

## Environmental Assessment:

### African Oil Palm

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Colombia Alternative Development Project



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**ENVIRONMENTAL ASSESSMENT STUDY  
AFRICAN OIL PALM ALTERNATIVE DEVELOPMENT PROJECT  
USAID MAIN CONTRACT No C-00-01-00091-00  
MUNICIPALITY OF TIBÚ, NORTE DE SANTANDER - COLOMBIA**

**FINAL REPORT**

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## INTRODUCTION

The measurement of the environmental impacts caused by alternative development projects, such as those of African oil palm, is an unavoidable task for the project designer, but above all, a duty that is regulated by the environmental legislation of the country. The idea is to know in advance the effects that this type of development may have on the natural resources of the region and to prevent them from the basic engineering stage itself. To this end, the USAID agency, through the CHEMONICS FOUNDATION, has contracted with the Centro Andino para la Economía en el Medio Ambiente – CAEMA, the development of the Environmental Impact Assessment Study for the alternative African oil palm development project in the Municipality of Tibú, Norte de Santander.

The report is divided into three parts or stages corresponding to the administration methodology recommended by the contracting party. The first two modules, which contain the diagnosis (second report) and environmental assessment (third report), are referred to in this text, but are not attached. In this report, special emphasis is placed on the practical results of the environmental impact study, that is: the Environmental Management Plan, the Monitoring and Control Plan, the EMP budget, the chronology of the works, the conclusions and the recommendations.

This preliminary report is placed in the hands of the inspectors, so that they contribute their suggestions before it is submitted for consideration by the competent authorities, as an instrument for the planning and legal and environmental organization of the proposed alternative development project.

The document has been designed basically in the form of index cards due to the versatility required in its management, not only for the decision-makers but also for those individuals in charge of managing the environmental tasks proposed therein.

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## **SECTION 1 EXECUTIVE SUMMARY**

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### **1.1 The Project and Its Most Important Features**

The project proposes the installation, maintenance and production of 1,000 hectares of African oil palm, of which a total of 400 fully developed hectares already exist, located in the property known as Los Naranjos, *Corregimiento* of Campo 2 and surrounding rural areas, Municipality of Tibú, Norte de Santander. The project will be entirely developed over a period of 4 years and it is expected that the total planting will be completed and in full production by the year 2005. In all, 133 families currently engaged in the planting and marketing of coca leaves will benefit from the project; these families have voluntarily agreed to eradicate 450 hectares of the illicit crop. The project includes the strengthening of the COOPAR Ltda. Cooperative, which has been selected as the implementer and operator entity for the project. The oil palm Fresh Fruit Bunch processing plant of this same cooperative, with a capacity of 3 tons per hour, will be used.

### **1.2 The EIA: Purpose, Scope And Methodology**

The basic purpose of the EIA is to identify the conditions that must be met by the project so that its installation, operation and eradication do not cause any substantial damage to the environment. The environmental management proposal presented must serve not only to guarantee a performance in line with the basic conditions of sustainable development, but must also meet the demands and requirements established by Colombian environmental regulations (Law 99 of 1993 and regulatory decrees), as well as the standards and procedures that guide the international action of the USAID agency (regulation 216, for environmental assessment). From the methodological point of view, the EIA starts from a detailed analysis of the project, the conditions set out in regulation 216 and Colombian environmental legislation for the development of the environmental requirements and conditions matrix for the interested parties. A diagnosis is then made, comprising an X-ray of the area to be directly and indirectly impacted by the project. Subsequently, with the help of matrix techniques, the environmental impacts are identified, described and rated. In this case, in addition to the knowledge of the assessment expert group, state-of-the-art techniques and procedures endorsed by the Ministry of the Environment are used for the environmental rating of impacts generated by African oil palm projects, which have been documented in the Environmental Guide for the African oil palm subsector. With the environmental impacts, which have been identified through the environmental rating process as medium (M), high (H) or very high (VH), we then proceed to design the Environmental Management Plan (or Environmental Action Plan), which is supplemented with the relevant budget, schedule and Monitoring and Control Plan.

The study is presented in three volumes, as follows: The first volume develops all aspects related to analysis of the environment and assessment of the African oil palm project. This has been entitled the “**environmental diagnosis report**”. The second volume, which has been entitled the “**environmental assessment report**”, develops the entire identification, description and rating of impacts process. Finally, the “**preliminary final report**” contains the Environmental Management Plan, the Monitoring and Control Plan, the budget, schedule, conclusions and recommendations of the study.

### **1.3 The Diagnosis of the Area of Influence and Its Most Important Cumulative Impacts**

The direct area related to the project includes a strip of approximately 400 hectares, which are already planted with African oil palm, located in the *Corregimiento* of Campo 2 and its surrounding rural areas. The 600 additional hectares that are going to be planted with African palm and will benefit a total of 133 families of the region which have voluntarily agreed to eradicate the illicit crops are also considered part of the direct area. The indirect area, in this case, is the expanse near the Catatumbo watershed and its most important rivers near the project area (Catatumbo, Sardinata, Nuevo Presidente and others). The environmental status detected can be summarized as: wide strips of land highly degraded by traditional agricultural activities (rice, cassava, cocoa, corn, etc.) with disorganized farming practices. Spontaneous pasturization processes, due to use of the lands for the temporary raising of mainly bovine cattle. Planting of illicit crops such as coca leaves and geomorphological deconfiguration, due to past oil exploration and production processes. Although shrub vegetation is very scarce, the region is still subject to an intensive deforestation process to obtain lumber. Despite the fact that this is a watershed area, there is a great deficit of water during dry periods, which have led to the construction of the artificial irrigation system of Zulia, which is used by the existing African oil palm infrastructure.

Both the planted area and the existing fresh fruit bunch processing plant cause certain environmental impacts, such as: deterioration of the quality of water sources and watersheds, due to the dumping of untreated liquid wastes, both agroindustrial and from workers’ homes. Deterioration of the quality of the soil, due to preparation processes for planting and to the management of solid plant, agrochemical and household wastes. Deterioration of the quality of the air, as a result of particulate material produced in the boiler area.

The region has a tradition and knowledge of the culture and development of African oil palm projects and is included within the Regional Action Plan for Biodiversity of the Department of Norte de Santander.

### **1.4 Assessment and Rating of Environmental Aspects and Impacts that may Result From the Proposed Action**

The socioeconomic element will receive the greatest positive impact, due to the fact that the project as a whole is a socioeconomic compensation, mitigation and correction measure. All related variables and indicators determine the community’s expectations and the possibilities of organizing the existing social structure, going from a clandestine and illegal organization to a scheme governed

by the values and standards of legality. The generation and stability of the jobs that will be created is the aspect that most contributes to this positive condition. As indicated in table below, the social element has a reported score of 6.2 (+) and the production stage contributes the highest score (8.9) to the average, as it is here that more jobs are created (up to one job for every 4 hectares).

In their order, the negative impacts with the highest environmental scores were detected for the elements water (4.7), soil (4.2), air (3.9) and biological (3.9). The project stages with the highest impact, that is, where the greatest number of environmental aspects to be controlled are identified, are in their order: the transformation stage (5.5), production (4.8) and the nursery and pre-nursery stage (3.1). The low environmental score of the biological element is basically due to 2 factors: the characteristics of the area, which is classified and included as a palm agro-ecosystem in the Departmental Biodiversity plan, and the few negative transformations generated by the project in the properties that are to be planted with African oil palm.

**Table 1 Summary of impact scores by natural elements**

Natural Element	SOCIAL		WATER		SOIL		AIR		BIOLOGICAL		TOTAL PER STAGE	
	Sc	EI	Sc	EI	Sc	Sc	EI	EI	Sc	EI	Sc	EI
Nursery and pre-nursery	4.9	M	1.6	ML	2.9	L	-	-	-	-	3.1	L
Production	8.9	MH	4.4	M	4.9	M	2.9	L	2.9	L	4.8	M
Transformation	4.8	M	8.1	MH	4.7	M	4.9	M	4.9	M	5.5	M
<b>Average</b>	<b>6.2</b>	<b>H</b>	<b>4.7</b>	<b>M</b>	<b>4.2</b>	<b>M</b>	<b>3.9</b>	<b>L</b>	<b>3.9</b>	<b>L</b>	<b>4.5</b>	<b>M</b>

## 1.5 The Environmental Management Plan, the most important actions and costs

The EIA process has enabled the identification of a total of 14 ENVIRONMENTAL ASPECTS of great interest and four natural elements, which receive the most significant ENVIRONMENTAL IMPACTS. The correlation between the environmental aspects and impacts has permitted the group of assessment experts to identify a total of 58 MANAGEMENT ACTIONS, broken down into three types: preventive (P), mitigation (M) and corrective (C) actions. For each action, the various measures are itemized, dimensioned, their costs are presented and the corresponding monitoring and control measures are referenced. This work is done through properly coded index cards, considering that these must be handled constantly and in a versatile manner by the employees of the COOPAR Ltda. Cooperative, which will be in charge of implementing and conducting a systematic monitoring of the ENVIRONMENTAL MANAGEMENT PLAN. Following is a summary of the most important environmental management measures and their costs.

**Table 2 Environmental Management Cost**

<b>Activity</b>	<b>Cost (CPS)</b>
1-Construction of excreta treatment and disposal systems for housing and administrative areas (does not include designs, operation and land costs)	272,000,000
2- Construction of treatment plant for liquid wastes generated at the FFB processing plant.	160,000,000
3- Preventive measures and minimization plan for all types of wastes.	148,000,000
4- Soil, solid and agrochemical waste management.	32,000,000
5- Management and treatment of atmospheric emissions (does not include design and operation).	30,000,000.00
<b>Total</b>	<b>642,000,000.00</b>

The minimization and treatment works for the decontamination of liquid wastes are urgent, as the company must pay up to one hundred million pesos (Ps\$ 100,000,000.00) per year on account of retribution rates to the Environmental Authority. In approximately 18 months, the retribution rates would be equivalent to the cost of the liquid waste treatment works for the fresh fruit bunch processing plant, which are in the neighborhood of Ps\$ 160,000,000.00.

The management of COOPAR Ltda., based on the Management Plan and the Environmental Administration System designed, must identify the individuals and departments of the institution that are to be placed in charge of the application, management and constant evaluation of the environmental management actions indicated. If it is decided to appoint an environmental management, care must be exercised to make sure that it is truly functional and effective.

### **1.6 Benefits to the Environment if the Project is Carried Out Implementing and Properly Administrating the Proposed Environmental Management Plan and the Monitoring and Control Plan.**

The management actions set out in the Environmental Management Plan and the Monitoring and Control Plan have been specially designed in order to comply with the ENVIRONMENTAL REQUIREMENTS OF A LEGAL ORDER MATRIX (Law 99/93 and Decree 1728/2003), as well as with the conditions imposed by the interested parties (basically, what is provided in Regulation 216). These conditions indicate that it will first be necessary to comply with the legal requirements and then to develop those actions designed to meet the voluntary goals and objectives of the company responsible for the project.

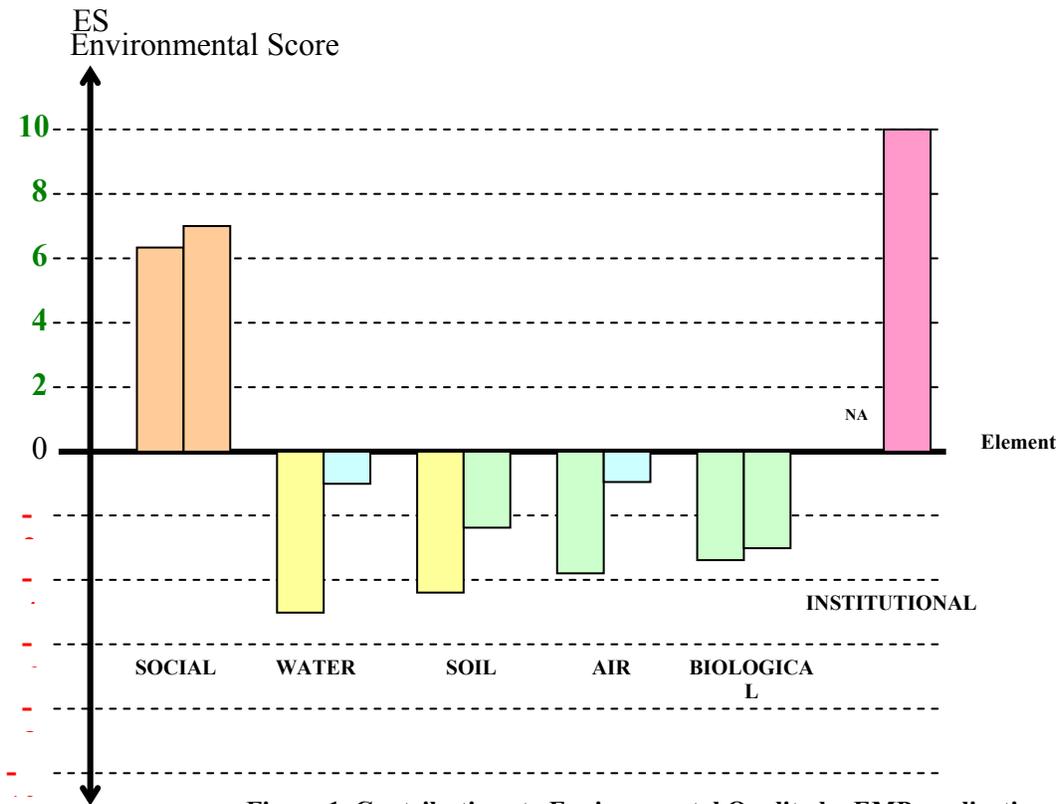


Figure 1. Contributions to Environmental Quality by EMP application

Based on these precepts, an assessment exercise was carried out, comparing the final scenario, with the project and its Environmental Management Plan duly implemented, against the BASELINE and the initial environmental score of the area without the Project (as established in the diagnosis and Environmental Impact Assessment). The result is shown in Figure 1. There, each pair of bars indicates the environmental score (ES) for each natural element. To the left, the initial conditions (BASELINE), and to the right, the environment with the Project and its respective Environmental Management Plan.

The most benefited natural elements, according to the final score, will be in their order, the institutional element, given that the company would for the first time have an implemented and periodically assessed environmental management plan; the water element, since the proposed waste minimization and treatment works would recover its quality and the condition of the watersheds; the air, due to the proposed minimization, management and treatment of atmospheric emissions, mainly with respect to the capture of particulate material; the soil, mainly due to the actions of a preventive and mitigation nature associated with the process of land improvement, management of withdrawals, eradication of unproductive trees, management of plant and agrochemical wastes, as well as those related to pest and disease management.

## **1.7 The Most Important Conclusions**

- 1- The project does not interfere with any zone classified as of special order or management.
- 2- All environmental aspects and their associated impacts are controllable with actions, technological resources and knowledge available in the country and in the region.
- 3- The permanent implementation and assessment of the proposed Environmental Management Plan improves the environmental conditions identified in the baseline diagnosis by up to 100%.
- 4- For economic and environmental reasons, the first actions to be undertaken are those for the minimization and treatment of liquid agroindustrial and household wastes. Thus the payment of the retribution rate, which could amount to Ps\$ 100,000,000.00 per year, will be reduced by up to 80%.
- 5- The 1,000 hectares of oil palm may capture up to 200 tons /Ha – year of CO<sub>2</sub>, which becomes an additional contribution to solve the problem of global warming.

## **SECTION 2 PURPOSE, SCOPE AND METHODOLOGY**

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### **2.1 Purposes**

To carry out a qualitative assessment of the environmental impact generated by the implementation of an alternative development project of 1,000 hectares of African oil palm and the improvement of the fresh fruit bunch processing plant, in the municipality of Tibú, Norte de Santander.

#### **Specific Purposes**

- € To identify the environmental quality of the location where the project is to be developed.
- € To carry out a qualitative assessment of the impacts and alterations which the project may have on the environment and its natural and anthropic components.
- € To propose the management conditions, in order to guarantee an equal or better environment, compared to the initially identified environmental conditions.
- € To assess the final quality of the environment with the project and its Environmental Management Plan.

### **2.2 Scope**

In the concept of the EIA, three different but totally complementary interpretations coexist:

- € The EIA as an **administrative procedure**, through which the environmental authority of a country establishes the manner in which the *preventive environmental management* process of development projects is to be carried out. In this respect, the EIA defines requirements and responsibilities, at the level of both the State and the proposer, in particular private proposers. To accomplish this, it establishes the specific forms of compliance with said requirements and responsibilities: permits, documentation, terms, fines, etc.

The EIA is an *environmental management instrument* used and developed by the State to fulfill its duty to protect the environment and the natural resources, which in many countries is a constitutional precept and is sanctioned by specially issued laws and

regulations. In the case of Colombia, the State has set out its precepts in the text of Law 99 of 1993.

- € The EIA is a **set of environmental management methodologies**, with considerable experience and development, to confront the issue of the environmental consequences of projects and, more specifically, the cause – effect relationships between the project and the environment in which it is carried out.

This concept is explained in the term “Environmental Impact Assessment” itself, which involves the idea of assessing (quantifying, estimating or rating) the environmental impacts (due to the actions of a project) on the environment (as a natural life-support system) in their physical, biological and socio-economic dimensions.

- € The EIA is a **label**<sup>1</sup>. Beyond the mentioned linguistic scopes, it is accepted today that the EIA is a management system and a particular methodological approach, which serve to gather, analyze and process systematic information, in order to anticipate the environmental consequences of a project, in addition to the typical economic and social consequences that are linked to project formulation and assessment.

Methodologically, this EIA follows the precepts of USAID REGULATION 216 and the terms of reference specifically prepared for this study. As an environmental management system, the procedure is in line with the provisions of Law 99 of 1993 and Decree 1728 of 2002, which regulate the environmental organization procedure for development projects in the Colombian territory.

With respect to the EIA and the African oil palm alternative development project cycle, it is understood as part of the pre-feasibility stage, intended to identify and predict the consequences of a project, before proceeding to the design and detailed engineering stage.

## 2.3 Methodology

The general methodological approach is graphically summarized in Figure 2 (General Methodological Procedure of the EIA). The following is a summary of each of the steps included therein, given that in the partial reports submitted to the contractor, there is a comprehensive development of the methodological process in each stage of the assessment.

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<sup>1</sup> JOSÉ LEAL: “Guías para la evaluación del impacto ambiental de proyectos de desarrollo local”, ILPES. Santiago de Chile, 1997.

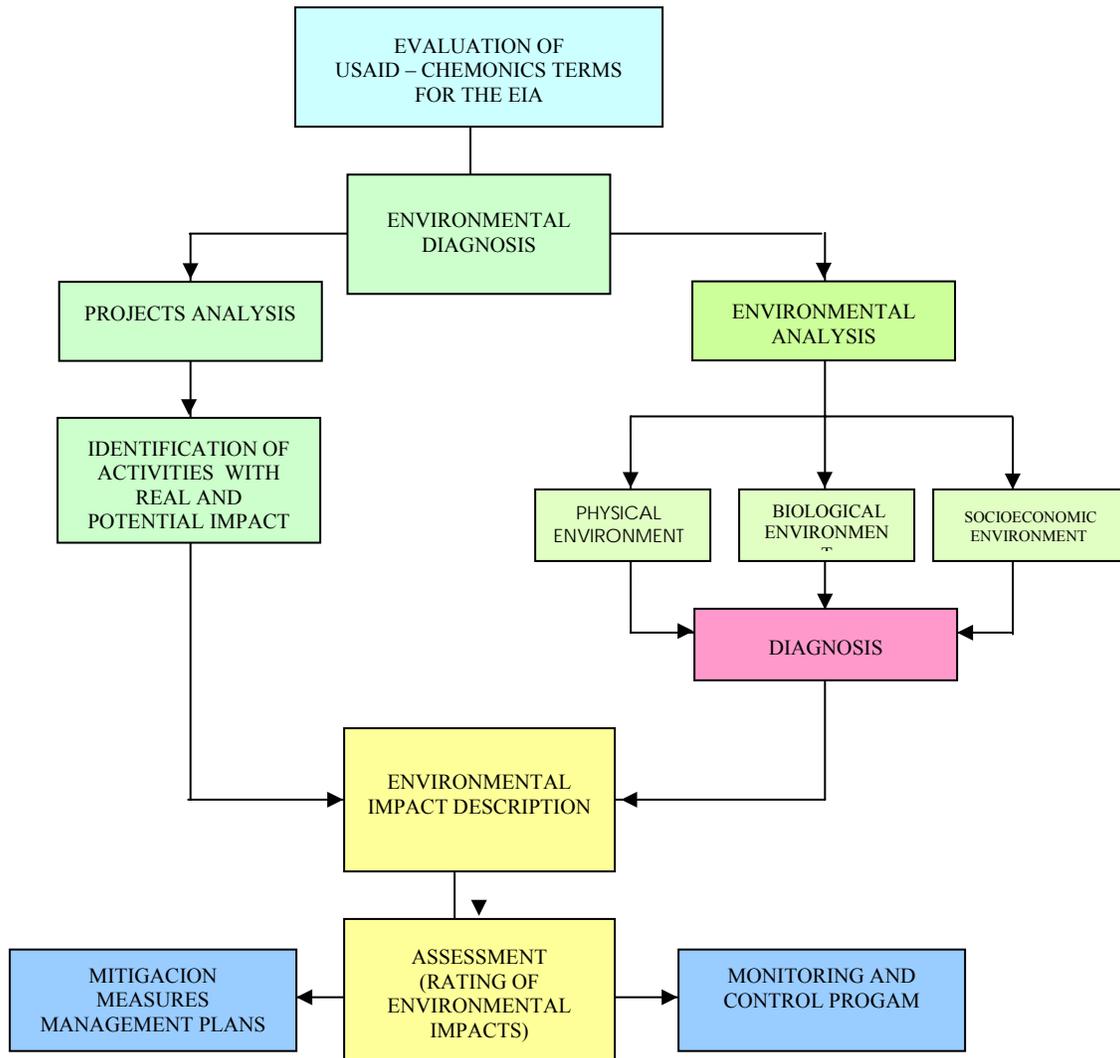


Figure 2. General methodological procedure of the EIA.

## 2.4 Evaluation of USAID - Chemonics EIA Terms of Reference

As established in the chapter on the scopes of the EIA, the study as an administrative instrument has certain development conditions established by the USAID agency for alternative development projects such as the African oil palm project object of this study. Thus, the EIA has been divided, according to subject, into four blocks entitled STAGES: Environmental diagnosis (first stage), Environmental Assessment (second stage), Environmental Management Recommendations (third stage), Monitoring Program (fourth stage). Stages 1 and 2, have been developed in their entirety and include detailed reports explaining the methodology applied. Stages 3 and 4, with all their

components, are presented in this report. In any event, for each stage or component, the respective report containing the methodological support is indicated.

## **2.5 Gathering of Information**

Includes the gathering of the baseline (environment) and project information. The information was gathered and assessed on the basis of a process of completion and verification in the field, through visits to the sites involved in the project and its operation.

## **2.6 Project Analysis**

The project information, the USAID regulations and directives, as well as the referenced guidelines and regulations, were entirely contributed by the contracting party, the subcontracting party (CHEMONICS INTERNATIONAL INC) and other alternate offices at the national level: PNAD and PLANTE program. All information related to the project analysis is contained in the SECOND REPORT, submitted and approved by the subcontractor. This portion of the study permits the identification and description of the activities with a potential impact on the environment.

## **2.7 Environmental Analysis**

Includes a detailed assessment of the physical environment, the biological environment and the socio-economic environment. The analysis reports, as a practical result, the description of the area of influence, indicating in detail the attributes and accumulative impacts that characterize the zone where the project will be located. The methodology, results and other details are documented in the second stage, in the ENVIRONMENTAL DIAGNOSIS report.

## **2.8 Environmental Assessment Process**

With the help of matrixes, where the various project activities are crossed with the elements of the natural medium, the environmental assessment is carried out in three stages: IMPACT IDENTIFICATION (PREDICTION) (first stage), IMPACT DESCRIPTION (second stage) and ENVIRONMENTAL RATING (third stage). In the third report submitted to CHEMONICS, the methodological procedure and the results of the environmental assessment stage are presented in sufficient detail. For this stage, impacts with a medium (M), high (H) and very high (VH) score have been identified, according to their type, magnitude, presence, duration and evolution. With this list of impacts, the Environmental Management Plan – EMP – and the related Monitoring and Control Program will be constructed.

## **2.9 Environmental Management Process**

The construction of the Environmental Management Process begins with the identification of the impacts, which the environmental assessment process has identified with an environmental score (Sc) of medium (M), high (H) and very high (VH).

The environmental aspects, understood as those actions that contribute to generate an impact, are grouped in accordance with the environmental elements (water, soil, air, socio-economic and biological), in order to proceed subsequently to prepare the list of actions to be developed in order to manage (compensate, prevent, mitigate or correct) the impacts generated. Said actions are listed, with a code which identifies: the natural element receiving the impact that is to be managed, the type of measure to be implemented (preventive - P, mitigative – M or corrective- C) and a consecutive, which shall be referred to whenever there is a reference to a specific management action. All this leads to the creation of four types of Tables, broken down by natural elements, as follows:

- 1- Type of measure and actions to be developed in order to improve the water resource and its associated impacts,
- 2- Type of measure and actions to be developed in order to improve the soil resource and its associated impacts,
- 3- Type of measure and actions to be developed in order to improve the air resource and its associated impacts,
- 4- Type of measure and actions to be developed in order to improve the biological resource and its associated impacts.

Seeking a more friendly and didactic methodology, the EMP is presented in the form of index cards, as follows: **the master index card**, which presents the basic information of the management action: affected resource, type of measure, action to be developed, purpose of the action, code, associated environmental impacts, description of the measures to be implemented, goal, dimensioning of the proposed action, costs of the proposed action, control and follow-up and finally monitoring. **The cards attached to the master index card**, which serve to support and develop information related to the dimensioning of the proposed actions. These must be filled out only in certain cases. Cost index cards are also developed, in the event that the proposed actions require special works and investments. When special control and monitoring actions are required, the master index card indicates their location within the text.

## **2.10 Follow-Up And Monitoring Plan**

The Follow-Up Plan is proposed as a tool so that the person in charge of the Environmental Administration System – EAS, if the company adopts this method for the environmental management of the project, will carry out a permanent control of the objectives, goals and requirements of the EMP. The Monitoring Plan is designed in order to gather the necessary basic information for decision-making with respect to the achievement of the goals and requirements, as well as the operation of the environmental infrastructure implemented by the company.

## SECTION 3 ALTERNATIVES INCLUDING THE PROPOSED ACTION

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### Environmental Alternatives and Options

Based on the requirements and recommendations contained in Regulation 216 regarding projects entirely or partly financed with AID funds, following is a trend analysis of the different environmental vectors associated with the African Palm Project, and their behavior if THE PROPOSED ACTIONS ARE NOT TAKEN. The diagnosis of alternatives is based on the conditions presented in the INITIAL REFERENCE STATUS, which were identified and documented in the ENVIRONMENTAL DIAGNOSIS REPORT submitted to and approved by Fundación Chemonics on September 20, 2002. That report is used herein as a methodological foundation, and a final comment is added at the end of each section on environmental vectors, specifying environmental trends or environmental behavior in the absence of the proposed project.

### 3.1 Classification and Use

The current cultivation area is part of the central region and was awarded, according to FEDEPALMA, to 64 families starting in 1991. Currently these families have planted 400 hectares. This area was included in the national inventory of African Palm development areas, according to the study *La situación ambiental de la cadena de oleaginosas (palma de aceite) en Colombia* [Current Environmental Status of the Oleaginous (oil palm) Plant Cluster in Colombia]. The total area planted with palm is reported to be approximately 150,000 hectares.<sup>2</sup>

The area selected for development has been identified and officially set aside for agribusiness use, such as the one proposed. The cultivation area does not interfere with Special Management Areas [Áreas de Manejo Especial] nor with national parks, indigenous community lands (be they *resguardos* or traditional indigenous communal lands, or *cabildos* or traditional indigenous self-governing bodies), among others, either on account of its location or its expansion plans. According to the Plan de Acción Regional en Biodiversidad [Regional Biodiversity Action Plan] (CORFONOR 2001), the area is classified as appropriate for the African palm agricultural ecosystem.

### Trends

Non-implementation of the project would forego an opportunity of articulating with territorial possibilities for the legitimate development of the agricultural and ecological capacity of the soil. As these areas are unsafe and there is scant state presence, and soil edaphology favors development of illicit crops such as coca, increased opportunities would be generated for this type of activities.

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<sup>2</sup> Currently there are approximately 1,950 hectares (0.96%) in the Department of Norte de Santander.

### 3.2 Production and Chemicals for Agriculture

The 400 hectares currently in production have already accumulated a (controlled) impact in this respect. The 100 hectares to be developed will surely undergo the same process.

The production process requires the use of fertilizers, insecticides, nutrients, herbicides and other types of chemicals used to sustain crop productivity. The following are the most widely used chemicals, by types and ranges:

∄ Herbicides:

- |               |  |
|---------------|--|
| 1 Glyphosate: | 3.5 to 5.0 cc/palm ( <b>Toxicity Rating IV</b> )<br>500 to 715 cc/hectare/year |
| 1 Folar:      | 2.0 to 4.0 cc/palm<br>286 to 572 cc/hectare/year                               |

∄ Insecticides:

- |                          |  |
|--------------------------|--|
| 1 <u>Monocrotophos</u> : | 2 to 20 cc/palm ( <b>Toxicity Rating I</b> )<br>50 to 2860 cc/hectare/year |
| 1 Elosal:                | 50 to 100 cc/hectare/year  |

∄ Fungicides:

- |                 |  |
|-----------------|--|
| 1 Dithane M-45: | 20 a 50 gr/hectare/year ( <b>Toxicity Rating III</b> ) |
| 1 Fudiolan:     | 20 a 200 cc/hectare/year                               |
| 1 Vittavax:     | 20 a 50 g/hectare/year ( <b>Toxicity Rating III</b> )  |

Table below lists the most frequently used chemicals in African palm cultivation as reported by Coopar technicians, and the toxic level classification of the most widely used chemicals in the country, respectively. Categories I and II are prohibited due to their high toxicity.

According to the first revision, based on the Forbidden Chemicals List dated May 21, 2001 issued by the Division of Agricultural Inputs [División de Insumos Agrícolas] of the Colombian Agricultural and Livestock Institute ICA [Instituto Colombiano Agropecuario], only the herbicide *Paraquat (Gramaxone)* is forbidden. The insecticide *Monocrotophos* was shown to have high levels of toxicity. These substances should be replaced.

The Oil Palm crop may pose a certain number of challenges regarding the management of its pests and the pesticides used to control them, which could likewise present environmental risks that need to be dealt with. A brief description of the agrochemicals is presented here, but the in-depth analysis follows the detailed requisites for pesticides in Reg. 216.3.(a).10.(b).(1).(i).(a) – (l). The following section presents a summary of the pests liable to appear in the project and their management, as well as the chemicals most likely to be used, presenting a toxic and eco-toxic analyses for the main pesticides used, as well as the existing options for an Integrated Pest Management (IPM) program that allow for a continuous decrease in the altogether use of agrochemicals.

**Table 3. List of Chemicals Used in African Palm Cultivation**

<b>CHEMICALS TRADITIONALLY USED IN AFRICAN PALM CULTIVATION *</b>	<b>CHEMICALS USED IN THE AFRICAN PALM PROJECT IN TIBÚ, Norte de Santander**</b>
<b>PEST AND DISEASE CONTROL</b>	<b>A. ORGANOPHOSPHORUS GROUP</b>
<i>Azodrin</i>	Triclorphon ( <i>Dipterex: Cebiran</i> )
<i>Dart</i>	Monocrotophos ( <i>Azodrin, Nuvacron</i> )
<i>Nuvacron</i>	Metamifodos
<i>Kevin</i>	Phosphamidon
<i>Dithane (Toxicity III)</i>	<b>B. CARBAMATES</b>
<i>Polythion</i>	Carbaryl ( <i>Sevin</i> ) ( <b>Toxicity III</b> )
<i>Microthiol</i>	<b>C. INORGÁNIC</b>
<b>FERTILIZERS</b>	<i>Sulphur</i> : Acaricide fungicide ( <b>Toxicity III</b> )
Phosphorus ( <i>P</i> )	<b>D. SYNTHETIC PYRETHROIDS</b>
Potassium ( <i>K</i> )	Fenvalerate ( <i>Belmark</i> )
<b>CROP ERADICATION</b>	Cyfluthrin ( <i>Baytroide 100 EC</i> ) ( <b>Toxicity III</b> )
<i>Ansar</i>	<b>E. BENZOIC UREAS</b>
<i>Roundup (Toxicity IV)</i>	Diflubenzuron ( <i>Dimilin</i> )
<b>WEED CONTROL</b>	Triflubenzuron ( <i>Alsystin</i> )
Glyphosate ( <i>Roundup, Faena, Glifosol</i> ) ( <b>Toxicity IV</b> )	Teflubenzuron ( <i>Dartz</i> )
<i>Diuron</i> , as a liquid and solid ( <b>Toxicity IV</b> )	<b>F. HERBICIDES</b>
<i>Imazapir</i> (Arsenal)	<i>Round Up</i> ( <b>Toxicity IV</b> )
Ametrynes ( <i>Gesapax</i> ) ( <b>Toxicity III</b> )	<i>Mixel</i>
Atrazines ( <i>gesaprin</i> )	<i>Karmex</i>
<i>Amefrina+Ametrina+Atrazina</i> (Cañero) ( <b>Toxicity III</b> )	<i>Folar</i>
MSMA ( <i>Ansar</i> )	<i>Ally</i>
Sulfonil-urea ( <i>Ally</i> )	<i>Ansar</i>
Fluazifop-butyl ( <i>Fusilade</i> )	
Quizalofop-ethyl ( <i>Assure</i> )	
Alaclor ( <i>Lazo</i> )	
Oxyfluorfen ( <i>Goal</i> )	
Paraquat ( <i>Gramaxone</i> ) ( <b>Toxicity I – PROHIBITED</b> )	
Terbutylazine ( <i>Folar</i> )	

\* MINISTRY OF THE ENVIRONMENT. “Informe preliminar sobre la situación de la cadena de oleaginosas (palma de aceite) en Colombia” [Preliminary Report on the Current Environmental Status of the Oleaginous (oil palm) Plant Cluster in Colombia]. Santa Fe de Bogotá D. C., 1998.

\*\*LEÓN B., GUSTAVO, Project Technician, Palma – Coopar Ltda. Project. Insecticidas de mayor uso en el cultivo de Palma [The Most Widely Used Insecticides in Palm Cultivation]. Tibú, Norte de Santander, September, 2002.

No exact amounts were obtained because no records are kept regarding the use of these substances.

## **Trend**

There are no rigorous evaluations of productivity losses due to degradation caused by conventional systems used to prepare the soil. Technical opinions nevertheless indicate that in the majority of traditional agricultural production systems the soil is subject to high levels of pressure, there are no rest [fallow] periods or they are insufficient, and no practices are used to prevent degradation processes originated in the agricultural techniques employed.

Throughout the Department and in all project areas there are severely as well as very severely eroded areas of limited use, caused by inappropriate use of cultivation tools. Aside from direct erosion, this creates conditions whereby runoff and wind produce erosion. Within the systems considered, two types of practices may be distinguished:

- € High level of topsoil removal, as in the case of potato, pineapple, sugar cane, rice and yucca [manihoc] crops, which are characterized by intensive and inadequate preparation, removal of large portions of the soil, and loss of structure.
- € Localized removal of the topsoil under practices that may include long cycles (every 10 to 30 years), such as in cocoa and grass production. In these systems the soil is removed only when trees are transplanted, and it is generally covered to prevent soil degradation processes. Practically the same phenomenon occurs in African palm agricultural systems.

### **3.3 Geo-Morphology**

The area to be developed is characterized by a slightly flat configuration ---required for the technical and economic feasibility for this type of crop. These are stubble plots with a reduced tree population and are mainly dedicated to cattle and in some cases, illicit crop cultivation. In terms of the environment it should be noted that these lands have been subject to intervention and their drainage system has been entirely modified and supplemented, since the Zulia Irrigation and Drainage System [Sistema de Riegos y Drenaje del Zulia], which will benefit the project, was built here.

## **Trend**

If the project is not undertaken, an opportunity for plot improvements would be lost. The creation of “suros” (flooded depressions caused by the abovementioned erosion processes) is a serious problem for *campesinos* since these depressions prevent the tilling of large areas and become traps for cattle, leading to considerable losses. The first benefits palm cultivation would bring include drainage canals and the leveling of the land.

### 3.4 Water: Quality and Quantity

The territory is part of the bi-national Catabumbo basin, which contains significant water resources and is crossed by the Department's largest rivers: the Catatumbo, Sardinata, Nuevo Presidente, Socuavó, Sur Y Norte, Río de Oro and San Miguel.

The hydrology has been thoroughly intervened, both at the surface and sub-surface levels. Oil exploitation was very active through the forties and led to the construction of many freshwater wells in the region and project area. Most wells were later abandoned, but some are still used locally during low water level periods [dry season].

In terms of surface water, the area of El Zulia is among the few with an irrigation and drainage system. The field visit determined that the water is adequate for the proposed use, but inadequate for conversion into drinking water. This type of irrigation system uses chemical maintenance to control weeds and eutrophication. The water carries a considerable concentration of suspended solids, color, turbidity and organic matter. It must be noted that the Coopar Ltda. extraction plant discharges the untreated liquid residues generated by all its processes into these canals. This crop may contribute with as much as 1.2 m<sup>3</sup> of effluent per ton RFF.<sup>3</sup> Table below shows the physical and chemical properties of the raw effluents discharged into streams by the COOPAR Ltda. extraction plant.<sup>4</sup>

**Table 4. Physical and Chemical Properties of the Liquid Effluents Generated by the African Palm Transformation Process<sup>5</sup>**

Parameter	DBO <sub>5</sub>	N	P	K	Mg
Value (mg/l)	25,000	948	154	1,958	345

The above is the baseline for specific agribusiness contaminants found in the effluents, and to this baseline must be added domestic liquid effluent contaminants, since –as the diagnosis indicates- no proper infrastructure exists to treat and provide for the final disposal of excrement. Technical opinions reveal a use figure of approximately 6 persons per hectare. The current project has 400 hectares planted and between 50 and 60 g/person/day are generated --DBO<sub>5</sub> and SST. This waste has

<sup>3</sup> CENIPALMA (García, J.A., 1993)

<sup>4</sup> Estimates based on the document *La situación ambiental de la cadena de oleaginosas (palma de aceite) en Colombia* [Environmental Status of the Oleaginous (oil palm) Plant Cluster in Colombia]. Ministry of the Environment, 1998.

<sup>5</sup> The procedures and information required by the Environmental Authority [Autoridad Ambiental] are specified in the respective decree listed in the requirements matrix (see Table 6).

a ratio of 100/20/5 equal to DBO<sub>5</sub>/N/P, respectively. Water consumption is estimated at between 150 and 200 l/person/day.<sup>6</sup>

### **Trend**

The two main problems related to water use are the high pollution levels due to the liquids discharged from the Coopar Ltda processing plant, and the precarious basic sanitation conditions of the homes of the potential project users. If the project is not undertaken, water systems will continue to be polluted on both counts and oral-fecal contamination sources will rise, along with the morbidity and mortality rates associated with these factors.

It is important to note that responsibility for the sanitation of dwellings lies with each user, owner or tenant. If the project is not undertaken, community work alternatives will be denied, as will the possibility of improved income, the establishment of roots and the social work required for effective management.

### **3.5 Air: Quality and Quantity**

The only specific discharge source that alters air quality is the Coopar Ltda. extraction plant chimney. In these emissions mainly solid particles and incomplete oxidation gases such as CO can be perceived and deduced. No toxic gases (NO<sub>x</sub>, SO<sub>x</sub>) can be detected in these emissions. No houses or communities were found close to emission centers and no complaints regarding the pollution caused by these discharges were known.

### **Trend**

Without the project, there will be increased emissions and be less air pollution control. The Coopar Ltda. plant does not meet the minimum legal requirements for atmospheric emissions.

### **3.6 The Biological Environment Identified**

The specific current and planned cultivation areas are located within regions classified by the Environmental Authority as having biological interest. Inclusion of these lands within agribusiness development areas, according to the Territorial Organization Plan POT [Plan de Ordenamiento Territorial] of the Municipality of Tibú, renders them fit for a special use but fails to acknowledge their significance in terms of natural biodiversity. And in fact this is a vast area traditionally dedicated to agriculture and livestock (cattle). As was repeatedly stated in the description of the diagnosis, its vegetation is characterized by low-lying stubble in pasture areas and a total of approximately 400 hectares of African palm in the areas with the most technological investment. There is no inventory of or specific information about invertebrates.

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<sup>6</sup> Calculations made by the expert, sanitation engineer LUIS FERNANDO CASTRO HERNÁNDEZ.

## Trend

According to observations, subsequently reaffirmed by the REGIONAL BIODIVERSITY ACTION PLAN [PLAN DE ACCIÓN REGIONAL EN BIODIVERSIDAD]<sup>7</sup>, the biodiversity baseline of the Department is threatened, mainly by the following factors:

- € Uncontrolled harvesting of wood in the Catatumbo reserve (Cataumbo – Barí National Park<sup>8</sup>). As stated in the document quoted above, the project influence area does not coincide with this reserve, and neither is its location adjacent to the reserve.
- € Loss of vegetation in the higher regions of the micro-basins used as water supply for municipal aqueduct systems. The project is located on the slopes and not in the water source areas.
- € Soil erosion in the provinces of Ocaña, Pamplona and in the Cúcuta metropolitan area.
- € Construction of roadways and pollution of rivers and streams due to attacks with explosives on the Caño Limón – Coveñas oil pipeline.
- € Pollution of water sources by discharges containing domestic liquid residues, industrial liquid residues and solid residues. This aspect must be carefully evaluated and improved, as the diagnosis indicates deficiencies in the existing infrastructure.
- € Indiscriminate use of the natural forest in activities related to the exploitation of coal mines and limestone quarries.

### 3.7 Social and Economic Baseline

The regional economy is essentially based on commerce, oil, agriculture, livestock-raising activities and forestry, in that order. We must note the enormous pressure the natural forest is subject to in terms of illegal extraction of wood. The Municipality of Tibú also has cocoa, plantain, corn, yucca [manihoc], coffee, sugar cane for *panela* [Colombian hardened molasses] and modernized rice crops.

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<sup>7</sup> Norte de Santander. See Regional Biodiversity Action Plan. Biodiversidad Siglo XXI [Biodiversity 21st Century], CORPONOR-INSTITUTO VON HUMBOLDT, Bogotá, October, 2001.

<sup>8</sup> Idem previous note.

Declared a National Natural Park by Executive Resolution No. 121 of 1989. It covers 158,125 hectares and is distributed in the following in the following municipalities in the Department of Norte de Santander: Convención (35.1%), El Carmen (41.2%), Tibú (1.9%) y Teorama (21.8 %). CORPONOR 1998.

