2.9. EIA Survey of the Development of Sierra Pampacche Cloud Forest Park

2.9.1. Objectives of the EIA Survey

Based on the results of the IEE, present pristine forests will enhance and improve its nature tourism values by the Project, which includes climbing mountain railing-cart, canopy walk, and trekking trails. As the trekking trail is developed from the Quejá community, the Project will contribute the local economy such as the generation of the alternative sources of income for the local peoples. However, the trailing-cart and canopy walk may cause disturbance of the present habitats of the wildlife and the present natural landscape. It is concluded that the Project needs an EIA survey.

The objectives of the EIA Survey are: to identify/evaluate possible environmental impacts, which could be caused by the project based on the available data/information and field reconnaissance; to analyze/forecast possible environmental impacts, to propose mitigation measures for possible significant adverse environmental impacts as necessary; and to recommend environmental monitoring plan.

2.9.2. Description of the Project

(1) Background

Sierra Pampacche is located to the north of the town proper of San Cristóbal Verapaz in Alta Verapaz Department. The area constitutes part of the Verapaz Eco-Corridor, and is one of invaluable forested areas. The area, however, is under the risk of deforestation due to tough socioeconomic situations of local communities.

In this context, it is recommended to develop a cloud forest park in Sierra de Pampacche for use as a tourism attraction thus contributing to the improvement of the economic conditions of the local communities. It is noted that the forest park is to be integrated as part of the Community Tourism of San Cristóbal Verapaz as an anchor tourism attraction of the community-based tourism development project.

(2) Site location and main components of the Project

The candidate development site is located in the Municipality of San Cristóbal Verapaz, in Alta Verapaz Department.

Projects components include the improvement of trekking trails with information and signboards, construction of resting huts, benches and observation decks, a railing-cart that plies between the community and the top of the mountain, and canopy walkways for observing rainforest, eco-lodge in the forest, and re-forestation within the area.

2.9.3. Present Environmental Conditions of the Project Area

(1) Natural environment

a. Climate

The rain pattern in Cobán, which is the nearest *INSIVUMEH* station of the Project site, varies between 1,985 mm and 4,100 mm of annual precipitation.

b. Landscape

The landscape in the Project site of the high mountains is significant and amazing, with lower hills nearby, at the highest part of the mountain with slopes and rock formations of color gray and white. The predominant color is green from the foliage, with mixtures of dark broom from the recently deforested soil.

c. Characteristics of ecosystem

The main area of the Project site belongs to the Pluvial Forest Montano Low Subtropical (bp-MB) life zone.

The flora of the surrounding areas mainly consists of oak, pine in the cloud forest.

The fauna of the surrounding areas has considerably reduced due to the deforestation; some of the remaining birds are Quetzal and Quail. There are some wild animals such as lizards and rodents.

d. Geology and geomorphology

Because of its location at the mountainside of Pampacche, the slope is moderate, allowing access to agriculture activity, but some of the top slopes are rough and inaccessible.

The soils of the Project site are of little depth, developed from a sedimentary, which were fragmented during its formation. The soils have in average an effective root deepness of 30 cm, with a texture of Plastic clay with a dark brown color.

e. Hydrology

The surface water bodies near the Project site is the Waterfall Quejá, which flows to the Chixoy River.

f. Water quality

In order to understand the conditions of the water quality and bacteria conditions in the Project site, the water sampling was conducted on December 19, 2001.

The water in the Project site is suitable for human consumption from the physical, chemical, and bacteriological points of view, according to the Guatemalan regulations for drinking water.

The waterfall Quejá has to be disinfected to fulfill the regulation mentioned before; according to the international regulation used in Guatemala it may be used for recreational purposes.

g. Noise

In order to determine the sound levels in the surroundings of the Project, some measurements where conducted in different parts.

The noises levels do not exceed the maximum limits of the Guatemala's standard for a residential area.

(2) Socio-economic environment

a. Demography

The population of the municipality of San Cristóbal Verapaz in Alta Verapaz, in the rural area as well as in the urban area are identified in its majority as belonging to the Mayan ethnic group Pocomchí.

b. Main economic activities

The main economic activity of the zone is agriculture of coffee, cardamom and citric, for the commercialization in local markets, there is also agriculture of subsistence for own consumption as corn and beans. The commerce is at a small scale and for consumption of products of basic needs.

c. Public facilities

The village of Quejá has electric system in some parts, but no system for electric distribution, the system for drinking water is partial and its coverage is not enough, there is no sanitary drainage system, only some houses have pipes. The life conditions are difficult due to the lack of basic services and the difficult access to the place.

d. Wastes

The population generates 0.40kg/day garbage per person; from this 75% are food residues. The majority of the local peoples deposit garbage in empty sites near their houses. The municipal authorities of San Cristóbal Verapaz have planned a future project for improvement of collection and disposition of wastes.

e. Rights of common

There is an ancestral right for the natural resources such as soil and water in the Project site. In the local communities, there are committees for the improvement of the community managed by community leaders, who represent and decision making among the local authorities.

2.9.4. Environmental Impacts

A multidisciplinary professional group (AD-hoc Committee) was formed for the Environmental Impact Assessment and the EIA Survey with experiences in environmental, social and health sciences that considered the legal, technical standards and those related to the environmental and health protection. Then, the committee proceeded to identify and evaluate the actions of the Project that could cause environmental impacts on the area.

