedback.
- Public forum for regular feedback.
- Survey conducted in 2003 to determine adequate food basket according to UN World Food Program guidelines.

Key Recommendations for Food

- None (Food packaging and waste are covered in other sections above).

4.5 Assessment of Energy

TBBC's energy consumption is limited mainly to the headquarters and field offices. Tham Hin is the only refugee camp with a diesel generator owned by TBBC for use by the refugee committee and TBBC warehouse.

4.5.1 Offices

The TBBC headquarters is a modest office, centrally located in Bangkok, with several additional extensions, generally good natural lighting and air conditioning in each office room. The monthly electricity bills for 2011 remained relatively constant indicating no major changes in use throughout the year. Most electric appliances have Label 5⁵ (highest efficiency). The electricity bills could potentially be reduced by improvement of insulation of TBBC headquarters but this would come at a very high cost, long term payback and is not seen as viable based on the construction characteristics.

The field offices also have good natural lighting minimizing the need for electric lighting and most appliances are Label 5 (Figure 15 and 16). The field offices typically do not require air conditioning during the dry season due to the cool temperatures.

All offices use either Compact Fluorescent Lamp (CFL) or Fluorescent Tube Lamp (Figure 17) which are within the most efficient (lumen/watt) and affordable lighting types available in the market. Whenever possible, TBBC staff should ensure correct disposal of lamps.



Figure 15 – Label 5 Air Conditioning at TBBC Field Office

⁵ The Thai government established in 1993 a voluntary Energy Efficiency Labeling No. 5 Programme to raise awareness on appliance and equipment efficiency and highlighted those with highest efficiency allowing consumers to reduce their electricity bills. The most efficient appliances have Label 5.



Figure 16 – Label 5 Fridge at TBBC Field Office



Figure 17 – Fluorescent Tube Lamp at TBBC Field Office

4.5.2 Refugee Camps

The TBBC warehouse construction follows international best practices and most have transparent fiberglass on the roof or side walls to allow for natural lighting (Figure 18). This avoids any need for electricity in the warehouses, especially as all activities are carried out during the day. Only Tham Hin warehouse (large size) seemed to have CFL lamps as there is limited natural lighting from the ceiling in some areas.

TBBC also owns a small diesel generator managed by the refugee camp committee in Tham Hin (Figure 19). During the visit to the camp, the generator seemed to be operating throughout the day for lighting purposes. There might be an opportunity for TBBC to improve energy management to avoid unnecessary diesel consumption, respective noise and fuel emissions. Refugee committee and refugee

staff responsible for managing diesel generator should be trained to ensure efficient use of the generator as and when required. This includes training to ensure adequate storage and disposal of diesel tins to minimize any fire risk and diesel spills that could contaminate soil and water. This should include improvement of diesel storage house in Tham Hin to match high quality construction and best practices of existing TBBC warehouses.



Figure 18 – Warehouse with natural lighting on rooftop at Site 1 (left) and charcoal warehouse with natural lighting on side wall at Umpiem Refugee Camp (right)



Figure 19 – TBBC diesel generator at Tham Hin refugee camp

Charcoal is the main fuel source for refugees for household use in cooking and water heating. Some refugees have access to electricity (about 5% of households in Mae La camp according to the refugee camp committee) and wood depending on the camp. 74% of interviewed households collect firewood due to insufficiency of charcoal leading to additional pressure on forests. On the other hand it shows the difference charcoal can make, if supplied in sufficient quantity, to reduce pressure on local forests and carrying capacity. Other alternative energy sources could be considered but generally the disadvantages outweigh the advantages as shown by Table 2.

Table 2 – Basic comparison of alternative fuel sources against charcoal

Source	Advantage	Disadvantage
Biogas⁶	<ul style="list-style-type: none"> - Use of local livestock waste - Simple to install - TBBC not responsible for livestock management except in Tham Hin. 	<ul style="list-style-type: none"> - Requires technical expertise - Dependent on supply and number of livestock - Electricity grid required
Diesel Generator	<ul style="list-style-type: none"> - Lower impact on human health and environment than charcoal (one source emission) 	<ul style="list-style-type: none"> - Noise - Diesel availability in some camps - Impact on environment if mismanaged - Space requirements for generator - Electricity grid required - Supply of light bulbs – waste management
Grid Electricity	<ul style="list-style-type: none"> - Lower emissions than charcoal - Lower impact on human health and environment 	<ul style="list-style-type: none"> - Expensive compared to charcoal - Amount of electricity required for electric stove is high - Only 5 to 10% households have electricity in Mae La and Umpiem only - Electricity grid required - Supply of light bulbs – waste management
Kerosene	<ul style="list-style-type: none"> - Higher calorific value than charcoal - No dust 	<ul style="list-style-type: none"> - Kerosene stove and fuel containers required + training required - Transportation to camps not viable - Fire and explosion risk - Significant impact on environment with spill (liquid form) - Kerosene fumes
Liquid Propane Gas (LPG)	<ul style="list-style-type: none"> - Higher calorific value than charcoal - Lower emissions - Lower impact on human health and environment 	<ul style="list-style-type: none"> - Slightly more expensive than charcoal - Transportation – heavy and poor road access – only viable in Mae La - Safety – Risk of fire and explosion - Availability and re-sale management
Hydro-Power	<ul style="list-style-type: none"> - Renewable - No emissions - Applied successfully at Nu Po - Energy produced locally 	<ul style="list-style-type: none"> - Location specific - Impact on water resources if too many installations - Maintenance Used for battery charging – waste management
Solar Panel	<ul style="list-style-type: none"> - Renewable - Easy to install - No emissions and impact on environment - Energy produced locally 	<ul style="list-style-type: none"> - Expensive compared to charcoal (10 USD per watt installed) - Forest cover + low solar insolation in Thailand - Battery management and maintenance
Woodfuel/ Firewood	<ul style="list-style-type: none"> - Cheaper than charcoal - Lower impact on human health and environment 	<ul style="list-style-type: none"> - Smoke inhalation - Deforestation unless it involves reforestation and sustainable forest management - Area required to supply to all households in a refugee camp

Note: The solar cooking stove is not seen as a viable option for practical reasons including forest cover limits access to sunlight and long cooking time required.