Cattle-raising has always been a major regional activity but is currently experiencing a crisis due to the “boleteo” [for “ticketing,” a warning note seeking extortion money] and [other forms of] extortion perpetrated by illegal groups.

Another economic aspect of major significance due to its influence on the initial state of reference is the decline of the oil sector. The oilfields of the state oil company ECOPETROL are in decline. African palm has been exploited technologically since 1991 and its principal development is located in the southern part of the Department, on the border between Santander del Norte and Santander del Sur.

African palm production is organized as a modern agribusiness system involving high technology in the entire process, from the establishment of plantations to the processing of the fruit and marketing of the oil. The 1,450 hectares currently in production yield of 6,210 tons of oil every year, and a profit of \$ 3. 185 [*Translator's Note: figure unclear*] each year. In spite of its existence in a sizable portion of the Department and its cultivation in relatively large plots of land (greater than 100 hectares) that are directly owned, as well as its use of a salaried workforce, the culture of production in municipalities such as La Esperanza is closely related to the social and economic development conditions prevailing in the departments of Santander and southern Cesar. There is, therefore, a certain degree of disconnection from the conditions that prevail in the Department of Norte de Santander.

### **Trend**

If African palm or any other legitimate alternate development option is not implemented, the economy of the region will continue to be dominated by illicit coca crop income. As conditions indicate, the prevalence of illegality coupled with lack of opportunities favor precisely these types of activities.

### **3.8 Public Services**

The urban portion of the Municipality of Tibú is part of a group of Colombian municipalities with good infrastructure, including equipment, drinking water, basic sanitation, electric power, telephone service, housing, residential gas service, a slaughterhouse and a marketplace.

At the rural level there is no proper inventory of dwellings and their basic sanitation conditions. Many deficiencies have been detected in the project area, especially regarding drinking water, the disposal of human waste and the handling of solid residues.

### **Trend**

The project will not exert [added] pressure on the urban public service infrastructure, since the personnel required will simply change activities at the same location. If the project is not

implemented, economic opportunities will be lost as well as the motivation and knowledge that may help the community to modify its behavior and stop using untreated water, stop using its precarious human waste disposal system, and stop throwing solid residues directly onto their own backyards and into rivers and streams.

### **3.9 Institutions**

In this case the situation has already been defined in the information supplied by CHEMONICS in support of the preparation of the EIA. The current situation is described as follows: "With the drop in agricultural and livestock production in general as well as in other sectors of the regional economy, triggered by the public law and order situation, two forms of *campesino* or peasant migration have developed: the violent displacement of growers / producers and their families, and the displacement of labor away from the region, towards the illicit coca crop, which is much more lucrative despite its higher risk. This has deterred investment in the establishment and management of the agricultural, livestock and forestry sectors, which are the traditional regional activities."

#### **Trend**

For the beneficiaries of the 400 hectares that have already been established, an opportunity would be lost, which would otherwise extend support scenarios leading to improved productivity, higher income and setting up roots and strengthening a licit sector of the economy. This situation, coupled with the higher income offered by coca crop cultivation, becomes a permanent threat since people may feel tempted to plant these crops at any time.

The remaining individuals who don't benefit from the 400 hectares would continue to live in institutional secrecy, as the activity pursued and its illegality would not allow them to safely and officially benefit from the public and private institutional infrastructure.

## **SECTION 4    AFFECTED ENVIRONMENT**

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### **PESTICIDE EVALUATION REPORT AND SAFER USE ACTION PLAN, PERSUAP.**

#### **PESTS AND PESTICIDE PROBLEMS IN OIL PALM CROP**

##### **Introduction**

Oil palm farming poses a certain number of challenges regarding the management of crop pests and pesticides used to control them, which could likewise pose certain environmental risks that need to be dealt with.

The PERSUAP presents a summary of the pests of the oil palm crop and their management, including toxic and eco-toxic analyses for some of the main pesticides used, as well as the existing options for an Integrated Pest Management (IPM) program that allow for a continuous decrease in use of agrochemicals<sup>9</sup>.

#### **4.1    The Colombia Alternative Development (CAD) Program**

The Colombia Alternative Development (CAD) program, funded by USAID in the context of Plan Colombia, supports farmers, farmers' families and farming communities that have been involved in production of illicit crops, such as coca and poppy, to switch voluntarily to licit crop production. Working with communities, community associations, and municipalities in the departments of Bolivar, Cauca, Caqueta, Huila, Nariño, Norte de Santander, Putumayo, and Tolima, the program is creating licit economic opportunities to generate income, improve the quality of life, protect the environment, and support ethnic and cultural values for peaceful coexistence. The program uses an open-bid approach to call for proposals from farmers' organizations in support of basic staple crops (*'cultivos de pan cojer'*) as well as 'industrial' crops targeted to internal or external markets, many of them with associated industrial processing and transformation.

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<sup>9</sup> The detailed requisites for pesticides in Reg. 216.3.(a).10.(b).(1).(i).(a) – (l), being literals (a) through (l) will be presented as numerals 1 to 4.2 plus the subsequent explanatory tables 1 through 8.

So far, most agricultural projects supported by CAD include low-input agricultural systems, ecologically appropriate, with an integrated, if not ecological or organic, approach to crop production and pest management. This is the case of oil palm where palm oil grower's research center, Cenipalma, changed 10 years ago the pest management approaches from a very heavy reliance upon pesticides, to the present IPM program based mainly on biological controls (see "Pest in Oil Palm Farming and Management Guide" in table No. 10). This is the type of alternative development that, by protecting the health of Colombians and their environment not only maximizes the chance of becoming sustainable in the long-term but also through diversifying production systems, increases production and reduce marketing risks.

**Recommendation No.1: CAD should continue with this eco- friendly approach to promote alternative crops, leading into sustainable development, to benefit Colombian eco-environment and health of participant farmers and their families, as well as of consumers.**

#### **4.2 Spread of insect pests and diseases**

CAD is actually taking plant samples from traditional palm oil farming areas to be introduced in other zones in Colombia. Although, most of these crops are not of foreign origin in the regions where CAD is operating, or in Colombia for that matter, they are grown in few places.

**Recommendation No.2: In order to prevent dissemination of contaminated crop seeds with pathogens, insect pests, and weed propagates, CAD should establish a strict plant sanitation/quarantine system based on international standards and follow the Instituto Colombiano Agropecuario's (ICA) certification procedures and quarantines to control importation/transportation of plant materials into the country as well as from one region to another within Colombia.**

#### **4.3 Pesticide use today**

There is no clear evidence of abuse or misuse of pesticides in CAD project crops. Two issues of concern, however, need to be mentioned. The first issue relates to the mentality of farmers that will participate in alternative development programs. Illicit crop farmers, such as those dealing with coca and poppy, are used to abundance of inputs to produce highly marketable and economically valuable illicit crops. Due to the extremely high prices paid for coca and poppy, the economic and action thresholds for pest control, as traditionally used in Integrated Pest Management (IPM), are so low that they become totally irrelevant for rationalization of use of pesticides. As such, pesticides as well as other agricultural production inputs are used in large quantities, subject to abuse and misuse. The tendency to use pesticides as the main, or even the sole, resource for pest management is one of the major challenges facing CAD in order to 'rationalize' pest management programs in alternative development farming.

The second issue is distribution of pesticides in Colombia. This is done through large- and medium-size distributors located in Bogotá, Cali, Medellín, and in other major cities in Colombia, continuing through mid- to small-size pesticide dealers located closer to the final users. During the visits carried out by the consultants to distributors, at all levels, we perceived (1) full compliance of Colombia manufacturers and importers with international codes regarding labeling and packaging of pesticides; (2) adequate size of pesticide packages as reported by the final users; (3) good degree of cleanness and organization in all stores visited; (4) no evidence of re-packaging of pesticides; and (5) a relatively good level of knowledge about pesticides, their toxicity and labeling by store attendants. A problem, although not directly observed but heard of in the field, seems to be illegal distribution of smuggled foreign pesticides, including products cancelled and prohibited in Colombia. Given the general insecurity situation of the rural areas where CAD operates, Colombian authorities are limited in their capacity to fully control this illegal traffic of pesticides.

In summary, due to extremely favorable cost/benefit ratio on the use of pesticides in illicit crops, CAD farmers overuse pesticides in licit crop production as well, without the benefit of rigorous health or environmental analysis. Many of the products used are highly toxic and many are environmental hazards<sup>10</sup>. The well-controlled legal pesticide market is offset by illegal trading of pesticides that are difficult to control. These are major challenges that both, the Government of Colombia (GOC) and CAD, face in promoting environmentally friendly and sustainable alternative development.

**Recommendation No.3: CAD should follow a strategy that (a) supports project operators to make farmers, and their families, fully aware of the health hazards of pesticides; (b) supports project operators, civil society and government authorities to make farmers, their families, and the larger Colombian community aware of environmental hazards, and social costs, related to pesticide abuse and misuse; and (c) provide technical assistance to project operators for Safer Use of Pesticides (SUP) and Integrated Pest Management (IPM), based on the principles of economic injury and action levels and thresholds<sup>11</sup>.**

#### 4.4 Pesticide evaluation

The review of oil palm pesticides, presently used by farmers, recommended by technical institutions and/or so far requested by project operators for their productive activities are shown in the tables below. Most of these pesticides were cleared based on review of the 12 points of 22 *CFR* 216.3(b)(1). However, some of them do not fully comply with USAID environmental requirements for development projects. As a whole, only 5 active ingredients were selected, to be further studied as possible pesticides to be used in oil palm crop pest management control (see table 12). These pesticides were then subject to more complete risk analyses, discussed and shown in table 13.

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<sup>10</sup> More than 30 commercial pesticides are regularly used in Putumayo. Thirty percent of local farmers use paraquat at least once a month and 14% regularly use metamidophos, among other products (US Embassy, 2001).

<sup>11</sup> IPM programs may use economic injury thresholds, e.g. when pest populations reach high numbers causing economically 'significant' damages, and/or action thresholds, e.g. the population density or the damage level require application controls to prevent the pest to reach the economic injury threshold.

**Recommendation No.4: Some of the pesticides being presently requested and or purchased by CAD operators are to be *phased out* following the subsequent timeline. (a) In order to allow time for search of alternative products, preferably non-chemical, while still protecting the crops, the insecticides: carbofuran, chlorpyrifos, and profenofos, and the fungicides: chlorothalonil and copper oxychloride should be phased out in the medium term (1-1.5 years); (b) Due to higher than accepted health and environmental risks, and the availability of pest management alternatives to these molecules, the fungicides: benzimidazole, captafol, hexaconazole, kasugamicine and ofurace, and the insecticides: methomyl, cyfluthrin, cyalothrine (lambda) and cypermethrine should be phased out in the short term (0.5-1 year);(c) highly toxic and easily replaceable insecticides: monocrotophos, metamidophos, aldicarb, isazophos, and methyl parathion and the herbicide: paraquat should be phase out immediately; and finally, (d) no product listed in the prohibited pesticides category in the U.S.A. or in Colombia, should ever be used in this project.**

#### **4.5 Safe use practices**

Colombia is one of the most advanced countries in Latin America in regards to pesticide registration, regulation and control, as well as in agronomy and associated disciplines. Colombia has adopted state of the art pesticide registration procedures, including international standards and codes for pesticide labeling and a follow-up system to control pesticide manufacturing and distribution, albeit limited by security issues during the past 25 years. Most technicians working in Colombia in pest and pesticide management have solid knowledge and understanding of IPM and safer use of pesticide procedures. However, there is room for improving interventions on Safer Use of Pesticides (SUP). The majority of farmers participating in CAD projects do not use the ‘best practices’ approach in dealing with SUP: less than 10% use some type of personal body protection in handling and product applications, and 70% of those directly exposed to pesticide spills do nothing, not even cleaning up or decontamination procedures (US Embassy, 2001).

**Recommendation No.5: Considering the traditional attitudes and practices of participant farmers regarding use of pesticides, as well as the limited GOC official presence in isolated, and conflictive, areas where CAD is operating, it is recommended that a strong SUP program be implemented. Such program should (a) be based on the pre-existing training offer already available in Colombia; (b) attempt to raise ‘awareness’ of health and environmental pesticide hazards, as well as to teach ‘good practices’ on SUP; and (c) include parallel training in ‘ecological agriculture’ and IPM, to prevent SUP to become a false panacea.**

#### **4.6 Pest management approaches**

The majority of Colombian professional agronomists have been either exposed to or trained in, or understand IPM. IPM has become, not only the ‘official’ approach to pest management at the state-

government institutional level (ICA), but also it has taken root in para-statal (Corpoica) institutions, in charge of pest and pesticide R&D, as well as in private R&D organizations. This is the case of grower's associations, such as Cenipalma, Cenicafé, Cenicaña, and Fedecacao. Moreover, Colombia is the headquarters for the well-reputed CIAT, the International Center for Tropical Agricultural Research, that has conducted pioneer research on Integrated Pest Management (IPM) of insect pests and diseases affecting various crops, especially in cassava. In regards to this PERSUAP, we highlight the availability of IPM programs for oil palm, cacao, plantain, sugar-cane and rice crops, and timber plantations.

As shown in the tables below, Colombia is well advanced in the production of bio-inputs for pest management, such as microbial pesticides, entomopathogen fungi, bacteria and viruses, as well as nematodes and parasitic wasps. These bio-inputs are produced and sold in the country by a variety of small, mainly national, industries (see tables below). The important issue, from an IPM perspective, is that these products become readily available, a healthier and environmentally friendly option to use of chemical pesticides. Quoting an expert entomologist and IPM practitioner, "Colombia is better positioned than the U.S.A. in supplying bio-pesticides to agriculture".<sup>12</sup>

**Recommendation No. 6: CAD is encouraged to disseminate among project operators the lists of bio-pesticides shown below, and to enterprises producing bio-products in an effort to promote use of bio-pesticides to substitute more toxic and environmentally hazardous chemical pesticides.**

As per Reg 216 requirements, as stated previously, in order to avoid transmitting the false idea that pesticides, if used safely, could be the sole solution to pest problems, SUP should not be promoted in isolation but rather within the context of a larger, more comprehensive approach to pest management, i.e., Integrated Pest Management, or IPM. Colombia is well ahead in IPM research and development as well as in IPM training. In addition to pesticide analyses, a considerable amount of effort in the preparation of this PERSUAP has been allocated to the development of IPM matrices that summarize available tactics to manage major crop pests and provide the user with additional references on the subject, as well as main contacts for technical support and management in this section. This is aimed to benefit CAD project operators, providing guidelines in these tables guidance, to avoid the most toxic pesticides as well as providing non-chemical options for pest management.

**Recommendation No.7: In spite of the technical level of field technicians working in CAD and CAD project operators, technical support in IPM should be strengthened. This may take the form of (a) crop specific field demonstrations on the use of non-chemical pest control methods; and (b) provision of support to technical staff of the operators for training-of-trainers, as well as training for farmers in specific IPM crop programs.**

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<sup>12</sup> Dr. Anthony Bellotti, Cassava IPM Leader, CIAT, personal communication.

**Table 5 Main Biological Inputs Produced in Colombia\***

<b>Entomopathogen Fungi</b>	<b>Fungi Bio-fungicides</b>	<b>Parasitoids</b>	<b>Predators</b>	<b>Entomopathogen Bacteria</b>	<b>Entomopathogen Viruses</b>
<i>Beauveria bassiana</i>	<i>Trichoderma harzianum</i>	<i>Trichogramma exiguum</i>	<i>Chrysoperla externa</i>	<i>Bacillus thuringiensis</i>	Nuclear Polyhydrosis Virus (NPV)
<i>Metarhizium anisopliae</i>	<i>T. lignorum</i>	<i>T. pretiosum</i>	-	-	<i>Baculovirus ello</i>
<i>Paecilomyces fumosoroseus</i>	<i>T. viridae</i>	<i>T. atopovirilia</i>	-	-	-
<i>Nomuraea rileyi</i>	<i>Gliocadium spp.</i>	-	-	-	-
<i>Paecilomyces lilacinus, minense</i>	-	-	-	-	-
<i>Verticillium lecanii</i>	-	-	-	-	-

∄ Table courtesy of Dr. A. Bellotti, CIAT.

**Table 6 Main Enterprises Producing Biological Inputs in Colombia\***

Enterprise	Inputs = Organisms
Agricultura Biológica <b>(Buga-Valle del Cauca)</b>	Entomopathogen fungi, Parasitoids, Predators, Bio-fungicides
<b>Agrobiol</b> (Buga-Valle del Cauca)	Parasitoids
<b>Bioecológicos</b> (Palmira-Valle del Cauca)	Entomopathogen fungi, Parasitoids, Predators, Bio-fertilisers
<b>Biocontrol</b> (Palmira-Valle del Cauca)	Entomopathogen fungi
<b>Productos Biológicos Perkins</b> (Palmira-Valle del Cauca)	Entomopathogen fungi, Parasitoids, Predators
<b>Productos Biológicos El Bolo</b> (Palmira-Valle del Cauca)	Parasitoids
<b>Laverlam</b> (Cali-Valle del Cauca)	Entomopathogen fungi and viruses
<b>Orius</b> (Villavicencio-Meta)	Entomopathogen fungi
<b>Biogarden</b> (Bogotá-Cundinamarca)	Entomopathogen fungi
<b>Biocaribe</b> (Medellín-Antioquía)	Entomopathogen fungi
<b>Live System Technology-LST</b> (Bogotá)	Entomopathogen fungi, Bio-fungicides

\* Table courtesy of Dr. A. Bellotti, CIAT

#### **4.7 CAD Environmental Compliance**

CAD is undertaking full compliance of USAID environmental regulations in Colombia. Previous Initial Environmental Examinations (IEE) have been completed for most CAD projects and related activities, as per LAC-IEE-99-38 and LAC-IEE-00-35. A Programmatic Environmental Assessment (PEA) was completed for CAD and approved in June 2003. USAID required CAD to regularize environmental compliance, including preparation of a full study on pesticides used in alternative crops promoted by CAD. To this effect, Chemonics International commissioned the present Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) for crop projects supported by CAD to date.

#### **4.8 PERSUAP**

This PERSUAP has been prepared to achieve the dual purpose of (a) complying with USAID environmental regulations, and (b) providing CAD project operators with practical tools for better and safer management of pests affecting their crops. The PERSUAP not only analyses pest and pesticide issues in crops supported by CAD, but also addresses broader issues related to pest and pesticide management in CAD and in Colombia, such as GOC regulatory and institutional frameworks, agro-ecology of areas of intervention, training and technical capacity strengthening, and provides guidelines for SUP and IPM, as well as identifying project opportunities in Colombia. Future commodities, pests and pesticide products to be considered under CAD, are covered in this document.

During preparation of the PERSUAP, visits were made to the Instituto Colombiano Agropecuario (ICA), the Colombian pesticide authority, and to major Colombian and international technical institutions offering pest management technology and training, such as Cenipalma, Fedecacao, IICA, Corpoica, Centro de Excelencia en Fitoprotección (Aphis, USDA, IICA, ICA, USAID), CONIF; universities (Nacional) and training centers (SENA); private sector (Bayer CropScience, ANDI, BioEcológicos, SEG, pesticide dealers); and environmental consultant companies (Tres Elementos, CAEMA). The consultant traveled to Norte de Santander (Cúcuta) and Putumayo (Puerto Asís), to meet CAD project operators, technical staff and conduct project observations on-site.

#### **4.9 Status of Registration of Pesticides in Colombia and with US-EPA: 22 CFR 216.3 (b)(1)(i)(a)**

Close to 55 pesticide active ingredients were screened to determine the status of registration with (CA)<sup>13</sup>, and with the U.S. Environmental Protection Agency (USEPA)<sup>14</sup> The list of pesticides in oil

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<sup>13</sup> Updated “Chemical Pesticide, Bio-inputs and Generics” database obtained courtesy of ICA authorities.

<sup>14</sup> EPA databases were consulted at web sites.

palm crop farming was compiled from information provided by CAD operators to Chemonics requesting clearance for purchasing pesticides as of June 2003, and other pesticides following the recommendations of Colombian public and private technical institutions<sup>15</sup>.

**Recommendation No. 8:** The list of pesticides to be purchased by CAD operators should be screened by the CAD Natural Resources and Environment (NRE) team, based on pesticide lists included in this PERSUAP. Pesticides not mentioned in this PERSUAP should be subject to a screening process. Products not registered with ICA, Colombia and with US-EPA should not, in principle, be approved (see exceptions discussed below).

**Recommendation No.9 :** Below is a summary of the oil palm crop pesticide analysis and recommendations:

- ↓ **Products not registered in the U.S. and Colombia or in PIC<sup>16</sup> list.** NOT TO BE USED UNDER ANY CIRCUMSTANCE: captafol, isazofol, methyl parathion and methamidophos.
- ↓ **Products not yet registered in the U.S. or Colombia.** Although the first product listed in this category is a microbial product, and the second is a plant extract, both products are NOT TO BE USED UNTIL REGISTERED at least in Colombia: *Baculovirus spodopterae* and *Swingla* (extracts).
- ↓ **Products not registered in Colombia.** NOT TO BE USED UNDER ANY CIRCUMSTANCE: endosulfan.
- ↓ **Products not registered with USEPA.** NOT TO BE USED UNDER ANY CIRCUMSTANCE: benzimidazole, hexaconazole, kasugamicine, monocrotophos, and ofurace.
- ↓ **Products not registered with USEPA but registered in Colombia,** APPROVED TO BE USED: extracts of *Glyricidia sepium*, since the product (*Glyricidia*), the crop (vanilla) and the pest (*Cylsia*), do not exist in the U.S.. *Paecilomices liacinus*, both the crop (heart of palm) and the pest (*Leptopharsa*) do not exist in the U.S.A., and the pesticide is a microbial insecticide with unlikely environmental or health impact; and *Trichogramma pretiosum* and *Verticillium lecanii*, are both microbial insecticides with unlikely environmental or health impacts.
- ↓ **Products that are RUP with USEPA.** NOT TO BE USED: aldicarb, cyalothrine (lambda) cyfluthrin, chlorothalonil, chlorpyrifos, copper oxychloride, cypermethrine, methomyl, paraquat, profenofos
- ↓ **Products that are RUP<sup>17</sup> with USEPA.** USE ONLY CERTAIN FORMULATIONS to reduce health or environmental risk: carbofuran (pellets/tablet), and picloram (Tordon 101R).

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<sup>15</sup> Technical information sources: ICA or Corpoica, Colombia government recommendations, growers' associations, research centers, international research centers and literature references applicable to Colombian conditions, with solid technical and scientific background.

<sup>16</sup> 'PIC List' is the Prior Informed Consent List of the Rotterdam Convention, led by UNEP and FAO, that applies to international shipment of most-hazardous chemicals.

<sup>17</sup> RUP: Restricted Use Pesticide.

**Timelines for implementation of recommendations are shown in Table below:  
Table 7 Summary of Pesticides to be Phased Out by CAD**

<b>To be phased out immediately:</b>			<b>To be phased out within 6-12 months</b>		
Technical Name	Trade Name	Uses	Technical Name	Trade Name	Uses
Monocrotophos	Azodrin	Heart of palm	Benzimidazole	Benomyl+	Requested by operators
Methamidophos	Tamaron	Various crops	Captafol	Difolatan	Cassava
Aldicarb	Temik	Potato	Cyfluthrin	Bulldock	Requested by operators
Isazofos	Miral	Potato	Hexaconazole	Anvil	Requested by operators
Methyl-parathion	Methyl-parathion, etc.	Rice	Methomyl	Lannate	Requested by operators
Paraquat	Gramoxone	Various crops	Kasugamicine	Kasumin	Potato
To be phased out within 12-18 months			To be phased out within 6-12 months		
<b>Technical Name</b>	<b>Trade Name</b>	<b>Uses</b>	<b>Technical Name</b>	<b>Trade Name</b>	<b>Uses</b>
Carbofuran	Furadan	Cassava,Rubber, Plantain, Nurseries	Ofurace	Grolan	Requested by operators
Copper oxychloride	Agrotox	Cassava	Cyalthrine, lambda	Karate, Terminex	Potato
Chlorpyrifos	Lorsban	Plantain, Oil Palm, Cassava, Rubber, Forest Plantations	Cypermethrine	Saat Pop, Agroper, Cipermetrina	Rice
Profenofos	Curacron	Rubber	-----	-----	-----
Chlorothalonil	Bravo	Rubber	-----	-----	-----

#### **4.10 Basis for Selecting Pesticides: 22 CFR 216.3 (b)(1)(i)(b)**

The main reason for selecting these pesticides is availability, efficacy and cost. This is typically the case of products such as chlorpyrifos and carbofuran that, although both are RUPs, they are some of the most effective, and cheapest, insecticides and nematocides, as well as preferred products for ant control.

A criterion usually overlooked in the selection of pesticides is pesticide formulation. A simple way to reduce exposure risk to certain pesticides, such as chlorpyrifos, is to switch to formulations like granules or pellets not subject to dangerous spills and drift. The same criteria may be applicable in reducing environmental impacts caused by certain pesticides, such as picloram, an herbicide, by injecting this product in bushy weeds, instead of spraying; this helps in reducing the volume of the product applied on the target and the area impacted. Care must be exercised, however, because granular or pellet formulations, a more attractive method, are toxic to birds. In summary, the

potential health and environmental impacts inherent to one or more formulations available in the market should always be considered, checked and analyzed in selecting a pesticide.

**Recommendation No. 10: CAD should implement training in SUP for operator’s technical staff on pesticide selection. Other variables such as product toxicity (using color-coded labels), potential environmental impact, and product formulation should be considered in selecting pesticides, in addition to efficacy, availability and cost.**

#### **4.11 Pesticides in the Context of Integrated Pest Management Programs: 22 CFR 216.3 (b)(1)(i)(c)**

USAID’s “Integrated Pest Management” policy is the most effective, economical and safest approach to pest control. IPM attempts to control pests economically and environmentally; it emphasizes non-chemical tactics that cause minimal disruption of the ecosystem”<sup>18</sup>. Pesticides should be used as the last resource in pest management after all other options have proven ineffective. Genetic (plant tolerance or resistance), biological (natural enemies), ethological (naturally occurring chemical disrupters), cultural (production practices), and mechanical (physical removal) are preferred tactics to be used before resorting to chemical control (pesticides).

Introduction on IPM possibilities for oil palm crops are shown in Table 9; including a list of various crop pest problems, management options available, specific pesticides for pests and potential problems and control options. The list also offers technical support offers at the institutional level, as well as individuals and other sources of information, such as literature references and websites.

**Recommendation No. 11: No crop should be promoted without first establishing an IPM program. CAD should install at least one IPM demonstration site for each crop in project sites. To this effect, CAD should work with local UMATAS (Municipal Agronomic Technical Assistance Unit) and request technical support of the institutions and individuals listed in pest management proposals.**

#### **4.12 Method of Application: 22 CFR 216.3 (b)(1)(i)(d)**

Although a few farmers may have access to stationary-pump spraying systems, a common device in illicit crop zones, most pesticide applications are done with back-pack sprayers. Using sprayers often result in: (a) poor maintenance causing leaks and significant exposure of the applicator to pesticides, and/or (b) inappropriate nozzle settings not responsive to pesticide specifications (insecticides, fungicides or herbicides). Pesticide mixing is also an issue; more often than not, farmers do not follow precautionary measures, high product concentration or undiluted mixes increases the risk of exposure. Often enough, women and children in project areas participate in mixing operations or stay close to mixing sites, or near spraying equipment being cleaned or

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<sup>18</sup> USAID/AFR Guidance: Preparing PERSUAPs for Pesticide Programs in Africa.

maintained. Finally, cleaning and disposing of surplus pesticides and product containers should follow strict safety regulations, to minimize human and environmental risks.

**Recommendation No.12: CAD SUP program must support three essential components: (a) a comprehensive training program on “best practices” in SUP (see 3.11); (b) insist operators in wearing appropriate<sup>19</sup> protective clothing and equipment (gloves, masks, boots, etc.); and (c) maintenance and repair of spray equipment.**

#### **4.13 Possible toxicological hazards to humans or to the environment: 22 CFR 216.3 (b)(1)(i)(e)**

A pesticide risk analysis was done on 9 products that passed the first screening test (see Table 13.). This analysis included identifying acute and chronic toxicity of selected pesticides on humans, ecotoxicity and potential for water contamination. As a result, recommendations were drawn in regards to general and specific mitigation activities to be conducted in order to prevent and/or reduce the potential health and/or environmental impact hazard of pesticides used in program activities. These mitigation activities are all included within the comprehensive risk-mitigation SUP and IPM programs.

**Recommendation No. 13: CAD should socialize and share with project operators the results of the risk analysis of the pesticides and assure full implementation of mitigation measures recommended.**

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<sup>19</sup> This means adequate for local climatic conditions (temperature and humidity) and possible adaptations using local materials (plastic bottle masks, plastic bags-gloves, etc.) instead of imported clothing.

#### **4.14 Effectiveness of Pesticides: 22 CFR 216.3 (b)(1)(i)(f)**

Recommendations for pesticide and other pest management tactics to be used in project crops have been drafted and/or double-checked with authorized agricultural R&D institutions in Colombia. Additionally, technical literature references and relevant websites were consulted. It should be noted that CAD has access to many institutions that can provide technical information and support, as well as training in pest and pesticide management.

#### **4.15 Compatibility of Pesticides with Target and non-target Organisms: 22 CFR 216.3 (b)(1)(i)(g)**

The pesticide risk analyses mentioned above, discusses the main risks inherent to use of pesticides on non-target organisms and the environment, as well as potential impacts on target organisms, such as the likelihood of encouraging development of pest resistance. Information on main direct mitigation measures to prevent and reduce the potential impact of pesticides to non-target organisms is also provided. General approaches to prevent and mitigate health and environmental impacts of pest management activities are discussed elsewhere in this PERSUAP, as well as SUP and IPM.

#### **4.16 Prevailing Conditions in Areas Subject to Use of Pesticides : 22 CFR 216.3 (b)(1)(i)(h)**

Large portions of Colombia are plains, located below 500 meters above sea level (m.a.s.l.). The country could be roughly divided into six great geographical regions: the Andean zone, including three mountain ranges and the “inter-Andean” valleys; two coastal regions, the Caribbean and the Pacific; the plains of Antioquia; the Amazonian forests; and finally, the insular region.

CAD is being implemented in southeastern Colombia, in the Departments of Putumayo, Huila, Cauca, Nariño, Caquetá, and in the department of Norte de Santander, in northeastern Colombia. Illicit crops, coca and poppy, abound in these departments.

Colombia’s climate is tropical with weather patterns strongly influenced by the Andes. They are normally classified as: (a) hot zones covering close to 84% of the territory, reaching up to 1,000 m.a.s.l. with average temperature of 24° C; (b) temperate zones, at altitudes between 1,000 to 2000 m.a.s.l., with average temperature of 17.5° C; and (c) cold zones, with average temperature of 12° C, and altitudes of 2,000-3,000 and over m.a.s.l..

Ecologically, Putumayo, Caquetá, Norte de Santander, and Huila have predominant pre-mountainous humid forests (Bh-pm) with close to 1,000-2,000 mm/yr, 18-24°C, to low mountainous forest (Bh-mb) 2,000-2,500 m.a.s.l. 12-18°C. Cauca, Nariño and Tolima have predominance of pre-mountainous to mountainous forests with a variable levels of humidity and temperate to cold climate.

**4.17 Availability and effectiveness of other pesticides and of non-chemical Controls: 22 CFR 216.3 (b)(1)(i)(i)**

The use of pesticides in CAD projects will be inserted into comprehensive IPM programs. The “Decision Making Tree for IPM & a Guideline for SUP”, discussed above, should help in making decisions in regards to pesticide use. Matrices shown in this section present available pesticide options and pest management tactics for crops and pests in question. There are, however, some problems with certain recalcitrant pests, such as ants, that are ubiquitous and pose a serious threat to certain crops, such as young trees, rubber, oil palm and heart of palm. Ants are not easy to control, and tend to draw to some of the most toxic chemicals, such as carbofuran and chlorpyrifos. Non chemical options are being suggested and proposed in the pest and pest management matrices for some crops.

**Example of a non-chemical approach to recalcitrant pests: the case of ants**

- ↓ Attractive baits
- ↓ Nest destruction early in development stages
- ↓ Prevention of the emergence of winged ants with covers
- ↓ Applying cal to change pH and destroy the fungi that is used as a food by ants
- ↓ Seeding castor bean (*Ricinus communis*) in rotation or inter-cropped (inhibits ants)
- ↓ Plough-in green manure (organic matter attracts them away from crop)
- ↓ Irrigation

**4.18 Capability of Colombian institutions to regulate and control pesticide use: 22 CFR 216.3 (b)(1)(i)(j)**

As stated above, Colombia is one of the most advanced countries in Latin America with respect to pesticide registration, regulation, and control. Colombia has very modern registration procedures, applies international standards and codes for pesticide labeling and has a system to follow up and control pesticide manufacturers and distributors that is only limited by the insecurity situation that the country has been living in for the past 25 years. The Instituto Colombiano Agropecuario, ICA, in charge of pesticide regulation, has taken more than 30 actions to ban hazardous pesticides or groups of pesticides, among which DDT, methyl bromide, canfechlor, captafol, all organochlorides, and

toxaphene. Moreover, ICA requires that all Class IA and IB pesticides sold in the country have a back up ‘prescription’ written by a professional agronomist. Undoubtedly, the widespread insecurity in the majority of the rural territory of the country, and more specifically in the areas where CAD is active, limits the enforcing capacity of the GOC institutions. Although, the degree and effectiveness of controls in these areas is somehow limited and less than desirable, during the preparation of this PERSUAP we had first hand evidence of on going inspections to pesticide dealers in the Department of Putumayo, one of the most affected by the conflict.

Colombia pesticide regulations fits within its larger environmental framework, as per law 99 of 1993, “Fundamentals of the Colombian Environmental Policy”. This law created the Ministry of Environment and the National Environmental System and established the “Environmental License” further regulated by decrees 1728 of 2002 and 1180 of 2003.

The modernization of Colombia’s legislation related to pesticides begins with a major law, No. 09, approved by the National Congress in January 1979, regulating “hazardous substances, pesticides, and pyrotechnic articles”. This law was followed by decree No. 1843, from 1991, that further “regulates the use and management of pesticides”. This decree defined and clarified terms and elements for the registration of pesticides, such as “efficacy”, “contamination”, “fumigation”, “residue limits”, “risk” and “toxicity”, and officially adopted the four-classes WHO hazard classification of pesticides<sup>20</sup>. The same decree further regulated the manufacture and distribution of pesticides in the country.

More recently, Colombia has fully adopted the regional norms that derive from the actions taken by the ‘Andean Community’ (Comunidad Andina, CAN), to which Colombia is a signatory. The CAN, a result of the integration of Bolivia, Colombia, Ecuador, Peru and Venezuela, began activities in 1997 and in 1998, the ‘Andean Norm for the Registration and Control of Chemical Pesticides for Agricultural Use’ (Decision 436) was enacted. In this regulation, the five Andean countries committed themselves to a normative towards a common system for registration, control and use of pesticides. CAN decision No.436 established, among other things, (a) the requirements for pesticide registration; (b) norms for labeling and packaging; (c) maximum residue tolerances; and (d) norms for product efficacy research. Later, according to resolution 532, of August 2001, CAN adopted the ‘Technical Manual for the Registration and Control of Chemical Pesticides for Agricultural Use’, which was fully developed and published in June 2002, in Resolution 630. This is very comprehensive manual, including detailed instructions to register chemical pesticides, with all the information requirements on the technical as well as the formulated material, as they relate to efficacy, human and eco-toxicology, residues, labeling, packaging, risks and the environmental management plan. Finally, ICA, as the GOC institution in charge of registration and control of pesticides, fully executes the application of the CAN decrees internally to Colombia, in its resolution No. 00770 of March 2003.

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<sup>20</sup> The WHO classification: IA (extremely hazardous), IB (highly hazardous), II (moderately hazardous), III (slightly hazardous), and ‘U’ (improbable of presenting an acute risk in normal use). The LD<sub>50</sub> used for chronic toxicity is either oral (O) or dermal (D). Colombia uses the same classification but classes are numbered I-IV.

Given this comprehensive and detailed pesticide regulation framework, again, the capacity of Colombia to regulate and control pesticides is only restricted by the general situation of the country, with somewhat weak institutional presence in certain isolated areas. This, however, does not preclude, as we reported above, that ICA authorities are still enforcing some pesticide rules and regulations.

#### **4.19 Provisions for Training in SUP and IPM: 22 CFR 216.3 (b)(1)(i)(k)**

CAD supported SUP training program should focus on risk reduction rather than on safe use of pesticides. In other words, instead of sending the message that pesticides could be used safely, the main goal of the training program should be to reduce the risk of farmers and their families by the careful analysis, and management, of the variables that affect the components of risk:

$$\text{Risk} = \text{toxicity} \times \text{exposure}$$

This means that the “safer use”, through risk reduction, begins before the “use” of the product, during its selection and preparation, and continues well after its use, in the field where the product is applied<sup>21</sup>.

SUP training could be sub-contracted with Bayer CropScience or with the Servicio Nacional de Aprendizaje-Asociación Nacional de Industriales (SENA-ANDI). The former, a chemical company, runs a program called “Agrovida” that focuses on SUP for farmers or farmer’s families. Since women and children are in the higher vulnerability group, and women are often involved in storing pesticides as well as in cleaning farmer’s clothes, they are an audience of extreme importance to be reached with messages of risk reduction. The second is a joint program between a GOC agency, SENA, and the Association of Industrialists, offerings two options, a two-day user targeted training course, and a 5-day training-of-trainers event. CAD should consider training a few ‘trainers’, from the operators’ staff, in each one of the regions where it operates.

The contents of the training program may need to be adjusted to attend to various audiences, but nevertheless, it should include the themes listed in the training program attached, such as risk management, toxicology, labels, transporting, storage, mixing, spraying, cleaning, discarding, container management, applicators protection, etc.

**Recommendation No. 14: Training on SUP should (a) focus on risk reduction; (b) reach the various important audiences: pesticide dealers, farmers, farmer families (women and children), staff of CAD project operators (trainers); (c) use already available training offers in Colombia, such as the ‘Agrovida’ program sponsored by Bayer CropScience, for farmers and**

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<sup>21</sup> For more details see in section 5.3 the Power Point presentation “A Practical Guide: Reducing Pesticide Risk”, in Spanish.

**their families (women and children), and/or the SENA-ANDI joint training program for farmers and trainers.**

As stated previously, in order not to transmit the false idea that pesticides, used safely, could be the sole solution to pest problems, SUP should not be promoted in isolation but rather in the context of a larger, more comprehensive approach to pest management, i.e., the Integrated Pest Management, or IPM. Moreover, training in ecological and organic agricultural concepts and practices may always help CAD project operators to better understand, and even search for and experiment with, non-chemical options for pest control

**Recommendation No. 15: CAD should promote a holistic agro-ecological approach, not only to pest management but also to crop producers. Training facilities, as well as technical support, in topics such as IPM, organic or ecological agriculture, are available in Colombia from various institutions. A list of possible technical partners that CAD could resort to in the search for technical support follows.**

**Table 8 Technical agreements for CAD**

<b>Institution</b>	<b>Crop</b>	<b>The Topics</b>
CIAT	Cassava, dry-beans, vanilla	Pest & crop management
Fedecacao	Cacao	Pest & crop management
Cenicaña	Sugar-cane	Pest & crop management
Cenipalma	Palm oil, heart of palm	Pest & crop management
Centro de Excelencia en Fitoprotección (CEF)	Tree tomato, lulo, passion fruit, tomatoes, Amazonian fruits	Quarantine, pest management, pest risk analyses
Corpoica	Various	IPM in general; training
CONIF	Forest plantations, nurseries	Pest & crop management
IICA	Various	Ecological agriculture
IPGRI	Various	Quarantine & plant introductions
ICA	Various	Pesticides: registration & control; training
SENA	Various	IPM & organic agriculture; SUP; training
ANDI	Various	SUP training
Bayer CropScience	Various	SUP training: Agrovida
SGS / BioTrópico	Various	Certifications

#### **4.20 Effective Monitoring and Pesticide Use: 22 CFR 216.3 (b)(1)(I)(1)**

CAD is working with farmers associations and enterprises that have a relatively good level of organization. Most have well-trained field technicians monitoring pest management problems and the effectiveness of pest management methods being used, on a regular basis. Open and regular reporting lines exist within CAD project operators and Chemonics to communicate issues such as new pest appearances as well as failures of standard methods being used. Moreover, Chemonics Natural Resources and Environment Group has the capacity for, and it is taking a lead role in,

monitoring the most significant environment related variables of the project, including the effectiveness of pesticides.

## 4.21 Environmental Compliance

### 4.21.1 Monitoring

A set of compliance indicators and PERSUAP recommendations grouped by major themes is being proposed, as shown in the table below.

**Table 9 Monitoring Plan for PERSUAP Recommendations**

Monitoring Theme	Recommendation	Indicator/s	Special Requirements
Sustainable alternative development	1	<ul style="list-style-type: none"> <li>↓ Poly-cropping promoted &amp; adopted by farmers</li> <li>↓ System approach to alternative development in place, promoted &amp; being implemented</li> </ul>	Re-asses promotion of crops versus systems
Phytosanitary system for movement of plant materials	2	<ul style="list-style-type: none"> <li>↓ ICA certification in place for internal movement of plant materials</li> <li>↓ Quarantine in place for foreign materials</li> </ul>	Establish links with ICA
Safer Use of Pesticides: hazard awareness, pesticide phase out, pesticide screening, training program, equipment support, risk analysis	3, 4, 5, 8, 9, 10, 12, 13	<ul style="list-style-type: none"> <li>↓ Operators aware of color band meaning in products &amp; using info for selecting pesticides</li> <li>↓ Operators pesticide request list regularly checked by CAD-NRE<sup>22</sup> team</li> <li>↓ Trend for decreased 'red &amp; yellow' band pesticides request lists</li> <li>↓ No monocrotofos &amp; paraquat by Dec '03</li> <li>↓ No methomyl &amp; others by Aug 04</li> <li>↓ No chlorpyrifos, carbofuran &amp; others by Aug 05</li> <li>↓ SUP KAP changed</li> <li>↓ Parts &amp; repairs offered for spray equipment</li> </ul>	Training programs contracted & courses offered. Financial resources from CAD allocated for training & equipment
Integrated Pest Management: training (IPM, Eco), bio-pesticides, field demos	6, 7, 11, 14	<ul style="list-style-type: none"> <li>↓ Ecological agriculture &amp; IPM training contracted, offered, finished &amp; KAP<sup>23</sup> monitored</li> <li>↓ IPM demo fields installed &amp; monitored for all crops</li> <li>↓ Operators aware of &amp; using bio-pesticides</li> <li>↓ Operators using a wide range of pest management practices (more than 3 per pest)</li> </ul>	Training programs contracted & courses offered. Financial resources allocated for IPM demos
Sustainability of Environmental Compliance	16	<ul style="list-style-type: none"> <li>↓ Market-led environmental compliance through: organic agriculture, EurepGap, Illicit-to-Licit or other type of certification in place, or</li> <li>↓ A third party system installed for auditing environmental compliance</li> </ul>	Contacts made, bids open, resources allocated to initiate / catalyze both processes

<sup>22</sup> Natural Resources and the Environment

<sup>23</sup> KAP: Knowledge, Attitude and Practices.