The group of the experts that took part in the EIA, which are identified the possible impacts on the environments at the following phases:

- Project Construction Phase
- Project Operation Phase

(1) Project construction phase

The possible environmental impacts caused by the construction activities of the Project are as follows:

- Economic activities, employment: The different types of the construction works could generate the job opportunities for the local peoples;
- Fauna and flora: The construction of the trekking trails, canopy walkway, and eco lodge will accelerate deforestation and the disturbance of the habitats fauna and flora, so the impacts will be slight adverse; and
- Landscape: The construction works of the trekking trails could show an unpleasant image inside the green mountain, so the impact will be slight adverse.

(2) Project operation phase

The possible impacts on the environment due to the operation of the Park are the followings:

- Erosion processes: The reforestation components as well as the operation and maintenance of the facilities could mitigate the erosion processes;
- Fauna and flora: The Project will cause slight favorable impacts for the conservation of the forests mainly due to the reforestation Project components;
- Landscape: The reforestation components as well as the operation and the maintenance activities of the Park will cause slight favorable impacts on the present landscape; and
- Economic activities, employment: The Project will cause slight favorable impacts for the employment opportunities that the different activities of the Park will offer.

2.9.5. Analysis of Alternative Plan

The possible impacts on the environment in the Project site without the Project are the followings:

- Economic activities, employment: The present situations of the regional economy and job opportunities will not changed, if the Project were not implemented;
- Erosion processes: The erosion process at the Project sites, including steep and deforested areas, will not be improved, if the Project were not implemented;
- Fauna and flora: Present fauna and flora will not be changed, if the Project, including the construction activities of the proposed facilities and reforestation were not implemented; and

- Landscape: Present natural landscape compositions will be maintained, but not will be recovered, if the Project particularly in the reforestation components were not implemented.

2.9.6. Mitigation Measures for Adverse Impacts

In order to mitigate the possible adverse impacts, the following measures could be proposed:

(1) During the preparation phase

All the related institutions, such as *INGUAT*, Ministry of Public Health and Social Assistance, Ministry of Environment and Natural Resources (*MARN*), the National Forestall Institute, National Commission for Protected Areas (*CONAP*), and the Municipality of San Cristóbal Verapaz, should approve the Project.

It is also very important to elaborate the development plan with the municipality of San Cristóbal Verapaz and the local community.

The Project should be designed taking into account of the present natural landscape.

The treatment of liquid wastes by septic tanks and absorption wells or infiltration fields should be considered based on the recommendations of the Ministry of Public Health, having special care in determining the infiltration capacity of the land.

It needs to prepare an operation and maintenance manual for the facilities including the septic tank and the absorption well or infiltration field.

It is prepared a protection plan for the forest, which will include a program for the forest keepers with the participation of the community.

(2) During the construction phase

The Project area should have sanitary services and services for the collection of the wastes for the workers.

It should be avoided cutting trees and try to hire the construction workers from the community.

The trekking trails should be built in a winding way in order to avoid the disturbances of the present ecosystems.

It needs to check the manual for the operation and maintenance of the facilities, including treatment of the residual waters. It should be reforested with local species and to be created nurseries with the purpose of continuing the reforestation of the Project site. The reforestation should be done, particular in the erodible site.

(3) During the operation phase

The program of maintenance management should be integral, facilities, and services, as well as the forest. The person in charge of the operating in the Park should be trained and be followed the regulations.

INGUAT and *CONAP* should prepare the training program for the communities and the promotion program for the effective Park operation.

It needs to consider for creating a green belt surrounding the Park with native species at the surrounding site.

It needs to place identification/information signs for the Project and its activities.

2.9.7. Environmental Monitoring Plan

(1) Environmental monitoring plan

With the purpose of conserving the environment and human health, the following monitoring activities should be done:

- Follow up and evaluate each phase of the mitigation measures; and
- Once the Park is operating, it should be evaluated every six months by the sanitary authorities to guarantee the fulfillment of the standards and regulations for the protection of the health and comfort of the users.

(2) Recommended mitigation and monitoring cost

Develop the municipal and community plan	US$	3,000
Study of treatment for residual waters	US$	2,000
Preparation of the manual for operation and maintenance	US$	2,500
Develop the reforestation plan with community participation	US$	1,100
Sanitary services and disposition of wastes for workers	US$	700
Reforestation and conservation of soils	US$	6,000
Training of personnel	US$	1,800
Education program for the community	US$	1,200
Signaling of the road	US$	1,500
Total	US$	18,800

2.9.8. Conclusion and Recommendations

(1) Conclusion

In terms of the Environmental Impact Assessment (EIA) Survey of the "Development of Sierra Pampacche Cloud Forest Park", it is concluded as follows:

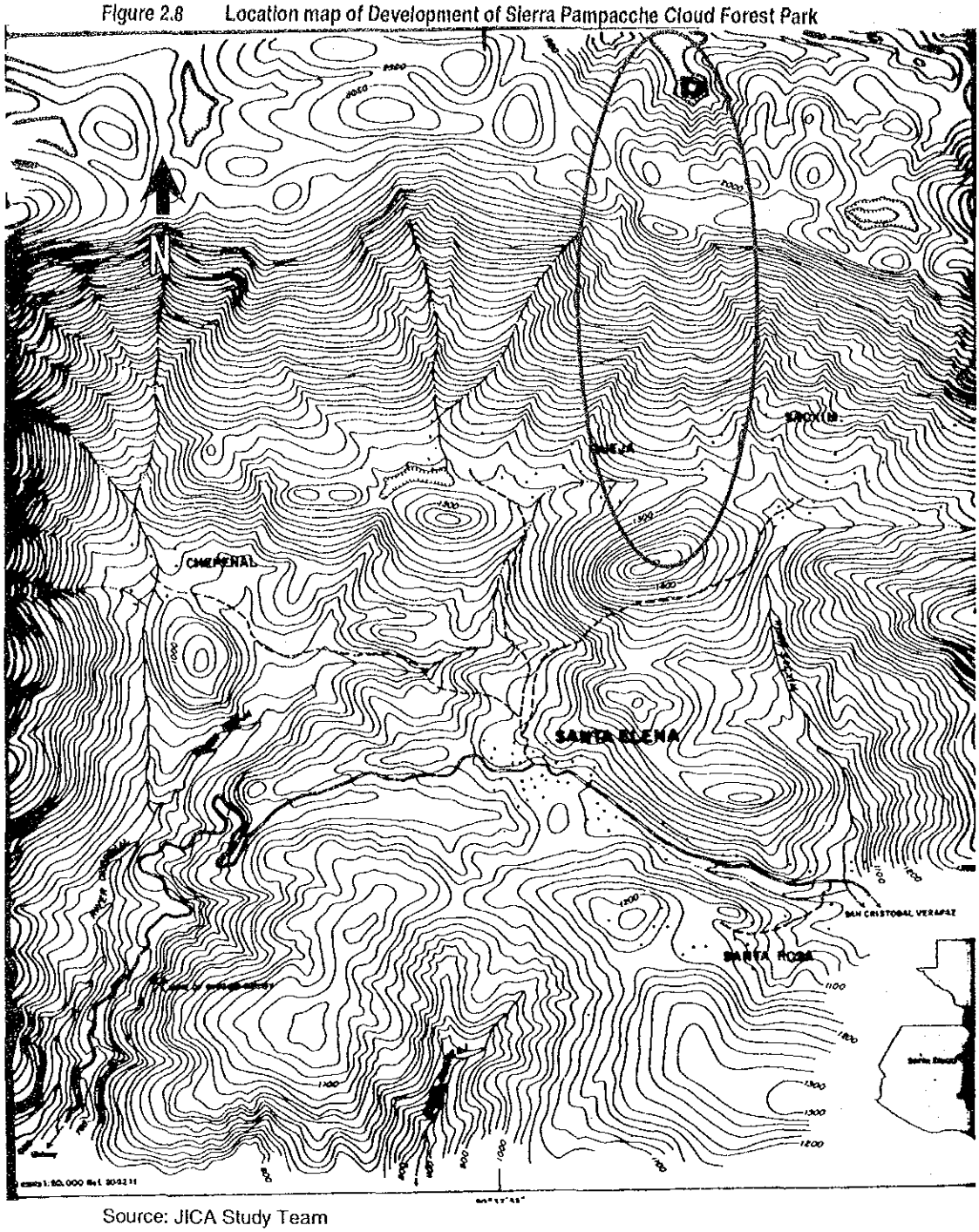
- In general, Development of Sierra Pampacche Cloud Forest Park Project will not cause serious adverse impacts;
- However, it needs to elaborate the Project development plan with all stakeholders, in particular the surrounding forests owners in order to avoid the user conflicts; and
- Reforestation should include as the one of the Project components.

(2) Recommendations

In order to mitigate possible significant adverse impacts and to promote favorable impacts by the Project, it is recommended that the following actions should be considered:

- It needs to build the Park with all the architectural, sanitary requirements of the work with the present landscape and nature;
- The final disposition of liquid wastes after being treated in septic tanks should be done in infiltration fields or absorption wells, which needs sanitary studies;
- The construction work of the Project should be taking into account of the conservation forests and prevention from possible soil erosion;
- It needs to develop a program for the management of the solid wastes for segregating the organic wastes and the others; and
- It needs to consider the installation of a community plant nursery to continue reforesting the capital of the basin and influence area of the Park.

Figure 2.8 **Location map of Development of Sierra Pampacche Cloud Forest Park**



Source: JICA Study Team

2.10. EIA Survey of the Development of Poncho Textile Museum and Demonstration Workshop

2.10.1. Objectives of the EIA survey

Based on the results of the IEE, high quality and unique textiles will be core tourism products for vitalizing the local economy in Momostenango community. The Project will contribute to enhance the local economic activities. However, the proposed exhibition and interpretation building may cause soil erosion and related water contamination due to the erodible location. It is concluded that the Project needs an EIA survey.

The objectives of the EIA Survey are: to identify/evaluate possible environmental impacts, which could be caused by the project based on the available data/information and field reconnaissance; to analyze/forecast possible environmental impacts, to propose mitigation measures for possible significant adverse environmental impacts as necessary; and to recommend environmental monitoring plan.