⁶ If TBBC wishes to explore biogas production for electricity production in the refugee camps, the Department of Animal Sciences and Aquaculture, Faculty of Agriculture, University of Chiang Mai has successfully developed and implemented simple livestock biogas projects in Thailand (<http://www.biogas-cmu.com>).

When looking at alternative fuel supplies it is important to also take into consideration self-reliance. When returning to Myanmar, most refugees might only have access to firewood, charcoal and electricity through diesel generators.

4.5.3 Assessment of Energy

Good Practices by TBBC in Energy

- Use of high efficiency appliances in most of TBBC's field offices – Label 5.
- Use of natural lighting in the warehouses and therefore no lighting requirements at the camp.

Key Recommendations for Energy

- Improve management of diesel generator at Tham Hin camp. Provide basic training to generator manager and camp committee on adequate management of generator and storage and disposal of diesel tins to minimize any fire risk and diesel spills that could contaminate soil and water. In addition, improve diesel generator warehouse to match high quality construction and best practices of existing TBBC warehouses.

4.6 Assessment of Forestry, Agriculture and Livestock

4.6.1 Understanding Forestry, Agriculture and Livestock at the refugee camps

Generally, most refugee camps are located in mountain or valley areas surrounded by sub-tropical and/or deciduous forests, streams and rivers. Forest users include government officials (e.g. Forestry Department and Department of National Parks, Wildlife and Plant Conservation), commercial developers, Thai villages and refugees. The forest provides refugees with bamboo and leaves/grass (Figure 20) for shelter and wood for fuel.



Figure 20 – Grass thatch for use as shelter material

All camps are located in forest parks or reserve forest areas except for Nu Po. Nu Po camp is situated in the Umphang Wildlife Sanctuary. The rivers and streams following through the camp lead to the Thungyai-Huai Kha Khaeng Wildlife Sanctuaries, both UNESCO World Heritage Sites. The camp is already located in an area with Thai Karen villages and far from the heart of the Umphang Wildlife Sanctuary. The Nu Po school curriculum includes environment and forest management education.

All refugee camps utilize the surrounding forest resources to complement TBBC's food, fuel and shelter supply. Restrictions in accessing the forest vary according to camp commander but are generally flexible. Potentially, the more provisions provided by TBBC, the less the impact on the surrounding environment from refugee activities outside the camp. However this would reduce the refugee camps self-reliance and traditional way of living.

The critical issue for all refugee camps is the long-term high population density and considerable pressure on the carrying capacity of the surrounding forest, ecosystem and its services. Lower pressure on the environment would be expected if the population was dispersed over a large area. In Umpiem and Tham Hin, the forest carrying capacity has clearly been exceeded with no forest cover within a 1 km radius of the camp boundaries. These are the most vulnerable camps and complementary shelter and fuel should be considered. In Tham Hin camp, deforestation seems to have been caused by both refugees and local Thai people. The causes are related to when refugees leave the camps in the search for shelter, food and fuel to complement TBBC's provisions as well as local Thai people utilizing the low-cost refugee labor to grow several plantations next to the camp.

TBBC has significant experience on refugee camp environmental management as shown by the innovative pilot projects implemented that reduce the impact of the refugee camps on local resources and its carrying capacity as well as support the refugee's self-reliance. These pilot projects include:

- Mudbrick Production
- Concrete Post Production (to commence soon)
- Leaf/Grass Collection and Thatch Production
- Community Agriculture and Nutrition (CAN) Programme
- Bamboo Smoking/Water Leaching
- Bamboo and Eucalyptus Growing and Community Based Natural Resource Management

Most of these projects are located in Nu Po due to the proactive and enthusiastic refugee committee and being situated in the Umphang Wildlife Sanctuary. However, this represents a significant pressure on field staff to manage these entire projects adequately.

4.6.2 Mud bricks

TBBC has used mud bricks for warehouse construction in Nu Po (1), Mae La Oon (6) and Mae Ra Ma Luang (4). The mud brick durability has been good with the first warehouse built in 2007 still in good conditions. The quality of the mud brick will depend on the skill and experience of the builder in correctly mixing the mud, rice husk and water to avoid cracking and crumbling. The bottom of the mud brick warehouses has a concrete skirting for greater protection from rain water. The mud bricks production is limited by TBBC's budget and not extended to households. However, if budget is available, mud bricks could potentially reduce shelter materials avoiding continuous need for repairs each year and use of forest resources. The critical issue is the fact that Thailand is subject to frequent floods and people opt to live on raised houses. Therefore, the mud bricks would only be used for warehouses and offices – limited impact on total shelter amount provided by TBBC.

4.6.3 Leaf/Grass Collection and Thatch Production

The local leaf/grass collection and thatch production supports self-reliance and sustainable livelihoods. All camps use leaf/grass for shelter material except for Tham Hin as the camp commander specified that all roofs should be made using plastic sheets to reduce fire risk. Table 3 provides a summary of disadvantages and advantages of leaf/grass collection against plastic. The critical disadvantage for the plastic sheets is self-reliance of the refugees in the future.