#### 4.21.2 Long-term sustainability

Environmental compliance with Regulation 216 provisions, vis-à-vis pesticide issues could be assured through the auditing role of Chemonics NRE group. The group could check the pesticide purchasing lists submitted regularly by CAD project operators to Chemonics for approval and pesticide screening. It may also conduct project operator's field-checks to inspect pesticide storage buildings, follow up selected field operations and check on pesticide selection, mixing and use. [This has already been proposed in Recommendation No. 8]. However, since this monitoring is based mainly on a 'police' approach to compliance, its sustainability is somewhat questionable. Although, an important 'educational' component, on SU and IPM, has been included in this PERSUAP, farmers may 'comply' with environmental regulations only and as long as the policing pressure is maintained. And this will probably happen as long as USAID and Chemonics continue funding and implementing CAD activities. It could very well end-up right after that ...

A similar approach, one that promotes a more direct participation and appropriation of environmental compliance issues by the Colombian civic society, is allocating the 'policing' role to a 'third party' such as a local NGO or a consultant. The profile of this auditing may be similar to the NGOs or consultants that Chemonics NRE group has already contracted to do the environmental studies of CAD productive activities. The local, Colombian, NGOs and consultant companies visited have demonstrated the capacity and the interest to undertake such work. Based on the table 9, and on the 16 recommendations of this PERSUAP, CAD could develop a more detailed monitoring plan, agreed to among USAID, Chemonics, and the CAD operators, and assign a third party agency its verification following a system of open bids, as it is normally done in CAD.

A more sustainable path to environmental compliance may be a 'market-led' mechanism. If the market rewards an environmentally sound, clean, ecological or whatever product, then farmers will have to comply with certain production norms in order to be able to access and receive that reward. Third party certification is the key to this and not necessarily has to take the form of purely 'organic' production. Some of the Colombian certifying agencies contacted, such as *Biotrópico*, are working on organic produce certification, with the support of IFOAM, but also certify other producers. Among the latter are the coffee growers associated in COSURCA, exporting 'fair trade' coffee to the U.S. market, through a project funded by USAID and UNDP. Other enterprises, such as the Swiss SGS, are certifying aromatic plant producers for EurepGap norms, as well as Colombian flower exporters. Finally, the fruit growers association ASPROME, based in Cali, is exporting 'organic marmalades' to Europe, certified by Naturland-IFOAM, from fruits produced in a project funded by GTZ, the German Government and the European Community. The certification system is so simple as to work out a detail set of agreed rules, and corresponding indicators to track them, between producers, donors, project implementers and the certifying agency. The rules could easily be those established as environmental compliance requirements in Regulation 216, tracked by indicators such as pesticides registered with Colombia-ICA and US-EPA, no RUP pesticides, no class IA and IB products, etc. Again, in the table 9, the 16 recommendations could be used as the basis for a framework for certification of USAID environmental compliance.

**Recommendation No. 16: CAD is encouraged to seek a sustainable mechanism for pesticide environmental compliance. This could take the form of (a) a third party independent auditing on use and management of pests and pesticides by project operators; and/or (b) a market-lead environmental (vis-à-vis pesticides) compliance mechanism through a third party, independent, certification agency that assures ‘organic’, ‘EurepGap’, ‘low-intensity pesticide use’, ‘IPM-based’, or agricultural production based on Regulation 216 requirements.**

#### **4.22 Training and Best Agricultural Practices Plan (BPA). Recommendations in the Pesticide Evaluation Report and Safe Use Action Plan PERSUAP<sup>24</sup>**

Insect Pest<sup>25</sup> are one of the principal problems affecting agricultural production and crops, decreasing productivity and/or product quality, resulting in important economic losses. Moreover, improper management and abuse of pesticides utilized in plague control may also lead to severe economic losses and negative environmental impacts (air pollution, contamination of soil and water resources) as well as loss of biodiversity and other negative effects. The combination of the negative factors mentioned above also cause the worst of all affectations i.e., the health of agricultural workers, their families and even, the health of consumers of agricultural products, is threatened.

CAD complies fully with USAID’s provisions, the grantee agency, established in USAID’s regulation 216. CAD has already carried out detailed environmental assessments of productive agricultural and transformation activities that are being or will be supported by the project. Such studies are known as Environmental Assessments (EA) and include, normally, an environmental diagnosis of the project site, a study of potential impacts caused by project activities and an environmental management plan that proposes prevention and mitigation measures of possible environmental impacts caused by development activities.

Specifically, CAD just completed phase 1 of a detailed study on pesticides currently used in more than 20 productive projects, including alternative methods to replace the use of pesticides available in Colombia for agricultural plague management. CAD is presently implementing phase 2 of this study covering almost 40 additional crops. This study, called “Pesticide Evaluation Report and Safer Use Action Plan”, or PERSUAP, follows closely the requirements stated in Regulation 216 of the United States Government applicable to each type of pesticide that may or will be used in CAD projects, planned or recommended, for crop plague management, as called for in 12 sections of Regulation 216, including:

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<sup>24</sup> Draft No. 3, 29 October 2003

<sup>25</sup> The term Plague utilized through this document refers to its broad generic meaning, including insects, other arthropods and invertebrates, several pathogens, weeds and vertebrates.

1. Status of registration of pesticides in Colombia and with USEPA;
2. Basis for selection of pesticides for any particular application; why was such pesticide selected?
3. To which extent are pesticides part of Integral Plague Management systems?
4. Methods of application, including availability and use of appropriate equipment for application of pesticides and protective measures;
5. Acute long-range risks to humans and the environment, associated to proposed use of pesticides and available measures to reduce dangers thereof;
6. Efficacy of selected pesticides to meet expected results;
7. Compatibility of pesticides with natural ecosystems within their main objectives or other project objectives proposed;
8. Conditions under which pesticides will be used, including weather, flora, wildlife, geography, hydrology and soils;
9. Availability and effectiveness of other pesticides and/or non-chemical methods to control target plague(s);
10. Capability of operators and project implementers throughout Colombia to regulate or controlling distribution, storage, use and final disposal of pesticides;
11. Provisions for training of pesticide users and operators;
12. Provisions for effective monitoring, use and efficacy of pesticides.

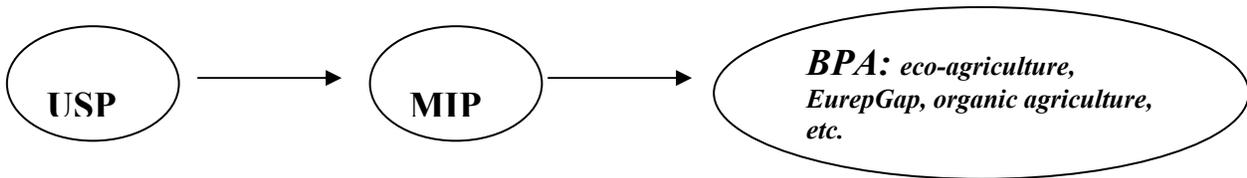
The study mentioned above includes a list of (a) **banned pesticides**, prohibited in Colombia and in The United States (the donor country) or in both countries; (b) **products not approved**, or restricted in The United States, or products potentially harmful to human health or the environment in Colombia. A process of substitution of these products within a 0.5 – 1 year timeframe has been established; and (c) **approved products** that may be utilized in CAD projects. Beyond the strict control measures exerted by CAD on the use of pesticides in CAD projects, there is a commitment to promote the Best Agricultural Practice (BPA) production activities, including Integrated Plague Management (MIP) and Safe Use of Chemical Pesticides (USP), to contribute to sustainable alternative development. With this in mind, CAD developed a far-reaching training plan in support of BPA, MIP and USP.

#### 4.23 Training Plan, Objectives

The Training Plan follows-up the application of PERSUAP recommendations. Its general objective is **to develop technical capacity within CAD project operators, at the technical and production levels, to implement clean environmental production systems contributing to minimize hazardous risks on producers and consumers health.** This plan was developed to assure that CAD not only complies with PERSUAP recommendations, but also will meet program indicators and goals listed in the Monitoring Plan, in regards to use of pesticides and agricultural plague management activities carried out by project operators.

Specifically, the Training Plan aims to develop particular and broad technical skills in (a) **safer use of pesticides in agriculture**, such as appropriate approaches: ecological, economical and social; (b) **integrated management of agricultural Pest**, applying appropriate technological, economic and social systems approach; (c) **ecological or organic agricultural production**, if such approach is economically feasible within a production methodology context applicable to protection of the

environment and human health. The proposal aims towards offering general training and specific training to technicians to strengthen their capability, thus enabling technicians to offer productive options to participant farmers, including social, economical and environmentally acceptable elements.



**Table 10. Pest in Oil Palm Farming (*Elaeis guineensis*) and Management Guide**

**General Comments:** Cenipalma is a staunch supporter of MIP principles and application. In the last ten years, Cenipalma changed application of pesticides in oil palm farming, a system that was widely employed in the past. Cenipalma adopted new plague control policies that minimize the use of agrochemicals. Cenipalma’s new approach to plague control includes decreasing natural destruction of Pest by (1) increasing biodiversity in oil palm plantations, i.e., turning to nectarial plants instead of planting kudzu grass only, and applying new spacing patterns between plants; (2) reviewing new Pest emerging in plantations to identify their origin; and, (3) reducing pesticides in plague management control.

Plague(s)	Control Methods	Pesticides	Problems
Arthropods:			
Small horny worm ( <i>Stenomacropis cecropia</i> )	Biological and microbiological:	Release of <i>Trichogramma pretiosum</i> . Application of <i>Beauveria bassiana</i> or <i>Bacillus thuringiensis</i> during high humidity periods. More recently, application of <i>poliedrosis</i> , a nuclear virus, is being used in insect control.	Foliage plague in northern and western zones.  Cenipalma isolates and selects <i>Beauveria</i> stocks to be delivered to oil palm growers to promote widespread use of product. (“Palma de Oriente” produces <i>Beauveria</i> for Cenipalma to be sold to third parties).
	Cultural: manual collection of cases.		
	Natural Biological: <i>Trichogramma spp.</i> Use parasitoids: <i>Rhysipolis</i> and <i>Elasmus</i> for larvae and <i>Brachymeria</i> and <i>Tripoxilon</i> for cocoon control..		
Large horny worm ( <i>Loxotoma elegans</i> )	Cultural: Use nectarial plants, such as ‘pata de tórtola or dove’s legs ( <i>Croton trinitatis</i> ).		Foliage plague in Eastern zones.
	Natural: Use <i>Trichogramma spp.</i> for eggs and <i>Tachinido</i> and <i>Pteromalidae</i> for cocoon control, and <i>Beauveria</i> for larvae.		
	Microbiologic:	Release <i>Trichogramma spp.</i> and <i>Bacillus thuringiensis</i>	

<b>Plague(s)</b>	<b>Control Methods</b>	<b>Pesticides</b>	<b>Problems</b>
Goatee palm worm ( <i>Opsiphanes cassina</i> )	<u>Cultural</u> : Use of nectarial plants.		Defoliant countrywide
	<u>Natural</u> : <i>Telenomus sp.</i> and <i>Ooencyrtus</i> for controlling egg parasites; and <i>Caccoleptus wicki</i> , predator; <i>Apanteles alius</i> larvae parasitoid. <i>Spilochalcis spp.</i> Cocoon parasite. Predators: <i>Alcaeorrhynchus</i> . <i>Beauveria</i> and <i>Nomouraea</i> for larvae		
	<u>Mechanical</u> : bait traps with fermented material. Pick up cocoons.		
	<u>Microbial</u> :	Release <i>Bacillus thuringiensis</i> and <i>Telenomus sp</i>	
Darna ( <i>Euprosterina elaeasa</i> )	<u>Natural</u> : Use <i>Thricogramma</i> egg parasite, <i>Casinaria</i> , <i>Rhogas</i> , <i>Stenomesus</i> and <i>Sarcodexia</i> for larvae. <i>Alcaeorrhynchus</i> a larvae predator. Use <i>Theronia</i> , <i>Barycerus</i> , <i>Spilochalcis</i> , <i>Brachymeria</i> and <i>Pseudobrachymeria</i> for cocoon control.		Defoliant in center and eastern zones.
	<u>Mechanical</u> : manual collection of cocoons.		
	<u>Microbiological</u> :	<i>Bacillus thuringiensis</i> , <i>Beauveria</i> (selected stocks) and <i>poliedrosis</i> , a nuclear virus.	
Pony worm ( <i>Sibine spp.</i> )	<u>Natural</u> : many parasites and natural predators.		Countrywide.
	<u>Cultural</u> : Keep nectarial plants.		
	<u>Microbiological</u> :	Poliedrosis virus prepared with sick larvae collected in plantations.	

Plague(s)	Control Methods	Pesticides	Problems
Leave miner ( <i>Hispoleptis diluta</i> )	<u>Natural</u> : several parasites and predators.		
	<u>Cultural</u> : keep nectarial plants, prune affected leaves.		
	<u>Chemical</u> : systemic insecticide by radicular absorption or injection		
Screw worm, Bunch borer ( <i>Cyparissius daedalus</i> = ex <i>Castnia</i> sp.)	<u>Natural</u> : egg parasitoid and predator. Also in pre-cocoons.		Serious plague, typical of the Amazonian region.  Improved practice: Hunt adult individuals with a blanket, place in cage, allowing eggs to fall, pick up eggs, and breed the <i>Ooencyrtus</i> sp. parasitoid in eggs, then release parasitoid. Four plantations are implementing this method.
	<u>Mechanical</u> : Normalize harvesting using short-cycles and appropriate pruning.		
	<u>Chemical</u> : does not operate if injected or applied by radical adsorption.		
	<u>Cultural</u> : use nectarial plants		
	<u>Biological</u> : release parasitoid <i>Ooencyrtus</i> sp. to hatch plague eggs. Use nematodes in larvae control: <i>Stainerema carpocapsae</i>		
Root borer ( <i>Sagalassa valida</i> )	<u>Agronomic</u> : apply with MO: cob / root (Physical barrier); irrigate.		Serious plague in soils countrywide.
	<u>Biological</u> : Nematode <i>Steinerm</i> carpocapsae.		
	<u>Chemical</u> :	Old publications recommend <u>endosulfán</u> . This product is no longer registered in Colombia. <u>Carbofurán</u> .	Endosulfán registry cancelled.  Carbofurán Is a PUR. See recommendation.
Fruit scraper ( <i>Imatidium neivai</i> )	<u>Natural</u> : Ant <i>Crematogaster</i> , excellent predator		Causes enormous losses by scrapping off external fruit.
Red army ants ( <i>Atta</i> sp.)	<u>Cultural</u> : avoid emerging adults in rainy season.		

Plague(s)	Control Methods	Pesticides	Problems
<b>Associated Arthropods-Pathogens</b>			
Lace mite ( <i>Leptopharsa gibbicarina</i> )	<u>Natural</u> : Predatory Insects, spiders, s and ants (Crematogaster). Fungi Beauveria, Paecilomices and Sporotrix insectorum.		Main damages are caused by Péstalopta, Pestalotiopsis and other fungi causing 'Pestalopsis
	<u>Biological-cultural</u> : redistribution of Crematogaster colonies.		
	<u>Cultural</u> : plant 'bajagua' trees (Cassia reticulata) to control ants. Fertilization and pruning recommended for controlling disease.		
	<u>Chemical</u> : Use radicular injection or adsorption.	<u>Monocrotofós</u> , bordelés broth	Monocrotofós is a PUR. See recommendation.
	<u>Microbiological</u> : use entomopathogen fungi	<i>Paecilomices liacinu</i> ,	
Sprout worm ( <i>Rhynchophorus palmarum</i> )	<u>Ethological</u> : use tramps systematically to capture adult individuals using pheromones and fermented plants to attract insects.		Most damages are related to nematode transmission Rhadinaphelenchus cocophilus, nematodes cause red ring.
	<u>Cultural</u> : opportune inspection of plants to spot disease, eradication of sick palms.		
<i>Diseases:</i>			
<b><i>Phytophthora palmarum</i></b>	<u>Cultural</u> : Management of humidity in nurseries, adequate selection of strata and proper bagging.		
	<u>Microbiological</u> :	<i>Trichoderma sp.</i>	
Sprout rotting	<b>Adequate agronomical management.</b>		<b>More serious in eastern zones</b>

Ring stain (virus)	<b><i>Cultural: soils covering management to reduce pastures in plantations associated with disease: kudzú, Arachis</i></b>		<b><i>Attacks young palms. Indigenous to the Tumaco zone in western Nariño.</i></b>
Sudden withering (possible fitomona)	<b><i>Cultural: soil covering management to reduce pastures in plantations associated with disease: kudzú, Arachis</i></b>		<b><i>Typical in northern Santander. Destroys plantations</i></b>
Stipe rotting (basal Gamoderma)	<b><i>Cultural: adequate water management of soils, improvement of drainage.</i></b>		

**Technical assistance sources, training and contacts:**

1. Hugo Calvache Guerrero, Coordinator, Phytoprotection Area, Oil Palm Research Center, Cenipalma, Bogotá [hugo.calvache@cenipalma.org](mailto:hugo.calvache@cenipalma.org) . Ceniplama offers training for technicians and “*plaguero*” or plague field controllers responsible for identification of disease focal points. This offer is available for all parties. ***CAD should send participants to these events.***
2. Jairo A. Osorio, Head Researcher and MIP Coordinator, Cooperación Colombiana de Investigación Agropecuaria (Corpoica), Tibaitatá, [Josorio@corpoica.org.co](mailto:Josorio@corpoica.org.co).
3. Leonor Romero, Palm Information Center, Fedepalma, Carrera 10A, No.71-98, Bogotá.

**Principal Bibliographic References:**

1. Cenipalma. 2002. Oil Palm Pest in Colombia. Cenipalma, Fedepalma, Fondo de Fomento Palmero.
2. Cenipalma. 2002. Integrated Management of Oil Palm Pest. National workshop, Cenipalma, Fonade, Marzo 2002.

**Table 11 Basis for the selection of Palm Oil Pesticides  
[Addresses Reg. 216 point (b)]**

Pesticide		Uses		Basis for Selection
Technical Name or Active Ingredient	Trade or Commercial Name in Colombia	Crop	Pest	
<i>Bacillus thuringiensis</i>	Xentari, Ecotech-Pro, Turilav, Thuricide, Javelín, Batón, Dipel	Oil palm & rubber	<i>Loxotoma elegans</i> & <i>Erinnys ello</i>	Effectiveness; No health & environmental impacts
<i>Beauveria bassiana</i>	Conidia, Nativo, Brocavec, Cebio-pest, Brocaril, Agronova, Bio-expert, Botani-gard, Mycotrol	Plantain Oil palm Heart of palm	<i>Metamasius hemipterus</i> , <i>Brassolis sophorae</i> <i>Rinchoforus palmarum</i> , <i>Methamacius hemipterus</i>	Effectiveness; No health & environmental impacts
<b>Chlorpyrifos</b>	Lorsban, Clorpirifós, Clorpiricol, Arriero	Plantain Oil Palm Cassava Rubber, Forest plantations	<i>Metamasius hemipterus</i> , defoliant. Sting bugs. <i>Strategus aloeus</i> Ants ( <i>Atta</i> spp.) & stem cutters (various spp.) & white grubs. Erynnis ello.	Cost. Availability. Effectiveness. One of the very few products used for ant control. Wide spectrum of insect pests controlled
<b>Copper sulphate + lime (Bordeaux mixture)</b>	Bordeaux mix	Heart of palm, oil palm Vanilla Nurseries	<i>Pestalopsis sp.</i> <i>Colletotricum sp.</i> <i>Fusarium oxysporum</i> & <i>Phytophthora sp.</i> <b>Damping off</b>	Effectiveness. Limited health & environmental impacts. Easiness to prepare.
<b>Glyphosate</b>	Roundup	Cacao Oil palm, Heart of palm, Rubber, Plantain, Forestry plantations	Cacao plants affected by <i>Rose-llinia pepo</i> Weeds in general	Effectiveness. Reduced health & environmental impacts. Cost. Availability.
<b>Malathion</b>	Inition, Cropthion, Fyfanon, Malathion, Algodonero	Cacao Plantain Cassava	Ants ( <i>Atta</i> sp.), 'stings bugs'. Defoliant. Stem borers ( <i>Coelosternus</i> , <i>Lagochirus</i> , <i>Chilomima</i> )	Cost. Availability. Effectiveness.

Pesticide		Uses		Basis for Selection
Technical Name or Active Ingredient	Trade or Commercial Name in Colombia	Crop	Pest	
<i>Mancozeb</i>	Manzate, Curzate, Dithane	Plantain  Oil palm Rubber Heart of palm	<i>Ralstonia solanacearum</i> (Moko or maduraviche) Stem rotting Round spot Southamerican disease( <i>Microcyclus ulei</i> )	Cost. Availability. Effectiveness.
<i>Trichoderma</i>	Tricobac, Mycobac, Tricodex, Tricho	Heart of palm Oil Palm	<i>Phytophthora palmarum</i>	Effectiveness. No health & environmental impacts
<i>Trichogramma pretiosum</i>	Trichogramma	Various	Various	Effectiveness. No health & environmental impacts

**Table 12 Palm Oil Pesticides<sup>26</sup>**  
**Registration, Problem Analysis & Preliminary Decision [Reg. 216 point (a)]**

Pesticide			Crop(s)	Pest(s)	Type of Problem, if any	Recommendations & alternative/s
Technical Name <sup>27</sup>	Trade Name <sup>28</sup>	Type & Toxicological Class <sup>29</sup>				
<i>Bacillus thuringiensis</i>	Xentari, Ecotech-Pro, Turilav, Thuricide, Javelín, Batón, Dipel	Microbial insecticide: bacteria. WHO TC: not available; Colombia TC: U.	Oil palm, rubber, potato	<i>Loxotoma elegans</i> & <i>Erinnysello Tecia solanivora</i>		<b>Approved.</b>
<i>Beauveria bassiana</i>	Conidia, Nativo, Brocavec, Cebiopest, Brocaril, Agronova, Bio-expert, Botani-gard, Mycotrol	Microbial insecticide: entomopathogen fungi. WHO TC: not available. Colombia TC: III.	Plantain  Oil palm  Heart of palm	<i>Metamasius hemipterus</i> , <i>Brassolis sophorae</i> , <i>Rinchoforus palmarum</i> , <i>Methamacius hemipterus</i>		<b>Approved.</b>

Pesticide			Crop(s)	Pest(s)	Type of Problem, if any	Recommendations & alternative/s
Technical Name	Trade Name	Type & Toxicological Class				
Chlorpyrifos (Clorpirifós)	<i>Lorsban</i> , <i>Clorpirifós</i> , <i>Clorpiricol</i> , <i>Arriero</i>	Insecticide, nematocide. WHO TC II;	Plantain	<i>Metamasius hemipterus</i> , defoliant. Sting bugs.	RUP with USEPA In the 'Bad Actor' list of PAN: cholinesterase	<b>Should not be used. Stop using formulations EC &amp; WP within 12</b>

<sup>26</sup> Includes all pesticides being mentioned for the crops in question, requested by CAD project operators and/or recommended as part of pest management programs for oil palm crop.

<sup>27</sup> Generic name or active ingredient

<sup>28</sup> Name under which is sold in Colombia.

<sup>29</sup> Type of action: fungicide, insecticide, herbicide, etc. As per WHO classification: IA (extremely hazardous), IB (highly hazardous), II (moderately hazardous), III (slightly hazardous), and U (improbable of presenting an acute risk in normal use). The LD<sub>50</sub> used for chronic toxicity is either oral(O) or dermal (D). WHO TC is that of the active ingredient. Colombia TC is that of the formulated product available in the country.

		Colombia TC III	Oil Palm Cassava Rubber, Forest plantations Potato	<i>Strategus aloeus</i> Ants ( <i>Atta</i> spp.) & stem cutters (varias spp.) & white grubs. Erynnis ello. <i>Premnotrypes</i> & <i>Tecia</i>	inhibitor. Organophosphate.	<b>months. Eliminate all formulations within a max of 24 month.</b> For the time being & to reduce risk, use only granular formulation.
<b>Copper sulphate + limel [Copper, sulfate + Lime (calcium carbonate)]</b>	Bordeaux mix	Cu sulfate: fungicide, algacide, molluskicide. WHO TC II.	Heart of palm, oil palm Vanilla  Nurseries	<i>Pestalopsis sp.</i> <i>Colletotricum sp.</i> <i>Fusarium oxysporum</i> & <i>Phytophthora sp.</i> <b>Damping off</b>	Bordeaux mix is not registered with USEPA but Cu sulphate & Ca carbonate yes, each separately.	<b>Approved.</b>
Glifosato	Roundup	Herbicide. WHO TC U; Colombia TC III ó IV	Cacao  Oil palm, Heart of palm, Rubber, Plantain, Forestry plantations	Cacao plants affected by <i>Rose-llinia pepo</i> Weeds in general		<b>Approved.</b>

Pesticide			Crop(s)	Pest(s)	Type of Problem, if any	Recommendations & alternative/s
Technical Name	Trade Name	Type & Tox Class				
Malathion	Inition, Crophthion, Fyfanon, Malathion, Algodonero	Insecticide. WHO TC III; Colombia TC II-III	Cacao  Plantain Cassava	Ants ( <i>Atta</i> sp.), 'stings bugs'. Defoliant. Stem borers ( <i>Coelosternus, Lagochirus,</i>	In IRED-03 list. In 'Bad Actor' list of PAN for cholinesterase inhibitor. Organophosphate.	<b>Approved.</b> But pending of re-registration with USEPA in 2003.

				<i>Chilomima</i>		
Mancozeb	Manzate, Curzate, Dithane	Fungicide. WHO TC U; Colombia TC III	Plantain  Oil palm & heart of palm Rubber Forestry Papa	<i>Ralstonia solanacearum</i> (Moko or maduraviche) Pudrición cogollo Mancha aerolada Mal suramericano ( <i>Microcyclus ulei</i> ) Oak rust. <i>Phytophthora</i>	In RED-04 list. In 'Bad Actor' list of PAN for possible carcinogenic & reproductive toxin.	<b>Approved.</b> But pending re-registration with USEPA in 2004.
<i>Trichoderma sp. (harzianum y lignorum)</i>	Tricobac, Mycobac, Tricodex, Tricho	Microbial fungicide: antagonistic fungi. WHO TC not available; Colombia TC III ó IV	Heart of palm Oil Palm	<i>Phytophthora palmarum</i>	<i>T. lignorum</i> is not registered with USEPA. However, both crop & pest do not exist in the USA. <i>T. harzianum</i> is registered with USEPA.	<b>Approved.</b> Microbial product with unlikely environmental impact. Similar species registered
<i>Trichogramma pretiosum</i>	Trichogramma	Biological antagonist of insects: parasitoid wasp. TC not available.	Various	Various	Registered in Colombia. Not yet with USEPA	<b>Approved.</b> Microbial product with unlikely environmental impact

**Table 13 Palm Oil Pesticides – Risk Analysis**

<b>Pesticide<sup>30</sup></b>	<b>Acute Tox Class<sup>31</sup></b>	<b>Type</b>	<b>Chronic Toxicity</b>	<b>Eco-toxicity</b>	<b>Groundwater Contamination Potential</b>	<b>Mitigation of risks / Comments<sup>32</sup></b>
<b>Bacillus thuringiensis</b>	WHO: not available. Colombia: III	Microbial insecticide: bacteria	Unlikely to cause any effect. No indication of reproductive, teratogenic & carcinogenic effects. Possible some mutagenic effects in plants.	Bio-product with unlikely environmental impact. Not toxic to fish, birds & other animals.	No evidence for potential ground water contamination.	Repeated applications over extended periods may promote the development of resistance. Rotate products.
<b>Beauveria bassiana</b>	WHO: not available. Colombia: III	Microbial insecticide: fungi	Unlikely to cause any effect. No indication of carcinogenic, teratogenic, reproductive or mutagenic effects.	Bio-product with unlikely environmental impact.	No evidence for potential ground water contamination.	
<b>Chlorpyrifos</b>	WHO: II; Colombia: III	Insecticide, nematocide	Organophosphate = cholinesterase inhibitor. No other adverse effects except those associated to central nervous system.	May be toxic to some plants, e.g. lettuce. Moderately toxic to birds & very highly toxic to fish & aquatic organisms	Unlikely to leach & contaminate water.	RUP. There is a 24 hour minimum re-entry time for field treated with it. Applications should be carefully supervised to prevent human & environmental exposure.
<b>Cu sulfate + lime (Bordeaux mixture)</b>	WHO:II Colombia: not available.	Fungicide	No evidence for chronic effects in humans is available.	No evidence for adverse effects on the environment.	No evidence for potential for water contamination.	

<sup>30</sup> Technical name or active ingredient.

<sup>31</sup> As per WHO classification: IA (extremely hazardous), IB (highly hazardous), II (moderately hazardous), III (slightly hazardous), and U (unlikely to present acute hazard in normal use). The LD<sub>50</sub> used for acute toxicity is either oral (O) or dermal (D). Colombia uses the same scale but classes numbered I-IV.

<sup>32</sup> General mitigation tactics to (a) reduce human exposure risks: protective clothing (mask, hat, glasses, long sleeves shirt, long pants, boots, gloves or plastic bags, washing clothing, no food, no drink, no smoking, no re-entry to fields, etc.) and (b) reduce environmental risks (mix exact amounts, no spray close to water bodies, to bee hives, to bird nesting areas, avoid windy days, etc.) are part of a more general SUP.

<b>Pesticide</b>	<b>Acute Tox Class</b>	<b>Type</b>	<b>Chronic Toxicity</b>	<b>Eco-toxicity</b>	<b>Groundwater Contamination Potential</b>	<b>Mitigation of risks / Comments</b>
<b>Glifosato</b>	WHO U; Colombia: III-IV	Herbicide	No evidence of any carcinogenic, teratogenic, mutagenic effects.	Slightly toxic to birds, non toxic to fish & bees.	Unlikely due to soil adsorption.	
<b>Malathion</b>	WHO III; Colombia: II-III	Insecticide	Organophosphate = cholinesterase inhibitor. Possible carcinogenic & suspected endocrine disrupter	Highly toxic to honey bees, moderately toxic to birds & variable toxicity to fish	Possible contaminant. It has been detected in well & ground waters.	In IRED-03. Revise registration status in 2003. Malathion should be used with great care in order not to expose workers & prevent water contamination & effects on bees & birds
<b>Mancozeb</b>	WHO: U; Colombia: III	Fungicide	Possible carcinogenic, reproductive toxin promoter & endocrine disrupter	Moderately to highly toxic to fish, slightly toxic to birds & not toxic to bees	Not a possibility.	In IRED-04. Revise registration status in 2004. Use with care to minimise workers exposure.
<b>Trichoderma</b>	WHO: not available; Colombia: II-IV.	Biological antagonist: microbial fungicide.	Unlikely to cause any effect. No indication of carcinogenic, teratogenic, reproductive or mutagenic effects.	Bio-product with unlikely environmental impact.	Unlikely contaminant.	Some spp. not yet registered with USEPA but the genus Trichoderma is.
<b>Trichogramma pretiosum</b>	WHO & Colombia: not available.	Biological antagonist: parasitic wasp.	Unlikely to cause any effect. No indication of carcinogenic, teratogenic, reproductive or mutagenic effects.	Bio-product with unlikely environmental impact. No adverse effects in animals. Naturally occurring in soils.	Unlikely contaminant.	Not yet registered with USEPA.

**Table 14 PROHIBITED PESTICIDES**  
**Pesticides PIC, Prohibited, Restricted or Cancelled**  
**In Colombia and/or in the USA<sup>33</sup>**

Pesticide <sup>34</sup>	PIC List <sup>35</sup>	Registration status in <sup>36</sup>	
		Colombia	United States
Aldrin	Yes	P (1974 in tobacco), C (1988)	No
<b>BHC</b>		P (1974 in tobacco), P (1978 in coffee), P (1993)	No
<b>Methyl Bromide</b>		P except for quarantine (1996)	RUP
<b>Canphechlor</b>		P (1978 in coffee), C (1988), P (2000)	No
<b>Captafol</b>	Yes	P & C (1989)	No
<b>Chlorinated in tobacco</b>		P (1974)	No
<b>Chlordane</b>		P (1974 in tobacco), C (1988), P (1993)	No
<b>Chlordimeform</b>		P (1987), C (1988)	No
<b>DBCP (di-bromo-chloro-propane)</b>		P (1982)	No
<b>DDT</b>		P (1974 in tobacco), P (1978 en café), P except in health (1986), P (1993)	No
<b>Dicofol</b>		P (1993)	Yes
<b>Dieldrin</b>		P (1974 in tobacco), C (1988), P (1993)	C
<b>Dinoseb</b>		P (1987)	C
<b>Dodecachlor (Mirex)</b>		P (1993)	C
<b>2,4,5-T &amp; 2,4,5-TP</b>		C (1979)	C
<b>Endosulfan</b>		P except for coffee borer (1993 & 1997)	RUP
<b>Endrin</b>		P (1974 in tobacco), P (1985)	No
<b>Ethylene di-bromine (EDB)</b>		P (1985)	No
<b>Fonofos</b>		P (1992)	No
<b>Fosfamin</b>		C (1997)	RUP?
<b>Mercury Fungicides</b>		C (1974)	No
<b>Heptachloro</b>		P (1974 in tobacco), C (1988) P (1993)	No
<b>Isazofos</b>		C (1996)	No
<b>Leptofos (Phosvel)</b>		C 1977	No
<b>Lindane</b>		P (1978 in coffee), C (1993), P except in health (1993), P (1997)	RUP
<b>Maneb</b>		C (1989), P (1993)	Yes
<b>Metamidophos</b>	Yes	Yes	Yes
<b>Monocrotophos</b>	Yes	Yes	Yes

<sup>33</sup> It is not an inclusive list for the US or PIC. It is based on Colombian prohibited products.

Pesticide <sup>34</sup>	CIP List <sup>35</sup>	Registration status in <sup>36</sup>	
		Colombia	United States
<b>Organochlorines in general</b>		P (1974 in tobacco), P (1978 in coffee)	No
<b>Paraquat</b>		P aerial application (1989)	RUP
<b>Parathion &amp; methyl-parathion</b>	Yes	R only for cotton & rice (1991)	RUP
<b>Pentachlorophenol (PCP)</b>		P (1993)	GUP & RUP (treatment of wood)
<b>Posphamidon</b>	Yes	No	No
<b>Toxaphene</b>		P (1975 in tobacco), P (2000)	No
<b>Zineb</b>		P (1993)	No

<sup>34</sup> Technical name.

<sup>35</sup> The list of products for 'Previous International Consent', or 'PIC' (1998), of the United Nations Environment Program (UNEP) and the Food and Agriculture Organisation (FAO). FAO leads in relation to pesticides. Allow importing countries to better know the potentially hazardous products that may be sent.

<sup>36</sup> **P** = 'Prohibited' = 'Banned' = the uses of the product are not permitted in the country, by explicit decision of the regulatory agency. **R** = 'Restringido' = 'Restricted' = in the sense of the USEPA, it is a pesticide that can only be applied by a certified applicator. **C** = 'Cancelado' = 'Cancelled' = registration cancelled without a specific prohibition. **No**: not registered

## SECTION 5 ENVIRONMENTAL CONSEQUENCES

### 5.1 Environmental Management Plan - EMP

The EMP consists of four (4) special elements: the index cards of actions to be developed, which indicate “**what to do**” to manage the associated impact, the management index cards, which contain the technical guidelines indicating “**how to do it**”, the dimensioning cards and the cost cards for the proposed actions.

Table below groups four (4) DEFINITIVE ENVIRONMENTAL IMPACTS, which are a specification of multiple associated impacts, and fourteen ENVIRONMENTAL ASPECTS, based on which the summary chart of actions to be developed is prepared.

**Table 15. Summary of aspects, affected resources and environmental impacts.**

ENVIRONMENTAL IMPACTS	ENVIRONMENTAL ASPECTS OF THE ASSESSED OIL PALM PROJECT	AFFECTED RESOURCE
<b>1. CHANGES IN THE QUALITY, QUANTITY AND DISTRIBUTION OF WATER RESOURCES.</b>	1. Generation of liquid and solid wastes at the processing plant (oil extraction).	Water and soil
	2. Generation of liquid and solid wastes at the nursery administration area and extraction plant, as well as in the homes of the beneficiaries	Soil and water
	3. Preparation of agro-chemical solutions at nurseries and production areas.	Soil and water
	4. Gathering, treatment, distribution, measurement and consumption of water for industrial and household processes.	Water and soil
	5. Earth moving and runoff action on denuded soils.	Water, soil
	6. Use of water courses and bodies of water as recipients of discharges, effluents and solid wastes.	Water
<b>2. CHANGES IN THE QUALITY, QUANTITY AND DISTRIBUTION OF THE SOIL RESOURCE.</b>	7. Preparation of soils for planting in Pre-nurseries, Nurseries and Production areas.	Soil, water, biological
	8. Waste management, application and generation, through agrochemicals.	Soil, water, biological
	9. Equipment and machinery for soil preparation, gathering of bunches and eradication of unproductive palms.	Soil
	10. Use of lands for waste and nursery byproduct disposal, production, transformation, administrative areas and housing.	Soil, subsoil and groundwaters
<b>3. AIR POLLUTION</b>	11. Boiler operation with organic wastes from the processing and transformation process	Air
<b>4. AFFECTING OF THE BIODIVERSITY</b>	12. Removal of vegetation cover identified in the baseline.	Biological, soil
	13. Substitution of the grass and natural stubble cover with Kudzu	
	Planting of 1,000 hectares of African oil palm	

### **5.1.1 Impact management and actions to be developed.**

The actions to be developed, which determine “What to do” are shown in Tables below. As indicated in the methodology, an effort has been made to simplify this task, grouping the most significant impacts according to the results of the EIA, around the four elements affected: water, soil, air and biological. The impacts of an institutional nature are considered in the formulation of the Environmental Administration System – EAS.

As to the social aspect, it is necessary to indicate that the Impact Assessment yielded the highest positive score for this element. Nevertheless, certain recommendations must be made in order to improve the participation of the associates and the community in aspects related to the EMP.

**Table 16. Type of measure and actions to be developed in order to improve the water resource and its associated impacts**

<b>AFFECTED RESOURCE: WATER</b>		<b>No</b>
<b>ENVIRONMENTAL IMPACT:</b> Changes in the quality, quantity and distribution of the water resource.		<b>1</b>
<b>ENVIRONMENTAL ASPECT</b> <sup>37</sup>		<b>1 - 6</b>
<b>TYPE OF MEASURE</b>	<b>ACTION TO BE DEVELOPED</b>	<b>Code</b>
<b>Prevention P</b>	Study for minimization of liquid wastes and implementation of results	<b>1P – 1</b>
	Study for characterization of liquid and solid discharges	<b>1P – 2</b>
	Optimization oil extraction technology, processes and procedures.	<b>1P – 3</b>
	Optimization of the management and utilization of the energy sources.	<b>1P – 4</b>
	Include objectives, goals and responsibilities in the EMP and in the Environmental Administration System	<b>1P – 5</b>
	Control and monitoring plan	<b>1P – 6</b>
	Design and implement WATER CONSUMPTION AND USE MINIMIZATION PLAN	<b>1P – 7</b>
	Implement periodic AUDITS for waste minimization	<b>1P – 8</b>
	Conduct environmental education in the company	<b>1P – 9</b>
	Delimit and mark off water source protection strips, before beginning stripping and earth moving activities.	<b>1P – 10</b>
	Respect the natural vegetation in the prescribed surface and ground water source protection strips.	<b>1P – 11</b>
	Use 100% of the agrochemical solutions prepared for nurseries, planting and operation of the plantation.	<b>1P – 12</b>
	Develop operation manual for manual sanitary landfills by farm or module	<b>1P – 13</b>
<b>Mitigation M</b>	Implement WASTE MINIMIZATION AND CLEANER PRODUCTION PLANS	<b>1M – 14</b>
	Reuse, recycle and manage wastes.	<b>1M – 15</b>
	Treat wastes that were not reused and/or managed	<b>1M – 16</b>
	Guarantee efficiencies in waste treatment, as established in environmental legislation.	<b>1M – 17</b>
	Properly manage, dispose of and treat plant wastes.	<b>1M – 18</b>
	Build adequate excreta disposal systems for housing and administrative areas.	<b>1M – 19</b>
	Construct manual sanitary landfills by farm.	<b>1M – 20</b>
<b>Correction C</b>	Clean water courses and sites used for collection, temporary management or inappropriate disposal of wastes.	<b>1C – 21</b>
	Reforest the edges and water source protection strips, to prevent the transport of solids and erosion of those strips	<b>1C – 22</b>
	Periodic cleaning of the creeks and irrigation channels, in order to correct water course sedimentation.	<b>1C – 23</b>
	Close temporary solid waste dumps.	<b>1C – 24</b>

<sup>37</sup> See Table 1.

**Table 17. Type of measure and action to be developed to improve the soil resource and its associated impacts**

<b>AFFECTED RESOURCE: SOIL</b>		<b>No</b>
<b>ENVIRONMENTAL IMPACT:</b> Changes in quality, quantity and distribution of the soil resource.		<b>2</b>
<b>ENVIRONMENTAL ASPECT<sup>38</sup></b>		<b>7 – 10</b>
<b>TYPE OF MEASURE</b>	<b>ACTION TO BE DEVELOPED</b>	<b>Code</b>
<b>P</b> Prevention	All actions indicated in Table 16. Type of measure and action to be developed in order to improve the water resource and its associated impacts; and related to prevention for the generation of liquid and solid wastes affecting the soil and subsoil.	<b>2P – 25</b>
	Plan work fronts for removal of the vegetation cover and removal of the upper layer.	<b>2P – 26</b>
	Delimitation and marking off of work fronts for application of the EMP and its component.	<b>2P – 27</b>
	Design specific and mandatory routes for circulation of heavy machinery and vehicles that cause compacting.	<b>2P – 28</b>
	Use heavy machinery and equipment only on the ways defined in the routes.	<b>2P – 29</b>
	Design the planning fronts, respecting efficient and short drainages.	<b>2P – 30</b>
	Do not use agrochemicals of toxicological category I and II	<b>2P – 31</b>
	Select adequate sites for location of the Wastewater Treatment Plant.	<b>2P – 32</b>
	Carry out land improvement tasks during the dry season and prevent exposure of the denuded soils for long periods of time.	<b>2P – 33</b>
	Technically dispose of the sludge generated in the wastewater treatment systems.	<b>2P – 34</b>
	Define and regulate product and byproduct management sites in the processing plant area.	<b>2P – 35</b>
	Establish periodic clearing days in the areas of influence of the processing plant	<b>2P – 36</b>
	Define and regulate agrochemical product management, storage and processing areas.	<b>2P – 37</b>
	<b>M</b> Mitigation	All mitigation actions listed in Table 16. Type of measure and action to be developed in order to improve the water resource and its associated impacts, related to the soil and subsoil.
Build sanitary landfills for non-special solid wastes.		<b>2M – 39</b>
Carry out an adequate management and technical disposal of special solid wastes.		<b>2M – 40</b>
Carry out an adequate management and technical disposal of the liquid wastes for preparation and management of agrochemical solutions.		<b>2M – 41</b>
Carry out a technical and systematic management of the palm residue disposal sites, as an alternative for managing plant residues.		<b>2M – 42</b>
<b>C</b> Correction	Rectify erosion gullies resulting from poor management of the land improvement process.	<b>2C – 43</b>
	Restore the vegetation cover in the prescribed water source protection strips.	<b>2C – 44</b>
	Build drainages in the plantation in order to avoid pool formation.	<b>2C – 45</b>
	Gather the bags and solid wastes generated in palm transplants.	<b>2C – 46</b>

<sup>38</sup> See table 1.