2.10.2. Description of the Project

(1) Background

Momostenango is well known for the production of wool blanket (poncho) throughout the country. This satellite exhibits traditional Ponchos (blanket) of various designs, demonstrates the weaving process, and sells the products.

(2) Site location and main components of the project

Momostenango town is located in the Municipality of Momostenango, in Totonicapan Department. The project site is 40km north from Quetzaltenango City and 15km from department capital City of Totonicapan.

This Project consists of the construction of a building with the following specifications: area for exhibition and interpretation, front desk, training workshops, offices, warehouse, exhibition, sales room, bathrooms and septic tank for primary treatment of residual waters, in the area of Momostenango. The area of the building will be of approximately 300 square meters, with two floors and a concrete structure.

2.10.3. Present Environmental Conditions of the Project Area

(1) Natural environment

a. Climate

The total rainfall of a year is approximately 950 mm, which are mainly from May to November. The temperature of the surrounding site varies from 12 °C to 27 °C.

b. Landscape

The landscapes of the Project site at the entry to the proposed Museum site are some serial views of the houses and commercial area, with some clearings to the boulevard and view to the sky.

c. Characteristics of ecosystem

The Project site mainly belongs to humid forest low subtropical (bh-MB) life zone.

The tree formations are mainly Coniferous, which have been cut to sell to sawmills and for fuel. The more common species are pine, cypress, and others.

The major fauna has been reduced due to the intervention of human activities, but some birds such as wild pigeons and some lizards and rodents are found in the site.

d. Geology and geomorphology

The soil of the Project site is erodible. The erosion is defined alluvial movement of the soil particles by natural agents, such as wind and water; these may be also caused by human activities.

Slopes in an average from 4% to 23% define the town topography of the surrounding site.

e. Hydrology

The surface water body near the Project is the Pala River, which flows to the Chixoy River. The Pala River, which is a reservoir for the drainages of the town area of Momostenango.

f. Water quality

In order to understand the conditions of the water quality and bacteria conditions in the Project site, the water sampling was conducted in the Pala River on December 14, 2001.

The water quality of the Pala River are not suitable for drinking water, because it is the reservoir of residual waters, the water in the Pala River could be used for recreation use.

g. Noise

In order to determine the sound levels in the surroundings of the Project, some measurements were conducted in the Project site.

The noises levels in the Project site do not exceed the maximum limits of the Guatemala's standard for a residential area.

(2) Socio-economic environment

a. Demography

The population of the municipality of Momostenango (Totonicapán), in the rural area as well as in the urban area is identified in its majority as belonging to the Mayan ethnic group, *Quiche* speaking. At a departmental level, 94.5% of the Totonicapán population is indigenous. At the municipality level, 95.2% of the population is indigenous.

b. Main economic activities

The main economic activity of the Momostenango is agriculture, commerce and manufacturing of Ponchos. The municipality is considered as the greater in smallholdings, so in many cases the agricultural activity is not enough for the subsistence of the families, this has caused that the population dedicates mostly to commerce and textile manufacturing. This activity is in danger of disappearing because the prices of the ponchos cannot compete with the ponchos industrially manufactured.

c. Wastes

The municipal system for wastes collection is deficient; they pick up the wastes once a week and deposit them in the three sites. These sites do not fulfill the sanitary requirements for waste disposal. There are also some illegal dumpsites in the surroundings of the town, mainly in ravines.

d. Rights of common

In the indigenous communities, the rights are based in tradition and customs. The leaders who are finally make decision, if they accept or not a situation taking always in consideration with the customs or traditions of the community.

2.10.4. Environmental Impacts

A multidisciplinary professional group (AD-hoc Committee) was formed for the Environmental Impact Assessment (EIA) and the EIA Survey with great experience in environmental, social and health sciences that considered the legal, technical standards and those related to the environmental and health protection. Then the committee proceeded to identify and evaluate the actions of the project that could cause environmental impact in the environment.

The group of experts that took part in the EIA, which are identified the possible actions and the more impacted environments at the following phases:

- Project Construction Phase
- Project Operation Phase

(1) Project construction phase

The possible environmental impacts caused by the construction of the Project are as follows:

- Erosion processes: The construction of the Museum and landscaping may cause slight adverse impacts due to the erodible soil conditions;
- Wastes: The construction activities may cause slight adverse impacts such as the construction wastes problems, if appropriate measure were not taken; and
- Economic activities, employment: The construction works may cause slight favorable impacts through generating direct and indirect jobs by the construction works.

(2) Project operation phase

The possible impacts on the environment due to the operation of the Project are as follows:

- Economic activities, employment: The operation of the Poncho Museum will enhance the local textile industry as a core center;

- Erosion processes: As the operation of the Project consider the erosion control, the Project implementation will cause slight favorable impacts on the erosion processes; and
- Landscape: The landscaping by the Project will cause slight adverse impacts on the present landscape.

2.10.5. Analysis of Alternative Plan

The possible impacts on the environment in the Project site without the Project are as follows:

- Economic activities, employment: The regional economy, in particular the local textile industry will not be affected without Project implementation;
- Erosion processes: Erosion processes without the Project implementation may worsen due to the erodible soil conditions; and
- Landscape: The landscape of the Project surrounding area will not changed without Project implementation.

