

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

No. 52

MINISTRY OF AGRICULTURE AND ANIMAL RESOURCES
REPUBLIC OF COTE D'IVOIRE

STUDY
ON
THE INTEGRATED RURAL DEVELOPMENT PROJECT
IN
THE N'ZI RIVER MIDDLE BASIN

FINAL REPORT
(MAIN REPORT)

AUGUST 1995

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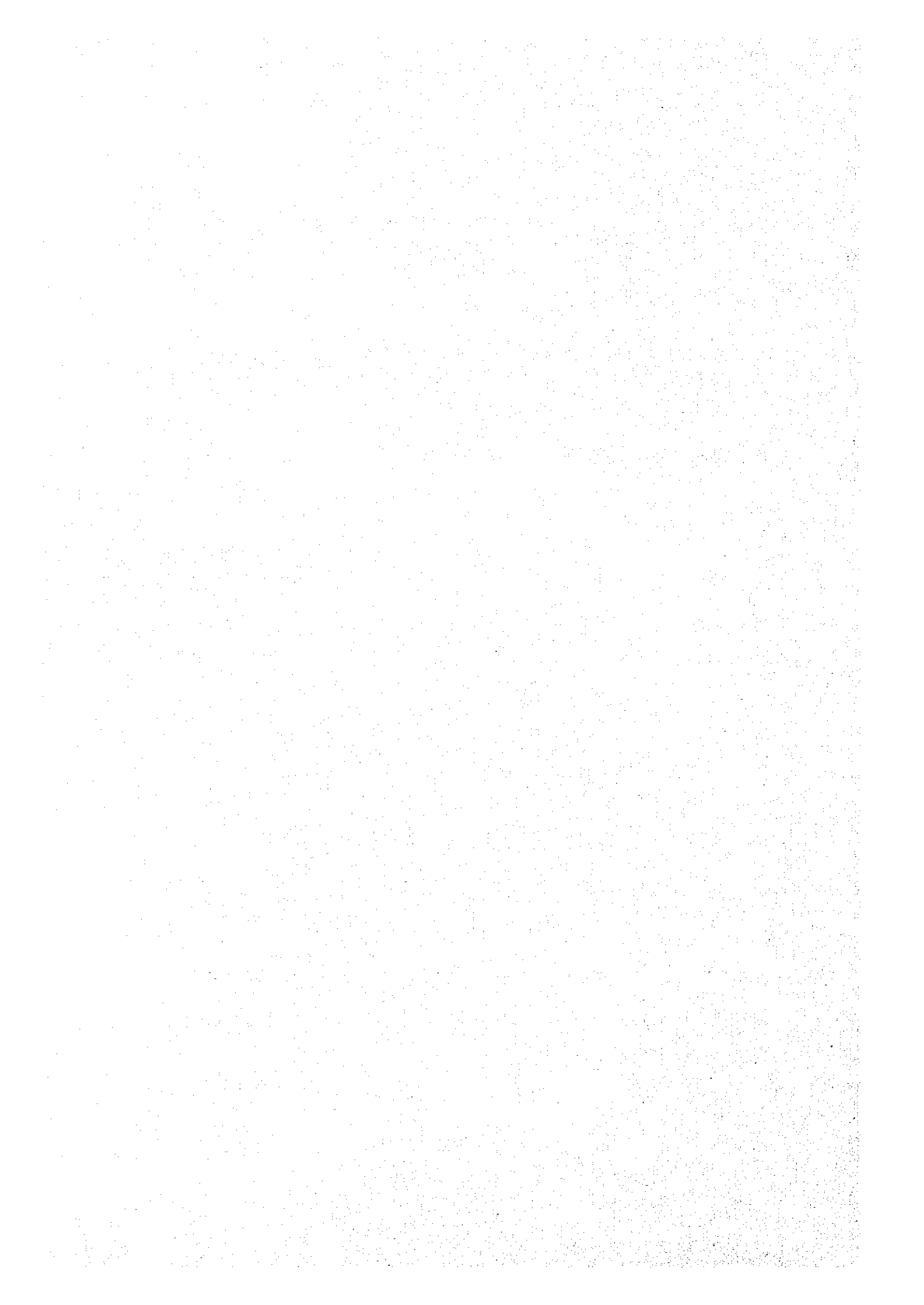
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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

**MINISTRY OF AGRICULTURE AND ANIMAL RESOURCES
REPUBLIC OF COTE D'IVOIRE**

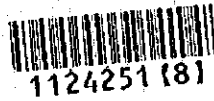
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The employed exchange rates : 1 US\$=100.8 Yen=5.29 France Franc,
1 France Franc=100 CFA Franc,
1 CFA Franc=0.19 Yen
(August 1994)



PREFACE

In response to a request from the Government of the Republic of Côte d'Ivoire, the Government of Japan decided to conduct the Master Plan and Feasibility Study on the Integrated Rural Development Project in the N'Zi River Middle Basin and entrusted this study to the Japan International Cooperation Agency (JICA).

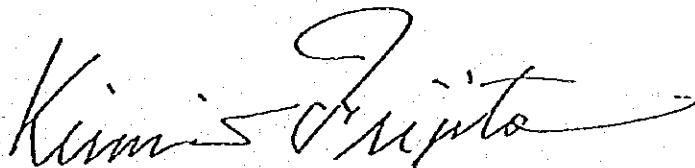
JICA sent to Côte d'Ivoire a study team headed by Mr. Toshihisa MURATA of Taiyo Consultants Co., Ltd., 4 times, from September 5th to December 18th, 1993, from April 10th to May 31st, 1994, from August 6th to October 11th, 1994 and from March 12th, 1995 to the 23rd of the same month.