**Table 18. Type of measure and action to be developed to improve the air resource and its associated impacts**

<b>AFFECTED RESOURCE: AIR</b>		<b>No</b>
<b>ENVIRONMENTAL IMPACT:</b> Boiler operation with organic wastes from the processing and transformation process		<b>3</b>
<b>ENVIRONMENTAL ASPECT</b> <sup>39</sup>		<b>11</b>
<b>TYPE OF MEASURE</b>	<b>ACTION TO BE DEVELOPED</b>	<b>Code</b>
<b>Prevention P</b>	All those indicated in Table 16. Type of measure and action to be developed in order to improve the <b>water</b> resource and its associated impacts, and Table 17. Type of measure and action to be developed in order to improve the <b>soil</b> resource and its associated impacts, related to prevention in the generation of wastes that affect the atmosphere.	<b>3P – 47</b>
	Avoid the use of wood as an energy source.	<b>3P – 48</b>
	Avoid the construction of housing within a diameter of 100 meters around the oil extraction plant.	<b>3P – 49</b>
<b>Mitigation M</b>	Minimization of particulate material generated in combustion.	<b>3M – 50</b>
<b>Correction C</b>	Guarantee the minimum height of the chimneys.	<b>3C – 51</b>

**Table 19. Type of measure and action to be developed in order to improve the biological resource and its associated impacts**

<b>AFFECTED RESOURCE: BIOLOGICAL</b>		<b>No</b>
<b>ENVIRONMENTAL IMPACT:</b> Affecting the biodiversity		<b>4</b>
<b>ENVIRONMENTAL ASPECT</b> <sup>40</sup>		<b>12 – 14</b>
<b>TYPE OF MEASURE</b>	<b>ACTION TO BE DEVELOPED</b>	<b>Code</b>
<b>Prevention P</b>	Prepare the Integrated Pest and Disease Management Study – IPDM.	<b>4P – 52</b>
	Preserve plant and animal niches in the protection and circulation zones and at the subsistence crop farms surrounding the oil palm plantations.	<b>4P – 53</b>
	Define and delimit biological control and preservation areas.	<b>4P – 54</b>
	Prevent the use of toxic materials in the biological conservation areas	<b>4P – 55</b>
	Comply with the management and regulation conditions established by CORPONOR for the AFRICAN OIL PALM AGROSYSTEM, applying all measures indicated by the EMP for their balanced management.	<b>4P – 56</b>
<b>Mitigation M</b>	Permit, to the extent that the phytosanitary control of the plantation allows it, the natural regeneration of weeds and other native vegetation.	<b>4M – 57</b>
<b>Correction C</b>	Control the maintenance and cleaning of the irrigation channels, avoiding the use of chemical substances and preferring the manual and or mechanical eradication of weeds.	<b>4C – 58</b>

<sup>39</sup> See Table 1

<sup>40</sup> See Table 1

## **5.1.2 Management action development cards.**

Tables 16-19 summarize a total of 58 **types of actions to be developed**, or what must be done in order to manage the impact. Below are the 58 environmental management master index cards completely filled out with their respective supporting cards containing the preliminary dimensioning and costs of the dimensioned actions. For the management of the cards it is important to recall the meanings of the codes. **Card 1P- 1, means**

- € **1:** Element water ( 2 is soil, 3 is air, and 4 is biological).
- € **P:** means it refers to a PREVENTIVE measure (M is mitigation and C is correction)
- € The **1** followed by a dash indicates that it is action to be developed No 1. There are 58 cards in all.

The attached dimensioning cards will have a letter, A, B, or C at the end (after the consecutive number). In this case, the letter A means a dimensioning attachment, the letter B means a cost attachment and C a control and monitoring attachment. In all cases, the master index card for actions to be developed indicates the type of card attached.

### **5.1.2.1 Management action development cards related to the water resource.**

The proposed actions are not necessarily performed on the water resource. They may refer to the soil, the biodiversity, among others, but their management benefits the water resource.

Following are the environmental actions or aspects that directly or indirectly impact the water.

**ENVIRONMENTAL ASSESSMENT STUDY  
AFRICAN OIL PALM ALTERNATIVE DEVELOPMENT PROJECT  
ENVIRONMENTAL MANAGEMENT PLAN**

**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 20. Action to be developed 1P – 1**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Liquid waste minimization study and implementation of results	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">1P – 1</p>
<b>Objective:</b> Prevent the reduction of the volume of flow and the loading of contaminating liquid substances at the source.	<b>Location:</b> Processing plant
<b>Associated environmental impacts:</b> All impacts classified as Medium (M), High (H) and Very High (VH) related to water contamination, alteration of courses and contamination of soils.	
<b>Description of measures to be implemented:</b> 1- Study to identify opportunities for minimizing liquid wastes in the transformation stage. 2 – Implementation of waste minimization programs	
<b>Goal:</b> 20 - 30%.	
<b>Basic dimensioning:</b> <b>Required:</b> YES <u> X </u> NO <u> ___ </u> <b>See attached card:</b> 1P – 1A	
<b>Costs:</b> Ps\$ 20,000,000.00	
<b>See attached card:</b> 1P – 1B. The dimensioning card includes the basic cost analysis.	
<p style="text-align: center; font-weight: bold;">Control and follow-up</p> <b>Description:</b> It is very important to conduct minimization audits. This will be an optional decision to be made by the company.  <b>Specific C and F Plan required?</b> YES <u> ___ </u> NO <u> ___ </u>  <b>See card:</b>	<p style="text-align: center; font-weight: bold;">Monitoring</p> <b>Description:</b>  <b>Specific Monitoring Plan required?:</b>  YES <u> ___ </u> NO <u> ___ </u>  <b>See card:</b>

**ENVIRONMENTAL ASSESSMENT STUDY  
AFRICAN OIL PALM ALTERNATIVE DEVELOPMENT PROJECT  
ENVIRONMENTAL MANAGEMENT PLAN**

**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 21. Action to be developed 1P – 2**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Liquid and solid discharge characterization study	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">1P – 2</p>
<b>Objective:</b> Obtain first-hand information for planning, administration, management and treatment of the company's liquid and solid wastes.	<b>Location:</b> Nursery, Pre-nursery and processing plant
<b>Associated environmental impacts:</b> All those related to liquid and solid waste generation.	
<b>Description of measures to be implemented:</b> 1- Identify waste discharge or generation points. 2- Prepare a characterization plan 3- Implement sample-taking and measurement points. 4- Define analysis methodologies. 5- Coordinate sample analysis with well-established laboratories. 6- Prepare a document with the characteristics, frequencies of the discharges, volumes, etc.	
<b>Goal:</b> Characterize 100% of the liquid and solid emission types.	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u>	
<b>See attached card:</b>	
<b>Costs:</b> Ps\$ 25,000,000.00. This cost is necessary in order to undertake waste minimization and treatment programs. To obtain permits, the data required by FEDEPALMA in its environmental guide will be sufficient..	
<b>See attached card:</b> No	
<p style="text-align: center; font-weight: bold;">Control and follow-up</p> <b>Description:</b> The standards for solid and liquid wastes require control plans.  <b>Specific C and F Plan required?:</b>  <p style="text-align: right;">YES <u>X</u>      NO ___</p>	<p style="text-align: center; font-weight: bold;">Monitoring</p> <b>Description:</b> See Follow-up and Monitoring Plan  <b>Specific Monitoring Plan required?:</b>  <p style="text-align: right;">YES <u>X</u>      NO ___</p>

**ENVIRONMENTAL ASSESSMENT STUDY  
AFRICAN OIL PALM ALTERNATIVE DEVELOPMENT PROJECT  
ENVIRONMENTAL MANAGEMENT PLAN**

**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 22. Action to be developed 1P – 3**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Optimization of oil extraction technology, processes and procedures.	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">1P – 3</p>
<b>Objective:</b> Prevent contamination by liquid and gaseous emissions using control at the source practices.	<b>Location:</b> FFB processing plant
<b>Associated environmental impacts:</b> All those assessed and mainly related to liquid and gaseous emissions.	
<b>Description of measures to be implemented:</b> With the help of FEDEPALMA, conduct an optimization study of the unit production operations related to oil extraction .	
<b>Goal:</b> This is an optional activity, which allows a minimization of treatment costs and a maximization of yields and industrial processes.	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u>	
<b>See attached card:</b>	
<b>Costs:</b> Ps\$ 20,000,000	
<b>See attached card:</b> 1P – 3B	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> <b>Specific C and F Plan required?:</b> YES ___ NO <u>X</u> <b>See card:</b>	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> <b>Specific Monitoring Plan required?:</b> YES ___ NO <u>X</u> <b>See card:</b>

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 23** Action to be developed **1P – 4**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Optimization of the management and utilization of energy sources	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">1P – 4</p>
<b>Objective:</b> Optimize the heat generation, transfer and utilization systems.	<b>Location:</b> Processing plant, steam management.
<b>Associated environmental impacts:</b> Those related to water contamination by temperature.	
<b>Description of measures to be implemented:</b> Propose to CENIPALMA and FEDEPALMA a joint study for optimization of the heat generation, transfer and utilization systems at the plant	
<b>Goal:</b> The goal must be assessed and accepted by senior management as part of its voluntary environmental policies.	
<b>Basic dimensioning:</b> <b>Required:</b> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> <b>See attached card :</b> no dimensioning card is presented.	
<b>Costs:</b> <b>See attached card :</b> there is no cost assessment for this item, as it is a voluntary action.	
<p style="text-align: center; font-weight: bold;">Control and follow-up</p> <b>Description:</b> the energy optimization and efficient use plan must propose the control plan <b>Specific C and F Plan required?:</b> <p style="text-align: right;">YES <input type="checkbox"/>                      NO <input checked="" type="checkbox"/></p> <b>See card:</b>	<p style="text-align: center; font-weight: bold;">Monitoring</p> <b>Description:</b> <b>Specific Monitoring Plan required?:</b> <p style="text-align: right;">YES <input type="checkbox"/>                      NO <input checked="" type="checkbox"/></p> <b>See card:</b>

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 24 Action to be developed 1P – 5**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Include objectives, goals and responsibilities in the EMP and in the Environmental Administration System ( EAS)	<b>Code:</b> <p style="text-align: center;"><b>1P – 5</b></p>
<b>Objective:</b> Define the individuals and areas responsible for the various tasks identified in the EIA and in the other actions identified in voluntary management programs such as the EAS.	<b>Location:</b> The three stages: Nursery, Pre-nursery and transformation
<b>Associated environmental impacts:</b> In this case, it benefits all aspects and processes related to contamination of the water sources, although in fact the actions to be developed that are described serve for all aspects identified and their respective impacts.	
<b>Description of measures to be implemented:</b> These are listed in detail in Card 1P – 5A	
<b>Goal:</b>	
<b>Basic dimensioning:</b> Required: YES <u>X</u> NO ___	
<b>See attached card: 1P – 5A: Guidelines for the implementation of an Environmental Administration System</b>	
<b>Costs:</b> Ps\$60,000,000	
<b>See attached card : 1P – 5B</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> The EAS must be periodically audited.  <b>Specific C and F Plan required?:</b> <p style="text-align: right;">YES <u>X</u> NO ___</p> <b>See card: 1P - 5C</b> The audit defines the conditions and corrective actions. It is not included in this study as it is a subsequent decision of the project management.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b>  <b>Specific Monitoring Plan required?:</b> <p style="text-align: right;">YES ___ NO ___</p> <b>See card:</b>

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DIMENSIONING CARD – CODE: 1P – 5A**  
**INCLUDE OBJECTIVES, GOALS AND RESPONSIBILITIES IN THE EMP AND IN THE  
ENVIRONMENTAL ADMINISTRATION SYSTEM- EAS**

**1. OBJECTIVE**

Present the Basic Plan of activities to be conducted for the implementation of an Environmental Administration System, during the operation of the Oil Palm Project in its various stages.

**2. DEVELOPMENT**

**2.1. General Basic Information**

The guide included below is based on the recommendations of the NTC ISO 14001 standard. If the company deems the implementation of each of these requirements feasible, they will allow it to access a certification process.

**2.2. Procedure for implementation of an EAS**

Following are the basic activities that must be carried out in a mandatory and sustained manner, see Cards 1P – 5A and 1P - 5C:

**Table 25. Card 1P – 5A. Procedure for implementation of an EAS**

STEP	ACTIVITY	OBSERVATIONS AND RECOMMENDATIONS
1.	Define Senior Management's commitment.	The General Management must appoint a person in charge of environmental matters in the Company.
2.	Prepare the INITIAL ENVIRONMENTAL REVIEW - IER. The most important sub-activities under this item are:	This is Management's responsibility.
2.1.	Identification of the legislative and statutory requirements.	Provided by the EIA study.
2.2.	Identify the environmental aspects of your activities, products or services, in order to determine which have or might have significant impacts on the environment.	This task will be entirely developed in the EIA.

2.3.	Performance assessment compared to pertinent criteria, external standards, regulations, practice codes and establishment of principles and guidelines.	The assessment must be carried out when the decision to implement the EAS is made.
2.4.	Identification of existing environmental policies and procedures.	New activity.
2.5.	Feedback of occupational accident or incident investigations.	New activity.
2.6.	Points of view of the interested parties (community, customers, employees, etc.).	New activity.
2.7.	Functions or activities of other Organizational Systems which may promote or prevent satisfactory results from the environmental point of view.	New activity.
2.8.	Document the conclusions and opportunities for improvement that have been identified.	Use participative techniques for strategic planning such as the SWOT as support.
3.	Define an environmental objective, establish the goals, prepare a plan to achieve it and allocate a budget.	It is recommended to implement item 4 of the NTC ISO 14001 standard.
4.	Establish a program	The company must define the persons in charge, their tasks, the times of performance and resources.
5.	Implement the EAS.	The system must be documented, communicated and financed. Management representatives must be formally appointed.
6.	Conduct employee training	Prepare an instruction and training needs plan. Assess your employees' capacities to perform the EAS tasks
7.	Define the communication channels	Design, implement and assess the communication strategy, both internal and external.
8.	Document the EAS. At least the following activities:	
8.1.	Environmental policy	
8.2.	Environmental aspects	All those activities that generate environmental impacts.
8.3.	Legal requirements	Developed in the EIA.
8.4.	Environmental objectives	
8.5.	Environmental goals	Must be defined on the basis of the company's aspirations.
8.6.	Environmental administration program(s).	Activities to attain the environmental objectives and goals defined.
8.7.	Structure and accountability.	

8.8.	Training.	
8.9.	Communications.	
8.10.	Document control.	
8.11.	Operations control.	
8.12.	Emergency procedures.	
8.13.	Monitoring and measurement.	The EIA includes a Management and Monitoring Plan.
8.14.	Non-conformities, corrective actions and preventive actions.	
8.15.	Records control.	
8.16.	EAS audit	
9.	Control of EAS documentation	Any person with a responsibility must have the correct information and everyone must know where the information is kept.
10.	Control of activities for attainment of the proposed goals	Operational control consists of those procedures necessary for an environmental action, system or technology to operate within the specified conditions.
11.	Identify emergency risks.	New activity.
12.	Verify progress in your programs.	The organization must establish and maintain documented procedures to monitor and measure regularly the key characteristics of your operations and activities that might have a significant impact on the environment. The EIA control and monitoring plan is a substantial contribution to this activity.
13.	Correct any errors detected.	Identify the causes of the errors, prevent their recurrence by applying the appropriate actions to correct the problem.
14.	Control the records.	Keep and control the following records: - Legislative and statutory requirements - Permits and compliance records - Environmental aspects of the organization -- Reports of the EAS audits and reviews. -- Personnel training certificates - Maintenance records - Incident reports - Communications with interested parties -- Acknowledgements for environmental results -- Identification of product composition - Customer – supplier agreements - Monitoring data - Plans to correct deficiencies - Result review - Calibration records. - Other.
15.	Periodically audit the EAS.	Periodically review the performance of your EAS, apply corrective actions and start again. Define the personnel and external specialized agencies.
16.	Review and improve your progress.	The Senior Management of the Project (African Oil Palm Company) must periodically review the EAS in order to guarantee its continuing suitability, appropriateness and effectiveness.

### 2.3 EAS Cost Analysis

The most important costs of the EAS are related to its design, implementation and periodic audits. The EAS is in essence a business performance culture and, therefore, the various activities must be assumed and performed by company personnel. Table below presents a summary of the items that must be budgeted when making the decision to implement an ISO 14001 project. In this case, they present the costs of certain important partial activities, as the budget is only valid when the decision to implement the EAS is made.

**Table 26 Card 1P – 5B. Costs of action to be developed.  
Costs of an ISO 14001 project - EAS**

<b>Affected resource: WATER</b>			
<b>Action to be developed:</b> Prevention Include objectives, goals and responsibilities in the EMP and in the Environmental Administration System			<b>Code:</b> <b>1P – 5B</b>
No.	Description	Value	Observation
1	Personnel costs		
2	Formation costs		
3	Initial diagnosis		
4	Advice for implementation	20,000,000	Design of the plan
5	EAS audits	40,000,000	
6	Certification process		
<b>TOTAL</b>		<b>60,000,000</b>	

The implementation of the EAS necessarily leads to an investment in other costs not attributable to the ISO 14001 System, but to compliance with the mandatory requirements identified in the EIA<sup>41</sup>. These costs are included in the Environmental Management Plan budget matrix. The EAS costs are not included in the EMP, as in this case this is a voluntary action, not required by the environmental authorities.

### 2.4 Guide for the Assignment of Responsibilities in the Implementation and Operation of the EAS.

Since the project does not yet have a defined organizational infrastructure, it is not possible to assign responsibilities by specific areas. In any event, an analysis broken down by basic activities is included, which activities shall be carried out independently of said structure. The activities, tasks and basic functions of the EAS for the company Coopar Ltda. are broken down in Table below. The profile of the responsible person or area is also presented.

<sup>41</sup> Clean technologies, measurement equipment, waste treatment systems, etc.

**Table 27.** Responsibilities, Functions and Tasks of the different areas (activities) of the company Coopar Ltda. with respect to the EAS

RESPONSIBLE AREA (ACTIVITY)	FUNCTION	TASKS TO BE PERFORMED AND RESPONSIBLE PERSON *
General Management	Is the moral leader of the project	<p>Defines the ENVIRONMENTAL policy of the cooperative.            Assigns RESPONSIBILITIES AND AUTHORITY in environmental matters.            Assigns the resources for the EAS.            Periodically reviews the effectiveness of the EAS.  <u>PROFILE:</u>            Plant Manager</p>
Human Resources	<p>Its main function relates to the topics of formation and professional competency of personnel in general and in the case of matters related to the environment.</p>	<p>Identify the needs for environmental EDUCATION.            Promote environmental AWARENESS in all employees.            Determine the level of FORMACIÓN and experience for specialized functions            Retain personnel formation and qualification records  <u>PROFILE:</u>            These functions and tasks may be assumed by the Social Development Department of the Cooperative</p>
Commercial Area	<p>The commercial officer, area or department must play the role of project promoter, detecting possible requirements or demands of customers and studying the steps of the competition. It will lead the communication tasks with the interested parties.</p>	<p>External communication.            Monitoring of competition.            Information to customers on environmental provision of products and services of the Cooperative.            Promotion of partial product (FFB) or final product (Palm Oil or Palm Nuts), as environmentally friendly products.  <u>PROFILE:</u>            Whoever performs these functions.</p>
Administrative Area	Management of information and records related to the EAS	<p>Gathering of process information.            Information flows.            File management            Record preparation and control.            Records.  <u>PROFILE:</u>            Administrative division of the Cooperative.</p>
Purchasing	Supplier and contractors control in topics related to EAS requirements.	<p>Encourage suppliers and contractors to adopt an environmental policy and effectively communicate any abnormality or incident.            Identification of environmental aspects related to products and services coming from abroad.            Supplier selection.</p>
Production (FFB production and processing)	<p>Ensure the application of written procedures to carry out effectively those key operations and activities that might affect the environment.</p>	<p>Implement Residue Minimization Plans            Residue management (reduction, reutilization, recycling, treatment)            Environmental objectives and goals.            Impact prevention.            Contingency plans.            Integrated Pest Management (IPDM)  <u>PROFILE:</u>            Separate responsibilities must be defined: 1). Purchasing Personnel (Plantation) and 2). Processing plant.</p>
Maintenance	<p>As with production, functions must be performed following specific and documented procedures.</p>	<p>Preventive maintenance of machinery and equipment.            Calibration of measuring equipment.            Stopping and startup of the activity.            Temporary closing of facilities.            Maintenance of protection zones in the fields.            Eradication of unproductive crops under environmental requirements.  <u>PROFILE:</u>            The persons responsible must be defined for: 1) nursery, pre-nursery and palm fields 2). For processing plant.</p>

RESPONSIBLE AREA (ACTIVITY)	FUNCTION	TASKS TO BE PERFORMED AND RESPONSIBLE PERSON *
Engineering and Design	This person, area or department has the responsibility for designing processes and products that are more respectful of the environment.	Reengineering of planting, gathering, processing and field eradications processes and procedures. Substitution of toxic materials. Sludge separation. Design of biological pest control systems <u>PROFILE:</u> The most convenient procedure would be to form an Engineering and Design committee, given that the project does not propose a department of this type.
Person or department for Environment, Quality and Safety (the ISO 14001 Standard, does not demand a department, but does require a structure and certain clearly defined environmental responsibilities).	Assume most of the workload involved in an EAS. To that end, it must coordinate the work with other departments or individuals. Process the permits. See card 1P - 5C.	Coordinate the creation of the documentary basis for the EAS. Manage documentation CONTROL. Carry out EAS audits. Identify and update the applicable environmental legislation. Perform measurements and records. Overall monitoring of the EAS. <u>PROFILE:</u> A person with great capacity to coordinate, negotiate, plan, attain goals and direct others.

\* Person or area of Coopar Ltda., which could be in charge of the mentioned tasks.

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**ENVIRONMENTAL ADMINISTRATION SYSTEM  
PROCEDURES AND STEPS BEFORE THE ENVIRONMENTAL AUTHORITIES FOR  
THE ENVIRONMENTAL REGULATION OF THE OIL PALM PROJECT<sup>42</sup>**

**Table 28. Basic dimensioning card 1P - 5C**

STEP	DEFINITIONS AND PROCEDURES BEFORE THE ENVIRONMENTAL AUTHORITY	REGULATORY DECREES
<b>SURFACE WATER CONCESSIONS</b>	<p>To access the use of water sources directly (that is when it is not supplied by a specific institution, such as a water company or an irrigation district) it is necessary to request from the respective Regional Autonomous Entities a specific permit known as a Water Concession.</p> <p>Concessions, which are valid for ten years, may be granted by two procedures:</p> <ul style="list-style-type: none"> <li>€ Individual assignments to individuals or legal entities requiring the water for any use</li> <li>€ Regulation of currents performed at the initiative of the Entity at the request of the interested party, when there are several users and competing uses in the area of influence of a current</li> </ul> <p>Concessions are granted according to this order of priorities:</p> <ol style="list-style-type: none"> <li>1. Urban or rural collective human consumption (water supply systems)</li> <li>2. Individual household uses</li> <li>3. Collective or individual agricultural uses.</li> <li>4. Hydro power generation.</li> <li>5. Industrial uses</li> <li>6. Mining uses</li> <li>7. Recreational uses</li> </ol> <p><b>General procedures to obtain a water concession</b></p> <p>Obtain the water concession form at any office of the corresponding Autonomous Entity (CORPONOR) and return it duly filled out with the information and certificates required as special attachments. In general terms, these are:</p> <ul style="list-style-type: none"> <li>€ Specify the use that will be given to the water.</li> <li>€ Description of the systems to be adopted for gathering,</li> </ul>	<p>Water concessions are governed by the provisions of Decree 1541 of 1978; they are administrative acts by which an individual or legal entity, public or private, acquires a right to utilize waters for any purpose. The administrative act defines the volume of flow and operating regime, as well as the user's obligations with respect to the management and building of the collection and distribution works required.</p>

<sup>42</sup> Adapted from the Environmental Guide for the Oil Palm Agroindustry Subsector. SOCIEDAD DE AGRICULTORES DE COLOMBIA, FEDEPALMA, May 2002. Editorial coordination, Communications Office of FEDEPALMA, Bogotá. 136 p

STEP	DEFINITIONS AND PROCEDURES BEFORE THE ENVIRONMENTAL AUTHORITY	REGULATORY DECREES
	<p>diversion, distribution and restitution of excess water.</p> <ul style="list-style-type: none"> <li>€ Information on the easements that will be required for the utilization of the waters and the execution of the projected works.</li> <li>€ Term for which the concession permit was requested</li> <li>€ Copy of the real-estate registration for the benefited property, issued the Public Instrument Registry Office.</li> <li>€ Pay the amount corresponding to the inspection visit at the financial institution indicated.</li> </ul> <p>The respective Regional Autonomous Entity will study the titled deeds and issue the admitting order, indicating the date and time for the inspection visit.</p> <p>At least 10 days before the inspection visit, the entity will post at a public place in its offices and at the mayor's office or inspector's office of the town, a notice indicating the place, date and purpose of the visit, in order that all persons who feel they have the right to intervene may do so.</p> <p>The resolution is communicated to the interested party so that it may attend the notification thereof and from this point on the work or activity is executed or the obtaining of resources is processed, if necessary</p> <p>The beneficiary must publish the approval resolution in the Official Gazette.</p>	
<p align="center"><b>GROUND WATER CONCESSION</b></p>	<p>The application must be filed by the owner. If the well is part of a project that requires an environmental license, the user must first process the license before the Regional Autonomous Entity.</p> <p>Once the well is built it is necessary to request the water concession or utilization license. The user must fill out a form which shall be delivered to it at the Entity, specifying the volume of flow requirements and management system. It is also necessary to attach the technical information for the well (pump test, lithological column and design), certificate of transfers of the property or public deed and Chamber of Commerce certificate in the event that the owner is a company or industry.</p> <p>Based on this information, the level of exploitation and the availability of ground waters in the area where the property is located, the entity issues the utilization license by means of a resolution. In it, it defines the volume of flow, the management system for each well (daily, weekly or monthly) or the ground water collection works, as well as the user's obligations. This license shall be in force throughout the useful life of the well. When a well is abandoned because its useful life has ended and is replaced by a new well, the respective utilization license must be processed for the new well.</p>	<p>For ground water concessions, it will first be necessary to process the well drilling permit. A letter is sent to the entity requesting the permit to drill a well. This letter must show the name of the property, the use of the water and the required volume or flow.</p>
<p align="center"><b>DISCHARGE PERMIT</b></p>	<p>To obtain the discharge permit, users must abide by the provisions of Decree 1594 of 1984. In the event that they do not comply with the permissible limits, they must enter into a compliance plan, specifying the activities proposed by the user, which must be approved by the environmental authority, establishing the relevant periods to attain the minimum quality requirements of the discharge.</p> <p>In addition to the information required for the water concession, for discharge permits, the following is normally</p>	<p>A discharge permit is the authorization granted by the environmental authority to all users that generate liquid discharges, as established by Decrees 1594 of 1978 and 1594 of 1984.</p>

STEP	DEFINITIONS AND PROCEDURES BEFORE THE ENVIRONMENTAL AUTHORITY	REGULATORY DECREES
	<p>required.</p> <ul style="list-style-type: none"> <li>€ Discharge quality study, conducted by an authorized laboratory.</li> <li>€ Identification of the bodies receiving the discharge.</li> <li>€ Description of the production facilities or processes and location of the discharges.</li> </ul> <p>The Regional Autonomous Entity shall process the application in legal form and after a technical analysis of the information, shall fix its position by means of a duly supported resolution.</p>	
<b>ATMOSPHERIC EMISSION PERMIT</b>	<p>The permit will only be granted to the owner of the works, activity, industry or establishment which originates emissions.</p> <p>The general procedure is as follows:</p> <ul style="list-style-type: none"> <li>€ Written application for permit filed with the respective environmental authority.</li> <li>€ Opening of an order for the visit</li> <li>€ Isokinetic and particulate material technical study.</li> <li>€ Technical opinion.</li> <li>€ Answer through duly supported resolution</li> </ul>	<p>The atmospheric emission permit is the authorization given by the environmental authority through an administrative act, within the permissible limits established in the respective environmental regulations: Decrees 02 of 1982 and 948 of 1995.</p>
<b>FOREST UTILIZATION PERMIT</b>	<p>The permit will only be granted to the owner of the works, activity, industry or establishment which evidences the ownership of the lands.</p> <p>The general procedure is as follows:</p> <ul style="list-style-type: none"> <li>€ Written application for permit filed with the respective environmental authority, evidencing the ownership of the lands.</li> <li>€ Certificate of existence and legal representation, in the case of a legal entity.</li> <li>€ Detailed technical study with all characteristics of the site and volume of utilization</li> <li>€ Estimated project cost.</li> <li>€ Description of the general environmental characteristics of the area where it is located</li> <li>€ Indicate whether areas of the national park system are affected</li> <li>€ Opening of an order for the visit.</li> <li>€ Technical opinion.</li> <li>€ Answer through duly supported resolution.</li> </ul>	<p>The forest utilization permit to establish oil palm plantations or related activities in appropriate areas, is the authorization given the environmental authority through an administrative act in keeping with the guidelines established in the relevant decrees.</p>
<b>SPECIAL PROCEDURES</b>	<p><b>For environmental management plans</b>  In the case of environmental management plans, the environmental authority, through an administrative act, notifies the company and attaches the terms of reference for their preparation. Once the environmental management plan is submitted, the respective Regional Autonomous Entity assesses it and issues its technical opinion for approval through a duly supported resolution.</p> <p>Furthermore, the corporation reserves the right to conduct the technical visits it deems appropriate, in order to verify data or to carry out the respective follow-up and control</p> <p>The legal representative of the company must promptly submit the environmental reports that may be requested through the means authorized by the Entity.</p>	

STEP	DEFINITIONS AND PROCEDURES BEFORE THE ENVIRONMENTAL AUTHORITY	REGULATORY DECREES
	<p><b>For environmental impact study and environmental license.</b>            In the case of the environmental impact study (EIA) as an instrument for decision-making and for environmental planning, it will be required in all cases requiring an environmental license. The content and depth of the EIA must be in line with the characteristics of the project, work or activity, according to the terms of reference established by the environmental authority.</p> <p>The environmental license is the authorization granted by the competent environmental authority, through an administrative act, to an individual, for the execution of a project, work or activity which under the law and regulations may cause serious damage to the renewable natural resources or to the environment, or introduce considerable or clearly evident modifications to the landscape, and establishes the requirements, obligations and conditions that must be met by the beneficiary of the environmental license</p>	<p>Decree No. 1728 of August 6, 2002, "Whereby Title VIII of Law 99 of 1993 regarding environmental licenses is regulated"</p>
	<p><b>For the implementation of retribution rates.</b></p> <p>In general terms, the Self-declaration form contains:</p> <ul style="list-style-type: none"> <li>€ Data of the catchment source (Volume of flow in l/sec and time of use in h/day BOD5SST in mg/l).</li> <li>€ Data of the contaminating load to the effluent, preferably, after the treatment (BOD5, TSS in mg/l, volume of flow in l/sec and discharge time in h/day).</li> </ul> <p>Based on the information, the value of the regional factor and the minimum rates, the amounts payable per load on a monthly basis are calculated, using formulas included in the decree.</p> <p>In the case of the Oil Palm agroindustry enterprises with processing plants and which are signatories to the Clean Production Convention, the proposals are delivered to each Regional Autonomous Entity through FEDEPALMA in order to then agree upon their form of application in accordance with the regional goals defined and approved by the Directive Council.</p>	<p>In accordance with Decree 901 of 1997, the interested party or duly organized enterprises request from the respective Entity the Self-declaration form which they must fill out.</p>

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 29. Action to be developed 1P -6**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Manage the Control and Monitoring Plan	<b>Code:</b> <p style="text-align: center; font-size: 1.2em;"><b>1P – 6</b></p>
<b>Objective:</b> Effectively control the processes, operations and other activities related to the environment, as well as the monitoring variables and routines.	<b>Location:</b> throughout the project
<b>Associated environmental impacts:</b> The card is specially related to impacts associated with the water resource, but is validated for all other environmental aspects and impacts.	
<b>Description of measures to be implemented:</b> Include the control and monitoring plan within the framework of responsibilities suggested for the EIA, developed in card 1P-5A.	
<b>Goal:</b> To ensure the full application of the control and follow-up, as well as environmental monitoring, measures throughout the life of the project.	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u>	
<b>See attached card:</b> The Control and Monitoring Plan developed within this EIA, presents a summary of the proposed actions, which are specified in the each action development card or its attached cards.	
<b>Costs:</b> For mandatory controls and monitoring, there is an analysis of basic costs in the respective cards.	
<b>See attached card:</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> The control and monitoring plan, must be periodically assessed and adjusted by senior management. Records certifying its control must be left therein.  <b>Specific C and F Plan required?:</b> YES ___ NO ___  <b>See card:</b>	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b>  <b>Specific Monitoring Plan required?:</b> YES ___ NO ___  <b>See card:</b>

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 30. Action to be developed 1P – 7**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Design and implement WATER CONSUMPTION MINIMIZATION AND USE OPTIMIZATION PLAN	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">1P – 7</p>
<b>Objective:</b> Promote a culture of saving and optimization of water uses at the farms, the nurseries and the FFB processing plant..	<b>Location:</b> Throughout the entire project with its different stages.
<b>Associated environmental impacts:</b> Those related to the use of the water, contamination of water resources, contamination of the soil through discharges and deterioration of watercourses.	
<b>Description of measures to be implemented:</b> 1- Prepare a diagnosis of the different consumptions, quality and quantity required. 2- Perform an assessment of the basic collection, piping, storage, macro and micro measurement infrastructure, as well as its condition and operation. 3 – Identify all opportunities for consumption optimization and minimization with the help of an expert and the participation of company personnel. 4- Prepare a WATER USE OPTIMIZATION AND MINIMIZATION PLAN, with objectives, goals, and budget. 5- Conduct periodic assessments of the accomplishments of the plan.	
<b>Goal:</b> The goals must be defined by management based on the plan and the budget.	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u>	
<b>See attached card:</b> In this case, the dimensioning is part of the minimization plan, which is a decision based on cost-effectiveness criteria.	
<b>Costs:</b> Ps\$ 20,000,000.00	
<b>See attached card:</b> 1P – 7B	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> <b>Specific C and F Plan required?</b> <p style="text-align: right;">YES <u>X</u>      NO ___</p> <b>See card:</b> The assessment and follow-up plan must be included within the design of the MINIMIZATION PLAN itself. It does not form part of this study.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> <b>Specific Monitoring Plan required?</b> <p style="text-align: right;">YES <u>X</u>      NO ___</p> <b>See card:</b> A monitoring plan is key to obtain the periodic variables that will allow the establishment of consumption and waste balances. It must be part of the MINIMIZATION PLAN. In is not included in this study.

**Table 31. Card 1P – 7B. Costs of the action to be developed.  
Costs of a water consumption minimization and optimization plan**

<b>Affected resource: WATER</b>			
<b>Action to be developed:</b> Prevention Design and implement a WATER CONSUMPTION MINIMIZATION AND USE OPTIMIZATION PLAN.			<b>Code:</b> <b>1P – 7B</b>
<b>No.</b>	<b>Description</b>	<b>Value (Ps\$)</b>	<b>Observation</b>
	Costs of specialized personnel	10,000,000.00	
	Training	2,000,000.00	
	Transportation and travel expenses	1,500,000.00	
	Logistics	500,000.00	
	Administrative and other	6,000,000.00	
	Implementation		
	Evaluation		
<b>TOTAL</b>		20,000,000.00	

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 32. Action to be developed 1P – 8**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Implement periodic AUDITS for waste minimization.	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">1P – 8</p>
<b>Objective:</b> Periodically and systematically assess the WASTE MINIMIZATION PLAN OR PROGRAM.	<b>Location:</b> Entire project
<b>Associated environmental impacts:</b> All those related to liquid, solid and gaseous waste generation.	
<b>Description of measures to be implemented:</b> 1- Train the person in charge of the environmental management, in the methodology of the MINIMIZATION AUDITS. 2- Define the audit routines. 3- Develop the AUDITS, based on the goals, objectives and progress proposed in the waste minimization plan. 4- Implement the actions intended to correct the NON-CONFORMITIES INDICATED BY THE AUDIT.	
<b>Goal:</b> Must be voluntarily established by management.	
<b>Basic dimensioning:</b> <b>Required:</b> YES <u>X</u> NO <u>   </u> <b>See attached card:</b> 1P – 1A. The same card designed for the minimization of liquid wastes serves as a guide for the formulation of a WASTE MINIMIZATION AUDIT methodology.	
<b>Costs:</b> Ps\$ 10,000,000.00 <b>See attached card:</b> 1P – 8B	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:.</b>  <b>Specific C and F Plan required?</b>  <p style="text-align: center;">YES <u>X</u>                      NO <u>   </u></p> <b>See card:</b> any audit ends with the observations and notification of non-conformities by the auditor. The company must prepare a development plan to eliminate the non-conformities (corrective actions). Not included in this assessment.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:.</b>  <b>Specific Monitoring Plan required?</b>  <p style="text-align: center;">YES <u>   </u>                      NO <u>   </u></p> <b>See card:</b>

**Table 33. Card 1P – 8B. Costs of action to be developed.  
AUDIT costs of a waste minimization and optimization plan**

Action to be developed: Prevention AUDIT of a waste minimization program			Code: <b>1P – 8B</b>
No.	Description	Cost ( Ps\$)	Observation
	Costs of specialized personnel	5,000,000.00	One moth of work of a specialized person. May be the person in charge or environmental leader of the company. May also be the internal auditor.
	Training	4,000,000.00	Training in waste audit techniques.
	Unforeseen expenses	1,000,000.00	
	<b>Total</b>	10,000,000.00	

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 34. Action to be developed 1P – 9**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Environmental education at the company.	Code: <p style="text-align: center; font-weight: bold;">1P – 9</p>
<b>Objective:</b> Conduct a general environmental training plan for all company employees. In this case, it is a different task from the training plan indicated and required as part of the Environmental Administration System – EAS.	<b>Location:</b> entire company.
<b>Associated environmental impacts:</b> All impacts identified, described and assessed in the EIA.	
<b>Description of measures to be implemented:</b> The delegate or leader for environmental management of COOPAR Ltda. must train the people of the Human Development Department (social work), so that these people will spread the objectives, scopes, goals, costs and benefits of the EIA and its results. If the company decides to implement an EAS, this task may be carried out simultaneously with the TRAINING PLAN in order to minimize costs. It is very important that the training responsibilities be delegated to certain officers of the company who handle critical processes. This will result in a greater empowerment of the individuals directly related to the management of the processes and their environmental management measures.	
<b>Goal:</b> All personnel must know the objectives, goals, scopes and results of the EIA and its outcome.	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u> <b>See attached card:</b> No dimensioning card is attached.	
<b>Costs:</b> Ps\$ 6,000,000.00  <b>See attached card:</b> 1P – 9B	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> the company, through the Human Development Department (social work) must carry out periodic assessments of the level of knowledge of general and specific environmental topics (EIA)  <b>Specific C and F Plan required?</b>  <p style="text-align: center;">YES ___ NO <u>X</u></p> <b>See card:</b> must be developed jointly between the person in charge of environmental matters and the social work department.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> <b>Specific Monitoring Plan required?</b>  <p style="text-align: center;">YES ___ NO <u>X</u></p> <b>See card:</b>

**Table 35. Card 1P – 9B. Costs of the action to be developed.  
Costs of a company environmental education plan at COOPAR Ltda.**

<b>Action to be developed:</b> Prevention Design and implementation of an environmental education plan			<b>Code:</b> <b>1P – 9B</b>
<b>No.</b>	<b>Description</b>	<b>Cost (Ps\$)</b>	<b>Observation</b>
	Costs of specialized personnel	2,000,000.00	One month of work of the person in charge (professional), preparing and developing the training plan.
	Training	3,000,000.00	Three information workshops.
	Unforeseen expenses	1,000,000.00	
<b>Total</b>		6,000,000.00	

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 36. Action to be developed 1P – 10**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Delimit and mark off water source protection strips, before beginning stripping and earth moving activities.	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">1P – 10</p>
<b>Objective:</b> Prevent the contamination of creeks, irrigation channels and water sources by solids and sediments resulting from earth moving, during the land improvement processes.	<b>Location:</b> Nurseries, pre-nurseries and production.
<b>Associated environmental impacts:</b> All those related to land improvement activities.	
<b>Description of measures to be implemented:</b> The planning of planting fronts must begin with the delimitation on plans and the marking off on the land, of protection areas for the bodies of water. As indicated in the figure of index card 1P - 10A, it is only necessary to trace out the protection strips and reforest the first rows of palm trees, on the delimited strips.	
<b>Goal:</b> For all bodies of water, it is necessary to prepare the protection sketch for their protection areas.	
<b>Basic dimensioning:</b> Required: YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	
<b>See attached card:</b> 1P – 10A	
<b>Costs:</b> The proposed activity does not involve extra costs, but rather a rescheduling of activities.	
<b>See attached card:</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> 1- It is necessary to observe the mandatory water source protection strips established in the Colombian Natural Resource Code (Law 2811 of 1974).  2- The agricultural engineer in charge of land improvement activities, must verify these protections before the start of earth moving activities. This information must be documented and marked out in plans.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> It is recommended to monitor, at least once a year, the TSS, COLOR, TURBIDITY AND PH of the bodies of water most involved in these activities.
<b>Specific C and F Plan required?</b>  YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	<b>Specific Monitoring Plan required?</b>  YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>
<b>See card:</b>	<b>See card:</b>

**AFRICAN OIL PALM PROJECT**  
**ENVIRONMENTAL IMPACT ASSESSMENT- EIA**  
**DIMENSIONING CARD – CODE: 1P – 10 A**  
**DELIMITATION AND MARKING OFF OF BUFFERS FROM WATER SOURCES, BEFORE**  
**STARTING STRIPPING AND EARTH MOVING ACTIVITIES**

**1. OBJECTIVE**

Protect the bodies of water from the contamination caused by earth moving activities and prevent the sedimentation of creeks and water courses.