Table 3 – Potential Advantages and Disadvantages of using leaf/grass thatch for roofing instead of plastic sheets

	Advantages	Disadvantages
Leaf/grass	<ul style="list-style-type: none"> - Self-reliance - Supports forest cleaning – reduce forest fire risk - Source of income for refugee and local Thai villagers - Cheaper than plastic - Can be reused/recycled for new thatches 	<ul style="list-style-type: none"> - Fire risk in highly dense housing - Short Life - Availability of leaf and grass - Intensive labour required
Plastic Sheets	<ul style="list-style-type: none"> - Durability (although the plastic sheets are currently replaced on annual basis) - Better roof protection during rainy season - Easy to install - Lower fire risk 	<ul style="list-style-type: none"> - Environmental impact of life cycle of plastic production and waste in the camps - Transportation required - More expensive than roof thatch - Does not allow fumes to dissipate through roof

4.6.4 Community Agriculture and Nutrition (CAN) Programme

TBBC's CAN Programme is a leading and pioneering project for promoting self-reliance and livelihood for refugees (Box 1). If possible, depending on funds available, the CAN Programme should be extended to other camps in particular vulnerable camps (carrying capacity exceeded) such as Tham Hin. TBBC should focus particularly on land renting for CAN as this seems to be more successful than household gardens due to the lack of space within most camps. It has been extremely successful in Nu Po and Umpiem compared to the household garden approach. Generally, according to interviews conducted in the camp, refugees with household gardens feel frustrated due to limited production and limited water resource nearby. Nevertheless, the household garden approach should continue to be supported as still makes an important contribution to food security in the camps.

A key challenge for extending the CAN Programme is the availability of land in the camps and the long process to rent land outside the camp. Camps located in forest area might be able to make use of agro-forestry practices. Furthermore, other NGO's such as COERR and ZOA have similar agricultural activities and land available. Therefore synergies should be explored, if possible, focusing on the successful CAN approach.

4.6.5 Bamboo Smoking/Water Leaching

This project is aimed at increasing the lifetime of bamboo poles used by TBBC for shelter purposes. The bamboo smoking at Nu Po involves the use of a waste incinerator where mainly plastic waste is burned potentially releasing particulate matter, acid gases, dioxins and many other hazardous elements. The absorption of these elements by the bamboo and their potential release in the household is not fully understood. Traditional bamboo smoking would be made using leaves and waste wood instead of urban waste. Therefore, using a precautionary principle, and to reduce use of the waste incinerator near the CAN Programme, the water leaching (Figure 21) project should be favored against bamboo smoking.

According to TBBC field staff, the refugees are well familiarized with the water leaching process and how often to change water, how long to leave bamboo immersed and which type of bamboo to use (young bamboo not adequate). TBBC should monitor closely this project and verify any need for training for field staff and refugees.



Figure 21 – Water leaching pond at Nu Po Camp

4.6.6 Bamboo and Eucalyptus Growing

TBBC is successfully undertaking a reforestation project in the slopes above Tham Hin camp using bamboo and eucalyptus. It is critical to continue to pursue this project as the camp has no surrounding forest and the respective protection a forest provides in terms of water retention and solid erosion (Box 4). According to the field staff, the occurrence of floods in the river in Tham Hin has risen in the last couple of years.

Box 4 – Basic Information on Ecosystem Services provided by Forests and Bamboo Growing

Forests play an essential role in support human life support systems, regulating local climates, water flow and nutrient cycles as well as supporting local biodiversity and respective habitats. Significant deforestation can lead to more frequent flash floods, soil degradation and landslides, and lower water retention in the dry season. In most refugee camps, except for Nu Po, the risk of flash floods and landslide is considerable.

TBBC cooperates with the Department of Agriculture of Thammasat University in bamboo growing both through plantations as community based initiatives and through the distribution of bamboo seedlings to individual households. The bamboo specialist from Thammasat University oversees the growing process of seedlings with regular site visits, mentoring a newly formed bamboo committee and the stipend workers from the camp who take care of seedling maintenance. His services are currently used mainly in Tham Hin camp. Another pilot bamboo project continues in Mae Ra Ma Luang and Mae La Oon camps and commenced in Nu Po (Figure 22).

Eucalyptus has the advantage of being fast growing and providing good quality shelter posts, however its fast growth comes at a cost – soil demineralization and high water consumption. In this case, as there is no forest surrounding the camp and the immediate benefits of eucalyptus growth can outweigh the disadvantages. However, in the long-term, priority should be given to bamboo and indigenous trees planting instead of eucalyptus trees. This would apply to other camps where eucalyptus is being planted – Mae Ra Ma Luang and Mae La Oon. In the forestation activities TBBC should ensure best practices continue to be applied best practices such as terrace planting and trenches as specified in the CAN handbook.

The CAN Programme in Umpiem is an excellent example of full compliance with environmental best practices. The best practices for bamboo planting and the CAN Programme are similar and therefore there is an opportunity to utilize the same field staff and training for bamboo growing and potentially in the form of agro-forestry.



Figure 22 – Bamboo Nursery at TBBC's Umphang field office

4.6.7 Community Based Natural Resource Management (CBNRM)

TBBC's efforts and resulting success with the Community Based Natural Resource Management Project (Box 5) in Nu Po and Mae Ra Ma Luang are evident. The one year project started in 2011 with support from the Regional Community Forestry Training Centre for Asia and the Pacific (RECOFTC also known as *The Center for People and Forests*). RECOFTC has been instrumental to ensure high level government support and authorization for these initiatives.

Box 5 – Community Based Natural Resource Management Pilot Project

The TBBC one-year pilot project aims to strengthen refugee and local Thai community cooperation in natural resource management and to explore sustainable and environmentally sensitive livelihood opportunities for both refugees and Thai villagers using the Community Based Natural Resource Management (CBNRM) model. CBNRM is a community driven approach that entails sustainable biodiversity conservation and ecosystem management. It fosters management of natural resources such as water, land and forest and helps to identify sustainable livelihood activities within specific natural environments. Such management capacities represent an effective tool to decrease potential conflict with neighboring Thai villages but might also prove extremely beneficial in a situation of refugees returning to Myanmar and recovering their livelihoods while preserving existing biodiversity and the natural environment. Multi stakeholder networks have been established in pilot areas, bringing together refugees, Thai villagers, local authorities, the Thai Department of Forestry, the Royal Thai Project, Sueb Foundation and CCSDPT organizations.