The team held discussions with the officials concerned of the Government of Côte d'Ivoire, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Côte d'Ivoire for their close cooperation extended to the team.

August 1995



Kimio FUJITA

President

Japan International Cooperation Agency

August 1995

Mr. Kimio FUJITA
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. FUJITA,

Letter of Transmittal

We are pleased to submit to you the final report of the Study on the Integrated Rural Development Project in the N'Zi River Middle Basin of the Republic of Côte d'Ivoire. The report contains the advice and suggestions of the authorities concerned of the Government of Japan and your Agency as well as the formulation of the above mentioned project. Also taken into consideration are comments made by the Ministry of Agriculture and Animal Resources of Côte d'Ivoire during technical discussions on the draft report which were held in that country.

This report presents a scheme of development which focuses on increasing the production of rice and other food crops by utilizing the land, water, and other resources in the study area and will contribute to the government's agricultural policy for achieving self-sufficiency, restore the agriculture of this area that has been in a slump due to the recent decline in cacao and coffee production, and is expected to contribute greatly to alleviating the efflux of younger generation and building up the local economy by increasing the income of farming households and creating more employment opportunities.

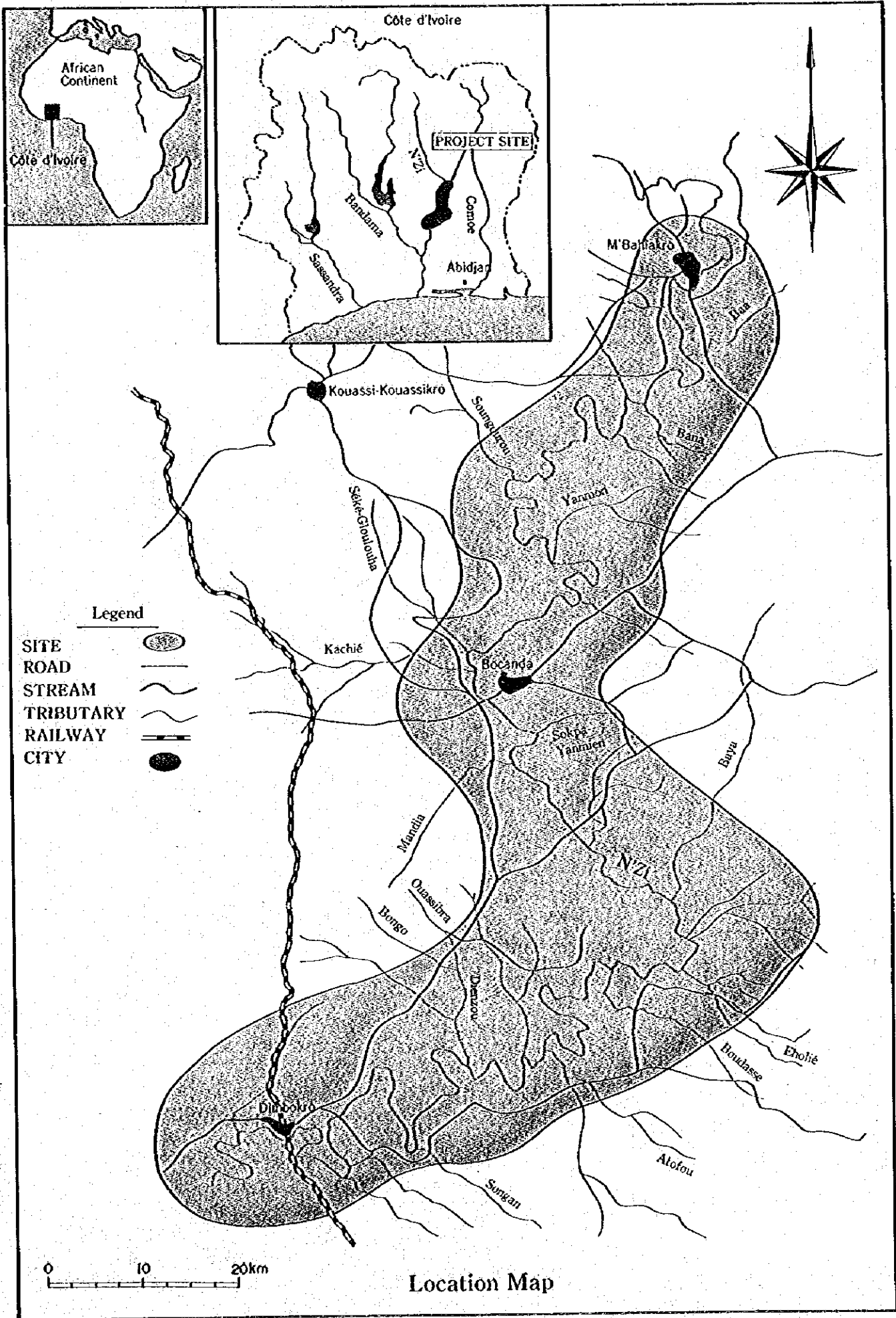
In view of the urgency of rural development in Côte d'Ivoire and of the necessity for socio-economic development of the country as a whole, we recommend that the Government of Côte d'Ivoire implement this Project as a top priority.