2.10.6. Mitigation Measures for Adverse Impacts

In order to mitigate the possible adverse impacts, the following measures could be proposed:

(1) During the preparation phase

All the related institutions, such as *INGUAT*, Ministry of Public Health and Social Assistance, the *MARN*, the INAB, and the Municipality of Momostenango, should approve the Project.

The Project should be designed with all the architectural elements that allow the integration of the project to the physical and natural environment of the zone.

It needs to prepare an operation and maintenance manual for the facilities, including septic tanks.

(2) During the construction phase

The Project site should provide sanitary services and services for the collection of wastes for the workers.

It needs to develop protection measures for preventing erosion and covering the steep slopes.

It needs to check the operation and maintenance manual for the facilities, including septic tanks.

(3) During the operation phase

The persons, who are in charge of the managing the Museum should be trained and follow the regulations in terms of the operation and maintenance manual for the facilities, including the septic tanks.

The Museum should prepare internal regulations for a better use of the facilities, for the workers and for the users of the Museum.

The municipality should collect the solid wastes in the Project surrounding area. The garbage equipments should be provided for enough volume and be distributed.

The workers and the facilities of the Museum should fulfill the sanitary and functioning regulations of the Ministry of Public Health and Social Assistance.

2.10.7. Environmental Monitoring Plan

(1) Environmental monitoring plan

With the purpose of conserving the environment and human health, the following monitoring activities should be done.

- Follow up and evaluate each phase of the mitigation measures; and
- Once the Museum is operating, it should be evaluated every six months by the sanitary and tourism authorities to guarantee the fulfillment of the standards and regulations for the protection of the health and comfort of the users.

(2) Recommended mitigation and monitoring cost

Manual for operation and maintenance of the facilities		US$	900
Sanitary Services and Waste recollection for workers		US$	300
Slope protection works		US$	2,500
Training of personnel		US$	1,200
Program for education to the community		US$	1,500
	Total	US$	6,400

2.10.8. Conclusions and Recommendation

(1) Conclusion

In terms of the Environmental Impact Assessment (EIA) Survey of the "Poncho Textile Museum and Demonstration Workshop", it is concluded as follows:

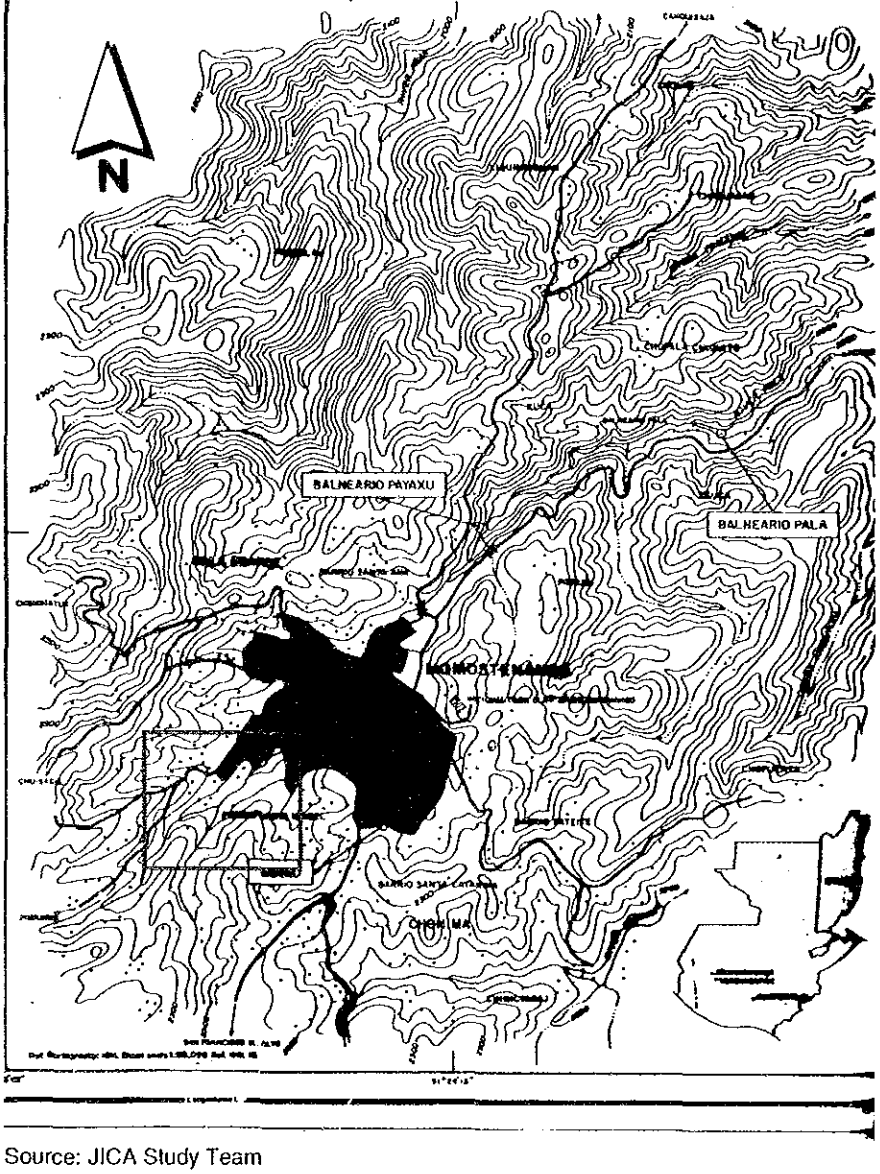
- In general, Poncho Textile Museum and Demonstration Workshop Project will not cause serious adverse impacts;
- However, the Project needs to consider the soil erosion control measures due to the soil and slope situations of the Project site.