The project commenced in February 2011 in Nu Po and Mae Ra Ma Luang Camp. According to RECOFTC's progress report (February – July 2011), a total of 147 people were trained in Nu Po and 41 people in Mae Ra Ma Luang. The report states further training should be provided to ensure full capacity building. In Nu Po, the Environment and Forest Conservation (EFCG) was established as a result of this project and in order to work closely with the Nu Po Environmental and Forest Conservation Committee (NEFCC) – leadership and motivation are key drivers for the success of these pilot projects in refugee camps. NEFCC has five full time staff and collects seeds, manages

tree nursery and reforestation and cleaning activities under supervision of the wildlife sanctuary staff. The Environment and Forest Conservation Group (EFCG), setup also by RECOFTC, carries out forest assessment, plantation of bamboo in the camps and educational activities. TBBC supports NEFCC and EFCG with materials, tools and prizes for educational activities.

RECOFTC also states in the progress report that at Mae Ra Ma Laung, the conflicts among different agencies and stakeholders are more obvious making into challenging to successfully implement this project. During the visits to the different camps, the difference between refugee committees was evident and a key challenge for TBBC pilot projects.

If possible, depending on funds available, TBBC should make an effort to extend these projects to other camps in forest areas with on-going support from RECOFTC. These projects can be implemented for one to two years until the refugee committee is able to implement them on their own. TBBC and RECOFTC should also explore a closer collaboration with the forestry department for forest cleaning activities to reduce fire risk during dry season. In addition, TBBC should evaluate the need for any further additional higher level training by RECOFT in Nu Po and Mae Ra Ma Laung camp.

4.6.8 Fire Risk

All refugee camps are subject to regular fires within the camp and these can spread easily to the nearby forests. Their proximity to wildlife and forest areas means it is imperative to ensure any fire within the camp is quickly contained and extinguished. In the dry season, there are also frequent fires outside the camps as result of land clearing for agriculture practices. In camps such as Umpiem, Nu Po and Mae La the camp committees and refugees seemed well informed about how to act. Most houses have hooks to quickly bring down the roof tops and water/sand to put out small fires. Most camps have a surrounding fire protection line to reduce fire spreading to the nearby forests.

This is a relatively ambiguous area for TBBC, UNHCR and other NGOs. As TBBC provides shelter material and it should ensure their materials are used effectively by all refugees including reducing damage during a fire. TBBC carries out annual survey of households needs for shelter material and, if possible should monitor if households have the correct tools and knowledge for fire prevention. If not, these should be reported back to the camp committee for respective action – this might be the case for Site 1. Site 1 was the only camp visited where there was little interest from the refugee committee in fire protection and prevention activities and support. Inclusively the Thai camp commander complained about this fact. This shows the importance of proactive refugee committee interested in support safety and the well-being of all refugees.

The same applies, if during the TBBC annual survey, TBBC staff identifies houses at risk from flooding and tree/rock falling or landslides. The lack of land available for relocation is a key issue but nevertheless houses at risk should be reported to the camp for their consideration. From an environmental perspective this ensures the shelter materials are effectively utilized and last their expected term minimizing waste.



Figure 23 – Houses in Mae La (left) and Umpiem (right) at risk of landslide and flash flood, respectively.

4.6.9 Decommissioning

The refugees' prospects of returning to Myanmar are improving based on actions by the Myanmar government over the last year and the recent cease-fire agreements between the Karen and Karenni. In one of the refugee committee meetings in Tham Hin, one refugee mentioned the prospect of returning to Myanmar soon. With this in mind, the refugee camps could be decommissioned in the near future. One of the Thai camp commanders mentioned the expectation that NGO's, CCSDPT and UNHCR would return the refugee camps to their natural environment. Thereafter, the Royal Thai Government departments such as Forestry Department would take over full recovery. It is important the TBBC is well informed on the decommissioning phase conditions and government expectations regarding closure of the camps. If necessary, and when opportune, TBBC might need to prepare a decommissioning plan with all key agencies to ensure appropriate actions to mitigate the impacts of the camps on the environment and return the camp to its natural state.

4.6.10 TBBC Income Generation Program - Livestock Raising

Tham Hin camp has a TBBC income generation program which provides grants for livestock purchase, mainly for pig raising. As result, it is TBBC's task to ensure adequate environmental management of pig manure (Box 6). There are approximately 204 pigs (88 pig raisers) in Tham Hin which are closely monitored by TBBC and also the Livestock Department from the Royal Thai Government. TBBC provides training on environment practices and rules for pig raisers. The rules pertaining to the environment are highlighted below:

- Every pig has to be sold after raising for four to six months, to be used for commercial purposes. This reduces the size of pigs in the camp and their waste.
- A maximum of three pigs is permitted per pig raiser, and one person cannot have more than one pig house. This ensures the pig density is low and controlled.
- Every pig has to be in a pig house. This ensures a controlled environment for the pigs.
- Everyone who wishes to become a pig raiser must follow all rules and regulations which ensure people follow best practices.

The pig raising is located at a distance from the camp and river stream minimizing any potential impacts on water quality. The pig houses are relatively dispersed and can have to 1 to 3 pigs in each house which seems to be within the ecosystem's carrying capacity (further testing would be required to fully evaluate the current impact on soil and water). The pig house is covered with roof and

concrete floor which contains a tube for directing all the urine into the soil. This reduces any direct contamination beyond the pig house.