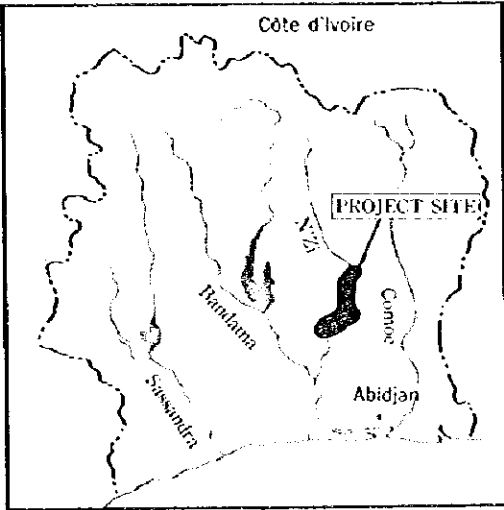
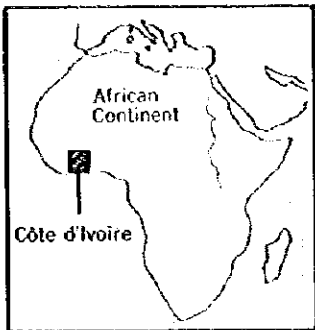
We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Agriculture, Forestry and Fisheries of Japan. We also wish to express our deep gratitude to the Ministry of Agriculture and Animal Resources and concerned agencies of Côte d'Ivoire for the close cooperation and assistance extended to us during our investigations and study.







Very truly yours,

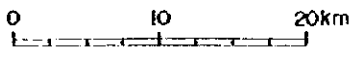
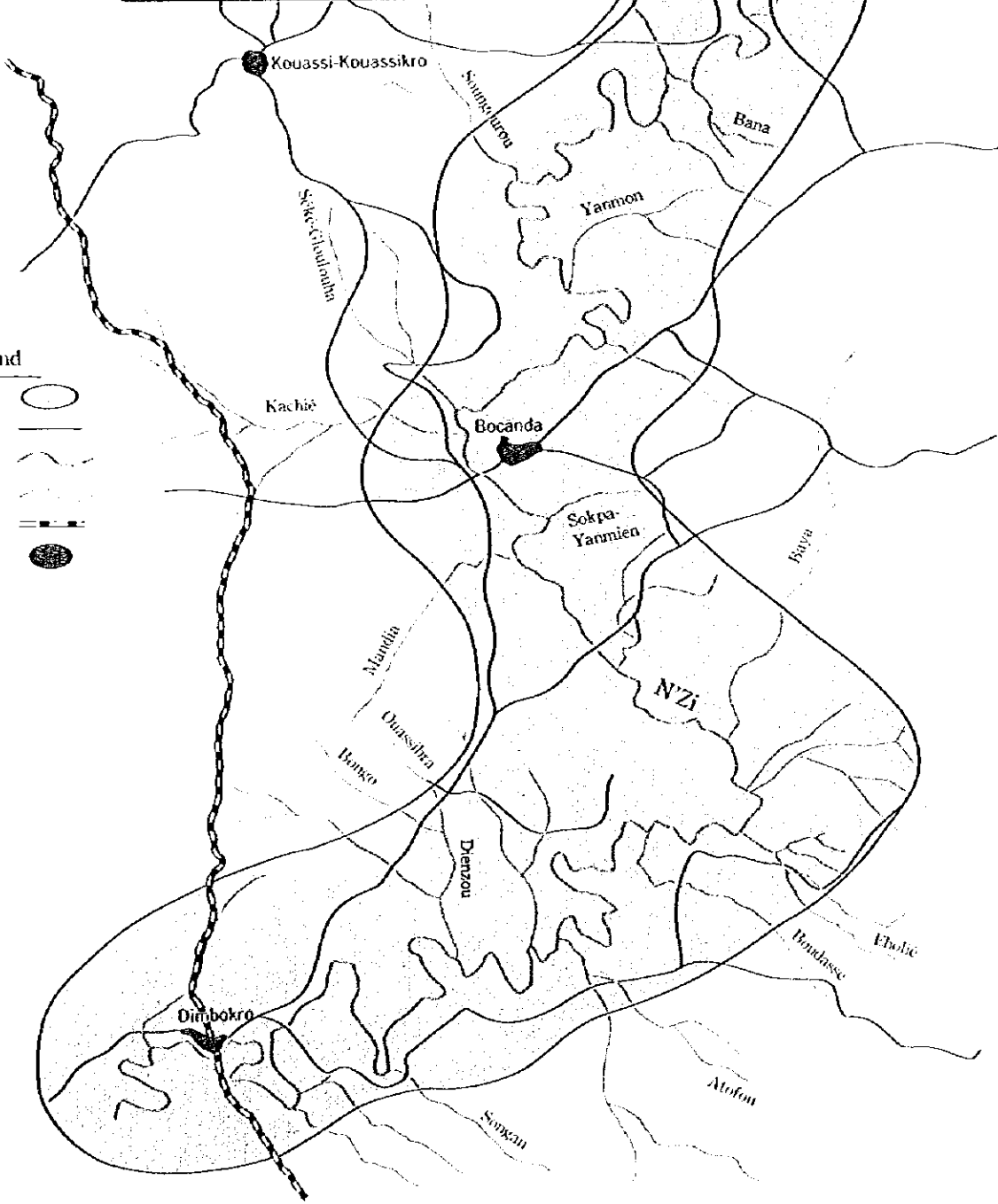


Toshihisa MURATA
Team Leader
Study on the Integrated Rural Development
Project in the N'Zi River Middle Basin
Taiyo Consultants Co., Ltd.