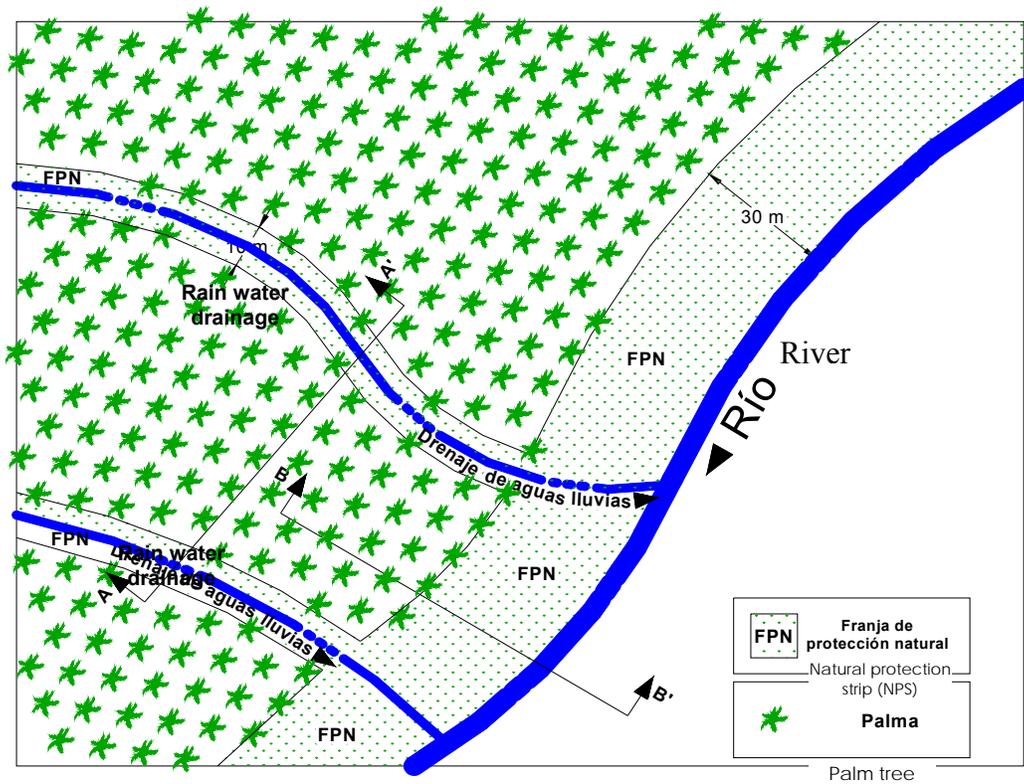
**2. DEVELOPMENT**

**2.1 GENERAL INFORMATION**

VARIABLE	N°	UNIT	VALUE
Buffers from not intervened water sources.	1	m	30
Buffers from irrigation system channels.	2	m	5
Buffers from maintenance and rain water drainage creeks.	3	m	5

**2.2 DIMENSIONING**

See Figure 3 below



PLANTA

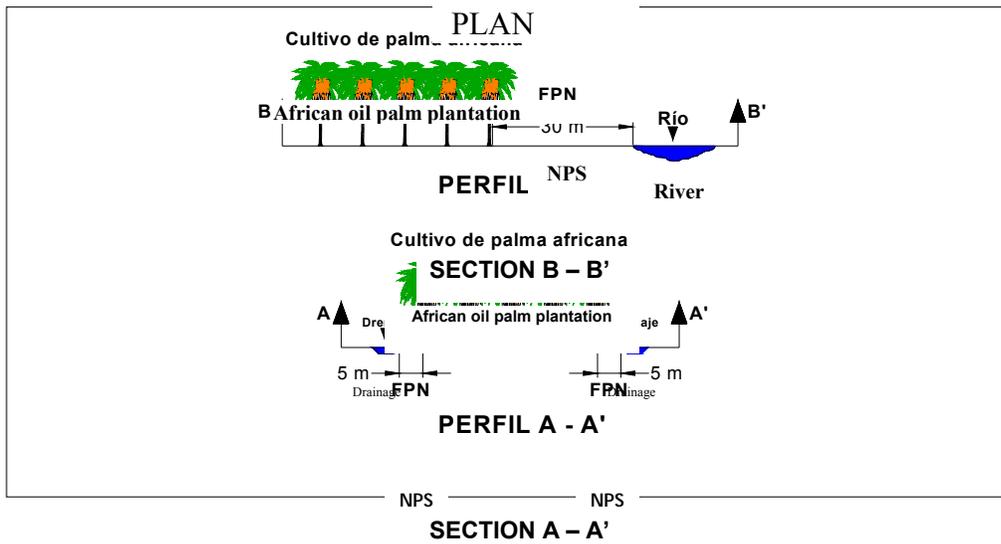


Figure 3. Delimitation and marking off of water source protection strips, before starting stripping and earth moving activities.

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 37. Action to be developed 1P - 11**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Respect the natural vegetation in the prescribed surface and ground water source protection strips.	<b>Code:</b> <p style="text-align: center;"><b>1P – 11</b></p>
<b>Objective:</b> Ensure strips that are free from oil palm cultivation, subjected to natural stubble succession processes and conservation of the invertebrate fauna that is native to these soils.	<b>Location:</b> Nursery, pre-nursery and production zones.
<b>Associated environmental impacts:</b> All those related to soils, biodiversity and preservation of water source protection strips.	
<b>Description of measures to be implemented:</b> Respect the vegetation cover and promote the natural vegetation regeneration process in the strips that were delimited and marked off for the preservation of water source protection strips.	
<b>Goal:</b> 100% of the water source protection strips.	
<b>Basic dimensioning:</b> Required: YES <u>X</u> NO ___ <b>See attached card:</b> 1P – 10A (Figure 4)	
<b>Costs:</b> Does not involve additional costs, only rescheduling of activities. The areas to be cultivated had already been planned with this in mind, so no purchase of lots is required.	
<b>Control and follow-up</b>	<b>Monitoring</b>
<b>Description:</b> From the PHYTOSANITARY point of view, the company must develop an inventory of the microfauna in these strips. This information is vital for the development of an integrated pest management program, as well as for disease control.	<b>Description:</b> Optionally, the company may participate with other interested entities (Environmental Authorities, universities, FEDEPALMA, CENIPALMA, etc.), to monitor certain botanical and microfauna species.
<b>Specific C and F Plan required?</b> YES <u>X</u> NO ___	<b>Specific Monitoring Plan required?</b> YES ___ NO ___
<b>See card:</b> Must be developed by decision of the company.	

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 38. Action to be developed 1P – 12**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Use 100% of the agrochemical solutions prepared for nurseries, planting and operation of the plantation.	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">1P – 12</p>
<b>Objective:</b> Prevent the generation of liquid wastes from agrochemical preparation.	<b>Location:</b> Nursery, pre-nursery and production
<b>Associated environmental impacts:</b> Those related to soil and water contamination due to liquid waste generation.	
<b>Description of measures to be implemented:</b> 1- Set aside appropriate sites for the preparation and management of agrochemical substances for fertilization and pest control in the plantations. 2- Plan the preparation of solutions, in such a way as to use the entire compound and eliminate leftovers. 3- Use the waters from the washing of containers and equipment for the preparation of a related solutions 4- Prepare technical designs of treatment systems for waste waters from agrochemical preparation. 5- Prevent these wastes or the treated effluents from the treatment system from ending up in the surface and ground water sources.	
<b>Goal:</b> Reduce liquid wastes from agrochemical preparation by 100%.	
<b>Basic dimensioning:</b> Required: YES <u>X</u> NO <u>   </u>	
<b>See attached card:</b> The company must design a treatment and final disposal system for effluents of liquid wastes from agrochemical preparation.	
<b>Costs:</b> Ps\$	
<b>See attached card:</b> Card 1M-16B presents a cost summary for this activity.	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> Decree 1594 of 1984 entirely prohibits the disposal of liquid wastes with untreated substances of sanitary interest into bodies of water or into the soil. The company must keep a strict and properly documented control of the substances, components, volumes, active components, times, frequencies and management implemented, among others. The treatment systems for water from washing and contingencies must be required under the respective operating manual  <b>Specific C and F Plan required?</b> <p style="text-align: center;">YES <u>X</u> NO <u>   </u></p> <b>See card:</b> Must be delivered by whoever designs the management and treatment system for wastewaters of this type.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> See follow-up and monitoring plan <b>Specific Monitoring Plan required?</b> <p style="text-align: center;">YES <u>   </u> NO <u>X</u></p> <b>See card:</b>

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 39. Action to be developed 1P – 13**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Develop an operating manual for manual sanitary landfills by farm or module.	<b>Code:</b> <p style="text-align: center;"><b>1P – 13</b></p>
<b>Objective:</b> Prevent excess production of domestic solid wastes and ensure an adequate management at the palm plantations.	<b>Location:</b> residential housing in the oil palm plantations.
<b>Associated environmental impacts:</b> Those caused by the generation of domestic solid wastes.	
<b>Description of measures to be implemented:</b> Cards 1M-18 and 1M – 18A show the actions to be developed and the dimensioning of the manual sanitary landfills for the farms. The activities proposed therein must be retaken by the social work department and converted into an educational booklet, to be distributed among all project partners	
<b>Goal:</b> %	
<b>Basic dimensioning:</b> <b>Required:</b> YES <u> X </u> NO <u> ___ </u> <b>See attached card:</b> 1M– 18A	
<b>Costs:</b> Ps\$ 2,000,000.00 These costs correspond to the printing of the booklets and their distribution. <b>See attached card:</b> No cost card is included.	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> Strict control must be kept on the volumes and composition of the farm wastes, the systems built, the defects in operation according to the booklet, etc. etc.  <b>Specific C and F Plan required?</b> <p style="text-align: center;">YES <u> X </u>                      NO <u> ___ </u></p> <b>See card:</b> the operating booklet must specify the controls.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> the volumes and composition of the solid wastes of each farm must be controlled on a monthly basis. This activity must be controlled with the users themselves, from the Social Work Division..  <b>Specific Monitoring Plan required?</b> <p style="text-align: center;">YES <u> X </u>                      NO <u> ___ </u></p> <b>See card:</b>

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 40. Action to be developed 1M – 14**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Implement WASTE MINIMIZATION AND CLEANER PRODUCTION PLANS	<b>Code:</b> <div style="text-align: center; font-weight: bold; font-size: 1.2em;">1M – 14</div>
<b>Objective:</b> Execute the actions recommended in the Waste Minimization study.	<b>Location:</b> entire project
<b>Associated environmental impacts:</b> All those that generate liquid, solid, gaseous or special wastes.	
<b>Description of measures to be implemented:</b> The mitigation of the impacts caused will only occur if the minimization strategy is implemented. Development card 1P-1 and dimensioning card 1P-1A indicate the activities and approximate costs of the plan.	
<b>Goal:</b> The goal and objectives are defined by management according to the cost-effectiveness analysis. In certain cases, wastes (such as liquids), may be minimized by up to 30%. In the case of solid wastes this may be less.	
<b>Basic dimensioning:</b> <b>Required:</b> YES <u>X</u> NO <u>   </u> <b>See attached card:</b> 1P- 1A.	
<b>Costs:</b> Implementation costs can only be determined after preparing the minimization plan. The costs of the plan were already indicated in card 1P-1B.  <b>See attached card:</b> 1P-1B	
<div style="text-align: center; font-weight: bold; font-size: 1.1em;">Control and follow-up</div> <p><b>Description:</b> When the minimization plan is designed, it must be audited and verified according to the proposed program.</p> <p><b>Specific C and F Plan required?</b>                      YES <u>X</u>                      NO <u>   </u></p> <p><b>See card:</b> Is not part of this study.</p>	<div style="text-align: center; font-weight: bold; font-size: 1.1em;">Monitoring</div> <p><b>Description:</b> The plan itself must propose the respective monitoring plan.</p> <p><b>Specific Monitoring Plan required?</b>                      YES <u>   </u>                      NO <u>X</u></p> <p><b>See card:</b> Is not part of this study.</p>

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 41. Action to be developed 1M – 15**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Reutilize, recycle and integrally manage wastes.	<b>Code:</b> <p style="text-align: center; font-weight: bold;">1M – 15</p>
<b>Objective:</b> Avoid greater costs in waste management and treatment.	<b>Location:</b> entire project.
<b>Associated environmental impacts:</b> All those related to the generation of liquid, solid, gaseous and special wastes.	
<b>Description of measures to be implemented:</b> Reutilization and recycling are supplementary measures to the minimization plans. Both at the plant and at the farmhouses it is necessary to promote waste separation, in such a way that only the strictly necessary amounts are treated and handled.	
<b>Goal:</b>	
<b>Basic dimensioning:</b> <b>Required:</b> YES ___                      NO <u>X</u>	
<b>Costs:</b> Ps\$ 20,000.000	
<b>See attached card:</b> 1M – 15B	
<p style="text-align: center; font-weight: bold;">Control and follow-up</p> <b>Description:</b>  <b>Specific C and F Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> The reutilization, recycling or other forms of management programs must include the control and follow-up procedures. Not included in this project.	<p style="text-align: center; font-weight: bold;">Monitoring</p> <b>Description:</b>  <b>Specific Monitoring Plan required?:</b> YES ___                      NO <u>X</u> <b>See card:</b>

**Table 42 Card 1M – 15B. Costs of action to be developed.**

**Costs of a REUSE, REUTILIZATION AND INTEGRAL WASTE MANAGEMENT PLAN**

<b>Action to be developed:</b> Prevention Design and implementation of an environmental education plan			<b>Code:</b> <b>1M –15A</b>
<b>No.</b>	<b>Description</b>	<b>Value ( Ps\$)</b>	<b>Observation</b>
1	Costs of specialized personnel	15,000,000.00	Specialized professional with two months dedication
2	Training and internal spreading	3,000,000.00	
3	Reports and unforeseen expenses.	2,000,000.00	
4	Implementation		The costs are a product of the plan developed.
<b>Total</b>		20,000,000.00	

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 43. Action to be developed 1M – 16**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Treatment of wastes that were not reutilized, recycled and/or managed	<b>Code:</b> <p style="text-align: center;"><b>1M – 16</b></p>
<b>Objective:</b> Prevent the wastes generated in the various project stages from being disposed of into the soil, the air or the water without any treatment.	<b>Location:</b> nursery, production and FFB processing plant
<b>Associated environmental impacts:</b> All those where wastes are generated.	
<b>Description of measures to be implemented:</b>  Treatment and management systems must be built for atmospheric emissions of particulate material, domestic liquid wastes, agroindustrial liquid wastes, agroindustrial solid wastes and special solid wastes.	
<b>Some wastes require certain special considerations:</b> <u><b>Management of plant wastes and byproducts:</b></u> Adequately dispose of the material from pruning and empty bunches, for their decomposition. Pests, if they occur, should, insofar a possible, be controlled with biological methods. Prevent generated leachates from contaminating surface and ground waters.	
<u><b>Management of liquid wastes, sludge and treated effluents:</b></u> Use the stabilized sludge from the pools to improve the soils in the plantation.	
<u><b>Management of special solid wastes – SSW</b></u> A safe procedure must be established for the management and sanitary disposal of SSW generated by the use of pesticides, in order to protect human health and prevent the contamination of the natural resources	
<b>Goal:</b> For each type of a waste, Colombian legislation establishes the discharge limits. Each design must comply with these requirements.	
<b>Basic dimensioning:</b> <b>Required:</b> YES <u>X</u> NO <u>   </u> <b>See attached card:</b> the following are the basic dimensioning cards that supplement the proposed activities: 1M-16A (management and treatment of liquid wastes from the FFB processing plant); 1M-20A (management and treatment of domestic liquid wastes); 1M-19A (management and treatment of excreta from the farms); 1M-16C (management and disposal of agroindustrial liquid wastes); 1M-16D (management of special solid wastes SSW).	
<b>Costs:</b> The Management Plan cost summary itemizes the treatment costs of the most important wastes.	
<b>See attached card:</b> Environmental Management Plan budget	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> each treatment system must contain as part of its design, the respective control and follow-up plan. In the control and follow-up plan there are certain guidelines and basic recommendations of this type.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> for each type of emission there is a basic monitoring card with its indicators, persons in charge, frequencies, monitoring sites, etc.
<b>Specific C and F Plan required?:</b> <p style="text-align: center;">YES <u>X</u>                      NO <u>   </u></p>	<b>Specific Monitoring Plan required?:</b> <p style="text-align: center;">YES <u>X</u>                      NO <u>   </u></p>
<b>See card:</b> See Follow-up and Monitoring Plan	

**AFRICAN OIL PALM PROJECT**  
**ENVIRONMENTAL IMPACT ASSESSMENT- EIA**  
**DIMENSIONING CARD – CODE 1M - 16A**  
**INDUSTRIAL WASTE WATER MANAGEMENT**

**1. OBJECTIVE**

Develop the basic dimensioning for the treatment system of waste waters generated by the transformation process of the Fresh Fruit Bunches FFB

**2. DEVELOPMENT**

**2.1. General Information**

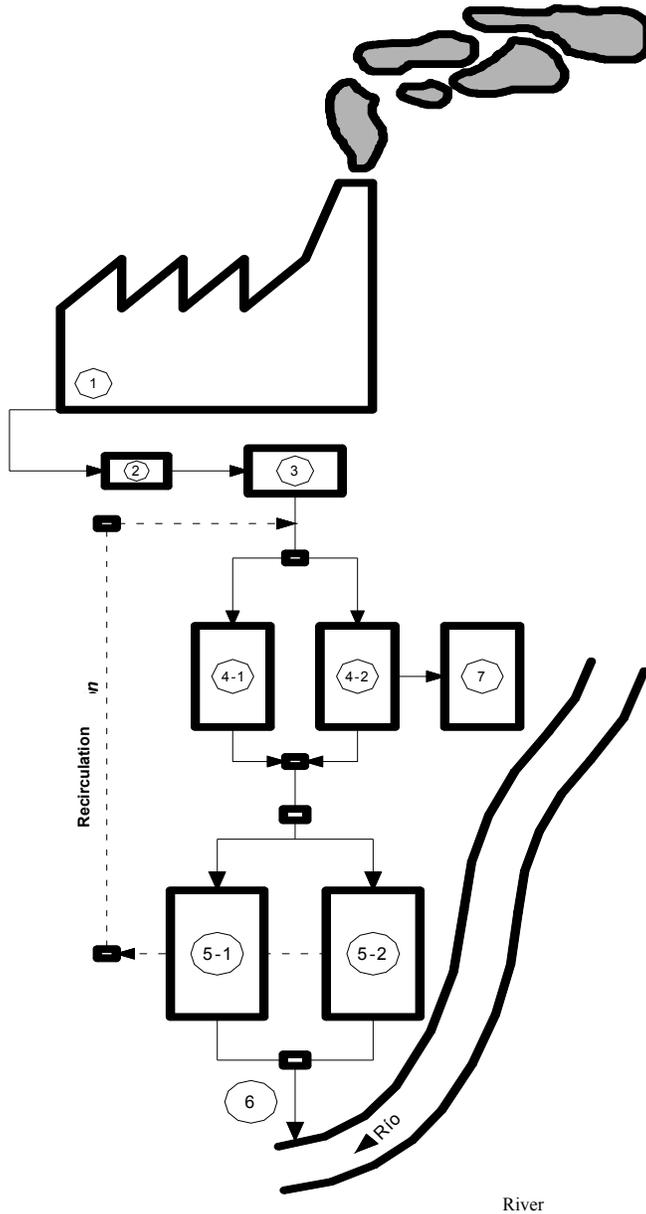
VARIABLE	UNIT	VALUE	SUPPORT
Processing capacity	t FFB /h	6.00	Current capacity (3t/h). In this case it is presumed improved by 100%.
Production peaks	hours	22.00	Projected for maximum production
Wastewater*	m <sup>3</sup> /t FFB	0.72	Clarification, sterilization and hydrocyclone effluents (FEDEPALMA - CENIPALMA)
COD*	mg/l	74,193.00	Weighted (for total effluent)
	Kg/m <sup>3</sup>	74.00	
Volume of flow (Q)*	m <sup>3</sup> /d	96.00	Q = (6)(22)(0.72)
	l/sg	2.30	
Soil Profile**			Texture, water table, structure, shear resistance, infiltration and permeability conditions, presumed APT, for pond construction

\* CENIPALMA, Management of extraction plant effluents, Bogotá. Technical index cards No. 11

\*\* It is mandatory to conduct soil studies for the Detail Engineering Stage.

## 2.2. Potential Treatment System Arrangements

The order of the treatment structures that is best adapted to the conditions detected is the following. See Figure 4:



### Legend

#	DESCRIPTION
1	Wastewater (clarification, sterilization and hydrocyclones) (minimization)
2	Pre-treatment System
3	Cooling and deoiling pond
4-1	Anaerobic methanogenic pond
4-2	Anaerobic methanogenic pond
5-1	Optional pond
5-2	Optional pond
6	Treated discharge per requirements of Decree 1594/84
7	Sludge drying beds.

Figure 5. Organization of industrial wastewater treatment systems

**2.3. Physicochemical and Hydrosanitary Foundations.**

STRUCTURE	N°	FUNCTIONALITY
Wastewater generation	1	By conducting a liquid waste minimization study, there will be a reduction between 20% and 30% in the wastes to be treated.
Pre-treatment	2	Retention of thick solids and sands which damage the next units of the system. Consists of a canal, a desander and two grilles.
Cooling and deoiling pond	3	Regulates volumes of flow, controls water temperature ( T 37°C) and recovers oil and acid floating on its surface.
Methanogenic stabilization ponds	4-1 and 4-2	Anaerobic fermentation in the absence of oxygen. Produce fatty acids, CO <sub>2</sub> and CH <sub>4</sub> .
Optional ponds	5-1 and 5-2	Removal of the organic load that escaped treatment in the anaerobic methanogenic ponds.
Discharge of treated effluent	6	Waters 80% free of contamination by TSS and BOD <sub>5</sub> , as required by the standard.
Sludge drying beds.	7	Sludge drying through water infiltration and evaporation
Recirculation	-----	Cools the water, inoculates adapted bacteria and increases alkalinity content by stabilizing PH.

## 2.4. DIMENSIONING

### 2.4.1. Pre - treatment

UNIT	BASIC DIMENSIONS (m)			BASIC SPECIFICATIONS
	Length (L)	Width (W)	Depth (D)	
Canal	2.0	0.40	Total: 0.50 Water height: 0.40	
Grille 1	0.80	0.40	0.50	Angle: 45° Bar separation: 30 cm
Grille 2	0.80	0.40	0.50	Angle: 45° Bar separation: 1.25 cm
Desander and oil recovery tank	12	0.70	Total: 1.50 Water layer: 1.10	Td= 60 s Horizontal V: 0.3 m/s Sedimentation V: 1.15 m/mm

### 2.4.2 Cooling and Deoiling Pond

UNIT	BASIC DIMENSIONS (m)			BASIC SPECIFICATIONS
	Length (L)	Width (W)	Depth (D)	
Cooling pond Area: 7.7 m <sup>2</sup> V = 192 m <sup>3</sup>	24	8.0	- Water layer: 1.40 - Total: 1.70	Length/width ratio equivalent to 3 - Inside slope 1:2 - Free edge: 0.30

### 2.4.3 Anaerobic Methanogenic Ponds

UNIT	BASIC DIMENSIONS (m)			BASIC SPECIFICATIONS
	Length (L)	Width (W)	Depth (D)	
Anaerobic methanogenic ponds	54	9.0	Total: 2.80 Water layer: 2.50 Free edge: 0.30	Length/ Width ratio: 6 Area per pond TRH = 23 days Area=486 m <sup>2</sup> Efficiency: 85% COD Effluent Load: 710 = (1 - 0.85) = 1065 Kg/d

#### 2.4.4 Optional Ponds

UNIT	BASIC DIMENSIONS (m)			BASIC SPECIFICATIONS
	Length (L)	Width (A)	Depth (D)	
Optional pond 1	46	23	Total: 2.0 Layer: 1.70 Free edge: 0.30	TRH: 22 days V = 2130 m <sup>3</sup> Surface area: 1065 m <sup>2</sup> Length/width ratio = 2 Effluent load: 266 Kg/d COD
Optional pond 2	40	20	Total: 2.0 Usable: 1.70 Edge: 0.30	Surface load: 0.35 Kg COD/m <sup>2</sup> - d S = 760 m <sup>2</sup> Length/width ratio = 2 TRH = 1.35 days Effluent load: 93 kg/d COD

#### 2.4.5 Drying Beds

UNIT	BASIC DIMENSIONS (m)			BASIC SPECIFICATIONS
	Length (L)	Width (W)	Depth (W)	
1	20	10	Total: 1.0 Usable: 0.50	6" collection pipe with 1" hole.
2	20	10	Total: 1.0 Usable: 0.50	

#### 2.5. Monitoring

It is mandatory to monitor water quality indicators, according to a monitoring card. See Monitoring Plan of point liquid discharge sources.

#### 2.6. Control and Follow-up

The process must be permanently controlled, as indicated in the respective wastewater treatment and management system control card and generating environmental aspects. See Follow-up Plan.

#### 2.7. Costs of the Wastewater Treatment System of the FFB Processing Plant

For the proposed and dimensioned infrastructure an overall cost of Ps\$ 150,000,000.00 is estimated<sup>43</sup>. This cost does not include the value of the lands, waste treatability study, designs and soils analysis.

<sup>43</sup> Eng. Jesús Alberto García, Coordinator of Processes and Uses Area. CENIPALMA. October 28, 2002. Telephone interview.

**ENVIRONMENTAL EVALUATION STUDY  
AFRICAN OIL PALM ALTERNATIVE DEVELOPMENT PROJECT  
ENVIRONMENTAL MANAGEMENT PLAN  
DIMENSIONING CARD - CODE 1M - 16D  
SPECIAL SOLID WASTE - SSW - MANAGEMENT**

## **INTRODUCTION**

SSWs are or may be produced within the pest and disease management activities process, when synthetic pesticides are used to control phytosanitary problems. The solid wastes generated also have toxic characteristics and are considered special (SSW). This situation demands a specific management and disposal in accordance with procedures that ensure the least possible risk for people, animals and the environment.

### **1. OBJECTIVE**

Establish a safe procedure for the management and sanitary disposal of the SSW generated by the use of pesticides, in order to protect human health and prevent the contamination of natural resources.

### **2. SCOPES**

Control the possible impacts on the surface and ground bodies of water, as well as the impacts on the soil.

### **3. DEVELOPMENT**

In order to ensure a proper management of the SSW, the following actions must be taken:

#### 3.1. Management of plastic and glass pesticide containers

3.1.1. Wash the containers applying the Triple Rinse<sup>44</sup> technique: This technique basically consists of the following activities:

- € Fully drain the remaining product in the mixing tank. You will thus use up to the last drop of the product.
- € Rinse, filling up to one-fourth of the container with clean water and covering it tightly.
- € Shake the container vigorously several times, horizontally and vertically.
- € Pour the product into the mixing tank.
- € Repeat the same steps three times.

3.1.2. Drain the product into the mixing tank.

3.1.3. Perforate the containers.

3.1.4. Store in a safe place, exclusively designed for SSW.

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<sup>44</sup> Source: Cámara de protección de cultivos ANDHACPA. Taken from La Guía Ambiental para el Subsector Floricultor. Ministry of the Environment – Asocolflores – SAC. Bogotá, May 2002.

3.1.5. Coordinate with Corponor, the management and final disposal of these wastes. They may be incinerated at sites authorized for such purpose by the environmental authorities.

### 3.2. Handling of pesticide bags.

- ε Carry out the triple rinse procedure
- ε Drain them inside the mixing tanks
- ε Store in the SSW storage site.

### 3.3. Handling of unused pesticide application and personal protection elements.

The wastes must be classified and sent to the SSW storage site. This site must comply with the following specifications:

1. Allow the classification of the various solid wastes.
2. Not allow access to individuals who are not in charge of handling these wastes. The Project management must delegate a responsible person to perform these tasks. It is suggested that this be a person from the operating ranks (preparer of agrochemical mixtures), with great responsibility and prior training.

The incineration, burial, donation or marketing of this type of materials to private individuals who are not qualified for their management and final disposal is prohibited.

## **4. CONTROL AND FOLLOW-UP**

The SSW gathering point must be adequately designed and built accordingly, within the oil palm plantation, for the temporary storage of the SSW. A sanitary disposal of the SSW must be guaranteed. It is recommended to lead, together with FEDEPALMA and CORPONOR, a program for the proper disposal of these wastes.

## **5. COSTS**

It is possible to set aside a place in the nursery area to set up the SSW storage site. Otherwise, it will be necessary to build a shelter, which will require an investment of approximately Ps\$ 10,000,000.00.

**ENVIRONMENTAL ASSESSMENT STUDY  
ALTERNATIVE AFRICAN OIL PALM DEVELOPMENT PROJECT  
ENVIRONMENTAL MANAGEMENT PLAN**

**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 44. Action to be developed 1M – 17**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Ensure the efficiencies of waste treatment established in environmental legislation	<b>Code:</b> <p style="text-align: center; font-weight: bold;">1M – 17</p>
<b>Objective:</b> Determine the permissible limits, as established by Colombian legislation, for control of the emissions and wastes generated by an oil palm project in the national territory.	<b>Location:</b> All stages of the project
<b>Associated environmental impacts:</b> This card retakes several of the impacts classified in the impact description matrix as SET. In this case, permissible limits and procedure guidelines are established.	
<b>Description of measures to be implemented:</b> The treatment works and management measures for each particular impact must meet certain legal requirements, but it is also necessary to take certain special steps to obtain the respective permits. The dimensioning card classifies the types of wastes, limits and steps to be taken by the company for each specific permit.	
<b>Goal:</b> Establish permissible limits and permit processing with CORPONOR for liquid wastes, atmospheric emissions, solid wastes and consumption waters.	
<b>Basic dimensioning:</b> <b>Required:</b> YES <u>X</u> NO ___ <b>See attached card:</b> 1P – 5 and attached.	
<b>Costs:</b> This product must be emphasized by the EAS design.	
<b>See attached card:</b> Does not require a cost-dimensioning card.	
<p style="text-align: center; font-weight: bold;">Control and follow-up</p> <b>Description:</b> each treatment and management system must have a follow-up and control system that will allow management to verify whether the legal requirements are being met.  <b>Specific C and F Plan required?:</b> <p style="text-align: center;">YES <u>X</u>                      NO ___</p> <b>See card:</b> See Follow-up and Monitoring Plan	<p style="text-align: center; font-weight: bold;">Monitoring</p> <b>Description:</b> each treatment and management system requires the control of special indicators in order to establish the current level of compliance and the type of control and corrective measures to be implemented.  <b>Specific Monitoring Plan required?:</b> <p style="text-align: center;">YES <u>X</u>                      NO ___</p> <b>See card:</b> the control and monitoring plan specifies the monitoring plan for each particular case.

**ENVIRONMENTAL ASSESSMENT STUDY  
ALTERNATIVE AFRICAN OIL PALM DEVELOPMENT PROJECT  
ENVIRONMENTAL MANAGEMENT PLAN**

**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 45. Action to be developed 1M – 18**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Adequate management, disposal and treatment of plant wastes.	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">1M – 18</p>
<b>Objective:</b> Mitigate the impact generated by the palm residue disposal sites and sites used for plant waste disposal and treatment.	<b>Location:</b> Production fields
<b>Associated environmental impacts:</b> Water, soil and subsoil contamination due to inadequate management of plant wastes from the operation, harvest and eradication of unproductive trees.	
<b>Description of measures to be implemented:</b> 1- Identify the potential sites for palm residue disposal in each hectare of the plantation. At least four sites are recommended, in such a way that the distances for moving the wastes are shortened. 2- Ensure that these sites are not near (more than 10.0 m) the water sources. 3- Ensure that the water table is at least 1.20 m below the ground of the palm residue disposal sites (composters). 4- Turn over the disposed of material sites. A natural and homogeneous waste decomposition process is thus ensured. 5- Carry out supplementary management with worm farming. Although this is an optional procedure, it is necessary to conduct preliminary tests in order to construct the variables that support the final design.	
<b>Goal:</b> To manage all wastes (plant byproducts) through this technique.	
<b>Basic dimensioning:</b> Required: YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	
<b>See attached card: 1M - 18A</b>	
<b>Costs:</b> There is no cost analysis, as this activity is being carried out at the plantation. Now it is only necessary to implement the recommendations made.	
<b>See attached card:</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> The chief field agronomist or the person in charge of environmental matters must see that the selection standards for palm residue disposal sites are met and these are properly operated.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> When contamination of soils and sources by leachates is detected, the site must be immediately closed. In these cases, a characterization of the effluents and the affected water source is recommended.
<b>Specific C and F Plan required?</b> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	<b>Specific Monitoring Plan required?</b> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>
<b>See card:</b>	<b>See card:</b>

**ENVIRONMENTAL ASSESSMENT STUDY  
ALTERNATIVE AFRICAN OIL PALM DEVELOPMENT PROJECT  
ENVIRONMENTAL MANAGEMENT PLAN**

**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 46. Action to be developed 1M – 19**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Set up adequate excreta disposal systems for housing and administrative areas.	<b>Code:</b> <p style="text-align: center; font-weight: bold;">1M – 19</p>
<b>Objective:</b> Decrease by at least what is established in Decree 1594 of 1984 the contamination levels from domestic liquid discharges generated at the housing and administrative areas of the nursery and the oil palm fruit processing plant.	<b>Location:</b> Housing, nurseries and processing plant
<b>Associated environmental impacts:</b> The impacts classified as Medium (M), High (H) and Very High (VH) related to water pollution, water course alteration and soil and water contamination, due to point domestic discharges.	
<b>Description of measures to be implemented:</b> Designs, implementation, control and monitoring of the domestic sewage treatment system for the 133 family homes of the benefited users, the administrative area of the nursery and the administrative area of the processing plant.	
<b>Goal:</b> 100% removal of greases, oils, floating solids, TSS, BOD <sub>5</sub> , pathogen microorganisms.	
<b>Basic dimensioning:</b> Required: YES <u>X</u> NO ___ <b>See attached card:</b> 1M - 19 A	
<b>Costs:</b> Ps\$ 272,000,000.00  <b>See attached card:</b> 1M – 19B	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> excreta management, treatment and disposal systems require strict control for their operation.  <b>Specific C and F Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> 1M- 19C	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> with an adequate control and follow-up plan, it is possible to ensure good operating conditions and a functioning of the proposed systems.  <b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> 1M- 19D

Source : CASTRO HERNÁNDEZ, Luis Fernando. Sanitary and Environmental Eng. 2002

**AFRICAN OIL PALM PROJECT  
ENVIRONMENTAL IMPACT STUDY – EIA  
DIMENSIONING CARD – CODE 1M - 18A AND 1M - 19A  
DOMESTIC SEWAGE – DS - MANAGEMENT**

**1. OBJECTIVE**

Develop the basic dimensioning for the treatment system of wastewaters generated in the housing and administrative areas of the nurseries and the processing plant.

**2. DEVELOPMENT**

**2.1. General Information**

VARIABLE	UNIT	VALUE	SUPPORT
Number of homes	#	133	Require construction of the system
Design installation	P/inhab-day	150-200	
BOD <sub>5</sub>	mg/l	150-200	
TSS	mg/l	150-200	
Return coefficient of waters to the sewage system	%	90	
Family density	Persons/home	4-8	
Efficiency	%	100%	In good design, location, operation and maintenance conditions.

2.2 Configuration of the Domestic Sewage Treatment System (DSTS) – Rural Areas  
See Figure 6.

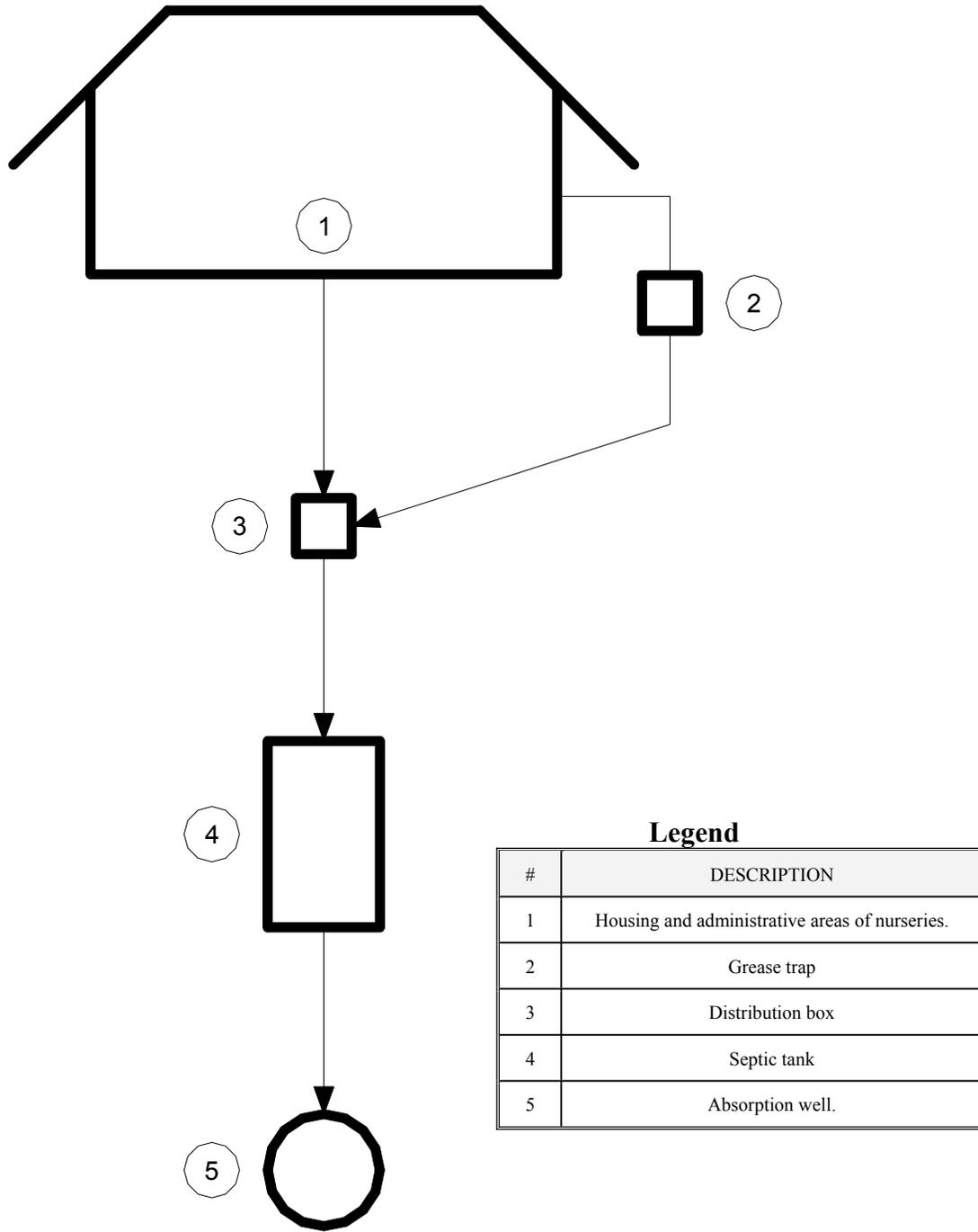


Figure 6. Rural DSTS

NOTE: The infiltration structure may be replaced by oxidation ditches, trenches or galleries. Its design depends on the infiltration tests.

### 2.3. Physicochemical and Hydrosanitary Foundations

STRUCTURE	N°	FUNCTIONALITY
Housing or administrative areas	1	Sewage generation points. Water consumption minimization practices must be implemented. This decreases the discharges and reduces the size of the treatment structures.
Grease trap	2	Must be installed immediately after the kitchens. Serves to remove greases and must be maintained every thirty days.
Volume of flow distribution box	3	Serves to connect underground pipes, where the use of fittings is not recommended (elbows, tees, crosses, ys, etc.).
Septic tank	4	This is a primary treatment system. Wastes with greases and soaps float and solids are deposited.
Absorption well	5	Structure that permits the infiltration of the effluent from the septic tank in the ground. Its final design depends on the infiltration tests of the ground and the location of the sytem.

### 2.4. Dimensioning

#### 2.4.1. Grease trap

This structure may be obtained pre-manufactured at any materials shop. Following are the dimensions for each family of up to 10 people. (See Figure 7)

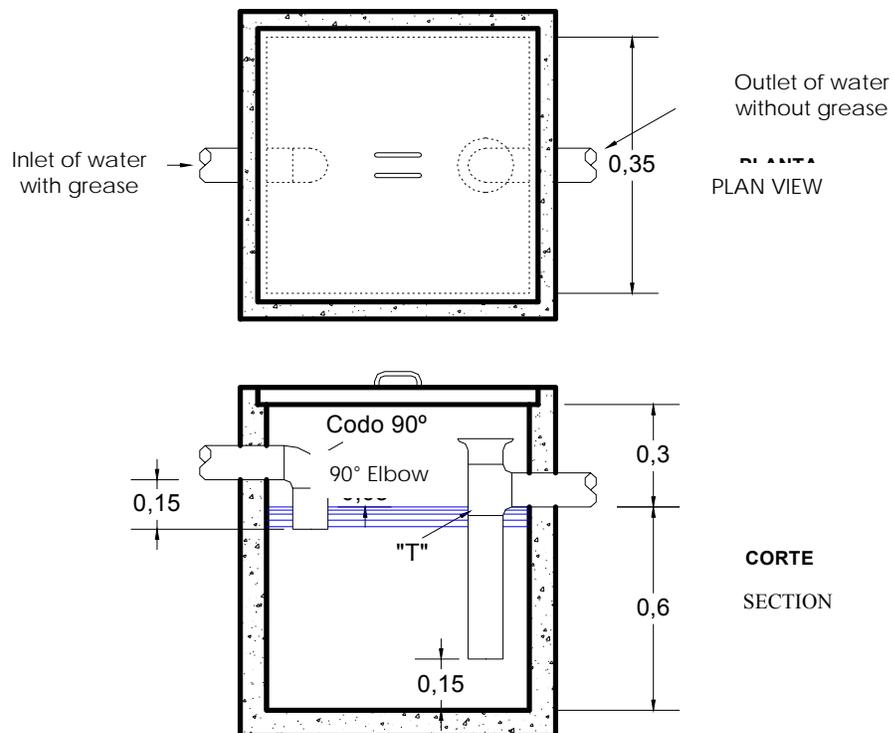


Figure 7. Grease trap

## 2.4.2. Septic Tank

It is recommended to install pre-manufactured tanks. Following are their basic dimensions. (See Figure 8)

Persons served		Capacity of the tank in liters	Dimensions in meters*						Observations
Housing	Offices		L	W	h1	h2	h3	H	
Up to 10	Up to 30	1,500	1.90	0.70	1.10	1.20	0.45	1.68	Septic tanks are not recommended for more than 100 individuals.
	31 to 45	2,250	2.00	0.90	1.20	1.30	0.50	1.78	

\*See Figure 8.

The  $h_3$  dimensions correspond the height of the perimeter beam, in the event that it is decided to build the tank at the site.