Figure 24 – Pig House at Tham Hin camp with roof cover and concrete floors

The pig manure is generally used by the refugees as natural fertilizer and it could potentially be used in TBBC's reforestation project at Tham Hin despite the distance.

Box 6 – Basic Information on Positive and Negative Impacts of Pig Raising

The potential positive impacts of livestock on the environment include fertilization of soil, stimulation of plant growth and therefore indirectly reducing water run-off. In addition, it provides additional income for refugees, potentially reducing their need to use forest resources.

The potential negative impacts from intensive pig raising could be water pollution, air pollution and soil pollution from excessive nitrogen, phosphorous and ammonia. Therefore, it is important to ensure the numbers of pigs in the camp are within the carrying capacity and do not lead to surface or ground water pollution in the camp and downstream, particularly in the dry season. As the level of impact depends on the pig density it might be relevant to monitor it using indicators such as number of pigs per hectare (rai) and number of complaints regarding water pollution in the camp and villages downstream.

4.6.11 Assessment of Forestry, Agriculture and Livestock

Good Practices by TBBC in Forestry, Agriculture and Livestock

- Supply of food, shelter and charcoal from TBBC reduces the pressure on forest area and wildlife considerably.
- CAN Programme handbook and film raising awareness on CAN Programme and environmental best practices.
- CAN Programme uses best environmental practices for agriculture and agro-forestry.
- TBBC supports reforestation activities and local shelter production mitigating the environmental impact of the refugee camps (e.g. cement post project, mud bricks, bamboo water leaching and bamboo planting).
- TBBC and partner RECOTFC support reforestation activities with local Thai communities, government agencies and refugees.

- TBBC Income Generation Project for Pig Raising follows best practices to minimize impact on environment.

Key Recommendations for Forestry, Agriculture and Livestock

- As mentioned in the TBBC Programme Report (January to June 2011), “*TBBC needs to further increase its advocacy work with Thai authorities including the Thai Forestry Department and also cooperation with RECOFTC on community-based natural resource management in order to explore possibilities for alternative shelter material procurement lines. This suggestion includes further need for TBBC to expand its bamboo and tree planting activities*”.
- TBBC should continue to support reforestation activities with RECOFTC in camps particularly where the carrying capacity has been exceeded and there is no surrounding forest area such as Umpiem and Tham Hin. TBBC should also explore use of pig waste as fertilizer for reforestation projects following CAN best practices.
- Explore opportunity with RECOFTC and Thai Authorities to support forest cleaning activities to reduce forest fire risk in the area. Activities could be monitored by forestry department.
- Evaluate results from pilot projects for mitigating impact on forest areas in Nu Po camp. If successful extended these to other camps and evaluate need for additional staff to carry out these projects successfully.
- If possible, despite its advantages, avoid eucalyptus planting as it is not an indigenous tree, and its fast growth is due to high water absorption and fast soil demineralization.
- Continue to disseminate CAN Programme handbook and film and other effective CAN promotional materials.
- Opportunity for greater integration and synergies between CAN staff and forest activities including agro-forestry.
- Continue to monitor pig raising in Tham Hin camp as pig density increases to ensure it does not exceed carrying capacity and impact on environment is kept to a minimal.
- Opt for bamboo water leaching rather the bamboo smoking using waste incinerator.
- During annual survey monitor warehouse and household landslide, flood and report to camp committee to minimize shelter material loss.
- As mentioned in the physical planning assessment, the Nu Po CAN Programme is located near waste incinerator and open air waste pit containing batteries. TBBC should evaluate resulting contamination of vegetables, soil and water and report situation to refugee camp committee for relocation of open waste pit.

4.7 Assessment of Chemical Effects

There are four items that TBBC manages on daily basis which can have potential adverse impact on the environment (see Box 3):

- Charcoal
- Cooking Oil (soya bean)
- Fish Paste
- Packaging and containers

The chemical effects of the four items are assessed in the above sections, particularly **Physical Planning** and **Water and Sanitation**. TBBC does not use any man-made fertilizers or pesticides in its activities. Rice fumigation using methyl bromide is applied by specialized staff in camps where

rice is stored for a minimum of 6 months – Mae La Oon and Mae La Ma Ruang. According to TBBC, the fumigation process complies with United Nations World Food Program requirements.

4.7.1 Assessment of Chemical Effects

Good Practices by TBBC in Chemical Effects

- Rice fumigation by trained staff and carried out according to the United Nations World Food Programme regulations.
- No use of man-made fertilizers and pesticides in the CAN Programme.
- See good practices regarding **Physical Planning** and **Water and Sanitation**.

Key Recommendations for Chemical Effects

- Continue to monitor and report any spills and provide regular training to TBBC field staff and refugee staff at the warehouses.
- See key recommendations regarding **Water and Sanitation** and **Physical Planning** in particular relocation of CAN Programme in Nu Po due to proximity of waste incinerator and open air waste pit containing batteries.

4.8 Assessment of People, Social Services and Education

TBBC provides regular training to TBBC field staff, camp committee, local Thai villagers and refugees for a number of activities and pilot projects. All training activities are reported in TBBC's Programme Report. The key challenge for TBBC is the high turnover of refugee staff particularly volunteers. These volunteers are responsible for managing some of the warehouses tasks including cleaning, verifying correct unloading/loading process, etc. If possible, TBBC should ensure these volunteers are trained and if turn-over regular, TBBC should opt for part-time staff to ensure staff is familiarized with TBBC's best practices.

A total of five pilot projects have or are being setup in Nu Po camp which contribute to reducing the impact on the refugee camp on environment. All these projects involve significant amount of dedication and training. The reason for the high number of projects is the location of the camp in the wildlife sanctuary which warrants particular attention but also the enthusiastic and proactive support of the refugee camp committee. The success of these projects depends on dedicated refugee staff and regular support and monitoring from TBBC field staff. TBBC should verify the need for additional staff to support all these pilot projects at Nu Po. Although working with less active refugee camp committees is a challenge, if possible, TBBC should continue to pursue and extend these projects and training to other camps and not only Nu Po, particularly the CAN Programme.