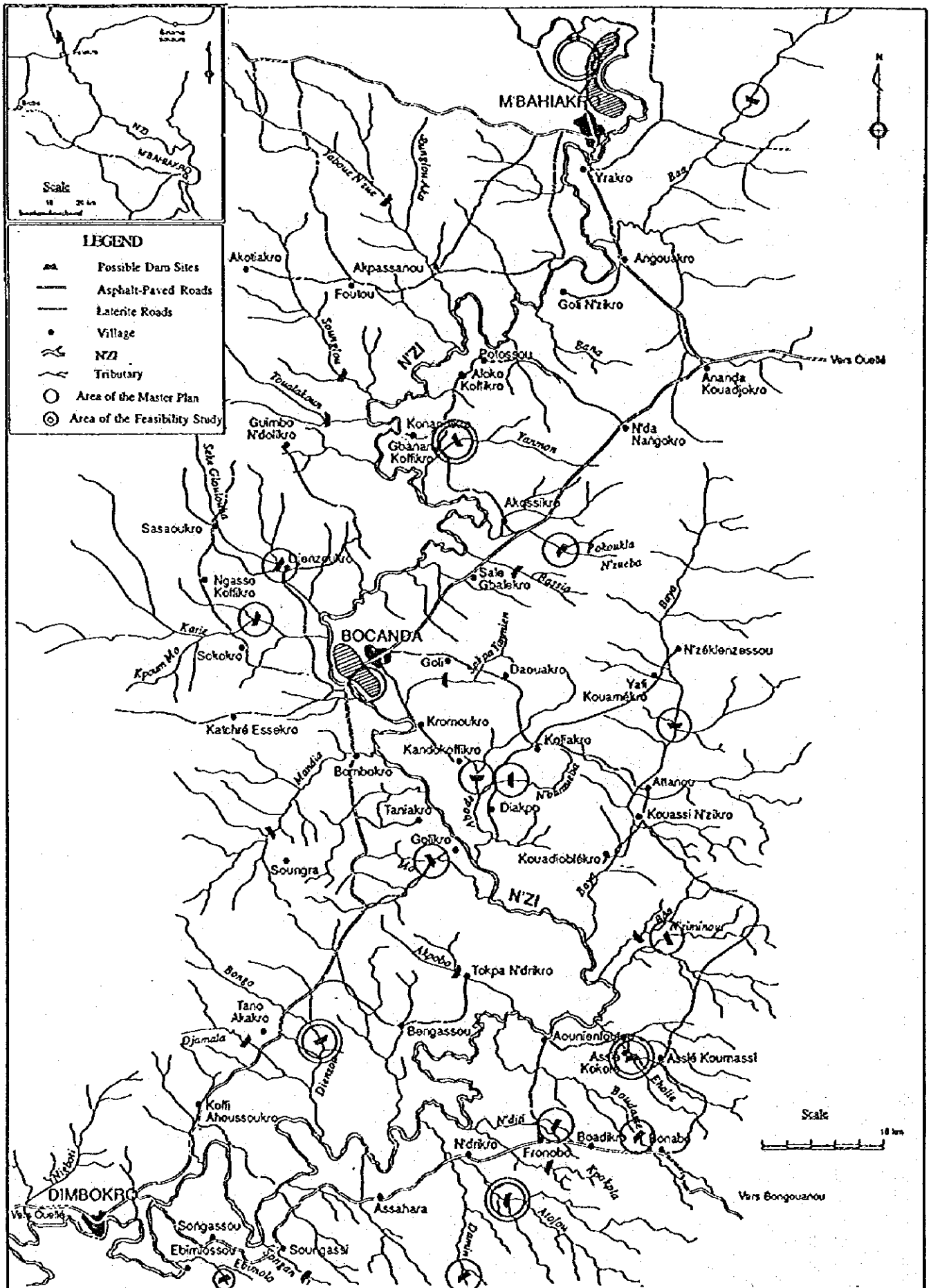




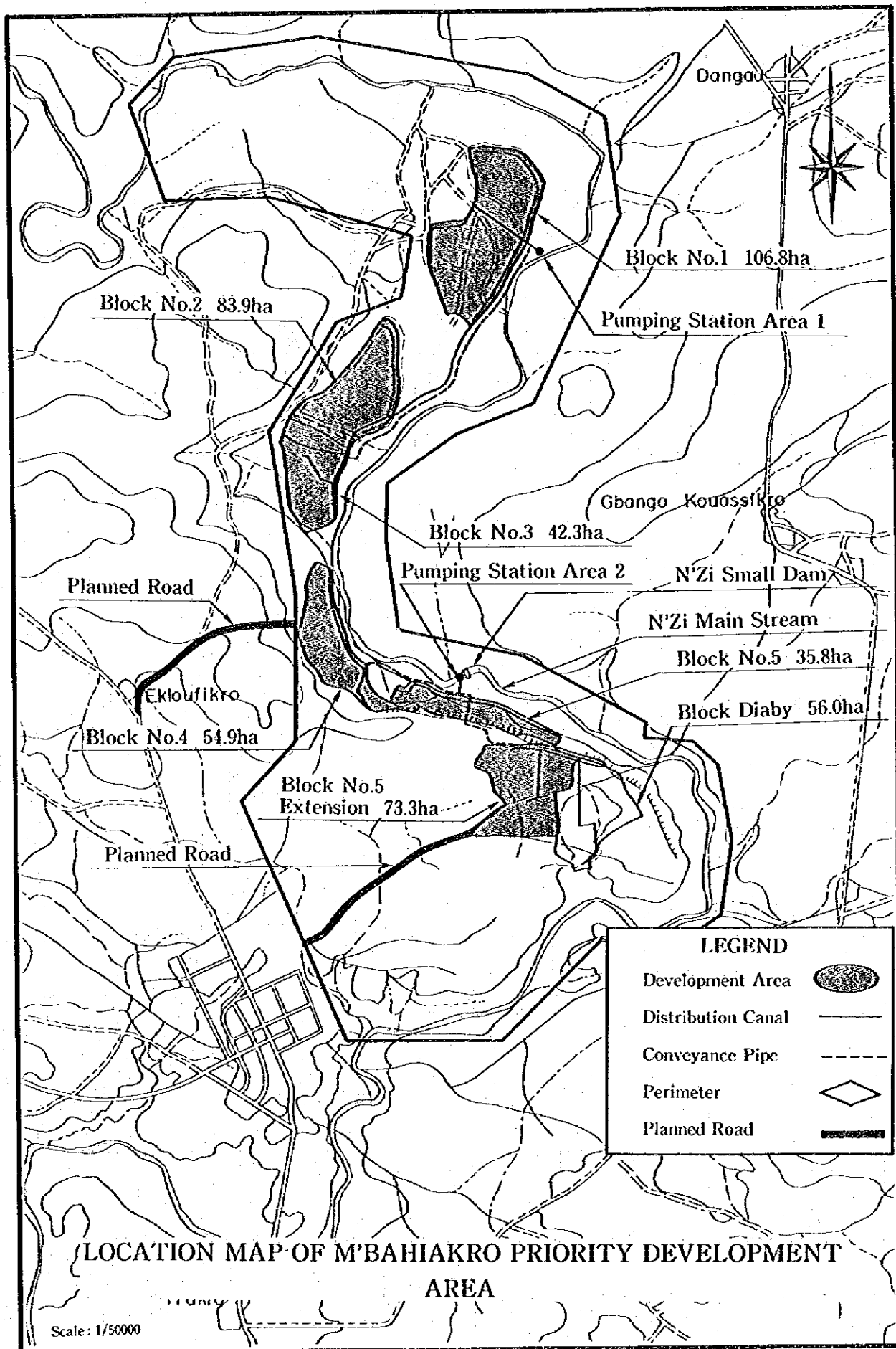
- Legend**
- SITE 
 - ROAD 
 - STREAM 
 - TRIBUTARY 
 - RAILWAY 
 - CITY 