(2) Recommendations

In order to mitigate possible significant adverse impacts and to promote favorable impacts by the Project, it is recommended that the following actions should be considered:

- It is recommended to build the Museum with all the architectonic, sanitary and integration requirements of the work to the landscape and nature;
- It needs to elaborate the development plan with all the stakeholders, in particular the local textile associations; and
- It is recommended to consider the construction methods in order to prevent from the soil erosion and the waste problems.

Figure 2.9 Location map of Development of Poncho Textile Museum and Demonstration Workshop



Source: JICA Study Team

2.11. EIA Survey of the Development of Hot Spring Baths and Accommodation

2.11.1. Objectives of the EIA Survey

Based on the results of the IEE, the Project is based on a concept of "Community Tourism" to facilitate tourists to visit and stay in indigenous community. The capacity of the facility development is not large, however, it is imperative to consider the community's acceptances of the project development. The local residents use the present spa as one of the places of social activities, especially for the old peoples. Also, adverse environmental impacts such as water contamination related to the construction of proposed water pumping system, if appropriate countermeasures are not be taken. It is concluded that the Project needs an EIA survey.

The objectives of the EIA Survey are: to identify/evaluate possible environmental impacts, which could be caused by the project based on the available data/information and field reconnaissance; to analyze/forecast possible environmental impacts, to propose mitigation measures for possible significant adverse environmental impacts as necessary; and to recommend environmental monitoring plan.

2.11.2. Description of the Project

(1) Background

Located in the outskirt of the Momostenango town, this Project is an experiment to develop a spa resort in Guatemala. Among the Projects of the Municipality of Momostenango with recreational Project for the population, it has created the thermal waters of Pala Chiquito as a decentralization action for the thermal waters of Payaxu that is currently used by the local peoples. The thermal waters of Pala Chiquito have limitations of hot water and access for the tourists.

(2) Site location and main components of the Project

Momostenango town is located in the Municipality of Momostenango, in Totonicapan Department. The Project, which consists of an induction center, 9 satellites/comets, and interpretative trails, site is 40km north from Quetzaltenango City and 15km from department capital City of Totonicapan. In terms of the "Hot Springs Bath and Accommodation", this is one of the Satellites is located in the outskirt of the Momostenango town.

The main components of the Satellite are: i) building for interpretation and exhibition, ii) water pumping system for thermal waters, iii) landscaping with car parking.

2.11.3. Present Environmental Conditions of the Project Area

(1) Natural environment

a. Climate

The Project site is at a height of 1,500m over sea level. The annual precipitation is approximately 950mm and average of rain in 134 days from May to November; the other

months are really dry. The maximum average temperature is 27°C and the minimum average temperature is 12°C.

b. Landscape

The landscape of the Project site could be divided into two types of landscape. The former is, located at the entry to the present pool, (higher part of the ravine, rough route). There are some serial forest views, with clearings with panoramic view between hills, little plains and view to the sky.

The latter landscape is a view by the side of the mountain and vegetation. A small attractive is a waterfall that ends to the present pool and continues to the Pala River, that crosses the buildings by the sides.

c. Characteristics of ecosystem

The main area of the Project site belongs to the humid forest Montano low Subtropical (bh-MB) life zone.

The tree formations are mainly coniferous, which have been cut to sell to sawmills and for fuel. The common species of the Project site are pine, and others.

The fauna has considerably reduced due to the deforestation. The important existent species are woodpecker, wild pigeon, squirrel, and armadillo.

d. Geology and geomorphology

The topography of the zone is defined by three vertical cuts at the riverbank of the Pala River; these are higher than 100m in some areas. This forms a ravine zone, with very steep slopes.

The soils are susceptible to erosion in moderated to steep slopes when they are not protected from the vegetation coverage, entering to the substrata, forming areas cut by gullies.

The geology of the Project site is the volcanic ash product of the volcanic eruption, the tertiary of the Cenozoic area.

e. Hydrology

The surface water body near the Project is the Pala River, flows to the Chixoy River. The Pala River is a reservoir for the drainages of the town area of Momostenango.

f. Water quality

In order to understand the conditions of the water quality and bacteria conditions in the Project site, the water sampling was conducted on December 14, 2001.

The quality of the thermal water and water used for the pool fulfils the international regulations, usually accepted in the country for recreational use. According to the Guatemalan's standard for drinking water, the water is not suitable for drinking from the physical-chemical and bacteriological point of view.

g. Noise

In order to determine the sound levels in the surroundings of the Project, some measurements were conducted in different parts of outside and inside the proposed facilities areas.