4.8.1 Assessment of People, Social Services and Education

Good Practices by TBBC in People, Social Services and Education

- Successful and on-going training provided for CAN Programme, CBNRM and other pilot projects that mitigate adverse impact of the refugee camps on the environment.

Key Recommendations for People, Social Services and Education

- Ensure all volunteer refugee staff at warehouses are trained and if necessary hire part-time staff if there is high rate of turnover of volunteers.
- Consider including environmental reporting in the TBBC Programme Reports and adoption of environmental policy principles by TBBC management.

- Consider requesting field staff to suggest a measure to reduce TBBC's environmental impact in each camp and for which they would be responsible for implementing and monitoring.
- Evaluate need for additional TBBC staff at Nu Po to manage and monitor all five pilot projects. If funding is made available, consider extending some successful pilot projects to other refugee camps which have no pilot projects.

5. Summary of Assessment and Key Recommendations

The aim of this section is to provide an overview of the **main** adverse environmental impacts identified at the refugee camps resulting or associated to TBBC’s activities. Table 4 lists the impacts, assesses these against qualitative criteria and highlights realistic recommendations for possible action by TBBC. Table 5 includes the criteria used for the assessment and identifies the several levels of environment impact possible to support Table 4. The impacts highlighted in Table 4 are those that require immediate / on-going action by TBBC. Note that the report also includes additional recommendations for TBBC to minimize the impact on environment and which require minor action by TBBC. The assessment is qualitative as no soil, surface water or ground water samples were taken for laboratory tests in any of the camps.

Table 4 – Assessment of the Main Adverse Environmental Impacts from TBBC’s Activities and Recommendations for Possible Action

Component ¹	Adverse/Negative Impact	Assessment of Environmental Impacts			Recommendations
		Durability	Significance	Reversibility	
Procurement and Logistics	High consumption of charcoal and poor quality of charcoal sack resulting in adverse impact from charcoal dust on air, water and soil quality.	High quantity	High quantity		Request supplier to improve quality of charcoal sack, avoid reuse of charcoal sack for erosion/flood protection purposes. Ensure charcoal distribution within an adequate location and not outside the warehouse. Ensure adequate stacking of charcoal sacks. Additional efficient cooking stoves could potentially reduce charcoal demand, although this will need to be assessed by TBBC.
	High use of heavy transportation for supplies.		High quantity	CO ₂ emissions	There is an opportunity to improve charcoal distribution in Site 1 and reduce respective transportation. There is also an opportunity to include environmental criteria in the procurement process to minimize impact of transportation and introduce best practices.
Physical Planning	Location of TBBC warehouses in areas with high risk of flooding and landslides in rainy season. Potential disaster and spill could impact significantly water and soil quality.	Depending on resulting spill and carrying capacity			TBBC should consider relocating two small charcoal warehouses located near water stream prone to potential flash floods in Site 1. In addition, TBBC should dismantle a poor quality charcoal warehouse in Site 1 and replace with an adequate warehouse following TBBC’s existing best practices. Umpiem charcoal warehouse has a high risk of landslide – location should be reconsidered. TBBC should monitor other warehouses in all nine camps for any high risks including ensuring charcoal warehouses are fully enclosed to avoid degradation of air quality.

	Location of CAN Programme in Nu Po camp next to incinerator and open waste pit containing AA batteries with heavy metals – risk of contamination to soil, surface and groundwater and food chain.	Lead poisoning			Although the management of waste is not the responsibility of TBBC, this issue should be presented to the refugee camp committee to avoid contamination of local water resources and food chain. TBBC should closely monitor and evaluate level of contamination at this stage.
Water and Sanitation	Cooking oil, charcoal and fish paste and their potential impact on water and soil quality in daily management.	High quantity	High quantity	High quantity	The number of spills at TBBC’s warehouses is minimal. However, cleaning activities should continue to be monitored and volunteer refugee staff should continue to receive regular training to ensure minimum impact.
	Waste originating from TBBC’s activities and supplies at the refugee camp.	High quantity	High quantity	Tin	Most packaging is reused by refugees. Charcoal sack and cooking oil tins should not be used for erosion or flood protection purposes due to their characteristics and potential adverse impact on the environment.
Food					
Energy	Soil and water contamination due to poor management of TBBC’s small generator by refugee camp committee.				TBBC should provide basic training to generator manager, refugee committee for correct disposal and management of diesel tins as well as generator operation. Diesel generator warehouse should be improved due to proximity to water stream and lack of concrete flooring.
Forestry, Agriculture and Livestock	High population density and pressure on forests and wildlife.		High density	Depends on the camp	If funds are made available, TBBC should continue to extend its successful CAN and forestry projects with partner RECOFTC to other camps and exploring opportunities for agro-forestry. TBBC should evaluate other on-going pilot projects and extend these to other camps beyond Nu Po – particularly Umpiem and Tham Hin.
	Use of Eucalyptus in reforestation projects leading to soil demineralization and high water consumption in the long-term				TBBC should prioritize on plantation of local indigenous trees and bamboo instead of Eucalyptus. Forestration projects should be implemented particularly in Tham Hin and Umpiem where the carrying capacity has been exceeded.

1 - Sida’s Guidelines for the Review of Environmental Impact Assessment - Humanitarian Assistance. Note: In some cases the components in Sida’s guidelines are closely interlinked.