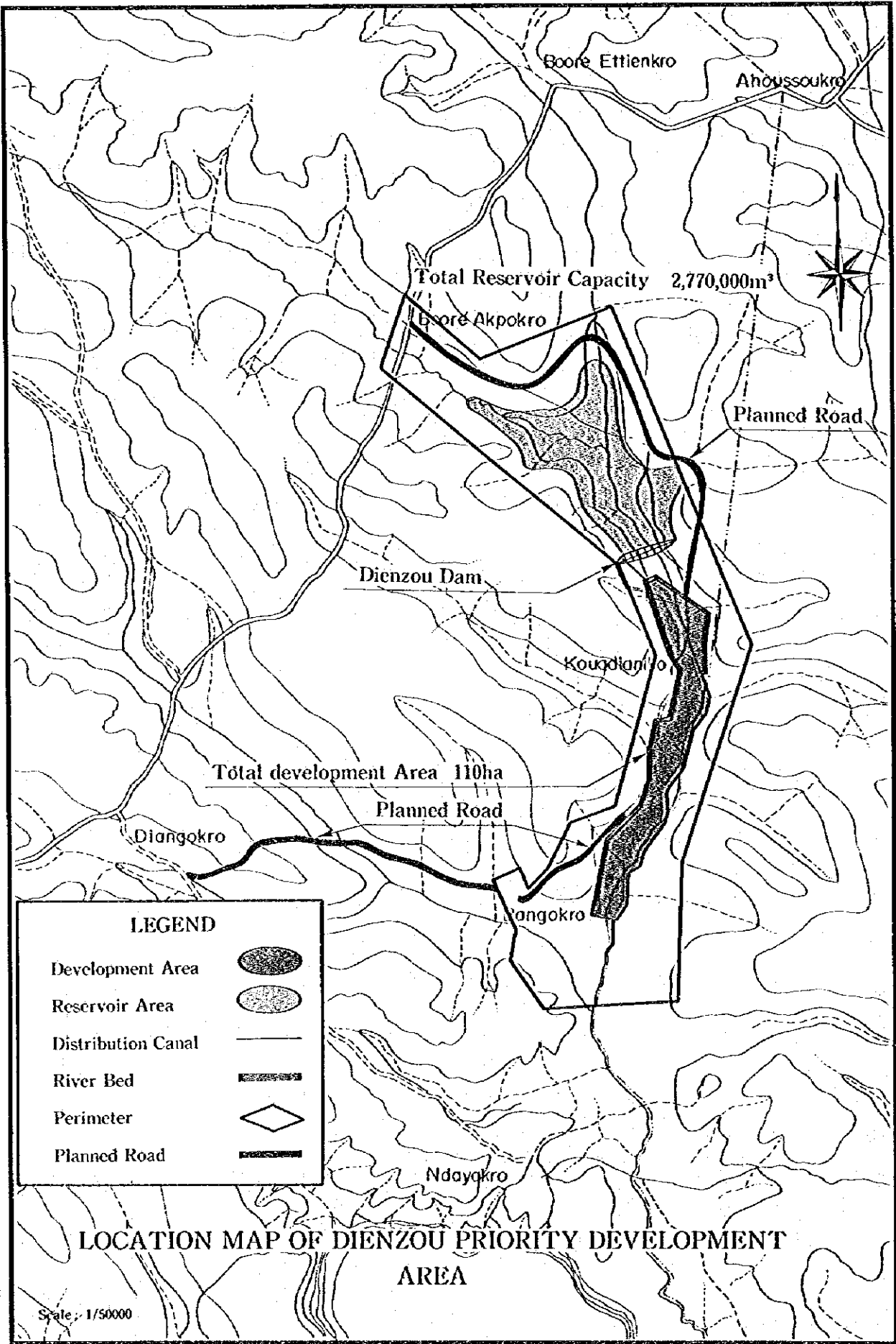


Location Map









Location Map of the Development Area concerned with the Master Plan Study



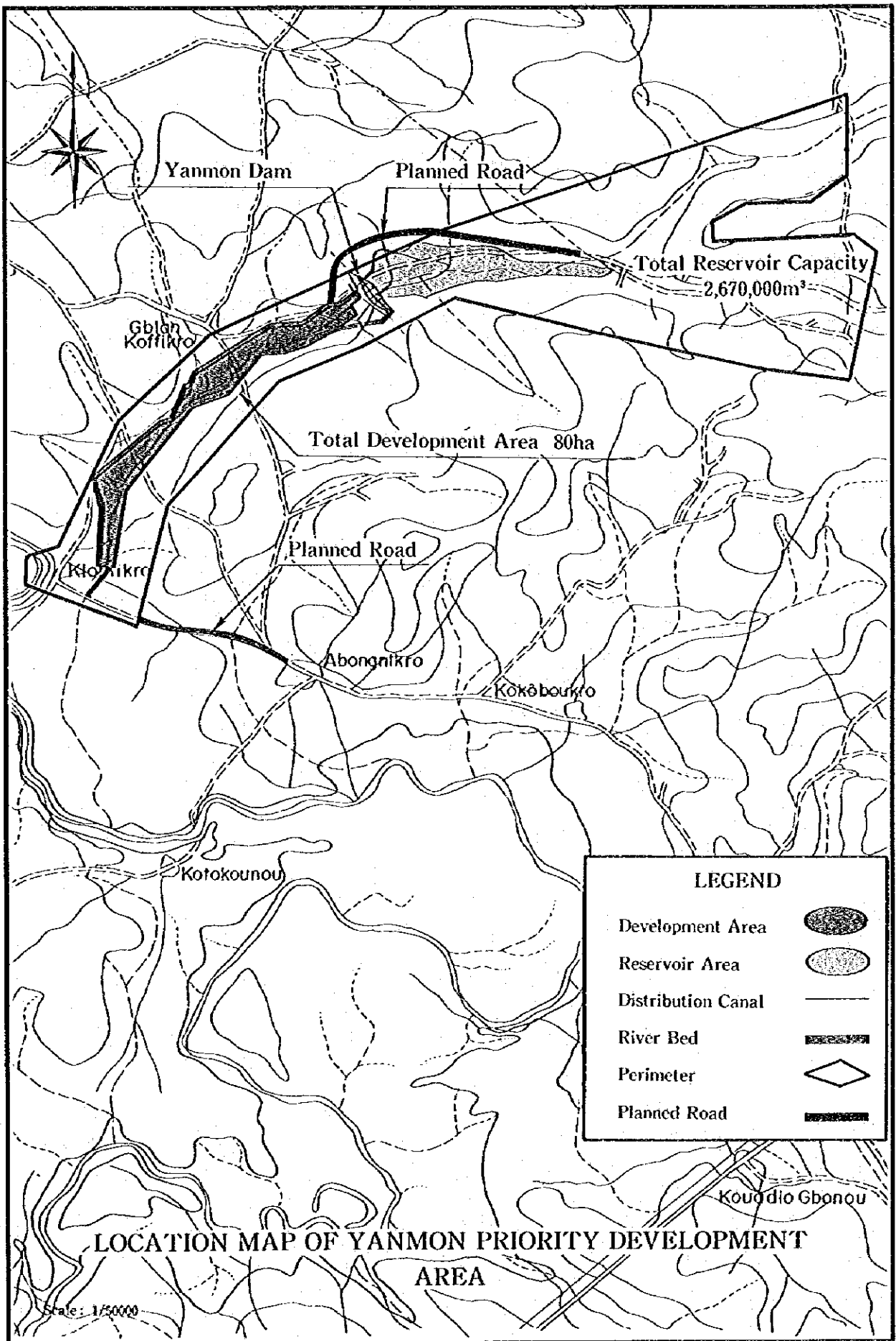


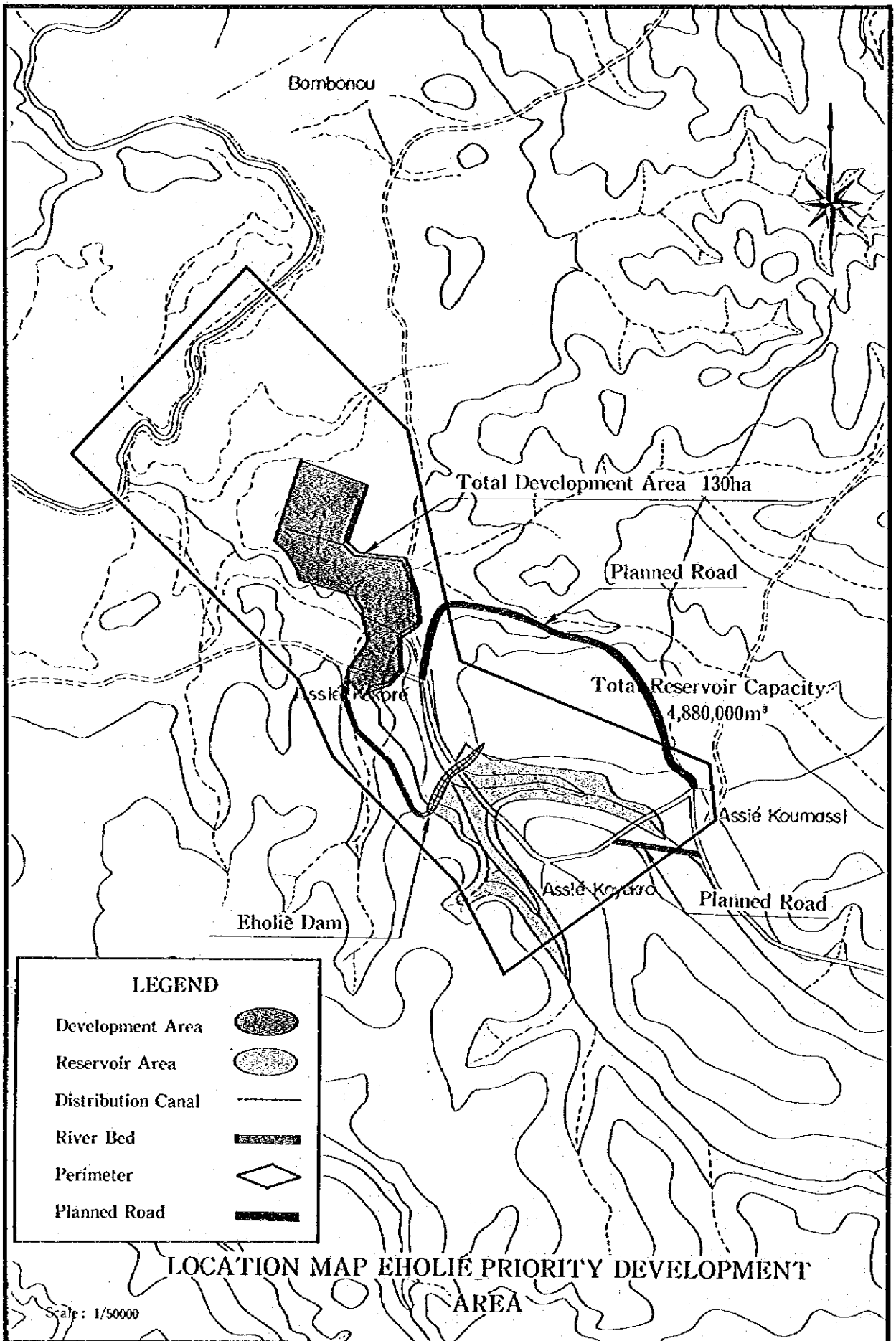
LEGEND

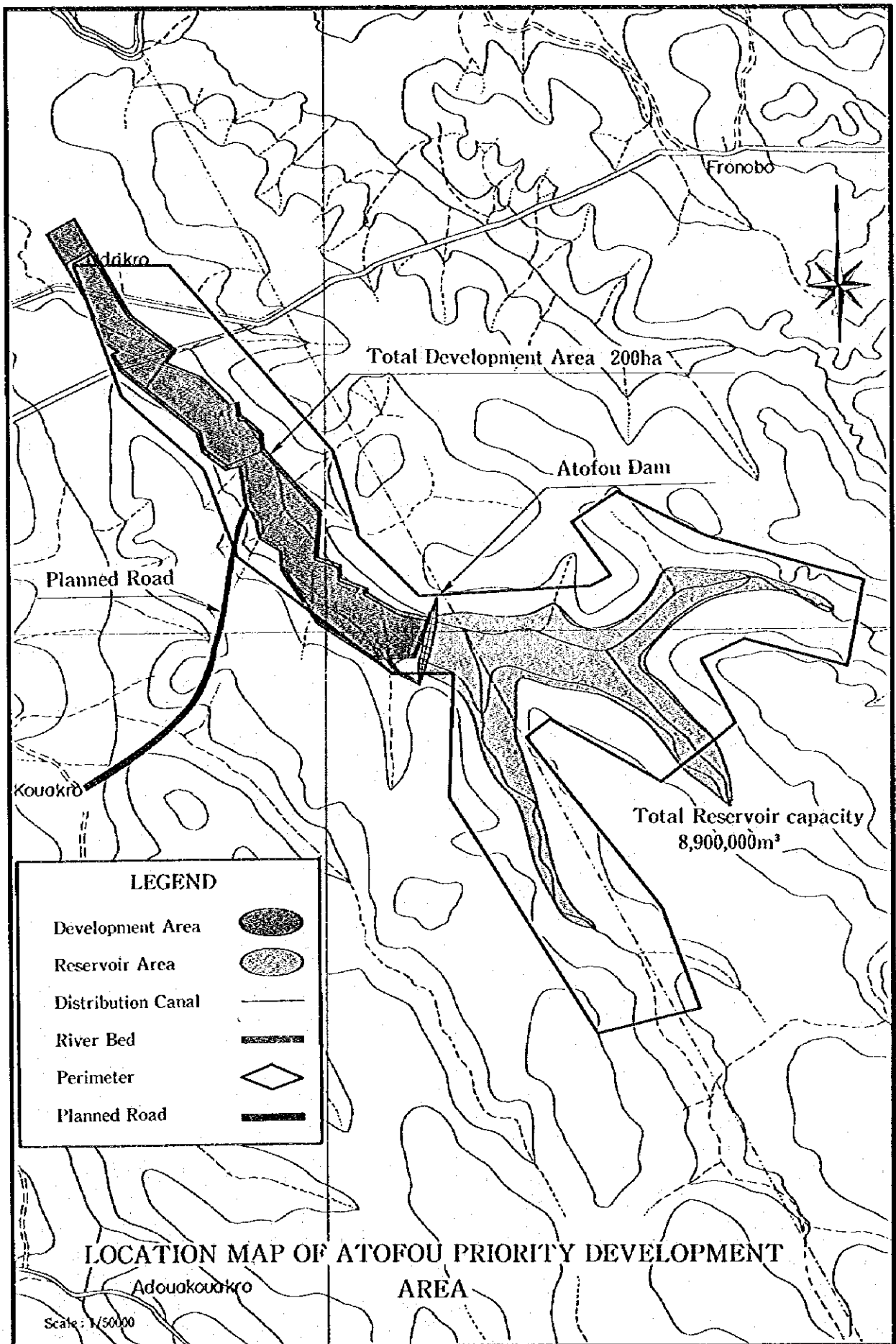
- Development Area 
- Reservoir Area 
- Distribution Canal 
- River Bed 