In general, the noises levels do not exceed the Guatemala's standard. The traffic on the surrounding roads increases in the noise levels, but it is not permanent.

(2) Socio-economic environment

a. Demography

The population of the municipality of Momostenango, in the rural area as well as in the urban area is identified in its majority as belonging to the Mayan ethnic group, Quiche speaking. At the departmental level, 94.5% of the Totonicapán population is indigenous. At the municipality level, 95.2% of the population is indigenous.

b. Main economic activities

The main economic activity of the population is agriculture, commerce and manufacturing of Ponchos. The municipality is considered as the greater in smallholdings, so in many cases the agricultural activity is not enough for the subsistence of the families, this has caused that the population dedicates mostly to commerce and textile manufacturing. This activity is in danger of disappearing because the prices of the ponchos cannot compete with the ponchos industrially manufactured.

c. Public facilities

The urban area of the population has 65% of the services of drinking water and system of sanitary drainages, but they have little supply of water, also some damages in the sewers.

In terms of the telephone service, there is the national network and the cellular system, but this is partial due to little coverage.

2.11.4. Environmental Impacts

A multidisciplinary professional group (AD-hoc Committee) was formed for the Environmental Impact Assessment (EIA) and the Survey with experiences in environmental, social and health sciences that considered the legal, technical standards and those related to the environmental and health protection. Then the committee proceeded to identify and evaluate the actions of the Project that could cause environmental impacts on the area.

The group of experts that took part in the EIA, which are identified the possible impacts on the environments at the following phases:

- Project Construction Phase
- Project Operation Phase

(1) Project construction phase

The possible environmental impacts caused by the construction of the Project are as follows:

- Economic activities, employment: The Project construction works may cause slight favorable impacts, for all the actions in the construction phase for the local peoples;
- Rights of commons: Conflicts among the users of the present baths. The out of the services due to the Project construction may cause slight adverse impacts for the present baths users;
- Water quality: During the construction, the water quality may be slightly contaminated relating to the infrastructure development;
- Erosion processes: The infrastructure of the buildings and the services, in this phase may cause slight adverse impacts due to the construction of facilities in the steep areas; and
- Public facility: The Project is considered that the impacts may be slight adverse impacts, due to the construction of infrastructure and buildings, which may affect temporarily close present community baths services. The closing of the baths will deprive the population of a place for recreation until finishing the construction of the proposed facilities.

(2) Project operation phase

The possible impacts on the environment due to the operation of the Project are as follows:

- Rights of Common: Conflicts for the use of water and land: The induction of thermal water from Payaxu to Pala Chiquito will be a continuous problem in the community, which will cause slight adverse impacts. Also, supply of thermal water using the Payaxu pool as source, may cause a social conflict in terms of water and land use;
- Erosion processes: The infrastructure of the Spa will take into consideration of mitigation of the present erosion;
- Landscape: The landscaping of the Project surrounding site will improve by the Project implementation; and
- Water quality: The infrastructure of the Spa and the water supply will cause slight favorable impacts because the Spa will have services for water treatment.

2.11.5. Analysis of Alternative Plan

The possible impacts on the environment in the Project site without the Project are as follows:

- Right of common: User conflicts relating the present community hot spring will not occurred without the Project;
- Erosion processes: As the infrastructure of the Spa will take into consideration of mitigation of the present erosion, the erosion processes will not mitigate without the Project operation;
- Landscape: The present landscape will not changed without the Project; and
- Water quality: The liquid and solid wastes of the present pool Pala Chiquito continue to discharge into the Pala River without treatment.

2.11.6. Mitigation Measures for Adverse Impacts

In order to mitigate the possible adverse impacts, the following measures could be proposed:

(1) During the preparation phase

Before beginning the works, the supply of thermal water must be guaranteed, by finding the solution to the conflicts with the community for the water use or by the use of an alternate source. For example, the continuous public hearing for the local residents affected by the Project is imperative.

All the related institutions, such as *INGUAT*, Ministry of Public Health and Social Assistance, the *MARN*, the *INAB*, and the Municipality of Momostenango, should approve the Project.

(2) During the construction phase

The Project should provide sanitary services and services for the collection of wastes for the workers.

It needs to avoid deforestation particularly in the steep areas due to the Project construction.

It is proposed to hire the local peoples as the construction workers.

The municipality should inform the local peoples before tentative closing of the present facilities such as pool Pala Chiquito due to Project construction.

(3) During the operation phase

The municipality of Momostenango should promote the cleaning of the basin of the Pala River, up to the Pala Chiquito pool by controlling of the discharge of residual waters and the solid wastes.

An internal conservation regulation for a better use of the proposed facilities, for the workers, and for the users of the facilities should be prepared to conserve the surrounding environment. Also, the persons, who is in charge of the operation in the proposed baths should be trained and follow the conservation regulations.

The municipality should collect solid wastes a minimum of three times a week. The facilities should have garbage collection equipments.

The workers and the facilities of the proposed baths should fulfill the sanitary regulations of the Ministry of Public Health and Social Assistance.

It needs to conduct water sampling in order to monitor the surrounding water bodies such as the Pala River.