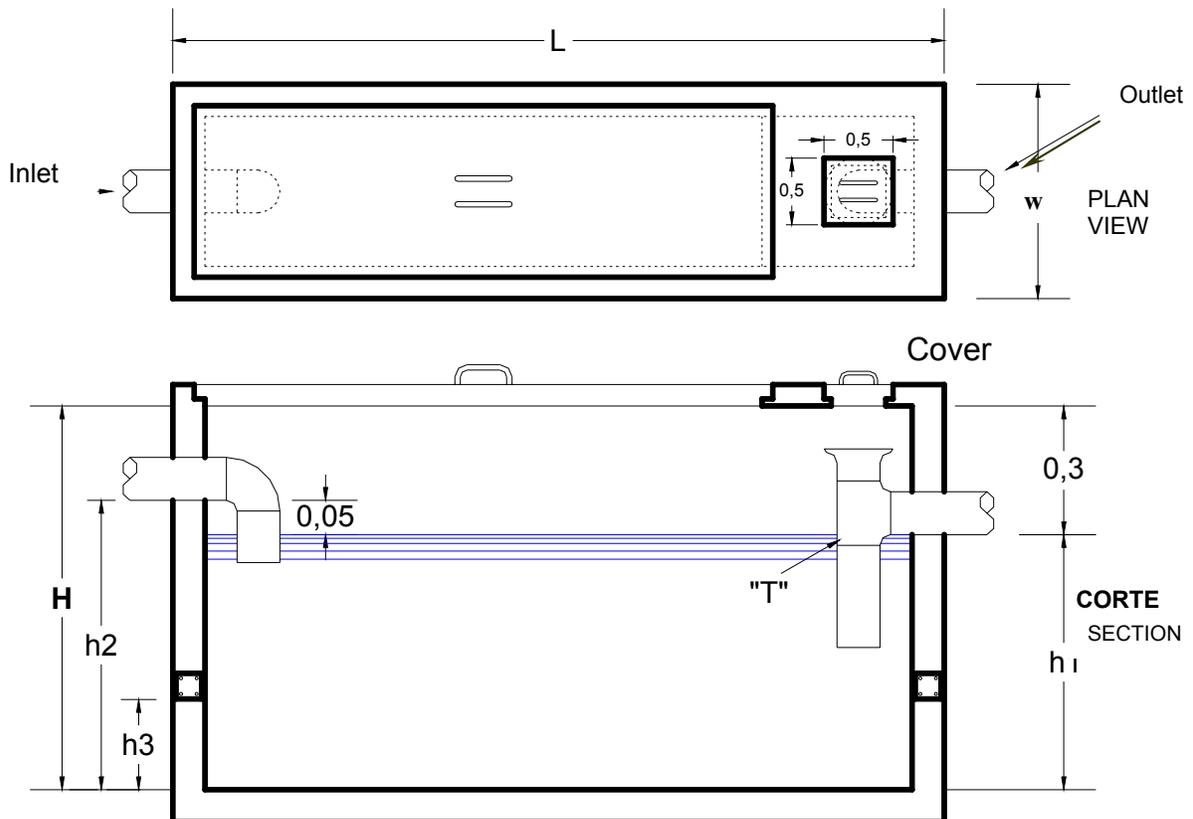


Figure 8. Dimensioning of the septic tank

### 2.4.3. Absorption well

The number and types of absorption wells depend on the infiltration tests. These determine the permeability and dimensions of the well. As indicated in Figure 8, the bottom of the well must be 1.20 above the water table. According to field observations, the dimensions of this structure that come closest to the conditions detected are the following:

Persons served		Dimensions in meters*								Observations
Housing	Offices	L	W	h1	h2	H3	hT	D1	D2	
Up to 10	Up to 30	1.2	0.9	0.5	0.6	0.9	2.0	1.0	1.1	Measured without considering thickness of walls and filters.
	31 to 45	1.3	0.9	0.5	0.6	0.9	2.0	1.1	1.2	

\* See figure 9.

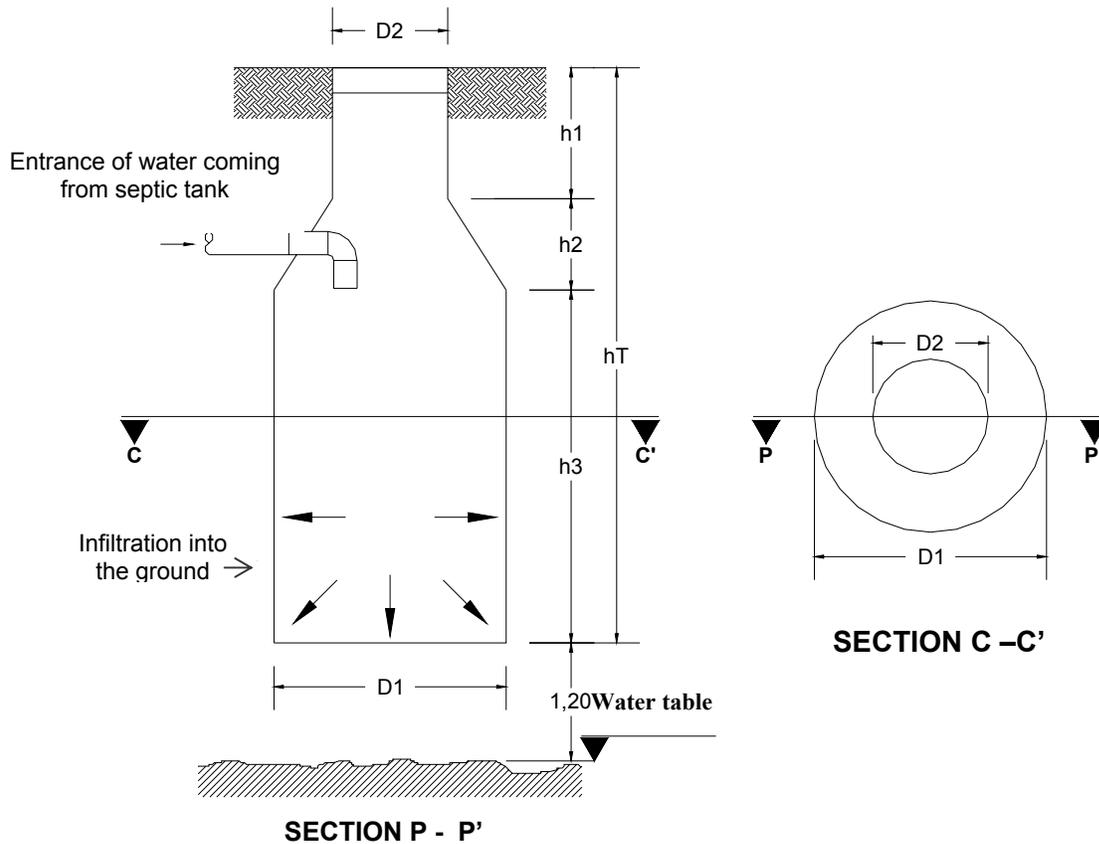


Figure 9. Basic Dimension Scheme for the Absorption Well.

**2.5. Monitoring**

See Monitoring Plan for Domestic Sewage Treatment and Management Systems

**2.6. Control and follow-up**

See Follow-up and Monitoring Plan.

**ENVIRONMENTAL ASSESSMENT STUDY  
ALTERNATIVE AFRICAN OIL PALM DEVELOPMENT PROJECT  
ENVIRONMENTAL MANAGEMENT PLAN**

**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 49. Action to be developed 1M – 20**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Construct manual sanitary landfills by farm	<b>Code:</b> <p style="text-align: center; font-weight: bold;">1M – 20</p>
<b>Objective:</b> Guarantee a proper treatment system for solid wastes of domestic origin and from administrative areas.	<b>Location:</b> Farms, processing plant and nursery administrative area.
<b>Associated environmental impacts:</b> All those associated with the contamination of water sources and soils due to an inadequate final disposal of domestic solid wastes.	
<b>Description of measures to be implemented:</b> Construction and operation of trench-type manual sanitary landfills.	
<b>Goal:</b> Perform and adequate management and treatment of solid wastes of a domestic nature	
<b>Basic dimensioning:</b> <b>Required:</b> YES <u>X</u> NO <u>  </u> <b>See attached card:</b> 1M – 20A	
<b>Costs:</b> Ps\$ 4,000,000.00  <b>See attached card:</b> 1M – 20B	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> the basic controls are established in the dimensioning card.  <b>Specific C and F Plan required?</b> YES <u>X</u> NO <u>  </u> <b>See card:</b> See Follow-up and Monitoring Plan	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> In order to avoid unnecessary monitoring tasks, it is recommended to simply make a good site selection, avoiding odor generation and water source contamination.  <b>Specific Monitoring Plan required?</b> YES <u>  </u> NO <u>X</u> <b>See card:</b>

**AFRICAN OIL PALM PROJECT  
ENVIRONMENTAL IMPACT ASSESSMENT- EIA  
DIMENSIONING CARD – CODE: 1M – 20 A  
MANUAL SANITARY LANDFILLS**

**1. OBJECTIVE**

Guarantee the proper disposal of domestic solid wastes at the beneficiary farms.

**2. DEVELOPMENT**

**2.1. GENERAL BASIC INFORMATION**

Data for the creation and operation of a manual sanitary landfill.

VARIABLE	UNIT	VALUE	SUPPORT
Housing	#	133	
Gross per capita solid waste production	Kg/inh-day	0.35	Non-classified solid wastes. Value assumed for the region
Net per capita solid waste production	Kg/inh-day	0,5	Considering a 30% recovery and recycling
Density	inh./home	5	Using an average of between 5 and 10 inhabitants / home
Design period	Year	1	
Burial frequency	Week	1	
Waste quantities	Kg/week	8.75	
Solid waste density	Kg/m <sup>3</sup>	500	
Trench volume	m <sup>3</sup>	1.50	Assuming an additional 50% volume.

## 2.2. DIMENSIONING

Figure 10, presents a ground plan and section sketch of the domestic sanitary landfill.

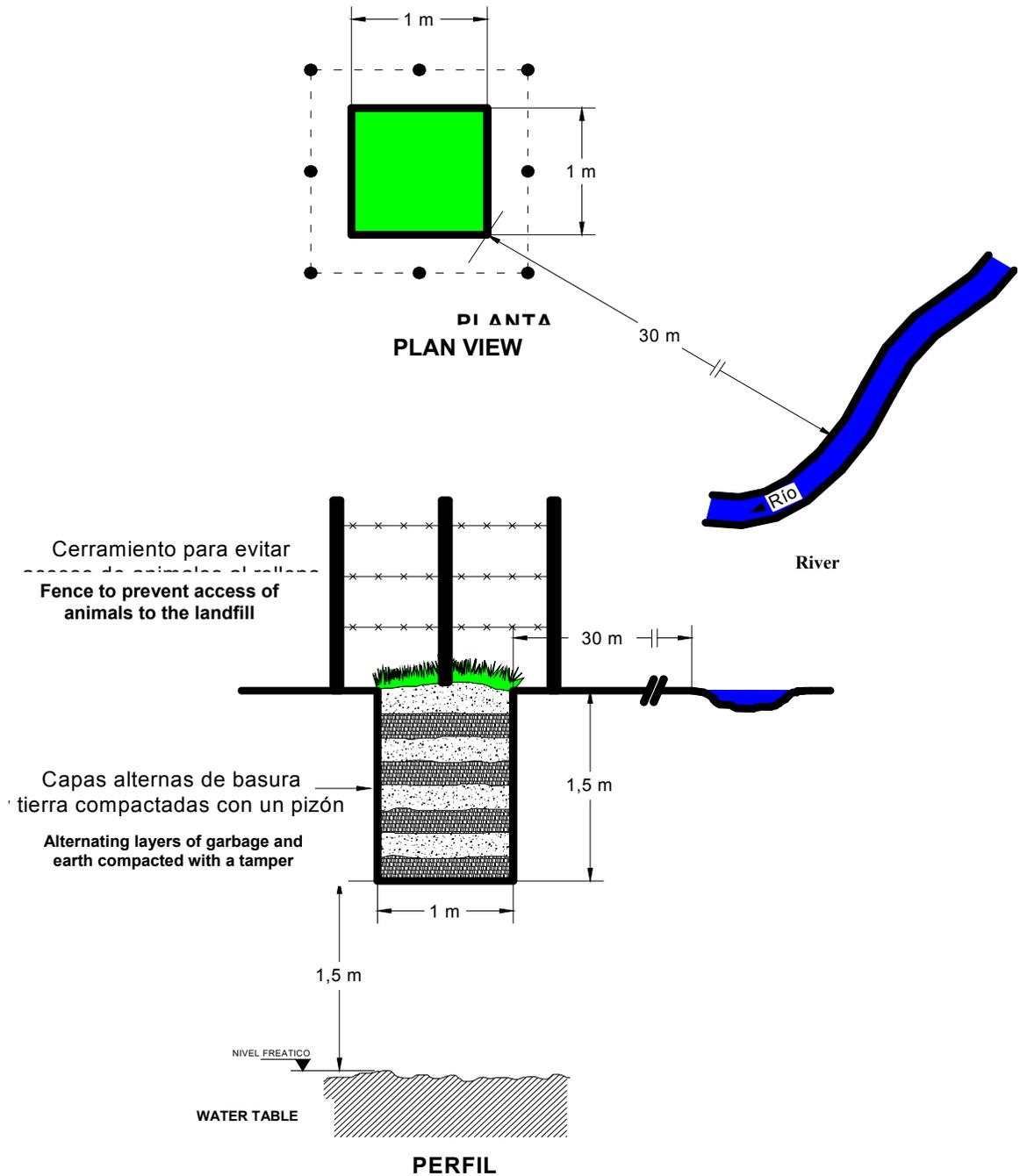


Figure 10. Diagram of the Trench-Type Domestic Sanitary Landfill

### 2.3. Operation

Following are the steps for operation of the Domestic Sanitary Landfill

STEP	PROCEDURE
1	Separate the wastes, taking only those that cannot be recycled (garbage) to the landfill.
2	Select a site at the farm, near the house, far away from the water sources and that will not flood.
3	Open a hole measuring 1.0 x 1.0 x 1.5 (See Figure 9)
4	Make sure that the water table is at least 1.50 m from the bottom.
5	Surround the trench with a wire fence so that no animals may come near it and dig up the garbage.
6	Deposit and compact the garbage produced over a one-week period.
7	Cover with earth and compact again. Repeat this procedure until the volume of the trench is filled up.
8	Close the trench and plant grass in the last layer of earth.
9	Select another site and repeat the procedure.

**Table 50. Card 1M – 20B. Costs of the action to be developed.  
Costs of a domestic solid waste management and treatment plan.  
Trench-type sanitary landfills for each farm.**

<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Construct manual sanitary landfills by farm			<b>Code:</b> <b>1M –15A</b>
<b>No.</b>	<b>Description</b>	<b>Value (Ps\$)</b>	<b>Observation</b>
	Enclosure	3,375,000.00	Four wooden posts and four wire lines (135 trenches). Ps\$25,000 each
	Labor	600,000.00	50 wages at Ps\$ 12,000 each
	Unforeseen expenses	1,000,000.00	
	<b>Total</b>	4,975,000.00	Rounded off to 5 million

**ENVIRONMENTAL ASSESSMENT STUDY  
ALTERNATIVE AFRICAN OIL PALM DEVELOPMENT PROJECT  
ENVIRONMENTAL MANAGEMENT PLAN**

**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 51. Action to be developed 1C – 21**

<b>Affected resource: WATER</b>	
<p><b>Type of measure:</b> Correction <b>Action to be developed:</b> Clean the water courses and sites used for gathering, temporary management or inappropriate waste disposal.</p>	<p><b>Code:</b> <b>1C – 21</b></p>
<p><b>Objective:</b> correct certain damages caused to the environment due to current deficiencies in the project operation.</p>	<p><b>Location:</b> Lands, water sources and infrastructure associated with the operation of the nurseries, plantations and FFB processing plant of COOPAR LTDA.</p>
<p><b>Associated environmental impacts:</b> Those associated with the deterioration of natural resources or infrastructure, due to the cumulative effects of an inappropriate environmental management.</p>	
<p><b>Description of measures to be implemented:</b>                      1- Clean the watercourses affected by discharges from the FFB processing plant.                      2- Close open domestic waste dumps.                      3- Close abandoned sewage water sumps.                      4- Clean the pipes and cross channels of internal and public ways.                      5- Carry out periodic maintenance (once every six months) of the irrigation channels, in order to prevent eutrophication and sedimentation.                      6- Close the palm residue disposal sites (composters) that are in poor condition.                      7- Clean the oil transfer areas                      8- Prevent the access of animals to the FFB transformation plant                      9- Periodically cut down the vegetation from the protection strips of the public ways, in order to prevent the burnings ordered by the groups in conflict.                      10- Gather all left over bags after the transplant of the seedlings.                      11- Organize the FFB and byproduct storage spaces, so as to ensure total asepsis.</p>	
<p><b>Goal:</b> All these activities must be carried out and management, through the person in charge of environmental affairs, must prepare an activity program, with objectives, goals, persons in charge and costs.</p>	
<p><b>Basic dimensioning:</b> Required: YES <u>X</u> NO <u>   </u></p>	
<p><b>See attached card:</b> the work program must be prepared by the company COOPAR LTDA.</p>	
<p><b>Costs:</b> Only when the work program has been designed and the activities to be conducted are decided upon, will it be possible to know the costs. In this case, the most important item is the wages of the persons in charge.</p>	
<p><b>See attached card:</b></p>	
<p><b>Control and follow-up</b></p>	<p><b>Monitoring</b></p>
<p><b>Description:</b> the program to be developed must include the control and follow-up recommendations.</p>	<p><b>Description:</b></p>
<p><b>Specific C and F Plan required?:</b> YES <u>X</u> NO <u>   </u></p>	<p><b>Specific Monitoring Plan required?:</b> YES <u>   </u> NO <u>X</u></p>
<p><b>See card:</b> the card is not included as part of this study</p>	<p><b>See card:</b></p>

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**Table 52. Action to be developed 1C – 22**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Correction <b>Action to be developed:</b> Reforest the fringes and water source protection strips, in order to prevent the transport of solids and erosion of protection strips.	<b>Code:</b> <p style="text-align: center; font-size: 1.2em;"><b>1C – 22</b></p>
<b>Objective:</b> Ensure a prompt revegetation of the water source protection strips which have been denuded for any reason.	<b>Location:</b> Production fields.
<b>Associated environmental impacts:</b> Contamination of water sources and deterioration of riverbeds, due to the transport of solids.	
<b>Description of measures to be implemented:</b> 1- Identify the mandatory water source protection strips, which are denuded and subject to erosion processes. 2- Plant with rapid-growth species and, insofar as possible, compatible with the biodiversity conditions of the area. 3- Mark the strips and control them so that they are not planted with palm or subjected to productive adjustment processes.  If the land improvements activities are carried out during the dry season, it would be most advisable to favor re-vegetation and natural succession processes. Priority should be given to work at the irrigation channel protection strips in order to prevent their silting. In this case, the strips must be at least 5 m. wide, from the maximum water line of the channel.	
<b>Goal:</b> All irrigation channel protection strips, creeks and natural sources. In this latter case, the standard requires a minimum 30 m. strip, from the maximum flood height.	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u> <b>See attached card:</b>	
<b>Costs:</b> If the preventive measures of isolating the protection strips are assumed, this activity, as indicated, has no additional costs; otherwise, the costs will be proportional to the total area to be corrected.  <b>See attached card:</b> it is presumed that the project will adopt the preventive measures from the start.	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> Work on land improvement, based on the strips indicated in the drawings for the protection of water sources.  <b>Specific C and F Plan required?:</b> YES ___ NO <u>X</u> <b>See card:</b> non-affected strips are presumed.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b>  <b>Specific Monitoring Plan required?:</b> YES ___ NO <u>X</u> <b>See card:</b>

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**Table 53.** Action to be developed 1C - 23

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Correction <b>Action to be developed:</b> Periodically clean creeks and irrigation channels, in order to correct water course sedimentation	<b>Code:</b> <p style="text-align: center; font-size: 1.2em;"><b>1C – 23</b></p>
<b>Objective:</b> recover the quality of the channel and creek courses that cross and serve the production field.	<b>Location:</b> The entire length of the irrigation channels and creeks within the production area.
<b>Associated environmental impacts:</b> See card 1C – 21	
<b>Description of measures to be developed:</b> See card 1C - 21.	
<b>Goal:</b> Guarantee the cleaning tasks once every six months	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u>	
<b>See attached card:</b>	
<b>Costs:</b> See attached card: See card 1C – 21	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> Specific C and F Plan required?: YES ___ NO ___ See card: 1C – 21	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> Specific Monitoring Plan required?: YES ___ NO ___ See card: 1C - 21

**Table 54. Action to be developed 1C - 24**

<b>Affected resource: WATER</b>	
<b>Type of measure:</b> Correction <b>Action to be developed:</b> Close temporary solid waste dumps.	<b>Code:</b> <b>1C – 24</b>
<b>Objective:</b> prevent diseases caused by vectors cultivated in open solid waste dumps.	<b>Location:</b> production field
<b>Associated environmental impacts:</b> Damage to human and domestic animal health, solid and water contamination, due to inadequate disposal and management of solid wastes.	
<b>Description of measures to be implemented:</b> 1- Prepare the list and location of the dumps. 2- Make a trench, following the instructions in card 1M-20A. 3- Bury the garbage in its entirety and properly close the trench. 4- Fence the site or plant it so that it cannot be reused as a dump. 5- Place signs indicating the prohibition and encouraging the use of the trenches.	
<b>Goal:</b> Close and recover 100% of the open dumps.	
<b>Basic dimensioning:</b> Required: YES <u>X</u> NO ___ <b>See attached card:</b> 1M-20A	
<b>Costs:</b> Does not involve additional costs. May be done in participation with the associates. <b>See attached card:</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> Must be given the same treatment indicated in card 1M-20. <b>Specific C and F Plan required?:</b> YES ___ NO ___ <b>See card:</b>	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> <b>Specific Monitoring Plan required?:</b> YES ___ NO <u>X</u> <b>See card:</b>

## Index Cards for Management Actions Related to the soil Resources.

Following are the actions or environmental aspects with a direct or indirect impact on the soil.

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**Table 55** Action to be developed **2P - 25**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> All actions indicated in Table 16. Type of measure and action to be developed in order to improve the water resource and its associated impacts, and related to prevention for the generation of liquid and solid wastes that affect the soil and the subsoil.	<b>Code:</b> <p style="text-align: center;"><b>2P – 25</b></p>
<b>Objective:</b> Prevent the generation of liquid and solid wastes that affect the soil and subsoil.	<b>Location:</b> All stages of the project: nursery, production and processing areas.
<b>Associated environmental impacts:</b> All impacts classified as Medium (M), High (H) and Very High( VH) related to soil contamination.	
<b>Description of measures to be implemented:</b> 1- Prevent the improper use of chemicals and fertilizers 2- Use appropriate equipment to manage the products applied and for irrigation. 3- Conduct training regarding management and use of chemical products. It is suggested to use the Sena and Andi works as reference. 4- Implement the waste minimization programs 5- Maintain the chemical storage areas and respective containers used in all project activities in good condition. 6- Assess the possibility of using various types of biological controls in order to prevent the improper use of traditional methods from contaminating the soil. 7- Favor organic agriculture and optimize the use of byproducts in order to reduce the application of synthetic products in connection with the fertilizer management.	
<b>Goal:</b> 30%	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u> <b>See attached card:</b>	
<b>Costs:</b> Ps\$ 20,000,000 <b>See attached card:</b> 2P – 25B	
<b>Control and follow-up</b>	<b>Monitoring</b>
<b>Description:</b>	<b>Description:</b>
<b>Specific C and F Plan required?:</b> YES <u>X</u> NO ___	<b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO ___
<b>See card:</b> See Follow-up and Monitoring Plan	<b>See card:</b> See Follow-up and Monitoring Plan.

**Table 56. Card 2P - 25B. Costs of action to be developed.**  
**Costs of actions to prevent the generation of liquid and solid wastes that affect the soil and subsoil.**

<b>Affected resource: SOIL</b>			
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> All actions indicated in Table 16. Type of measure and action to be developed in order to improve the water resource and its associated impacts; and related to prevention for the generation of liquid and solid wastes that affect the soil and the subsoil.			<b>Code:</b> <b>2P – 25B</b>
No.	Description	Value ( Ps\$)	Observation
	Costs of specialized personnel	10,000,000.00	
	Training	2,000,000.00	
	Transportation and travel expenses	1,500,000.00	
	Logistics	500,000.00	
	Administrative and other	6,000,000.00	
<b>TOTAL</b>		<b>20,000,000.00</b>	

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**Table 57. Action to be developed 2P - 26**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Plan work fronts for removal of the vegetation cover and removal of the upper layer.	<b>Code:</b> <p style="text-align: center; font-weight: bold;">2P – 26</p>
<b>Objective:</b> Schedule work fronts for removal of the vegetation cover and removal of the upper layer.	<b>Location:</b> Nurseries, pre-nurseries and production
<b>Associated environmental impacts:</b> All those related to soil improvement activities.	
<b>Description of measures to be implemented:</b> Apply the same actions of card 1P - 10.	
<b>Goal:</b> Apply the same actions of card 1P - 10.	
<b>Basic dimensioning:</b> Required: YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	
<b>See attached card:</b> The same dimensioning of card 1P – 10 applies	
<b>Costs:</b> The proposed activity does not involve extra costs but rather a rescheduling of activities.	
<p style="text-align: center; font-weight: bold;">Control and follow-up</p> <b>Description:</b> 1- It is necessary to observe the mandatory protection strips established in the Colombian Natural Resource Code (Law 2811 of 1974).  2- The engineer agronomist in charge of land improvement must verify these protection strips before beginning earth moving activities. This information must be documented and indicated in drawings.	<p style="text-align: center; font-weight: bold;">Monitoring</p> <b>Description:</b> It is recommended to conduct monitoring at least once a year.
<b>Specific C and F Plan required?:</b> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	<b>Specific Monitoring Plan required?:</b> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>

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**Table 58.** Action to be developed **2P - 27**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Delimitation and marking of work fronts for application of the EMP and its component.	<b>Code:</b> <p style="text-align: center;"><b>2P – 27</b></p>
<b>Objective:</b> Work by control areas with a scheduled organization of the EMP.	<b>Location:</b> Production areas
<b>Associated environmental impacts:</b> All those associated with the compacting of soils and those described in Card 1P - 10.	
<b>Description of measures to be implemented:</b> See Card 1P - 10.	
<b>Goal:</b> See Card 1P – 10	
<b>Basic dimensioning:</b> Required: YES <u>X</u> NO <u>__</u> See attached card: 1P - 10A	
<b>Costs:</b> See attached card: 1P - 10B	
<b>Control and follow-up</b>	<b>Monitoring</b>
<b>Description:</b>  <b>Specific C and F Plan required?:</b> YES <u>__</u> NO <u>X</u>	<b>Description:</b>  <b>Specific Monitoring Plan required?:</b> YES <u>__</u> NO <u>X</u>
<b>See card:</b>	<b>See card:</b>

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**Table 59.** Action to be developed **2P - 28**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Design specific and mandatory routes for circulation of heavy machinery and vehicles that produce compacting.	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">2P – 28</p>
<b>Objective:</b> Prevent soil compacting processes from the use of heavy machinery.	<b>Location:</b> Nursery and production areas
<b>Associated environmental impacts:</b> All those related to alteration of the soil structure due to the use of heavy machinery.	
<b>Description of measures to be implemented:</b> Avoid the use of heavy machinery in day-to-day tasks within the plantations so as not to alter the physical characteristics of the soils. Avoid excessive working as it causes erosion, compacting, loss of moisture of the soil and a poor structure that will prevent the radicular development of the crops. Protect water source and aquifer areas.	
<b>Goal:</b> Mobilization of all types of heavy machinery exclusively on the authorized routes.	
<b>Basic dimensioning:</b> <b>Required:</b> YES ___                      NO <u>X</u>	
<b>Costs:</b> The proposed activity does not involve extra costs, but rather a rescheduling of activities. <b>See attached card:</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> <b>Specific C and F Plan required?:</b> YES ___                      NO ___ <b>See card:</b>	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> <b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> See Monitoring Plan.

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**Table 60.** Action to be developed **2P - 29**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Use heavy machinery and equipment only on the ways defined in the routes.	<b>Code:</b> <p style="text-align: center; font-weight: bold;">2P – 29</p>
<b>Objective:</b> Transit with heavy vehicles only on ways authorized within the routes and plantations	<b>Location:</b> Nursery and production areas.
<b>Associated environmental impacts:</b> All those related to alterations in the structure of the soils and interferences in circulation and gas diffusion.	
<b>Description of measures to be implemented:</b> See Card 2P - 28.	
<b>Goal:</b> See Card 2P - 28.	
<b>Basic dimensioning:</b> <b>Required:</b> YES ___        NO <u>X</u>	
<b>See attached card:</b>	
<b>Costs:</b> The proposed activity does not involve extra costs, but rather a rescheduling of activities <b>See attached card:</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> Specific C and F Plan required?: YES ___        NO <u>X</u> See card:	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> Specific Monitoring Plan required?: YES <u>X</u> NO ___ See card: Monitoring Plan



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**Table 62.** Action to be developed **2P - 31**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Not use agrochemicals of toxicological categories I and II	<b>Code:</b> <p style="text-align: center; font-weight: bold;">2P – 31</p>
<b>Objective:</b> Prevent intoxications and contamination with SSW	<b>Location:</b> Production areas
<b>Associated environmental impacts:</b> All those impacts related to alteration of the biochemical characteristics of the soil through contamination by agrochemicals.	
<b>Description of measures to be implemented:</b> Supervise and control de dosages used. Promote the reuse or utilization of organic byproducts in order to partially substitute the use of fertilizers . Promote the use of clean technologies and strengthen agronomical research in order to maintain the best nutrition conditions for the crops and their natural environment.	
<b>Goal:</b> Not to use agrochemicals of toxicological categories I and II.	
<b>Basic dimensioning:</b> <b>Required:</b> YES <u>X</u> NO ___ <b>See attached card:</b> 2P – 31A	
<b>Costs:</b> Ps\$  <b>See attached card:</b> 2P – 31B	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b>  <b>Specific C and F Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> See Control and Follow-up Plan.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b>  <b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> See Monitoring Plan

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**DIMENSIONING CARD – CODE: 2P – 31 A**  
**NOT USE AGROCHEMICALS OF TOXICOLOGICAL CATEGORIES I AND II**

**1. OBJECTIVE**

Avoid the use of agrochemicals of toxicological categories I and II.

**2. DEVELOPMENT**

According to a first review, based on the list of chemical products prohibited by the Agricultural Inputs Division of the Instituto Colombiano Agropecuario ICA, dated may 21, 2001, only the use of the herbicide *Paraquat (Gramaxone)* is prohibited. It was also detected that the insecticide *Monocrotofos* presents a high degree of toxicity.

These substances must be substituted. It is recommended to complete and supplement the list of products in order to confront it and verify which substances must be restricted and establish an immediate substitution plan.

Table 63 presents a list of the most frequently toxics in categories I and II, which are prohibited.

**Table 63.** Agrochemicals with toxicological categories I and II most frequently used in the country<sup>45</sup>

<b>HERBICIDES MOST FREQUENTLY USED IN THE COUNTRY</b>		
<b>PRODUCT</b>	<b>PERCENTAGE (%)</b>	<b>TOXICOLOGICAL CATEGORY</b>
<i>2-4-D</i>	23.5	II
<i>Paraquat – Bichloride</i>	5.6	I
<b>FUNGICIDES MOST FREQUENTLY USED IN THE COUNTRY</b>		
<i>Captan</i>	1.41	II
<i>Edinfeños</i>	1.02	II
<b>INSECTICIDES MOST FREQUENTLY USED IN THE COUNTRY</b>		
<i>Metamidofos</i>	9.2	I
<i>Monocrotofos</i>	8.0	I
<i>Carbofurán</i>	7.4	I
<i>Emndosulfan</i>	7.5	I
<i>Clorpirifos</i>	6.7	II
<i>Metil partión</i>	5.3	I
<i>Dimetoato</i>	5.2	II
<i>Metomyl</i>	4.1	I
<i>Triclorfon</i>	4.1	II
<i>Canfecloro</i>	3.4	I
<i>Methyl bromide</i>	3.1	I
<i>Fosfamidon</i>	1.3	I
<i>Diazinon</i>	1.3	II
<i>Acefato</i>	1.0	I
<i>Aldicarb</i>	0.9	I

The exact quantities were not obtained, as no records are kept of applications of these substances.

<sup>45</sup> CORNARE, Fundaflor. Saneamiento básico en cultivos de flores. Módulo 3, Plaguicidas y salud ocupacional, Guía práctica, 1995.

The use of non-contaminating substitutes such as biological controllers of pest insects and diseases, the use of microorganisms that are beneficial to the soil (mycorrhizas, rhizobes, trichoderma) and the use of byproducts of the oil extraction process (empty fruit bunches and effluents) are easier to introduce into a permanent crop than in semiannual plantations. In fact, pesticide consumption is approximately 60% less in oil palm than in other annual crops and has gradually been replaced by entomopathogens already available in the market or produced at the plantations themselves and beneficial insects naturally present in many oil palm plantations.

One of the flagship programs of the Oil Palm Sector in Colombia is the implementation of efficient biological control systems throughout the national territory. Thus, the enormous costs of chemical treatment can be reduced, favoring, at the same time, environmental conservation and clean production. Among the oil palm areas of the country, those with the greatest number of studies and effective applications of biological controllers are located in the Eastern Zone, while the first release assays are only beginning in certain typical plantations in the Central and Northern Zones.

### **3. RECOMMENDATIONS**

Keep the list of prohibited agrochemicals substances up to date.

Conduct permanent education of company employees.

Eliminate the use of these substances.

Design and implement and Integrated Pest and Disease Management IPDM Plan.

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**Table 64.** Action to be developed **2P - 32**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Select adequate sites to set up the Sewage Treatment Plant.	<b>Code:</b> <p style="text-align: center; font-weight: bold;">2P – 32</p>
<b>Objective:</b> Avoid structural and environmental problems from the location and operation of the DSTS.	<b>Location:</b> Production areas
<b>Associated environmental impacts:</b> All those related to soil, water and air contamination from discharges.	
<b>Description of measures to be implemented:</b> Select the site on the basis of the dimensioning factors indicated in Card 1M - 16 and those attached to it. Use specialized personnel and the advise of Fedepalma.	
<b>Goal:</b> Colombian legislation establishes discharge limits. Each design must meet these requirements	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u> <b>See attached card:</b> See Cards 1M - 16	
<b>Costs:</b> See Cards 1M - 16	
<b>See attached card:</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> <b>Specific C and F Plan required?:</b> YES ___ NO <u>X</u> <b>See card:</b>	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> <b>Specific Monitoring Plan required?:</b> YES ___ NO <u>X</u> <b>See card:</b> Monitoring Plan

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**Table 65.** Action to be developed 2P - 33

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Conduct land improvement activities during the dry season and avoid exposure of denuded soils for long periods of time.	<b>Code:</b> <p style="text-align: center;"><b>2P- 33</b></p>
<b>Objective:</b> Avoid the exposure of denuded soils during the land improvement process.	<b>Location:</b> Production areas.
<b>Associated environmental impacts:</b> All those related to loss of nutritional elements, and affecting of waters through the transport of sediments.	
<b>Description of measures to be implemented:</b> Draw up topographical plans and mark off the areas of influence, the lots to be intervened and sensitive areas to be protected such as forests, water sources, water inlets and wetlands. Conduct the preparation taking into account technical criteria regarding soil management and the specific characteristics of the lots. Use the proper machinery and equipment in the lot preparation processes. Properly manage and dispose of surplus plant material in the "palm residue ways" Develop training activities to highlight the importance of natural systems in terms of sustainability and competitiveness in the offer of environmental goods and services.	
<b>Goal:</b> Carry out land improvement	
<b>Basic dimensioning:</b> Required: YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	
<b>See attached card:</b>	
<b>Costs:</b> Ps\$12,000,000.	
<b>See attached card:</b> 2P – 33B	
<b>Control and follow-up</b>  <b>Description:</b>  <b>Specific C and F Plan required?:</b> YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> <b>See card:</b> See Control and Follow-up Plan	<b>Monitoring</b>  <b>Description:</b>  <b>Specific Monitoring Plan required?:</b> YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> <b>See card:</b> See Monitoring Plan

**Table 66 Card 2P - 33B. Costs of action to be developed.  
Costs of actions for the prevention of denuded soil exposure during land improvement**

<b>Affected resource: SOIL</b>			
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Carry out land improvement during the dry season and avoid exposure of denuded soils for long periods of time			<b>Code:</b> <p style="text-align: center;"><b>2P – 25B</b></p>
No.	Description	Value (Ps\$)	Observation
	Costs of specialized personnel	8,000,000.00	
	Training	2,000,000.00	
	Transportation and travel expenses	1,500,000.00	
	Logistics	500,000.00	
<b>TOTAL</b>		12,000,000.00	

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**Table 67** Action to be developed **2P - 34**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Technically dispose of sludge generated in the sewage treatment systems.	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">2P – 34</p>
<b>Objective:</b> Avoid soil and water contamination through sludge discharges	<b>Location:</b> Production and Processing plant areas
<b>Associated environmental impacts:</b> Those associated with contamination by industrial wastes.	
<b>Description of measures to be implemented:</b>  Treatment and management systems must be built for atmospheric emissions of particulate material, domestic liquid wastes, agroindustrial liquid wastes, agroindustrial solid wastes and special solid wastes.  <b>Some wastes require certain special considerations:</b> <u><b>Management of plant wastes and byproducts:</b></u> Adequately dispose of the material from pruning and empty bunches, for their decomposition. Pests, if they occur, should, insofar a possible, be controlled with biological methods. Prevent generated leachates from contaminating surface and ground waters. <u><b>Management of liquid wastes, sludge and treated effluents:</b></u> Use the stabilized sludge from the pools to improve the soils in the plantation. <u><b>Management of special solid wastes – SSW</b></u> A safe procedure must be established for the management and sanitary disposal of SSW generated by the use of pesticides, in order to project human health and prevent the contamination of the natural resources	
<b>Goal:</b> See Card 1P – 16	
<b>Basic dimensioning:</b> Required: YES <u>X</u> NO ___ <b>See attached card:</b> 1P - 16A	
<b>Costs:</b> The Management Plan cost summary breaks down the treatment costs of the most important wastes. <b>See attached card:</b> 1P - 16B	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b>  <b>Specific C and F Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> See Control and Follow-up Plan	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b>  <b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> See Monitoring Plan

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**Table 68.** Action to be developed **2P - 35**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Define and regulate product and byproduct management sites in the processing plant area.	<b>Code:</b> <p style="text-align: center; font-weight: bold;">2P – 35</p>
<b>Objective:</b> Define and regulate product and byproduct management sites in the processing plant area	<b>Location:</b> Processing area.
<b>Associated environmental impacts:</b> Alteration of the landscape due to inappropriate disposal Alteration of the quality of the soils and waters by leachates. Contribution to the proliferation of vectors or organisms affecting human or animal health.	
<b>Description of measures to be implemented:</b> Prevent the inappropriate disposal of empty bunches, pest proliferation. Dispose of them properly for their decomposition. Do not burn in the open. Select the site and prepare final disposal areas. Conduct environmental education activities regarding the proper disposal of solid wastes.	
<b>Goal:</b> The total and proper disposal of solid wastes, byproducts and others.	
<b>Basic dimensioning:</b> <b>Required:</b> YES <u>X</u> NO <u>  </u>	
<b>See attached card:</b> 1M – 15A.	
<b>Costs:</b>	
<b>See attached card:</b> 1M – 15B	
<p style="text-align: center; font-weight: bold;">Control and follow-up</p> <b>Description:</b> <b>Specific C and F Plan required?:</b> <p style="text-align: right;">YES <u>X</u>                      NO <u>  </u></p> <b>See card:</b> See Control and Follow-up Plan.	<p style="text-align: center; font-weight: bold;">Monitoring</p> <b>Description:</b> <b>Specific Monitoring Plan required?:</b> <p style="text-align: right;">YES <u>X</u>                      NO <u>  </u></p> <b>See card:</b> See Monitoring Plan

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**Table 69.** Action to be developed 2P - 36

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Conduct periodic cleanings in the areas of influence of the processing plant	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">2P – 36</p>
<b>Objective:</b> Avoid the accumulation of wastes at the processing plant.	<b>Location:</b> Processing plant
<b>Associated environmental impacts:</b> Those related to soil contamination by leachates and solid and liquid wastes.	
<b>Description of measures to be implemented:</b> Plan cleaning days with the employees in order to make them aware and educate them on the importance of said task, emphasizing the following points: <ul style="list-style-type: none"> <li>– Reduce the generation of solid wastes at the source.</li> <li>– Select and classify them at the source for their possible reuse and final disposal.</li> <li>– Issue instructions regarding solid waste management and disposal.</li> <li>– Conduct educational campaigns on waste management.</li> <li>– Avoid the discharge of leachates into the bodies of water and soils in order to maintain their quality.</li> </ul>	
<b>Goal:</b> Hold periodic cleaning days	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u>	
<b>See attached card:</b>	
<b>Costs:</b> Not required, this is a simple orientation of the worker's activities.	
<b>See attached card:</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> <b>Specific C and F Plan required?:</b> YES ___ NO ___ <b>See card:</b>	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> <b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> See Monitoring Plan

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**Table 70.** Action to be developed **2P - 37**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Define and regulate agrochemical product management, storage and processing areas.	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">2P – 37</p>
<b>Objective:</b> Adequately and rationally manage agrochemicals in order to supply the nutritional needs of the palm trees, lessening their impact on the natural environmental.	<b>Location:</b> Nurseries and production areas
<b>Associated environmental impacts:</b> All those related to alteration of the biological characteristics of soils and waters.	
<b>Description of measures to be implemented:</b> Prefer organic agriculture and optimize the use of byproducts in order to reduce the application of synthetic products. Avoid the washing of soils, infiltration and runoff, so as not to alter the quality of waters and soils. Promote recycling. Avoid the use of not permitted dosages. Establish or adapt adequate storage and handling facilities, taking into account: 1- Designate appropriate sites for the preparation and handling of agrochemical substances for fertilization and pest control at the plantations. 2- Plan the preparations of solutions in such a way that the total amount of the compound is used and any leftovers are eliminated. 3- Use the waters from the washing of containers and equipment to prepare similar solutions. 4- Technically design the treatment systems for wastewaters from the preparation of agrochemicals. 5- Prevent these wastes or the treated effluents from the treatment system from ending up in the surface and ground water sources.	
<b>Goal:</b> Reduce agrochemical wastes due to improper handling or storage by 100%.	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u>	
<b>See attached card:</b>	
<b>Costs:</b> See development on Card 1M - 16	
<b>See attached card:</b>	
<p style="text-align: center; font-weight: bold;">Control and follow-up</p> <b>Description:</b>  <b>Specific C and F Plan required?:</b> YES <u>X</u> NO ___ See card: 1M – 16 and attached	<p style="text-align: center; font-weight: bold;">Monitoring</p> <b>Description:</b>  <b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO ___ See card: 1M – 16 and attached

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**Table 71. Action to be developed 2M - 38**