- Perimeter 
- Planned Road 

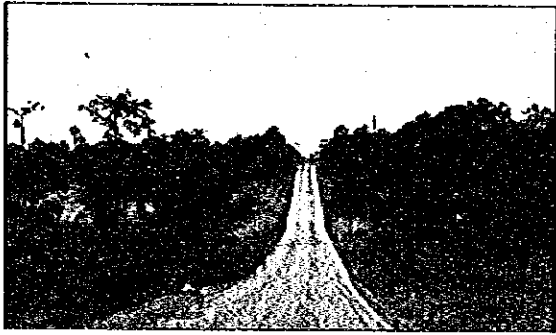
LOCATION MAP OF DIENZOU PRIORITY DEVELOPMENT AREA

Scale: 1/50000





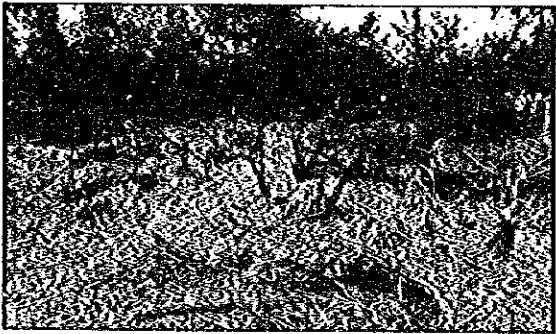




Two-Lane Road



**Dimbokro Provincial Office
(Ministry of Agricultural and Animal
Resources)**



Practice of Shifting Cultivation