2.11.7. Environmental Monitoring Plan

(1) Environmental monitoring plan

With the purpose of conserving the environment and human health, the following monitoring activities should be done:

- Follow up and evaluate each phase of the mitigation measures;
- Once the Project is operating, it should be evaluated every six months by the sanitary and tourism authorities to guarantee the fulfillment of the standards and regulations for the protection of the health and comfort of the users; and
- Investigate the water quality at least once a week and measure daily the concentration of residual chlorine.

(2) Recommended mitigation and monitoring cost

Resolution measures for possible user conflicts		US$ 15,000
Sanitary services and waste recollection for the workers		US$ 500
Reforestation and protection of slopes		US$ 3,000
Training of personnel that will work in the Project		US$ 800
Educational program for the local peoples		US$ 1,200
Monitoring of water quality		US$ 9,200
	Total	US$ 29,700

2.11.8. Conclusion and Recommendations

(1) Conclusion

In terms of the Environmental Impact Assessment (EIA) Study of the "Hot Spring Bath and Accommodation", it is concluded as follows:

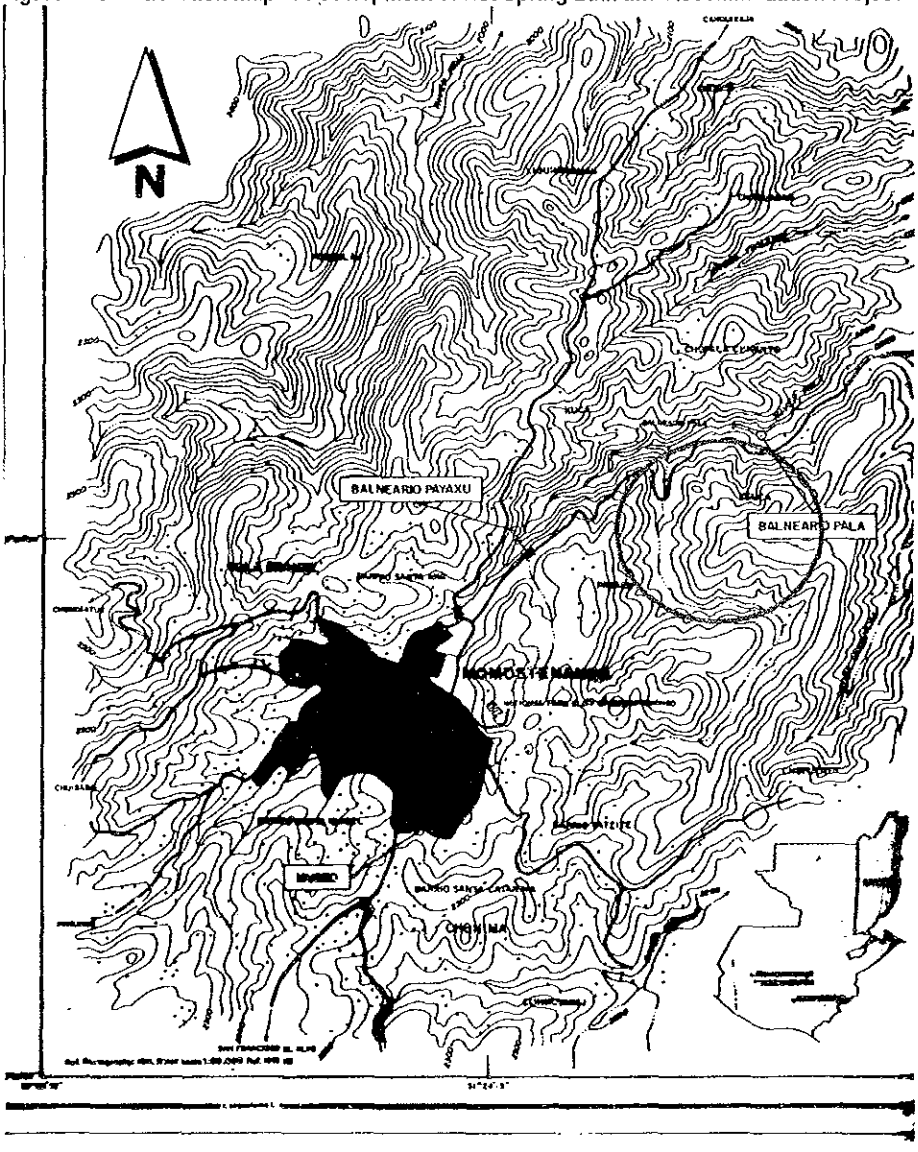
- In general, Hot Spring Bath and Accommodation Project will not cause serious adverse impacts;
- However, the supply and use of the proposed thermal water may cause significant adverse impacts due to the user conflicts for the water use, if the appropriate measures such as public hearing are not implemented at the Project preparation phase.

(2) Recommendations

In order to mitigate possible significant adverse impacts and to promote favorable impacts by the Project, it is recommended that the following actions should be considered:

- It is imperative to elaborate the development plan of the Project with the local residents and hold the public hearings for the present water and land users of the Project site;
- It needs to build the facilities with all the architectural, sanitary requirements of the work to the landscape and nature; and
- All the construction work of the Project should be taking into account of the conservation forests and prevention from soil erosion.

Figure 2.10 Location map of Development of Hot Spring Bath and Accommodation Project



Source: JICA Study Team