Table 5 - Criteria for Evaluation of the Level of Environmental Impacts of TBBC’s activities

Durability¹	Less than 6 months	6 to 12 months	Over 1 year
	Short Term	Medium Term	Long Term
Significance²	Not Significant or Slightly Significant		
	Significant		
	Very Significant		
Reversibility³	Reversible		
	Irreversible		

1 – Long-term or short-term exposure to the impact. 2 – A significant to very significant environmental impact is one that cannot be avoided or mitigated. 3- Reversibility is the ability to restore the natural conditions of the ecosystem after the lifespan of the refugee camp.

6. Annex I – Methodology and Key Questions

6.1 Procurement and Logistics

This involved a review of TBBC's procurement manual and interview of staff responsible for procurement and logistics at TBBC. The objective was to understand how transportation is managed, what kinds of products are transported and their characteristics, and identify any opportunities for improvements (e.g. maximize efficient transportation). The assessment and interview were conducted at TBBC's headquarters in Bangkok on the 11th January 2012.

6.1.1. Key Questions

Interviewees: Procurement Manager (Apatchana Goetz) and Logistics Manager (Krisana Atsawasrisakulchai) and Andrea Menefee (Nutrition Technical Specialist)

Supporting Documents: Procurement Manual – July 2011, list of products transported and their characteristics.

1. What are the types of transportation used by TBBC? What types of food and fuel are delivered? How are these delivered (level of containment, refrigeration etc.)?
2. Does the transportation apply only to refugee camps? Or is there transportation within the camps or to other locations? How is local produce transported?
3. How is staff transportation managed?
4. Is transportation planned as efficiently as possible? How?
5. Are there opportunities to reduce transportation? Opportunities to work with other NGO's for effective transportation?
6. Have measures been planned for environmental satisfactory procurements? If yes, which measures? Are these specified in the procurements and monitored/verified?
7. Do trucks come back empty from the camp after delivery? Opportunity to bring waste for adequate disposal or treatment?
8. The procurement manual does not seem to cover environmental aspects – could this be included in the manual – for example – criteria – tenderers must perform in accordance with environmental laws and best practices – e.g. maintenance of vehicles, eco-driving, etc?
9. What is the procurement process for food sourcing?

6.2 Physical Planning

The nine refugee camps in which TBBC has an active role, belong to and have been selected by the Ministry of Interior from the Royal Thai Government and are considered to be temporary (e.g. no use of cement for construction). This limits possible mitigation measures to be implemented by TBBC and selection of location of TBBC facilities and their characteristics. However, TBBC is involved in the physical planning of agricultural and forest areas. This fact is reflected in the questions below.

6.2.1. Key Questions

Interviewees: TBBC field staff involved agricultural and forest related activities. Thai Department of Forestry and experts at the Regional Community Forestry Training Centre at Nu Po.

Supporting Documents: UNHCR report on *Disaster Risk Management in Refugee Camps along the Thailand – Myanmar Border*, RECOFTC report on *Strengthening Local Communities and Support Organizations through a CBNRM Approach and Capacity Building in Burmese Refugee Camps and Neighboring Communities*.

1. What is the criteria for choosing the locations for agricultural and forestry products (i.e. material for shelter such as bamboo and eucalyptus)? What is the impact on local biodiversity, ground and surface water, etc? Any measures to minimize erosion such as terrace planting?
2. How is drainage managed and maintained?

3. How is planting carried out? What species? Are these local species or non-invasive?
4. Are fertilizers or pesticides used? Opportunity for use of organic fertilizers?
5. Is TBBC responsible for returning the locations to their natural condition upon conclusion? If yes, what is the plan? Any maintenance activities undertaken?
6. Do these activities conflict with any activities undertaken by local people? Opportunities for involving local people or Ministry of Forests? Produce used exclusively for refugee camps by TBBC?
7. If located in wildlife sanctuary what is the level of impact caused by these activities and local activities (e.g. significant illegal logging in the area, etc)?
8. What are the risks of land sliding particularly during flood periods? Is the soil left bare in any month of the year? What is the average slope level at the camp?
9. What type of training is provided to refugees in the agriculture and forestry related activities? Are their activities monitored regularly to minimum impact on the environment?
10. The shelter materials used have a minimum effect on the environment and are locally sourced? What are the materials used? Can these be recycled/reused or destroyed in an environmentally satisfactory way? Any opportunities to improved or upgrade existing shelter materials?

6.3 Water and Sanitation

TBBC is not directly involved in water and sanitation management at the refugee camps. However, TBBC's activities can directly or indirectly impact ground and surface water sources. These are related to TBBC's warehouses, livestock project supported by TBBC, and rented land for agricultural and forestry purposes.

6.3.1. Key Questions

Interviewees: Shelter Expert (David Curmi) and TBBC field staff

1. What are the criteria for choosing the locations of the warehouses and land rented by TBBC? Are the warehouses set up and owned by TBBC?
2. Any measures in place in case of spill at the warehouse? Training provided to staff? What quantities of each food and fuel products are in the warehouses – worst case scenario?
3. What type of training is provided to staff? Are their activities monitored regularly to minimize impact on the environment? Any measures to minimize water usage?
4. Any activities conducted by TBBC that have a direct or indirect impact on water resources?
5. What type of waste is generated at the warehouse and other TBBC activities? Any hazardous waste? How is this waste dealt with? Any impact of waste generated on water resources?
6. Is drinking water sourced from ground water and used by TBBC staff? What is the situation in terms of water availability?

6.4 Food

The TBBC's key activity is to provide food to the refugee camps. The transportation and food warehouse location were assessed in sections 6.1 and 6.2. This section focused particularly on food sourcing, storage and disposal.

The disposal process was assessed during an audit to the camps. The food sourcing was assessed based on interviews with TBBC expert staff at the Bangkok headquarters.

6.4.1. Key Questions

Interviewees: Nutrition Technical Specialist (Andrea Menefee), TBBC field staff and refugee camp committee.