<b>Affected resource: SOIL</b>	
<p><b>Type of measure:</b> Mitigation  <b>Action to be developed:</b>                      All mitigation actions listed in Table 17. Type of measure and action to be developed in order to improve the water resource and its associated impacts, related to the soil and subsoil.</p>	<p><b>Code:</b>  <b>2M – 38</b></p>
<p><b>Objective:</b>                      Decrease the generation of liquid and solid wastes that affect the soil and the subsoil.</p>	<p><b>Location:</b>                      All project areas</p>
<p><b>Associated environmental impacts:</b>                      All those which generate liquid, solid, gaseous or special wastes.</p>	
<p><b>Description of measures to be implemented:</b>                      The mitigation of the impacts generated only occurs if the minimization strategy is implemented. Development card 1P-1 and dimensioning card 1P-1A indicate the activities and approximate costs of the plan.</p>	
<p><b>Goal:</b> The goal and objectives are defined by management in accordance with the cost-effectiveness analysis. In some cases, wastes (such as liquids) can be minimized by up to 30%. In the case of solid wastes this may be less.</p>	
<p><b>Basic dimensioning:</b> Required: YES <u>X</u> NO ___                      See attached card: 1P- 1A.</p>	
<p><b>Costs:</b> Ps\$                      See attached card: 1P – 1B</p>	
<p><b>Control and follow-up</b></p>	<p><b>Monitoring</b></p>
<p><b>Description:</b> When the minimization plan is designed, it must be audited and verified according to the proposed program.  <b>Specific C and F Plan required?:</b>                      YES <u>X</u> NO ___                      See card: See C and F Plan.</p>	<p><b>Description:</b> The plan itself must propose the respective monitoring plan.  <b>Specific Monitoring Plan required?:</b>                      YES <u>X</u> NO ___                      See card: See Monitoring Plan</p>

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**Table 72.** Action to be developed 2M - 39

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Construct sanitary landfills for non-special solid wastes.	<b>Code:</b> <p style="text-align: center; font-weight: bold;">2M – 39</p>
<b>Objective:</b> Ensure an adequate treatment system for solid wastes of domestic origin and from administrative areas.	<b>Location:</b> Farms, processing plant and nursery administrative area
<b>Associated environmental impacts:</b> All those associated with the contamination of water sources and soils due to an inappropriate final disposal of domestic solid wastes.	
<b>Description of measures to be implemented:</b> Construction and operation of trench-type manual sanitary landfills.	
<b>Goal:</b> Adequately manage and treat solid wastes of a domestic nature.	
<b>Basic dimensioning:</b> Required: YES <u>X</u> NO <u>  </u> <b>See attached card:</b> 1M – 20A	
<b>Costs:</b> <b>See attached card:</b> 1M – 20B	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> Basic controls are established in the dimensioning card.  <b>Specific C and F Plan required?:</b> YES <u>X</u> NO <u>  </u> <b>See card:</b> See Follow-up and Monitoring Plan	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> In order to avoid unnecessary monitoring tasks, it is simply recommended to make a good site selection, avoiding odor generation and water source contamination.  <b>Specific Monitoring Plan required?:</b> YES <u>  </u> NO <u>X</u> <b>See card:</b>

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**Table 73. Action to be developed 2M - 40**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Adequately manage and technically dispose of special solid wastes.	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">2M – 40</p>
<b>Objective:</b> Prevent wastes generated in the various project stages from being disposed of in the soil, the air or the water without treatment.	<b>Location:</b> nursery, production and FFB processing plant
<b>Associated environmental impacts:</b> All those where wastes are generated.	
<b>Description of measures to be implemented:</b> See Card 1M - 16.	
<b>Goal:</b> Colombian legislation establishes discharge limits for each type of waste. Each design must comply with these requirements	
<b>Basic dimensioning:</b> Required: YES <u>X</u> NO <u>  </u>	
<b>See attached card:</b> 1M – 16D	
<b>Costs:</b> The treatment costs of the most important wastes are broken down in the cost summary of the Management Plan.	
<b>See attached card:</b>	
<b>Control and follow-up</b>	<b>Monitoring</b>
<b>Description:</b>  <b>Specific C and F Plan required?:</b> YES <u>X</u> NO <u>  </u> <b>See card:</b> 1M– 16 and attached	<b>Description:</b>  <b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO <u>  </u> <b>See card:</b> 1M– 16 and attached

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**Table 74** Action to be developed **2M - 41**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Adequately manage and technically dispose of the liquid wastes from the preparation and management of agrochemical solutions	<b>Code:</b> <p style="text-align: center; font-size: 1.2em;"><b>2M – 41</b></p>
<b>Objective:</b> Prevent wastes generated in the various project stages from being disposed of into the soil, the air or the water without treatment.	<b>Location:</b> : nursery, production and FFB processing plant.
<b>Associated environmental impacts:</b> All those where wastes are generated.	
<b>Description of measures to be implemented:</b> See Development card 1M - 16.	
<b>Goal:</b> See Development card 1M – 16.	
<b>Basic dimensioning:</b> <b>Required:</b> YES <u> X </u> NO <u>    </u>	
<b>See attached card:</b> See Development card 1M – 16 and attached	
<b>Costs:</b> See Development card 1M – 16 and attached	
<b>See attached card:</b>	
<b>Control and follow-up</b>	<b>Monitoring</b>
<b>Description:</b> . See Development card 1M - 16	<b>Description:</b> See Development card 1M - 16
<b>Specific C and F Plan required?:</b> YES <u> X </u> NO <u>    </u>	<b>Specific Monitoring Plan required?:</b> YES <u> X </u> NO <u>    </u>
<b>See card:</b>	<b>See card:</b>

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**Table 75.** Action to be developed **2M - 42**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Technical and systematically manage the composters, as an alternative for managing plant wastes.	<b>Code:</b> <p style="text-align: center;"><b>2M – 42</b></p>
<b>Objective:</b> Prevent wastes generated in the various project stages from being disposed of into the soil, the air or the water without treatment.	<b>Location:</b> nursery, production and FFB processing plant
<b>Associated environmental impacts:</b> All those where wastes are generated.	
<b>Description of measures to be implemented:</b> Developed in card 1M – 16	
<b>Goal:</b> Developed in card 1M - 16.	
<b>Basic dimensioning:</b> Required: YES <u>X</u> NO ___ <b>See attached card:</b> Developed in card 1M – 16	
<b>Costs:</b> <b>See attached card:</b> Developed in card 1M – 16	
<b>Control and follow-up</b>  <b>Description:</b>  <b>Specific C and F Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> Developed in card 1M - 16	<b>Monitoring</b>  <b>Description:</b>  <b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> Developed in card 1M - 16



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**Table 77. Action to be developed 2C - 44**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Restore the vegetation cover in the prescribed water source protection strips.	<b>Code:</b> <p style="text-align: center; font-weight: bold;">2C – 44</p>
<b>Objective:</b> Establish the vegetation cover in the environmental protection strips defined in card 1P – 10A.	<b>Location:</b> Production area
<b>Associated environmental impacts:</b> Those related to loss of the organic layer and nutrients of the intervened soils, transport of sediments and silting of beds and courses of bodies of water.	
<b>Description of measures to be implemented:</b> Determine the water source protection strip areas. Take into account the topography and various geoforms to carry out reforestation work. Establish a vegetation cover of a protective type following technical selection criteria.	
<b>Goal:</b> Protect and maintain the water source protection strips covered.	
<b>Basic dimensioning:</b> <b>Required:</b> YES ___        NO <u>X</u>	
<b>See attached card:</b>	
<b>Costs:</b> According to the point study of the influence of the oil palm plantations on the water systems and the determination of the area to be recovered.	
<b>See attached card:</b>	
<p style="text-align: center; font-weight: bold;">Control and follow-up</p> <b>Description:</b> 1- The mandatory protection strips established in the Colombian Natural Resource Code (Law 2811 of 1974) must be observed.  2- The agricultural engineer in charge of land improvement must verify these protection strips before the start earth moving activities. This information must be documented and indicated in drawings.	<p style="text-align: center; font-weight: bold;">Monitoring</p> <b>Description:</b> <b>Specific Monitoring Plan required?:</b> <span style="float: right;">YES ___        NO ___</span>
<b>Specific C and F Plan required?:</b> <span style="float: right;">YES ___        NO <u>X</u></span>	<b>See card:</b>
<b>See card:</b>	

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**Table 78. Action to be developed 2C - 45**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Build drainages in the plantation in order to avoid pool formation.	<b>Code:</b> <p style="text-align: center; font-weight: bold;">2C – 45</p>
<b>Objective:</b> Establish drainages at the plantations for the proper management of rain waters.	<b>Location:</b> Nursery and plantation areas
<b>Associated environmental impacts:</b> Related to creation of water stress and destabilization situations and erosion processes.	
<b>Description of measures to be implemented:</b> Design and set up the appropriate infrastructure for gathering and piping according to the project conditions in order to guarantee their efficiency. Avoid the loss of soils and nutrients due to an excessive flow of water from drainages. Reuse the drained water specially where fertilizers are used. Maintain the selected system in good operating condition in order to control negative effects such as erosion or flooding.	
<b>Goal:</b> Improvement of drainage systems in all project lots.	
<b>Basic dimensioning:</b> <b>Required:</b> YES ___                      NO <u>X</u>	
<b>See attached card:</b> 2C – 45A	
<b>Costs:</b> The design and establishment of drainages is an activity inherent to the project which must be properly carried out.	
<b>See attached card:</b>	
<p style="text-align: center; font-weight: bold;">Control and follow-up</p> <b>Description:</b> <b>Specific C and F Plan required?:</b> YES ___                      NO ___ <b>See card:</b>	<p style="text-align: center; font-weight: bold;">Monitoring</p> <b>Description:</b> <b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> See Monitoring Plan

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**Table 79 . Action to be developed 2C - 46**

<b>Affected resource: SOIL</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Collect the bags and solid wastes generated in palm transplants.	<b>Code:</b> <p style="text-align: center; font-weight: bold;">2C – 46</p>
<b>Objective:</b> Reduce the improper disposal of solid wastes and bags during the palm transplant process	<b>Location:</b>
<b>Associated environmental impacts:</b> All those related to soil contamination due to inappropriate solid waste disposal.	
<b>Description of measures to be implemented:</b> During transplant, the plastic bag is removed from the palm in order to plant it and placed on a stake beside the planted seedling in order to ensure that it was removed. Properly dispose of the bags after verifying that all were removed. If appropriate, gather all bags which may have been transported by the wind or for any other reason.  In general: Minimize risks and avoid the transport of materials to bodies of water. Avoid the improper use of water resources, mainly, as well as chemical products. Fit out areas for material storage and disposal. Provide special containers to manage wastes. Conduct training and education in environmental matters. Reuse materials and containers whenever possible..	
<b>Goal:</b>	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u>	
<b>See attached card:</b>	
<b>Costs:</b> The activity does not involve extra costs.	
<b>See attached card:</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b>  <b>Specific C and F Plan required?:</b> YES ___ NO <u>X</u> See card: 2C– 46C	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b>  <b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO ___ See card: See Monitoring Plan

## Index Cards for Management Actions Related to Air Resources.

Following are the environmental actions or aspects with a direct or indirect impact on the air.

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**Table 80. Action to be developed 3P - 47**

<b>Affected resource: AIR</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> All those indicated in Table 16. Type of measure and action to be developed in order to improve the <b>water</b> resource and its associated impacts and Table 17. Type of measure and action to be developed in order to improve the <b>soil</b> resource, related to prevention in the generation of wastes affecting the atmosphere.	<b>Code:</b> <div style="text-align: center; font-weight: bold; font-size: 1.2em;">3P – 47</div>
<b>Objective:</b> Prevent and minimize the generation of wastes that affect the atmosphere.	<b>Location:</b> FFB processing plant
<b>Associated environmental impacts:</b> All impacts associated with the generation of atmospheric emissions at the FFB processing plant	
<b>Description of measures to be implemented:</b> <ol style="list-style-type: none"> <li>1. Optionally, the company may adopt a waste minimization plan, similar to that indicated for liquid wastes in cards 1P-1 y 1P-1A.</li> <li>2. Ensure good operating conditions at the boilers.</li> <li>3. Comply with regulation standards: Minimum height of chimneys and installation of cyclones to capture particulate material.</li> <li>4. Not permit the building of homes near (at a distance of at least 100m) the location of the chimney.</li> </ol>	
<b>Goal:</b> Prevent, by up to 10%, the generation of the particulate material generated in the combustion of the fiber, for the operation of the boilers.	
<b>Basic dimensioning:</b> <b>Required:</b> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	
<b>See attached card:</b> The dimensioning conditions are similar to those of card 1P – 1A	
<b>Costs:</b> This option is cost-effective if the knowledge obtained from the minimization of liquid wastes is used.	
<b>See attached card:</b> Does not contain cost card.	
<div style="text-align: center; font-weight: bold; margin-bottom: 10px;">Control and follow-up</div> <b>Description:</b> - Detailed and period records, controlled by management, must be kept of the typology, composition and quantities of fuel used for the operation of the boilers. - Control the proper disposal of ashes, preventing them from contaminating the soil or the water sources.	<div style="text-align: center; font-weight: bold; margin-bottom: 10px;">Monitoring</div> <b>Description:</b> the air quality must be monitored according to parameters established by the following regulations: Decrees 02 of 1982 and 948 of 1995.
<b>Specific C and F Plan required?:</b> YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	<b>Specific Monitoring Plan required?:</b> YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
<b>See card:</b> See Follow-up and Monitoring Plan.	<b>See card:</b> See Follow-up and Monitoring Plan.

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**Table 81. Action to be developed 3P - 48**

<b>Affected resource: AIRE</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Avoid the use of wood as an energy source	<b>Code:</b> <p style="text-align: center; font-weight: bold;">3P – 48</p>
<b>Objective:</b> 1- Reduce the pressure on the natural forest, as a source of plant fuels. 2- Minimize ash and particulate material emissions.	<b>Location:</b> FFB processing plant and users housing.
<b>Associated environmental impacts:</b> All impacts related to the forest, the soil, the biodiversity and the air listed in the impact classification matrix.	
<b>Description of measures to be implemented:</b> 1- Implement wood forests for household consumption in those farms that require it. 2- Promote the construction of efficient stoves at homes that do not have a gas or electric power installation. 3- Avoid the use of wood in the operation of the boilers.	
<b>Goal:</b> As part of the company’s environmental policy, a goal must be established in accordance with the company’s interest, with respect to housing. At the plant, the use of wood from the natural forest must be totally prohibited.	
<b>Basic dimensioning:</b> <b>Required:</b> YES ___            NO <u>X</u>	
<b>See attached card:</b> there is no dimensioning card..	
<b>Costs:</b> The basic action of prohibiting consumption has no cost. Its implementation is related to changes in culture, instructions and procedures.	
<b>See attached card:</b> Does not include a cost card	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> - Conduct Periodic visits in order to establish wood uses at the farms. - See that no wood from the natural forest is used as fuel in the boilers.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> <b>Specific Monitoring Plan required?:</b> <span style="float: right;">YES ___            NO <u>x</u></span>
<b>Specific C and F Plan required?:</b> <span style="float: right;">YES ___            NO <u>X</u></span>	<b>See card:</b> No monitoring card is required.
<b>See card:</b>	

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**Table 82. Action to be developed 3P - 49**

<b>Affected resource: AIR</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Avoid the construction of housing within a diameter of 100 meters around the oil extraction plant.	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">3P – 49</p>
<b>Objective:</b> Avoid affecting the health of employees and locals, caused by particulate material emissions.	<b>Location:</b> Processing plant and cultivation areas
<b>Associated environmental impacts:</b> Those related to the emission of particulate material through the chimneys.	
<b>Description of measures to be implemented:</b> Delimit in the plantation maps the location of the atmospheric emission sources and their most significant areas of influence in order to prevent the building of homes by both plantation employees and local peoples.	
<b>Goal:</b>	
<b>Basic dimensioning:</b> <b>Required:</b> YES ___            NO <u>X</u>	
<b>See attached card:</b>	
<b>Costs:</b> Does not involve special costs	
<b>See attached card:</b> No card attached, not required	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> Ensure that the plantation planning, development and operation technicians know and enforce this regulation.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b>
<b>Specific C and F Plan required?:</b> YES ___            NO <u>X</u>	<b>Specific Monitoring Plan required?:</b> YES ___            NO <u>X</u>

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 83. Action to be developed 3M - 50**

<b>Affected resource: AIR</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Minimization of particulate material generated in combustion	<b>Code:</b> <p style="text-align: center; font-weight: bold;">3M – 50</p>
<b>Objective:</b> Decrease the generation of particulate material resulting from the combustion of fiber and organic material used in the boiler combustion furnaces.	<b>Location:</b> FFB processing plant
<b>Associated environmental impacts:</b> Those related to the emission of particulate material through chimneys	
<b>Description of measures to be implemented:</b> 1- Conduct an optimization study for the combustion system, in order to maximize its performance and minimize its particulate material effluents. 2- Implement particulate material capture systems, such as filters or cyclones. 3- Conduct an isokinetic and particulate material study, in order to determine flows, loads, behaviors and other variables related to this type of emissions.	
<b>Goal:</b>	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u> <b>See attached card:</b>	
<b>Costs:</b> Ps\$ 30,000,000  <b>See attached card:</b> 3M – 50A	
<b>Control and follow-up</b>  <b>Description:</b> Ensure compliance with the permissible limits established by Law 02 of 1982 and Decree 948 of 1995.  <b>Specific C and F Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> See Follow-up and Monitoring Plan.	<b>Monitoring</b>  <b>Description:</b> Monitor atmospheric emissions .  <b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> See Monitoring Plan

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 84. Action to be developed 3C - 51**

<b>Affected resource: AIRE</b>	
<b>Type of measure:</b> Correction <b>Action to be developed:</b> Ensure the minimum height of the chimneys	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">3C – 51</p>
<b>Objective:</b> Ensure the minimum levels of dispersion of gases and particles emitted into the air.	<b>Location:</b> FFB processing plant
<b>Associated environmental impacts:</b> Those related to atmospheric contamination due to gas and particulate material emissions.	
<b>Description of measures to be implemented:</b> Ensure that the mouth of the chimney of the furnace that heats the boilers is at least 15 m. above the floor area of the level where the emission is generated.	
<b>Goal:</b> It is a legal requirement	
<b>Basic dimensioning:</b> <b>Required:</b> YES ___                      NO <u>X</u>	
<b>See attached card:</b> No dimensioning card is required	
<b>Costs:</b> No additional cost involved, as the chimney is operating under this requirement.	
<b>See attached card:</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> Control the height of the chimney, particularly with respect to changes and remodelings.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b>
<b>Specific C and F Plan required?:</b> <p style="text-align: right;">YES ___                      NO <u>X</u></p>	<b>Specific Monitoring Plan required?:</b> <p style="text-align: right;">YES ___                      NO <u>X</u></p>
<b>See card:</b> See Follow-up and Monitoring Plan.	<b>See card:</b> See Follow-up and Monitoring Plan.

## Index Cards for Management Actions Related to Biological Resources.

Following are the environmental actions or aspects that directly or indirectly impact the biological resources.

### ENVIRONMENTAL ASSESSMENT STUDY ALTERNATIVE AFRICAN OIL PALM DEVELOPMENT PROJECT ENVIRONMENTAL MANAGEMENT PLAN

#### MANAGEMENT ACTION DEVELOPMENT CARD

**Table 85. Action to be developed 4P - 52**

<b>Affected resource: BIOLOGICAL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Prepare the Integrated Pest and Disease Management – IPDM – study.	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">4P – 52</p>
<b>Objective:</b> Use clean methods and technologies, preferably to control pathogenic organisms and prevent any possible damage to other species, whether or not beneficial to the environment in general	<b>Location:</b> Nursery and production areas
<b>Associated environmental impacts:</b> Those related to the contamination of natural areas and system due to discharges or overdoses of chemical products affecting beneficial organism populations. Alteration of the quality of the water resources. Incorporation and accumulation of substances in organisms within a food chain.	
<b>Description of measures to be implemented:</b> Strengthen the integrated management of pests and diseases and biological control. Decrease the use of substances that may cause damage to beneficial species. Promote greater biological diversity for the regulation of natural populations	
<b>Goal:</b> Apply integrated pest management in the entire nursery and production area.	
<b>Basic dimensioning:</b> Required: YES <u>X</u> NO ___	
<b>See attached card:</b> 4P – 52A	
<b>Costs:</b> According to quotation decided by the Project Management .	
<b>See attached card:</b>	
<p style="text-align: center; font-weight: bold;">Control and follow-up</p> <b>Description:</b> Specific C and F Plan required?: YES <u>X</u> NO ___ See card: Must be proposed in the design	<p style="text-align: center; font-weight: bold;">Monitoring</p> <b>Description:</b> Specific Monitoring Plan required?: YES <u>X</u> NO ___ See card: Must be proposed in the design

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**DIMENSIONING CARD – CODE: 4P – 52A  
PREPARE THE INTEGRATED PEST AND DISEASE MANAGEMENT STUDY  
- IPDM -**

**OBJECTIVE**

Present an example of the IPDM developed by the sector in Colombia.

Integrated Pest Management<sup>46</sup>

- |             |   |
|-------------|---|
| Activity 1. | Recognition and assessment of the natural control of <i>Loxotoma elegans</i> Zeller (Lepidoptera: Stenomidae).            |
| Activity 2. | Recognition and assessment of the natural mortality factors of <i>Stenoma cecropia</i> Meyrick (Lepidoptera: Stenomidae). |
| Activity 3. | Recognition and assessment of the natural enemies of <i>Retracrus elaeis</i> Keifer (Acari: Eriophyidae).                 |
| Activity 4. | Assessment of mortality factors acting on <i>Opsiphanes cassina</i> Felder (Lepidoptera: Brassolidae).                    |
| Activity 5. | Assessment of the natural enemies of <i>Leptopharsa gibbicarina</i> Froeschner (Hemiptera: Tingidae).                     |
| Activity 6. | Assessment of two pest review systems for the integrated control of pests in oil palm foliage.                            |
| Activity 7. | Assessment of the natural pest control associated with the establishment of beneficial weeds.                             |

The current trend in oil palm plantations is to allow strips, edges or reservoirs of arboreous plants, “beneficial weeds”, precisely so that these sites will serve as shelters and sources of food for beneficial insect adults.

In order to protect the genetic material it is necessary to know it. It is therefore vitally important to research the native flora and fauna in forest areas connected to the plantations. The use of pesticides and in particular of herbicides and insecticides is frequently the cause of drastic reductions in beneficial populations. (Aldana, J.A. et al, 1997).

The attraction of certain plant species to beneficial insects is the characteristic that is being used in order to implement some of the pest management programs, such as: *Croton hirtus* (L), *Crotalaria sp. pos. juncea* L., *Cassia tora* (L), *Cassia reticulata*, *Hyptis capitata* Jacq, *Hyptis atrorubens* Poit and *Hyptis mutabilis*, *Bacitrix gasipaes*, *Hibiscus sfarcelatus*, *Crotalaria pilosa*, *Croton trinitalis*, and *Senna occidentalis*.

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<sup>46</sup> MINISTRY OF THE ENVIRONMENT, 1998. “Informe preliminar sobre la situación de la cadena de oleaginosas (palma de aceite) en Colombia”. Santa Fe de Bogotá D. C.

- Activity 8. Integrated management of the stable fly *Stomoxys calcitrans* (L) in Casanare.
- Activity 9. Management of *Strategus aloeus* L. (Coleoptera: Scarabaeidae) – Biological Control with *Metarrhizium anisopliae*.
- Activity10. Management of the acarus *Retracrus elaeis* Keifer (Acari: Eriophyidae) in oil palm in the mid-Magdalena region.
- Activity 11. Management of *Loxotoma elegans* Meyrick (Lepidoptera: Stenomidae) pathogenicity tests of various isolations of *Beauveria bassiana*.
- Activity 12. Management of beneficial insects. *Crematogaster* sp. ant.



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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 87. Action to be developed 4P - 54**

<b>Affected resource: BIOLOGICAL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Define and delimit biological control and preservation areas.	<b>Code:</b> <p style="text-align: center; font-weight: bold;">4P – 54</p>
<b>Objective:</b> Delimit the natural areas of special interest for their protection and management and utilize their comparative advantages.	<b>Location:</b> All the Project zones
<b>Associated environmental impacts:</b> Fragmenting of the ecosystems and reduction of the habitats in order to maintain biodiversity. Inadequate development and extraction of renewable natural resources.	
<b>Description of measures to be implemented:</b> Delimit these zones and keep them in the best possible condition. Prevent their alteration due to discharges or spills of industrial wastes or effluents. Promote their protection and recovery if they have suffered alteration.	
<b>Goal:</b>	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u> <b>See attached card:</b>	
<b>Costs:</b> No additional costs are involved <b>See attached card:</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> <b>Specific C and F Plan required?:</b> YES ___ NO <u>X</u> <b>See card:</b>	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> <b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO ___ <b>See card:</b> See Follow-up Plan

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 88. Action to be developed 4P - 55**

<b>Affected resource: BIOLOGICAL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Prevent the use of toxic materials in biological conservation areas.	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">4P – 55</p>
<b>Objective:</b> Establish a special management system for dangerous wastes due to the risks they represent.	<b>Location:</b>
<b>Associated environmental impacts:</b> Those related to alteration in the natural systems due to discharges of chemical products and contaminated waters and dangerous to health and to the environment due to their chemical, toxic, explosive and corrosive activity.	
<b>Description of measures to be implemented:</b> See Card 4P – 52 and attachments.	
<b>Goal:</b> %.	
<b>Basic dimensioning:</b> Required: YES <u>X</u> NO ___	
<b>See attached card:</b> See Card 4P – 52 and attachments	
<b>Costs:</b> No additional costs are involved.	
<b>See attached card:</b>	
<p style="text-align: center; font-weight: bold;">Control and follow-up</p> <b>Description:</b> <b>Specific C and F Plan required?:</b> YES ___ NO <u>X</u>	<p style="text-align: center; font-weight: bold;">Monitoring</p> <b>Description:</b> <b>Specific Monitoring Plan required?:</b> YES <u>X</u> NO ___
<b>See card:</b>	<b>See card:</b> See Follow-up and Monitoring Plan

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 89. Action to be developed 4P - 56**

<b>Affected resource: BIOLOGICAL</b>	
<b>Type of measure:</b> Prevention <b>Action to be developed:</b> Adjust to the management and regulation conditions established by CORPONOR for the AFRICAN OIL PALM AGROSYSTEM, applying all measures indicated in the EMP for their balanced management.	<b>Code:</b> <p style="text-align: center; font-size: 1.2em;"><b>4P – 56</b></p>
<b>Objective:</b> Apply the guidelines of the Regional Action Plan in biodiversity. Biodiversidad Siglo XXI	<b>Location:</b> Applied to the project in general
<b>Associated environmental impacts:</b> All those related to the biodiversity associated with African oil palm agrosystems in the Department of Norte de Santander. <sup>47</sup>	
<b>Description of measures to be implemented:</b> Rescue from the mentioned study the strategic actions applied to the oil palm agrosystem and prepare, together with CORPONOR and FEDEPALMA, an action program with very clear short, medium and long-term goals and objectives.	
<b>Goal:</b> The goals and objectives must be agreed upon in the plan that is established	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u>	
<b>See attached card:</b>	
<b>Costs:</b> At the will of the company when the plan is developed. <b>See attached card:</b>	
<b>Control and follow-up</b>	<b>Monitoring</b>
<b>Description:</b>	<b>Description:</b>
<b>Specific C and F Plan required?:</b> YES ___ NO <u>X</u>	<b>Specific Monitoring Plan required?:</b> YES ___ NO <u>X</u>
<b>See card:</b>	<b>See card:</b>

<sup>47</sup> INSTITUTO ALEXANDER VON HUMBOLDT Norte de Santander. Plan de acción regional en biodiversidad. Biodiversidad siglo XXI, CORPONOR-, Bogotá, October, 2001

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 90. Action to be developed 4M - 57**

<b>Affected resource: BIOLOGICAL</b>	
<b>Type of measure:</b> Mitigation <b>Action to be developed:</b> Permit, to the extent that the phytosanitary control of the plantation allows it, the natural regeneration of stubble and other native vegetation.	<b>Code:</b> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">4M – 57</p>
<b>Objective:</b> Avoid the erosion of soils surrounding the water sources and their courses.	<b>Location:</b>
<b>Associated environmental impacts:</b> All those related to the quality of the water sources, their courses and the soil in general.	
<b>Description of measures to be implemented:</b> The areas planned and delimited as protection strips must be prepared to revegetate quickly and spontaneously with natural vegetation or induced with native vegetation, whenever possible.	
<b>Goal:</b> All protection zones and, whenever possible, part of the lots of the subsistence crop farms.	
<b>Basic dimensioning:</b> <b>Required:</b> YES <u>X</u> NO ___ <b>See attached card:</b> 1P – 10 and its attachments	
<b>Costs:</b> This is an action that can be developed on the basis of new instructions at no additional costs.	
<b>See attached card:</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> <b>Specific C and F Plan required?:</b> YES ___                      NO <u>X</u> <b>See card:</b>	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> <b>Specific Monitoring Plan required?:</b> YES ___                      NO <u>X</u> <b>See card:</b>

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**MANAGEMENT ACTION DEVELOPMENT CARD**

**Table 91. Action to be developed 4C - 58**

<b>Affected resource: BIOLOGICAL</b>	
<b>Type of measure:</b> Correction <b>Action to be developed:</b> Control the maintenance and cleaning of the irrigation channels, avoiding the use of chemical substances and preferring the manual and/or mechanical eradication of weeds.	<b>Code:</b> <p style="text-align: center; font-size: 1.2em;"><b>4C – 58</b></p>
<b>Objective:</b> Ensure the proper operation of the irrigation channels in the areas of influence of the project.	<b>Location:</b> Production areas of the project
<b>Associated environmental impacts:</b> All those associated with contamination of the water resources and deterioration of the courses.	
<b>Description of measures to be implemented:</b> 1. Identify the length of the irrigation channels in the area of the influence of the project. 2. Locate them on a map or freehand sketch. 3. Carry out a systematic and sustained manual cleaning program, whenever possible. 4. Prohibit the use of chemical products to clean the irrigation channels.	
<b>Goal:</b> The entire length of the irrigation channels identified and extended to the area of influence of the project.	
<b>Basic dimensioning:</b> Required: YES ___ NO <u>X</u>	
<b>See attached card:</b>	
<b>Costs:</b> This is an action that can be developed on the basis of new instructions at no additional costs. <b>See attached card:</b>	
<p style="text-align: center;"><b>Control and follow-up</b></p> <b>Description:</b> Specific C and F Plan required?: YES <u>X</u> NO ___ <b>See card:</b> The Project Management must develop a control plan.	<p style="text-align: center;"><b>Monitoring</b></p> <b>Description:</b> Specific Monitoring Plan required?: YES <u>X</u> NO ___ <b>See card:</b> See Follow-up and Monitoring Plan

## **5.2 FOLLOW-UP AND MONITORING PLAN**

### **5.2.1 Introduction**

The Follow-up and Monitoring Plan is the instrument provided by the Environmental Management Plan to evaluate, permanently and systematically, the company's level of performance with respect to the environmental requirements and to the commitments voluntarily assumed by it. Follow-up relates to the environmental impacts and the contamination reduction goals. Monitoring refers to the environmental indicators, frequencies and sampling points.

The Follow-up Plan included below is strategically adjusted to the control of those activities, processes and procedures that have been detected and assessed as critical, or of major importance within the EIA process. In the case of the monitoring, individual environmental cards are developed, attempting to group the most important indicators but, above all, covering the requirements established by law. In both cases it is recommended that the COOPAR Ltda. oil palm project directors observe the activities included within the Environmental Management System proposal<sup>48</sup>, developed within the results of the Environmental Management Plan.

### **5.2.2. Follow-up Plan**

The Follow-up Plan is developed for those basic actions of the management plan that truly justify it. The greatest number of these correspond to the mitigation and correction measures. The same codes assigned to the various actions developed in the Environmental Management Plan are used in table 92. It is important to recall, for an easy interpretation of the chart, the meanings of the code in the second column: the numbers 1-4 refer to the elements water, soil, air and biological respectively. The letter P is a preventive measure, M is mitigation and C is a corrective measure. The number following the dash is the order of the measure developed in the EMP.

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<sup>48</sup> The Environmental Administration System is equivalent, for purposes of the subcontract, to the Environmental Management Plan. It refers to the infrastructure and actions to be developed by the company in order to carry out the actions proposed in the Environmental Management Plan.

**Table 92. Environmental Follow-up Plan**

Action to be developed	Code	Type of measure	Description of the follow –up measure	Verification site or instance	Frequency	Responsible
Include objectives, goals and responsibilities in the EMP and in the EAS.	1P-5	Periodically update objectives and goals	Reviews on the part senior management	Management	Annual	Project manager and person in charge of the EAS
Control (follow-up) and monitoring plan	1P-6	Periodically update	Define work fronts	Division in charge of the EAS	Semiannual	Person responsible for the EAS
Design and implement a minimization plan for water consumptions and uses	1P-7	Maximize the use of the infrastructure and the water supply systems at the plant, the nurseries and the farms	<ul style="list-style-type: none"> <li>- Carry out maintenance and replacement of obsolete parts in water pumping equipment.</li> <li>- Carry out maintenance of wells and supply channels</li> <li>- Install consumption measurement equipment at process plant, nurseries and homes.</li> <li>- Induce rain water consumption.</li> <li>- Measure and document consumption.</li> </ul>	The promotion of these actions must have good support from management, much control from the person in charge of the EAS and much education of the part of the social work office.	<p>A Project must be carried out and the times for each activity defined.</p> <p>Successful cases must be used in pedagogy through semiannual workshops</p>	Management, maintenance, social work
Delimit and mark off water source protection strips, before beginning stripping and earth moving activities.	1P-10	Review planting schedules and verify the authorized areas, so that protection strips are not affected.	Control through maps and markings on the land	Production	Monthly update on maps. Daily review on the land.	Field agronomist
Implement waste minimization and cleaner production plans	1M-14	Audit the plans and measures implemented, on a periodic basis	Management must order the performance of audits and adopt the pertinent recommendations.	In all stages of the Project (Pre-nursery, nursery, production plant and FFB processing plant).	Semiannually during the first three years. After that, may be monthly.	Internal audits may be conducted by a company employee trained on the subject.

Action to be developed	Code	Type of measure	Description of the follow –up measure	Verification site or instance	Frequency	Responsible
Treat wastes that were not reused or managed.	1M-16	1- Follow-up on the Industrial Sewage Treatment System - ISTS	Verify, based on the monitoring plan, compliance with the standards established in Decree 1594/84 and Decree 901/97. Verify conditions specified in designs.	Input and output of ISTS.	Daily for parameters in situ, semiannually for BOD <sub>5</sub> and TSS. Annual for others.	Responsible for the EAS. With good training, sampling and laboratory analysis expenses are reduced.
	1M-16 and 1M-19	2- Follow-up on the Domestic Sewage Treatment Systems.	Verify, based on the monitoring plan, compliance with the standards established in Decree 1594/84 and Decree 901/97. Verify conditions specified in designs.	Input and output of the treatment and final disposal system	Monthly for grease trap. Annual for septic tank and other units.	Person in charge of EAS
	1M-16 and 2P-34	3- Follow-up on the ISTS sludge.	Keep records of sludge quality, quantity, frequency and disposal site.	ISTS and final disposal lots	According to purge and stabilization frequencies established in the operating manual.	Responsible for ISTS
	1M-16	4-Follow-up on management and disposal of special solid wastes - SSW	Carry out an effective control and application of the management and final disposal plan for SSW.	Generation points, mixing tank, SSW storage site and final disposal site.	Keep daily records	Employee delegated by person in charge of the EAS.
	3M-50	5- Follow-up on the atmospheric emission and particulate material management system.	Verify, based on the monitoring plan, compliance with the standards established in Decree. 948/94 and Law 02/82. Verify conditions specified in designs. - Carry out observation and assessment of the boiler operation. -Verify boiler maintenance and fuel consumption and quality records.	Boilers and burning points in production lots.	Carry out at least one isokinetic sampling before the expansion of the FFB processing plant. Depending on the boiler power after the expansion, the environmental authority will determine the new frequency.	Person in charge of the EAS or person delegated by management.
	1M-16	7-Follow-up on the management of liquid wastes from the preparation of agrochemicals	Keep strict controls on the solutions prepared, the leftovers and their final disposal. Records must be kept.	Preparation sites for fertilizers and agrochemical solutions for pest control.	The same frequency with which the mixtures are prepared.	All individuals preparing solutions of this type. The person in charge of the EAS shall be responsible.

Action to be developed	Code	Type of measure	Description of the follow –up measure	Verification site or instance	Frequency	Responsible
	1M-16 and 1M-20	8- Follow-up on the management of domestic solid wastes.	Record waste volumes and typologies, as well as problems with management of the trenches.	Housing of beneficiaries and person in charge of the administration of nurseries and FFB processing plant.	Weekly	Person responsible for EAS. Initially, can be done through the social work office.
Carry out management, disposal and treatment of plant solid wastes.	1M-18	6- Follow-up on the management of plant wastes.	Planning of sites for palm residue disposal and control of disposed plant material, in order to avoid saturation and bad odors. Ensure constant turnovers of the sites.	Selected sites in the oil palm plantation	Monthly	Person in charge of the EAS or delegate
Agrochemical management	2M-41	Dosing of pesticides	Ensure that washings generated are not discharged anywhere. Must be taken to pesticide mixing tanks.	Sites intended for pesticide dosing.	Whenever pesticides are dosed.	The person trained for these purposes.
		Internal pesticide transportation	Ensure that these are transported in safe containers, from the dosing site to the mixture preparation site.	Dosing sites and pesticide storeroom.	Whenever it occurs.	All competent personnel. Person in charge of EAS.
		Mixture preparation.	See that pesticide containers have undergone triple rinse, as indicated in the SSW dimensioning card.	Mixture preparation sites.	Whenever it occurs.	All competent personnel. Person in charge of EAS.
		Pesticide application	Ensure basic health, sanitation and industrial safety regulations.	Entire production field and eradication area.	Whenever it occurs.	All competent personnel. Person in charge of EAS.
		Washing of application and personal protection equipment.	See that resulting rinses are collected and reused within the plantation itself (that they go to pesticide mixing tanks or waterproof irrigation tanks). These rinses must go to a treatment system, which must be designed on the basis of treatability assays.	Sites intended for these special tasks	Whenever it occurs.	Person in charge of EAS.

Action to be developed	Code	Type of measure	Description of the follow –up measure	Verification site or instance	Frequency	Responsible
		Disposal of pesticide solid wasted	Ensure management according to SSW management and treatment card.	SSW storage site at farms or modules.	Whenever it occurs.	Person in charge of EAS or person trained and assigned.
		Storage of liquid fertilizers	See that there are confinement structures with a waterproof floor, at the storage sites for liquid concentrate fertilizers at the farms, whether their containers are tanks, plastic drums, jugs or others. The capacity of the structure must have at least 10% more volume than the container it contains. There must be elements or mechanisms at each site to allow the gathering of spilled liquid, such as sawdust and a dustpan or stopcocks to evacuate the spill from the container.	Fertilizer storeroom and irrigation and fertilization stations.	The confinement structures must constantly be checked to see that they do not have any cracks or leaks.	Chief or person in charge of infrastructure and maintenance.
Agrochemical management	2M-41	Solid fertilizer storage	Check that the solid fertilizers, conditioners and chemical substances contained in canvas bags are stored in a covered area. Bags containing fertilizers and not used in their entirety must remain closed and isolated from the floor and from the action of water. At each site, there must be tools and other means to allow their quick gathering	Fertilizer storeroom and irrigation and fertilization stations.	The condition of the stowages and roofs must be verified each month.	The employee in charge of this section.
Agrochemical management	2M-41	Assessment and follow-up of the EMP	- Programming of work fronts - Marking of areas	Preparation for planting fronts	According to scheduled agenda for soil	Agricultural engineer in charge of and

Action to be developed	Code	Type of measure	Description of the follow –up measure	Verification site or instance	Frequency	Responsible
			subject to land improvement - Identification of sites for temporary storage of the material to be disposed of - Confirmation of drainages - Report of contingencies and measures adopted to prevent contamination of water sources.		improvement	responsible for the EAS

### 5.2.3. Monitoring Plan

The systematic implementation of the FOLLOW-UP PLAN assures the company of the control of environmental aspects and the probability of occurrence of impacts. Nevertheless, the company must comply with environmental requirements and operating requirements, which must be periodically assessed and, therefore, first-hand information, obtained at the site and meeting certain specific technical conditions, is required. Based on the Environmental Requirements matrix, which is part of the Environmental Diagnosis report (see second report), the information regarding procedures and steps (which is part of the supporting attachments to Card 1P-5 (see card 1P-5C), as well as the results of the EIA, are presented after the monitoring procedures of greatest importance for the life of the project.

#### 5.2.3.1. Monitoring of point sources of liquid discharges

The EIA has allowed the identification, in order of importance, of three point sources of liquid discharges:

- 1- The Industrial Liquid Wastes of the Processing Plant (ILWPP),
- 2- The Liquid Wastes from Agrochemical Preparation (LWAP) and
- 3- The Domestic Liquid Wastes (DLW). In each case, the basis for the monitoring are presented below:

##### 5.2.3.1.1 Monitoring of Industrial Liquid Wastes from the FFB Processing plant – (ILWPP)

The characteristics and frequencies of the discharges mandatorily establish two (2) monitoring routines:

- 1- for compliance with the prescribed requirements and
- 2- to ensure the proper operation of the Sewage Treatment System.

5.2.3.1.2 ILWPP monitoring, for compliance with environmental requirements: Decree 1594 of 1984 and Decree 901 of 1997 require the obtaining and updating of the DISCHARGE BASE LINE<sup>49</sup>, as indicated in Table below.

When a company has a good Environmental Administration System – EAS, good environmental performance levels and good quality information for the discharges, it may reduce the sampling frequencies so as to minimize monitoring costs. In this case, the decision must be made by the respective Environmental Authority.

**Table 93. ILWPP monitoring based on environmental requirements**

PARÁMETER	UNIT	SAMPLING SITE	FREQUENCY	OBSERVATIONS AND REGULATIONS
PH	UPH	All final discharge points, 10 m upstream from the discharge, mixing area of the recipient body and 10m downstream.  Same as above	Once a year	Decree 1594 of 1984
Temperature	°C			
COD	mg/l		Semiannual	Decree 901 of 1997
BOD <sup>5</sup>	mg/l			
TSS	mg/l			
SS	mg/l		Once a year	Decree 1594 of 1984
GREASES AND OILS	mg/l			
NITRÓGEN	mg/l			
PHOSPHORUS	mg/l		Semiannual	
VOLUME OF FLOW	l/sec			

5.2.3.1.3. ILWPP Monitoring, for operation of the Sewage Treatment System of the FFB Processing Plant:

The most practical method would be for whoever performs the basic plant engineering to develop his own monitoring plan. In any event, the indicators, sites and frequencies to comply with the operating specifications and design efficiencies of the system are shown.

<sup>49</sup> The Environmental Authority may increase the indicators shown in this assessment.