1. Is the food culturally acceptable?

2. Is food selected in such a way that the use of energy for transport, packing, handling and cooking is minimised?
3. Are packaging materials recycled/reused/biodegradable?
4. How is food waste managed at each refugee camp? What other waste disposal mechanisms exist at the refugee camp? Is waste food recycled in hygienic composting systems? What is done to minimize food waste? How is waste cooking oil managed? Are there opportunities for cooking oil collection?
5. How is the charcoal ash from the cooking stoves managed at the refugee camps?

6.5 Energy

The assessment covered mainly energy use at TBBC's offices, warehouses and use of fuel for the cooking stoves and generator.

6.5.1 Key Questions

Interviewees: TBBC headquarters office manager, other TBBC offices, TBBC field staff.

Supporting Material: TBBC headquarters electricity bills over the last year. Report on *Energy Supply to Burmese Refugees in Thailand: A Follow-up Evaluation for the Burmese Border Consortium*, Report on *Review of Fuel Supply to Refugees on the Thailand/Myanmar Border*.

1. What are the types of fuel provided and used by TBBC at refugee camps? Are these sustainably sourced locally? Are there opportunities to use waste biomass for non-residential applications?
2. Does TBBC own any generator or electrical equipment at the refugee camps? If yes, how are they managed? What fuel used for generator?
3. Are energy-saving stoves and cooking equipment provided by TBBC?
4. What type of lighting used at the refugee camps in TBBC activities? CFL?

6.6 Forestry, Agriculture and Livestock

The objective of this component was to assess the interaction of the refugee land-use with the possible other land-uses such as agriculture, forestry and livestock to avoid any conflicts with local population. Recently TBBC expanded its bamboo plantations, setup a pilot community forest management project together with Thai authorities and pilot roofing leaf production and bamboo preservation projects.

This involved a brief visit to the surrounding areas (1-2 kms from the refugee camp) and conversation with TBBC field staff, organization partners, Thai government entities and local people. The Regional Community Forestry Training Centre is a good example of interaction between natural resource management, biodiversity preservation and was covered in the visit to Nu Po refugee camp.

6.6.1 Key Questions

Interviewees: TBBC field staff, particularly at Nu Po, Regional Community Forestry Training Centre staff and Thai authority, local people if possible, staff responsible for pilot projects.

Supporting Material: RECOFTC report on *Strengthening Local Communities and Support Organizations through a CBNRM Approach and Capacity Building in Burmese Refugee Camps and Neighboring Communities*.

1. Are there more details available on the pilot projects? Any other pilot projects under development? Other projects undertaken by other agencies? How is the local community involved? What is the opinion of the Thai authorities and local people on these projects?
2. The Karen people are well adapted to the living in the forest areas in a sustainable way – can any lessons be taken from their approach?

3. Are there plans for long-term sustainable forestry in the refugee areas? What are the key outcomes of the pilot projects? If successful, can these be implemented in other refugee camps with support of Thai authority?
4. Is sustainable agricultural production encouraged or negatively affected in the area?
5. Can the project diminish, directly or indirectly, the possibilities available to the existing local population of moving into or using natural resources inside or outside the project area? Are there plans to minimise any such effects?
6. Can the project lead to conflicts in respect of the present use or tenure of the land?
7. Are there plans to minimise such conflicts and preparedness for conflict resolution?
8. Does TBBC own or is responsible for livestock at the camps?
9. Does TBBC have measures in place for reducing forest fire – particularly at Nu Po?

6.7 Chemical Effects

Charcoal and generator fuel storage location and management were evaluated during the audit/visit to the refugee camps. It involved qualitative assessment of storage location, management and space as well as interviews with local staff to understand preparedness in case of spill, flood, landslide, fire or soil contamination.

6.7.1 Key Questions

Interviewees: TBBC field staff, TBBC shelter expert (David Crumi)

Supporting material: List of all relevant products provided and used by TBBC at the refugee camps and if possible information on their composition.

Will the project:

1. Use chemicals which are difficult to break down?
2. Have the result that large areas are exposed to chemicals?
3. Result in an increased or decreased risk that chemicals are unintentionally spread, for example by air, water or via food chains, through the use of chemicals, or through poor storage conditions or inadequate facilities for the destruction of waste products?
4. Contribute to a situation in which untrained personnel handle chemicals?
5. Result in acute and/or long-term health hazards for personnel who handle chemicals or for the population in the area?

If so are there proposals for measures to be taken to reduce/control the use of chemicals and to reduce negative effects on the environment, as well as plans to train personnel in handling chemicals and providing them with adequate protective equipment?

6.8 People, Social Services and Education

This component covers mainly the refugee camp site, its daily operation and services provided. To assess this component, an audit of the refugee camp and interviews with TBBC and local staff was required to understand daily operation tasks, training on environmental issues and how these affect the local environment.

6.8.1 Key Questions

Interviewees: TBBC organizational development manager (Ray Leclair) and other TBBC staff

Supporting material: None

1. Are there plans for education and training and common activities in local environmental issues? What training is provided in the warehouses, agricultural and forestry activities involving TBBC?

7. Annex II - General Checklist for Visit/Audits to Refugee Camps

Interview local TBBC camp staff to find out all activities undertaken by TBBC in the camp and training received	
Visit TBBC regional offices and other agencies such as UNHCR	
Visit TBBC warehouses to understand storage process and possible impacts	
Visit TBBC rented land for agricultural and forestry practices	
Visit TBBC offices in the refugee camps	
Visit and interview households	
Visit surrounding areas of the refugee camps	
Interview other relevant key stakeholders	
Interview local Thai people in the vicinity of the refugee camp	
Inspect water availability and usage, waste water disposal, waste disposal	
Inspect energy usage, electrical equipment and lighting	
Inspect slope, flood-risk, land slide risk and drainage/water run-off	
Inspect livestock projects supported by TBBC	

8. Bibliography

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