#### 5.2.3.1.4. Monitoring of system start-up:

The system proposed and referred to in dimensioning card 1M- 16A is a biological system and requires preliminary procedures pertaining to specialized sanitary engineering, in order to plant the microorganisms and ensure their permanence and successful development.

Table below shows a monitoring plan for a methanogenic pond such as that proposed<sup>50</sup> and developed in management action development card 1M-16.

**Table 94. Monitoring plan for the startup of a methanogenic (anaerobic) pond**

PARÁMETER / UNITS	SAMPLING SITE	FREQUENCY	OBSERVATIONS
PH (uph)	Entire pond and affluent to the pond	Daily	The design conditions could modify this plan
Total alkalinity	Entire pond		
Biocarbonate alkalinity	Entire pond		
Alkalinity ratio (R)	Entire pond		
COD ( mg/l)	Entire pond	2 /week	
Temperature (°C)	Entrance to the pond	Daily	
Volume of flow (l/sec)	Entrance to the pond		

#### 5.2.3.1.5 Monitoring of the system operation

##### **Preliminary treatments**

The preliminary systems are operated jointly with the maintenance and cleaning tasks of the extraction plant. In order to evacuate the sludge from the florentines (oil recovery system), it is recommended to purge and clean them every 8 or 15 days. Oil concentration at the outlet of the flornetines, when there is a controlled process, must not exceed 8,000mg/l. The grilles must be cleaned every day and according to the amount of the garbage present should be cleaned several times a day .

##### **Control parameters for stabilization ponds**

After the startup of the system, that is, when it is biologically acclimatized, a very serious and systematic monitoring routine will be required for the stabilization ponds. Table below shows the parameters, sampling sites and frequencies<sup>51</sup>.

<sup>50</sup> Source: CENIPALMA: “Arranque, operación y mantenimiento de lagunas de estabilización.” Jesús Alberto García Núñez, sanitary engineer. Bogotá, March 1996

<sup>51</sup> Source: CENIPALMA 1996. “Arranque, operación y mantenimiento de lagunas de estabilización.” Jesús Alberto García Núñez, sanitary engineer. Bogotá, March 1996

**Table 95. Control parameters for stabilization ponds**

PARAMETER / UNIT	SAMPLING SITE	FREQUENCY	OBSERVATIONS
PH (uph)	Affluent and effluent of each pond	3 times/week	The final design may modify this monitoring routine
Temperature (°c)	Affluent and effluent of each pond	Daily	
Total alkalinity (TAL)	Anaerobic pond effluent	1 time /week	
	Optional pond effluent	3 times/week	
Bicarbonate alkalinity (BAV)	Anaerobic pond effluent	1 time /week	
	Optional pond effluent	3 times/week	
Alkalinity ratio (R)	Anaerobic pond effluent	1 time /week	
	Optional pond effluent	3 times/week	
COD, mg/l	Deoiled tank (pond) effluent	1 time /month	
	Anaerobic pond effluent	1 time /week	
	Optional pond effluent	1 time /month	
Total Solids (TS), mg/l	Anaerobic pond effluent	1 time /month	
	Optional pond effluent	1 time /week	
Dissolved Solids (DS), mg/l	Optional pond effluent	1 time /month	
Solid profile	Deoiled pond (tank)	2 times /year	
	Anaerobic ponds	2 times/year	
	Optional ponds	1 time/year	
PH, TS, Suspended Solids (SS), DS, FS, TAL, BOD <sub>5</sub> , COD, N-TOTAL, N-NH <sub>4</sub> , P-TOTAL, S-TOTAL	Final Effluent to receiving body	2 times / year	The characterization must be complete and the analyses must be made at a laboratory recognized by the environmental authority.

#### 5.2.3.1.6. Monitoring of Liquid Wastes in the preparation of agrochemicals

The Management Plan, in its PREVENTION action development card (1P- 12) recommends in this case avoiding this type of wastes 100% due to their dangerousness and the complexity of their treatment. The company must train its field personnel very carefully, in particular those who prepare the fertilizing and pest control solutions, so that the total amount of the product is used. The rinse mixtures must be used in the preparation of new solutions.

In the event that there are any residues, the company must contract a treatability study for the type of wastes. Only thus will it be possible to know the type of system to be designed and the monitoring plan to be implemented. The greater the control at the source and the minimization of effluents, the lesser the treatment costs and the risks of contamination.

#### 5.2.3.1.7 Monitoring of Domestic Liquid Wastes.

Domestic liquid wastes, due to their universal characteristics<sup>52</sup>, offer the possibility of accessing very important secondary information. If this information is used by qualified personnel, it will be possible to avoid, or at least minimize, many of the treatability, design and, especially, effluent monitoring costs. The systems proposed in the dimensioning cards

<sup>52</sup> Their composition and volume are amply characterized for the various regions of the country.

that support card 1M-16, rather than monitoring procedures supported by samplings and laboratory analyses, require controls in essential aspects such as:

- 1- Designs made by qualified personnel,
- 2- Proper location of pretreatment and subsoil infiltration systems,
- 3- Construction and materials in keeping with the relevant designs
- 4- Rigorous operation and maintenance based on the respective manuals (which must be delivered by the designer or by the supplier of the units). If these conditions are met, no samplings are required, as the recommended infrastructure does not generate effluents and uses the natural capacity of the soil for the biological degrading (100%) of pretreated domestic liquid wastes.

#### **5.2.3.2. Monitoring of point sources of atmospheric emissions.**

As long as the company continues to use the organic byproducts from the processing of the FFB, there is no possibility of generating gaseous compounds or NO<sub>x</sub> and SO<sub>x</sub> toxic clouds. In any event, for the preparation of the atmospheric emission BASE LINE and for the periodic control of the environmental requirements, a monitoring plan for emissions of this type is necessary.

The first thing required is good information from the boiler, the type of fuel, the emission control equipment and the chimney. This information is generally required by the environmental authority, but above all for a good operation and control of the boilers, their efficiency and their emissions. Table 97 presents a summary of the most relevant parameters and information for this monitoring.

The other aspect of the monitoring has to do with emissions, parameters, frequencies and sampling sites. Table 96 presents the most appropriate plan for the conditions identified.

#### **5.2.3.3. Monitoring of bodies of water and isokinetic analyses.**

In order to be able to quantify and establish balances between what is discharged by the project and the baseline, it is recommended to measure, at least one every two (2) years, in the bodies of water and in the air (isokinetic sampling), the same parameters indicated in the previous charts, for point discharge sources. This information is very important, particularly in order to establish the historic behavior of the project and its relationship with the natural environment.

For the soil element there are no special monitoring recommendations, as the guidelines contained in the follow-up plan indicate that it is not necessary to establish procedures of this type.

**MONITORING OF POINT SOURCES OF ATMOSPHERIC EMISSIONS:**

**Table 96. Monitoring plan of equipment, accessories and fuels**

PARÁMETER / UNIT	SAMPLING SITE	FREQUENCY
Boiler information		
Type of boiler (horizontal or vertical)	Each boiler	For each boiler, maintain this information up to date
Capacity ( BHP)		
Design pressure ( PSIG)		
Working pressure (PSIG)		
Make		
Heating surface		
Thermal efficiency		
Steam production (kg/hr)		
Operating time (hours per day, week, month)		
Process in which the steam generated is used		
Fuel		
Type of fuel	Each boiler	For each boiler, maintain this information up to date
Fuel consumption (kg/hr)		
Type of fuel fed		
Calorific value ( kcal/kg)		
Excess air (%)		
Emission control equipment		
Type	Each piece of equipment	For each boiler and control equipment implemented, maintain this information up to date
Particle size (micras)		
Efficiency (%)		
Chimney		
Material	Chimney	For each chimney, maintain this information up to date.
Type		
Height (m)		
Dimensions		

**Table 97. Atmospheric emission monitoring plan**

PARAMETER / UNITS	SAMPLING SITE	FREQUENCY
$T_s$ °C Temperature of gas in the chimney	Chimney	At least once a year. Once the process is standardized and there is a good equipment operation and maintenance process, the monitoring period may be spaced out. This must be approved by the environmental authority.
$T_m$ °C of gases in the meter	Meter	
+H (mmH2O) orifice pressure	Chimney	
Ps (mmHg) gas pressure in the chimney	Chimney	
+P <sup>1/2</sup> (mmH2O) gas velocity head		
Vs (m/s) chimney gas velocity	Chimney	
Vm (m <sup>3</sup> ) total volume of gases in sampling	Chimney	
CO <sub>2</sub> Carbon dioxide		
O <sub>2</sub> Oxygen		
CO Carbon monoxide		
N <sub>2</sub> Nitrogen		
Ms (g/g-mol) Dry gas molecular weight		
V <sub>mstd</sub> (m <sup>3</sup> ) volume corrected to standard		
BWS % real humidity of gases		
Qs (m <sup>3</sup> /min) volume of flow at standard cond.	Chimney	
ETP (Kg/10 <sup>6</sup> Kcal) total particle emission		
ETP (Kg/h) total particle emission		
Emission standard (kg/10 <sup>6</sup> Kcal) Decree 02/82 article 48, 49, Chap. IV		
Standard met?		
% isokinetism		

### **5.3 Environmental Management Plan Schedule**

Table 92 presents the activity plan to be developed and the durations as of the time when it is approved and the company defines the zero date for implementation. The activities observe the same codes and definitions of the EMP. The activities with greater priority have been shadowed in a darker tone and those which, although important, could be managed by the company at a later date, have been shadowed in a lighter tone. The times indicated include, in most cases, the hours dedicated to review, final design, work scheduling, construction, start-up, operation, etc. A period of three-and-a-half years has been established as the time over which the works of a mandatory nature must be developed, that is, the mitigation, correction and prevention measures that meet the requirements and environmental goals established under Colombian law. It is understood that many of the proposed activities must remain as long as the project exists.

**Table 98. Schedule for actions to be developed for environmental management of the water resource.**

AFFECTED RESOURCE: WATER																																										No			
ENVIRONMENTAL IMPACT: Changes in the quality, quantity and distribution of the water resource																																										1			
ENVIRONMENTAL ASPECT	1 - 6	YEAR 1												YEAR 2												YEAR 3												YEAR 4							
ACTION TO BE DEVELOPED	CODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42		
Study for minimization of liquid wastes and implementation of results	1P - 1																																												
Liquid and solid waste characterization study	1P - 2																																												
Optimization of oil extraction technology, processes and procedures	1P - 3																																												
Optimization of the management and utilization of the energy sources	1P - 4																																												
Include objectives, goals and responsibilities in the EMP and in the Environmental Administration System	1P - 5																																												
FOLLOW-UP AND MONITORING PLAN	1P - 6																																												
Design and implement WATER CONSUMPTION AND USE MINIMIZATION PLAN	1P - 7																																												
Implement periodic waste minimization AUDITS	1P - 8																																												
Conduct company environmental education	1P - 9																																												
Delimit and mark off water source protection strips, before starting stripping and earth moving activities	1P - 10																																												

AFFECTED RESOURCE: WATER																																										No		
ENVIRONMENTAL IMPACT: Changes in the quality, quantity and distribution of the water resource																																										1		
ENVIRONMENTAL ASPECT	1 - 6	YEAR 1												YEAR 2												YEAR 3												YEAR 4						
ACTION TO BE DEVELOPED	CODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	
Respect the natural vegetation in the statutory surface and ground water protection zones	1P - 11																																											
Use 100% of the agrochemical solutions prepared for nurseries, planting and plantation operation.	1P - 12																																											
Develop manual sanitary landfill operating manual by farm or module	1P - 13																																											
Implement WASTE MINIMIZATION AND CLEANER PRODUCTION PLANS	1M - 14																																											
Reuse, recycle and manage wastes	1M - 15																																											
Treat wastes that were not reused and/or managed	1M - 16																																											
Guarantee the waste treatment efficiencies established in environmental legislation	1M - 17																																											
Adequately manage, dispose of and treat plant wastes	1M - 18																																											
Build adequate excreta disposal systems for housing and administration areas	1M - 19																																											
Build manual sanitary landfills by farm	1M - 20																																											

AFFECTED RESOURCE: WATER																																										No				
ENVIRONMENTAL IMPACT: Changes in the quality, quantity and distribution of the water resource																																										1				
ENVIRONMENTAL ASPECT	1 - 6	YEAR 1												YEAR 2												YEAR 3												YEAR 4								
ACTION TO BE DEVELOPED	CODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42			
Clean water courses and sites used for gathering, temporary management or inadequate disposal of wastes	1C - 21																																													
Reforest water source edges and protection strips, in order to prevent the transport of solids and erosion of the strips.	1C - 22																																													
Periodically clean creeks and irrigation channels, in order to correct water course sedimentation	1C - 23																																													
Close temporary solid waste dumps	1C - 24																																													



		<b>AFFECTED RESOURCE: SOIL</b>																																				<b>No</b>						
		<b>ENVIRONMENTAL IMPACT: Changes in the quality, quantity and distribution of the soil resource</b>																																				<b>2</b>						
<b>ENVIRONMENTAL ASPECT</b>	<b>7 - 10</b>	<b>YEAR 1</b>												<b>YEAR 2</b>												<b>YEAR 3</b>												<b>YEAR 4</b>						
<b>ACTION TO BE DEVELOPED</b>	<b>CODE</b>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	
Carry out land improvement in the dry season and avoid exposure of denuded soils for long periods of time.	<b>2P – 33</b>																																											
Technically dispose of the sludge generated in the sewage treatment systems	<b>2P – 34</b>																																											
Define and regulate product and byproduct management sites in the processing plant area.	<b>2P – 35</b>																																											
Hold periodic cleaning days in the areas of influence of the processing plant	<b>2P – 36</b>																																											
Define and regulate agrochemical product management, storage and processing areas.	<b>2P – 37</b>																																											
All mitigation actions listed in Table 17. Type of measure and action to be developed in order to improve the water resource and its associated impacts, related to the soil and subsoil.	<b>2M – 38</b>																																											
Construct sanitary landfills for non-special solid wastes.	<b>2M – 39</b>																																											
Adequately manage and technically dispose of special solid wastes	<b>2M – 40</b>																																											
Adequately manage and technically dispose of liquid wastes from the preparation and	<b>2M – 41</b>																																											

AFFECTED RESOURCE: SOIL																																					No							
ENVIRONMENTAL IMPACT: Changes in the quality, quantity and distribution of the soil resource																																					2							
	7 - 10	YEAR 1												YEAR 2												YEAR 3												YEAR 4						
ACTION TO BE DEVELOPED	CODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	
management of agrochemical solutions																																												
Technically and systematically manage the palm residue disposal sites, as an alternative for the management of plant wastes.	2M - 42																																											
Rectify erosion gullies caused by poor management of the land improvement process.	2C - 43																																											
Restore the vegetation cover in the prescribed water source protection strip areas.	2C - 44																																											
Ensure drainages in the plantation to prevent pool formation.	2C - 45																																											
Gather the bags and solid wastes generated in palm transplants.	2C - 46																																											

**Table 100. Schedule for actions to be developed for environmental management of the air resource.**

AFFECTED RESOURCE: AIR																																										No			
ENVIRONMENTAL IMPACT: Boiler operation with organic residues from the processing and transformation process																																										3			
ENVIRONMENTAL ASPECT	11	YEAR 1												YEAR 2												YEAR 3												YEAR 4							
ACTION TO BE DEVELOPED	CODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42		
All those indicated in Table 16. Type of measure and action to be developed in order to improve the <b>water</b> resource and its associated impacts and Table 17. Type of action to be developed in order to improve the <b>soil</b> resource and its associated impacts, related to prevention and generation of wastes affecting the atmosphere.	<b>3P – 47</b>																																												
Avoid the use of wood consumption as an energy source.	<b>3P – 48</b>																																												
Avoid the construction of housing within a diameter of 100 meters around the oil extraction plant.	<b>3P – 49</b>																																												
Minimization of particulate material generated in combustion	<b>3M – 50</b>																																												

**Table 101. Schedule for actions to be developed for environmental management of the biological resource.**

AFFECTED RESOURCE: BIOLOGICAL																																										No								
ENVIRONMENTAL IMPACT: Affecting of biodiversity																																										4								
ENVIRONMENTAL ASPECT	12 - 14	YEAR 1												YEAR 2												YEAR 3												YEAR 4												
ACTION TO BE DEVELOPED	CODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42							
Prepare the Integrated Pest and Disease Management study - IPDM.	4P – 52																																																	
Preserve plant and animal niches in the protection and circulation areas and in the subsistence crop farms adjacent to the oil palm plantations.	4P – 53																																																	
Design and delimit the biological control and preservation areas	4P – 54																																																	
Prevent the use of toxic materials in the biological conservation area.	4P – 55																																																	

AFFECTED RESOURCE: BIOLOGICAL																																										No									
ENVIRONMENTAL IMPACT: Affecting of biodiversity																																										4									
ENVIRONMENTAL ASPECT	12 - 14	YEAR 1												YEAR 2												YEAR 3												YEAR 4													
ACTION TO BE DEVELOPED	CODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42								
Comply with the management conditions and regulations established by CORPONOR, for the AFRICAN OIL PALM AGROSYSTEM, applying all measures indicated in the EMP, for their balanced management.	4P - 56																																																		
Permit, to the extent allowed by the phytosanitary control of the plantation, the natural regeneration of the stubble and other native vegetation.	4M - 57																																																		
Control the maintenance and cleaning of the irrigation channels, avoiding the use of chemical substances and preferring the manual and/or mechanical eradication of weeds.	4C - 58																																																		

## 5.4. Environmental management plan BUDGET

Continuing with the use of cards, Tables 102 – 105 present the general budget, itemized by actions to be developed according to the EMP.

### 5.4.1. Budget for actions to be developed for each or the resources.

Table 102. Budget for actions to be developed for the water resource<sup>53</sup>

AFFECTED RESOURCE: WATER			No
ENVIRONMENTAL IMPACT: Changes in the quality, quantity and distribution of the water resource			1
ENVIRONMENTAL ASPECT		1 - 6	Cost
TYPE OF MEASURE	ACTION TO BE DEVELOPED	Code	
Prevention	Liquid waste minimization study and implementation of results	1P – 1	20,000,000
Prevention	Liquid and solid discharge characterization study	1P – 2	25,000,000
Prevention	Optimization of oil extraction technology, processes and procedures	1P – 3	20,000,000
Prevention	Optimization of the management and utilization of energy sources	1P – 4	
Prevention	Include objectives, goals and responsibilities in the EMP and in the Environmental Administration System	1P – 5	-
Prevention	Follow-up and monitoring plan	1P – 6	-
Prevention	Design and implement WATER CONSUMPTION AND USE MINIMIZATION PLAN	1P – 7	20,000,000
Prevention	Implement periodic waste minimization AUDITS	1P – 8*	10,000,000
Prevention	Conduct company environmental education	1P – 9	6,000,000
Prevention	Delimit and mark off water source protection strips, before starting stripping and earth moving activities	1P – 10	-
Prevention	Respect the natural vegetation in the statutory surface and ground water protection zones	1P – 11*	-
Prevention	Use 100% of the agrochemical solutions prepared for nurseries, planting and plantation operation.	1P – 12	-
Prevention	Develop a manual sanitary landfill operating manual by farm or module	1P – 13*	2,000,000
Mitigation	Implement WASTE MINIMIZATION AND CLEANER PRODUCTION PLANS	1M – 14*	20,000,000
Mitigation	Reuse, recycle and manage wastes	1M – 15*	20,000,000

<sup>53</sup> The blank boxes indicate that these actions can be developed with the capacity, organization and operating resources of the project, without requiring, initially, a new investment.

AFFECTED RESOURCE: WATER			No
ENVIRONMENTAL IMPACT: Changes in the quality, quantity and distribution of the water resource			1
ENVIRONMENTAL ASPECT		1 - 6	Cost
TYPE OF MEASURE	ACTION TO BE DEVELOPED	Code	
Mitigation	Treat wastes that were not reused and/or managed	1M – 16	160,000,000
Mitigation	Guarantee the waste treatment efficiencies established in environmental legislation	1M – 17	-
Mitigation	Adequately manage, dispose of and treat plant wastes	1M – 18	-
Mitigation	Build adequate excreta disposal systems for housing and administration areas	1M – 19*	272,000,000
Mitigation	Build manual sanitary landfills by farm	1M – 20*	5,000,000
Correction	Clean water courses and sites used for gathering, temporary management or inadequate disposal of wastes	1C – 21	-
Correction	Reforest water source edges and protection strips, in order to prevent the transport of solids and erosion of the strips.	1C – 22	-
Correction	Periodically clean creeks and irrigation channels , in order to correct water course sedimentation	1C – 23*	-
Correction	Close temporary solid waste dumps	1C – 24*	-
<b>SUBTOTAL</b>			<b>580,000,000</b>

**Table 103. Budget for actions to be developed for the soil resource**

AFFECTED RESOURCE: SOIL			No
ENVIRONMENTAL IMPACT: Changes in the quality, quantity and distribution of the soil resource.			2
ENVIRONMENTAL ASPECT		7-10	Cost
TYPE OF MEASURE	ACTION TO BE DEVELOPED	Code	
Prevention	All actions indicated in Table 17. Type of measure and action to be developed in order to improve the water resource and its associated impacts; and related to prevention for the generation of liquid and solid wastes affecting the soil and subsoil	2P – 25	20,000,000
Prevention	Plan work fronts for removal of the vegetation cover and removal of the upper layer	2P – 26	-
Prevention	Delimitation and marking off of work fronts for application of the EMP and its component.	2P – 27	-

AFFECTED RESOURCE: SOIL			No
ENVIRONMENTAL IMPACT: Changes in the quality, quantity and distribution of the soil resource.			2
ENVIRONMENTAL ASPECT		7-10	Cost
TYPE OF MEASURE	ACTION TO BE DEVELOPED	Code	
Prevention	Design specific and mandatory routes for circulation of heavy machinery and vehicles that cause compacting.	2P – 28	-
Prevention	Use heavy machinery and equipment only on the ways defined in the routes.	2P – 29	-
Prevention	Design the planting fronts, maintaining efficient and short drainages.	2P – 30	-
Prevention	Not use agrochemicals of toxicological category I and II.	2P – 31	-
Prevention	Select adequate sites to set up the Sewage Treatment Plant.	2P – 32	-
Prevention	Carry out land improvement in the dry season and avoid exposure of denuded soils for long periods of time.	2P – 33	12,000,000
Prevention	Technically dispose of the sludge generated in the sewage treatment systems	2P – 34	-
Prevention	Define and regulate product and byproduct management sites in the processing plant area.	2P – 35	-
Prevention	Hold periodic cleaning days in the areas of influence of the processing plant	2P – 36	-
Prevention	Define and regulate agrochemical product management, storage and processing areas.	2P – 37	-
Mitigation	All mitigation actions listed in Table 17. Type of measure and action to be developed in order to improve the water resource and its associated impacts, related to the soil and subsoil.	2M – 38	-
Mitigation	Construct sanitary landfills for non-special solid wastes.	2M – 39	-
Mitigation	Adequately manage and technically dispose of special solid wastes	2M – 40	-
Mitigation	Adequately manage and technically dispose of liquid wastes from the preparation and management of agrochemical solutions	2M – 41	-
Mitigation	Technically and systematically manage the palm residue disposal sites, as an alternative for the management of plant wastes.	2M – 42	-
Correction	Rectify erosion gullies caused by poor management of the land improvement process.	2C – 43	-
Correction	Restore the vegetation cover in the prescribed water source protection strip areas.	2C – 44	-
Correction	Ensure drainages in the plantation to prevent pool formation.	2C – 45	-
Correction	Gather the bags and solid wastes generated in palm transplants.	2C – 46	-
<b>SUBTOTAL</b>			<b>32,000,000</b>

**Table 104 Budget for the actions to be developed for the air resource**

AFFECTED RESOURCE: AIRE			No
ENVIRONMENTAL IMPACT: Boiler operation with organic wastes from the processing and transformation process			3
ENVIRONMENTAL ASPECT		11	Cost
TYPE OF MEASURE	ACTION TO BE DEVELOPED	Code	
Prevention	All those indicated in Table 16. Type of measure and action to be developed in order to improve the <b>water</b> resource and its associated impacts and Table 17. Type of action to be developed in order to improve the <b>soil</b> resource and its associated impacts, related to prevention and generation of wastes affecting the atmosphere.	3P – 47	-
Prevention	Avoid the use of wood consumption as an energy source.	3P – 48	-
Prevention	Avoid the construction of housing within a diameter of 100 meters around the oil extraction plant.	3P – 49	-
Mitigation	Minimization of particulate material generated in combustion	3M – 50	30,000,000
Correction	Ensure the minimum height of the chimneys.	3C – 51	-
<b>SUBTOTAL</b>			<b>30,000,000</b>

**Table 105. Budget for actions to be developed for the biological resource.**

AFFECTED RESOURCE: BIOLOGICAL			No
ENVIRONMENTAL IMPACT: Affecting of biodiversity			4
ENVIRONMENTAL ASPECT		12-14	Cost
TYPE OF MEASURE	ACTION TO BE DEVELOPED	Code	
Prevention	Prepare the Integrated Pest and Disease Management study - IPDM.	4P – 52	-
Prevention	Preserve plant and animal niches in the protection and circulation areas and in the subsistence crop farms adjacent to the oil palm plantations.	4P – 53	-
Prevention	Design and delimit the biological control and preservation areas	4P – 54	-
Prevention	Prevent the use of toxic materials in the biological conservation area.	4P – 55	-
Prevention	Comply with the management conditions and regulations established by CORPONOR, for the AFRICAN OIL PALM AGROSYSTEM, applying all measures indicated in the EMP, for their balanced management.	4P – 56	-
Mitigation	Permit, to the extent allowed by the phytosanitary control of the plantation, the natural regeneration of the stubble and other native vegetation.	4M – 57	-

<b>AFFECTED RESOURCE: BIOLOGICAL</b>			<b>No</b>
<b>ENVIRONMENTAL IMPACT: Affecting of biodiversity</b>			<b>4</b>
<b>ENVIRONMENTAL ASPECT</b>		<b>12-14</b>	<b>Cost</b>
<b>TYPE OF MEASURE</b>	<b>ACTION TO BE DEVELOPED</b>	<b>Code</b>	
Correction	Control the maintenance and cleaning of the irrigation channels, avoiding the use of chemical substances and preferring the manual and/or mechanical eradication of weeds.	<b>4C – 58</b>	-
<b>SUBTOTAL</b>			<b>-</b>

Table above indicates that the actions to be developed do not require new investments but, rather, modifications in the activities and procedures related to planting, gathering and eradication of African oil palm.

#### 5.4.2. Budget summary broken down by Natural Element.

Table below shows how the environmental aspects related to water contamination demand the greatest investment for Prevention, Mitigation and Control.

**Table 106. Total budget broken down by natural elements.**

Affected resource: Water	<b>580,000,000</b>
Affected resource: Soil	<b>32,000,000</b>
Affected resource: Air	<b>30,000,000</b>
Affected resource: Biological	-
<b>TOTAL</b>	<b>642,000,000</b>

## **5.5. Final And Comparative Environmental Score**

The essence of the environmental impact assessment study is summarized in the capacity of the proposed Environmental Management Plan to improve, or at least maintain, the conditions identified in the BASELINE. This task is relatively easy when there are sufficient tools and environmental assessment information, or as in the case of the quantitative EIAs, the budget conditions allow the gathering and analysis of that information.

The proposed Environmental Management Plan, as the logical result of an environmental assessment process, the results of which afford much confidence, allow the group of expert evaluators to score the project environment, presuming that both the EMP and the Follow-up and Monitoring Plan will be rigorously applied.

In this case, supported by the PARETO TECHNIQUE, adjusted to the results of the EIA, that is : mitigating and correcting the impacts, observing the minimum percentages established by the environmental requirements for Colombia an the Norte de Santander region, the most significant environmental problems predicted for the project are resolved by up to 80% (weighted). Nevertheless, in order to eliminate subjectivity vices, reiterating that this continues to be an analysis with a certain level of subjectivity. Table 107 presents a support for the impact factors, broken down by natural elements. Thus, the initial environmental scores are again taken (environment with the project, but without implementing the EMP) and compared to the final scenario (environment with project, rigorously implementing the EMP). Figure 11 graphically represents the figures and results of Table below.

**Table 107. Final Environmental Score  
SUPPORT OF ENVIRONMENTAL QUALITY CONTRIBUTIONS THROUGH  
IMPLEMENTATION OF THE ENVIRONMENTAL MANAGEMENT PLAN**

ELEMENT	ENVIRONMENTAL SCORE WITHOUT EMP		IMPROVEMENT FACTOR (%)	JUSTIFICATION	ENVIRONMENTAL SCORE WITH EMP	
	ES*	EI**			ES	EI
SOCIAL	6.2	H	110%	Presumed (there are no quantified indicators for the score) mainly because the project strengthens general conditions of well-being, participation, family dynamics, institutional participation, among others.	6.8	H
WATER	4.7	M	20%	100% DLW mitigation 80% ILW mitigation and 100% Agroindustrial LW mitigation	0.9	ML
SOIL	4.2	M	60%	Weighted percentage resulting from: Mitigation of contamination through Plant R. management 80%. Management of sanitary waters (40%)	2.5	L
AIR	3.9	L	20%	80% reduction in atmospheric contamination, through application of waste minimization, improvement of boiler functioning, operation and maintenance conditions. Also contributes to implementation of a capture system for particulate material.	0.8	ML
BIOLOGICAL	3.	L	95%	The introduction of 600 new hectares of oil palm, compared to the diagnosis of the soils and their present use, does not imply a great change. A 5% improvement is considered from the proposed management for water source protection strips and basic subsistence farms.	3.5	L
INSTITUTIONAL	NA***	-	100%	The company would go from not having an EMP and an EAS, to 100% implementation.	10.0	MH

\* Environmental Score

\*\* Environmental Importance

\*\*\* Not applicable

The bars in Figure 10 represent the environmental Score according to the sense of the impact. The bar to the left right corresponds to the element without implementing the EMP and the bar to the right, to the element applying the EMP.

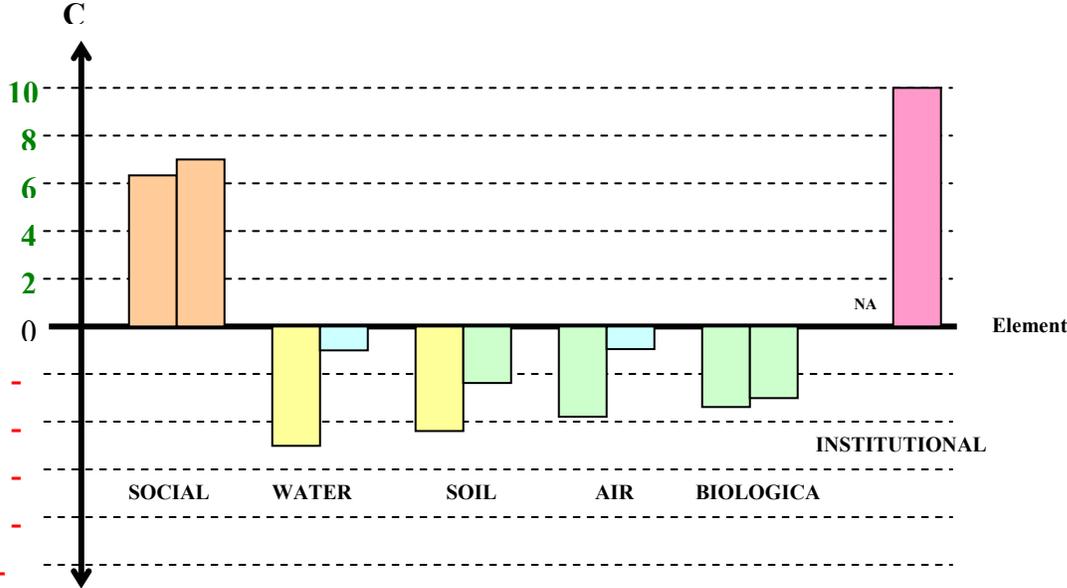


Figure 4. Contributions to Environmental Quality through application of the EMP

## SECTION 6 CONCLUSIONS

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1. The environmental diagnosis has enabled a determination of the pertinence of the project and its compatibility with the environment, given that this is region with an oil palm culture. But, furthermore, the proposal does not interfere with any zones regulated for special environmental management.
2. The BASELINE and its assessment allow the establishment of cumulative environmental impacts, both in the properties planted with oil palm and in the fields and other lands that will be subject to improvement and additional planting. In their order, the most important cumulative environmental effects are:
  - € Deterioration of the quality of water resources, due to an inadequate disposal of liquid discharges, mainly at the oil palm processing plant.
  - € Erosion gullies in the lands due to inadequate farming, pasturing and oil production practices.
  - € Atmospheric contamination, caused by emissions from the boilers of the FFB processing plant.
  - € Deficient health conditions in user housing, due to insufficient infrastructure for management and disposal of solid wastes and excreta.
  - € Loss of natural forest due to uncontrolled exploitation of natural and planted forests.
  - € Fragile social structure, caused above all by delicate security and public order conditions.
3. The Project and the proposed actions do not include any measure whose impacts cannot be prevented, mitigated and/or corrected. Which means that, in all cases, there is a technical feasibility of solving the problem. It is only necessary now, based on the information from the EIA and the Environmental Management Plan budget, to analyze cost- benefit in order to decide the total feasibility of the project.
4. The FFB processing plant is a deficient plant in terms of its organization, environmental management, technology, energy management and organization for production. Because certain aspects are substantially deficient, they are the cause of some of the most serious contamination problems detected and which may continue to occur.
5. The EIA has permitted the establishment of the following as the four most outstanding negative (real and potential) impacts: 1 – contamination of bodies of water and deterioration of water courses due to the generation and discharge of untreated liquid wastes. 2 – deterioration of the quality and quantity of organic soils, mainly due to land improvement processes for planting. 3 – deterioration of air quality, due to the generation of atmospheric emissions, and 4 – loss of biodiversity due to the substitution of the natural flora.

The high and positive score for the social element that is given as a result of the EIA is explained, briefly, by the perception of the project in the community, its potential with respect to factors such as official action and the possibilities of work and residential stability, in a region where informality, instability and a fragile participation in the opportunities provided by the institutions and the State policies in the region are prevalent. The project itself is a mitigation measure to the social problem constituted by the clandestine and illegal planting and marketing of coca leaves.

6. The stages of the Project which most contaminate and may continue to contaminate are in their order: 1- the Fresh Fruit Bunch (FFB) processing plant, 2- the production stage and, 3- the construction and operation of nurseries and pre-nurseries.
7. The implementation and periodic assessment of the proposed Environmental Management Plan, as well as the Follow-up and Monitoring Plan, would represent a significant and positive variation in the BASELINE as diagnosed. The social element would improve by 10%, the water resources would gain up to 80% in terms of quality, the soil would increase its environmental score from -4.2 to - 2.5 and the biological component would be benefited by 5%. Regarding this latter case, it is important to indicate that the oil palm agrosystems are included within the strategic biodiversity plan of the department of Norte de Santander.
8. From the environmental point of view, the present condition of the location is more negative and, on the contrary, the adoption of the project with the various measures identified, dimensioned, budgeted and planned would permit a substantial gain in the quality of the natural resources of the area of influence of the project.
9. The present conditions of the FFB processing plant indicate that its liquid discharge flow and load may represent an enormous economic burden due to the high values of retribution rates, which would have to be paid by the company to the environmental authorities, as established in Decree 901 of 1997. The quality of the discharges from this plant demands the payment of up to 100 million pesos per year, unless the mentioned treatment works are rapidly begun.
10. Before undertaking any effluent management and/or treatment system at the END OF THE PIPELINE, the company must give priority to the activities recommended in the management plan, related to CONTAMINATION CONTROL AT THE SOURCE.
11. The most important costs of the Environmental Management Plan relate to the following activities:

<b>Activity</b>	<b>Costs (Ps\$)</b>
1-Construction of excreta treatment and disposal systems for housing and administrative areas. (Does not include designs, operation and cost of the land).	272,000,000.00
2- Construction of the treatment plant for liquid wastes generated at the FFB processing plant.	160,000,000.00
3- Preventive measures and minimization plans for all types of wastes.	148,000,000.00
4- Management of soils, solid wastes and agrochemicals.	32,000,000.00
5- Management and treatment of atmospheric emissions (does not include design and operation)	30,000,000.00
<b>Total</b>	<b>642,000,000.00</b>

Although the EMP recommends many actions related to prevention, mitigation and correction of impacts associated with the ecology of the forests and soils, these are activities whose knowledge is assured in the formation of most personnel that work at activities related to planting and processing of African oil palm. This condition will permit a minimization of many of the costs, based on a good organizational scheme for the implementation and periodic assessment of the EMP.

## **SECTION 7    RECOMMENDATIONS**

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1. Submit for consideration by the environmental authority, the environmental assessment made with its respective products: Diagnosis, EIA, EMP; Follow-up and Monitoring Plan, Schedule and Budget, in order that, based on its positive opinion, it will be possible to develop the detail engineering stage and begin the pertinent works of the oil palm project in the Municipality of Tibú.
2. Adopt the procedure guidelines included as part of the card which develops the Environmental Administration System – EAS so that the company COOPAR Ltda. may begin the environmental organization process, obtaining the respective permits.
3. The COOPAR Ltda. Cooperative, as the entity in charge of the Project, must appoint and designate a person to lead the implementation and periodic assessment of the Environmental Administration System, which summarizes the most important elements of the Environmental Management Plan proposed and its results. This is not a case of creating useless bureaucracy and hierarchies, but rather of defining very clear responsibilities within the company, so that with good leadership, the proposed actions for a better environmental performance of the cooperative can materialize.
4. In order to minimize the costs of the EMP, it is recommended that the COOPAR Ltda. cooperative establish a relationship and joint management scheme with CENIPALMA and FEDEPALMA, which have, in addition to experience and knowledge, the function of advising their partners in these topics.
5. The company must urgently measure and characterize its liquid discharges. The non- existence of waste water minimization and treatment systems implies that in approximately in 20 months it would have to pay the authorities the total amount of the investment in the management and treatment infrastructure. This must be the first of the Mitigation works recommended in the Environmental Management Plan to be undertaken.
6. It is recommended that the project owners establish a critical route for the execution of EMP works, where the works related to compliance with the legal requirements, that is, those indicated by means of a darker color in the proposed schedule of activities, are given priority.
7. In order to minimize costs in the implementation of the works related to the basic sanitation of the houses of the associates operating the plantation, it is recommended to establish a cooperation alliance with the SENA, to carry out the training of individuals at the plantation or at least in the region, and to support the

constructive process. Thus, the problem would be resolved, training labor at the same time.

8. Before constructing any mitigation system based on waste treatment works, the company must develop and implement actions for the minimization and control of contamination at the source. These may have a slightly higher cost at first, but their investment will be recovered in a short time, as they optimize production systems and minimize operation and maintenance costs. There are two actions which must be urgently taken in this sense: 1- a Diagnosis of Waste Minimization Opportunities and 2- a Diagnosis of Technology and Process Optimization Opportunities. In both cases, much support can be obtained from FEDEPALMA, CENIPALMA and the CENTRO NACIONAL DE PRODUCCIÓN MÁS LIMPIA, which may be accessed with the cooperation of the Ministry of the Environment, as one of its most important partners.
9. Involve the plant and plantation personnel in the corrective activities indicated in the EMP.
10. Begin the training and pedagogy of the EMP, under the leadership of the social work office. The success and continuity of the EAS is based on capacity and motivation and the leadership attained with the personnel associated with the project.

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- ↓ *Cámaras Sectoriales /*
- ↓ *Industrias para la Protección de Cultivos*
- ↓ Documentos de la industria de agro-químicos y nexos a las compañías miembros de la ANDI.

**Environmental Protection Agency (EPA):** Toda la información sobre el registro de los plaguicidas en los EE.UU. [www.epa.gov/pesticides](http://www.epa.gov/pesticides)

- ↓ Bio-plaguicidas:  
[www.epa.gov/pesticides/biopesticides/ingredients/index.htm](http://www.epa.gov/pesticides/biopesticides/ingredients/index.htm)

- ↓ Situación de re-registro: <http://cfpub.epa.gov/oppref/rereg/status.efm>
- ↓ Plaguicidas prohibidos: [www.epa.gov/oppfead1/international/picklist.htm](http://www.epa.gov/oppfead1/international/picklist.htm)
- ↓ Plaguicidas en revisión especial: [www.epa.gov/oppsrrd1/specialreview.htm](http://www.epa.gov/oppsrrd1/specialreview.htm)
- ↓ Plaguicidas de uso restringido: [www.epa.gov/opprd001/rup/rupjun03.htm](http://www.epa.gov/opprd001/rup/rupjun03.htm) (al momento de hacer el PERSUAP, en agosto del 2003, actualizada a junio 2003)

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**Pesticide Action Network (PAN):** Bases de datos con información toxicológica, ecotoxicológica, de registro y otros sobre los plaguicidas en los EE.UU. y en otros países: [www.pesticideinfo.org/Index.html](http://www.pesticideinfo.org/Index.html). Más específicamente,

- ↓ para ingredientes activos: [www.pesticideinfo.org/Search\\_Chemicals.jsp](http://www.pesticideinfo.org/Search_Chemicals.jsp), o
- ↓ para productos comerciales: [www.pesticideinfo.org/Search\\_Products.jsp](http://www.pesticideinfo.org/Search_Products.jsp)
- ↓ para los plaguicidas colombianos:  
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[www.andeancenter.com](http://www.andeancenter.com)

## SECTION 9 TECHNICAL GLOSSARY

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**Free Fatty Acids (FFA):** Small carbon chains that break away from the structure of the Glycerol molecule (fundamental oil molecule) and give it unpleasant characteristics. Also called acidity.

**Sludge separator centrifuges or centrifuges:** Mechanical equipment that uses centrifugal force to separate oil from water.

**Harvest cycles:** Period of time, in days, between each harvest

**Clarifiers:** Circular or rectangular tanks in which oil is separated from water and impurities, through the force of gravity and flotation.

**Shell:** Portion outside the nut in the oil palm fruit, surrounding the kernel.

**Digesters:** Vertical cylindrical tanks provided with paddles, where the fruit is prepared in order to extract the oil in the presses.

**Sterilizer:** Equipment within the processing of the extraction plant where the fruit is sterilized.

**Florentines:** Grease traps as the final step in palm oil extractors designed to recover some oil and prevent certain accidental spills.

**Kudzú (*Pueraria phaseoloides*):** Grass most frequently used as cover in oil palm plantations.

**Tenera material:** The interspecific hybrid of the species *E. Guianeensis* and *E. Pisifera*. It is the type of material most commonly used nowadays in commercial plantations due to its higher mesocarp oil content which therefore produces more oil per bunch.

**Palmiste:** Palm kernel.

**Palmisteria:** Section of the extraction plant where the kernel is separated from the shell.

**Pruning:** Practice of removing some leaves from the palm.

**Subsolada:** Practice performed on the soils in order to correct their compaction.

**Fruit-removal drum:** Drum in the extraction plant where the fruit is separated from the properly broken up bunches, evacuating the empty bunches outside the extractor.

**Extraction rate or oil extraction percentage:** Ratio expressed as a percentage of the oil produced and the fresh fruit bunches processed.

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