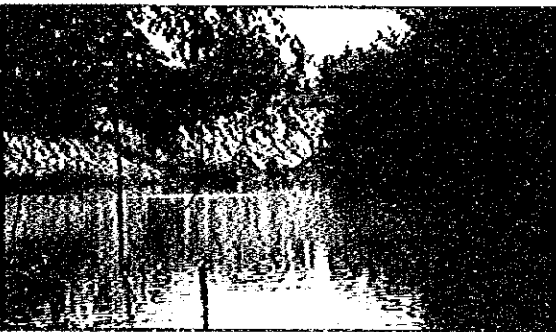
**Cropping of Cassava and Yam (Root Crops)
by Shifting Cultivation**



**Interviewing of Village-Chief and Seniors for
Permissions on Field-Surveys and Guides
(Guimbo NDolikro Village)**



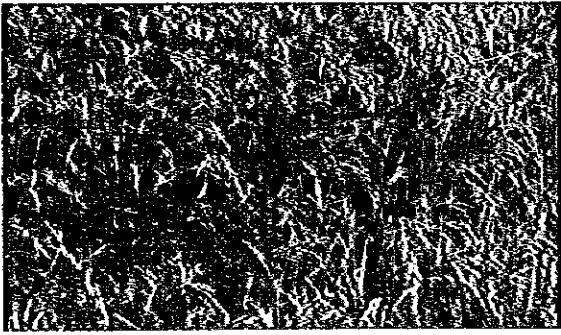
**Reserve Forests for Environmental
Conservation Purposes (Ahua Reserve Forest)**



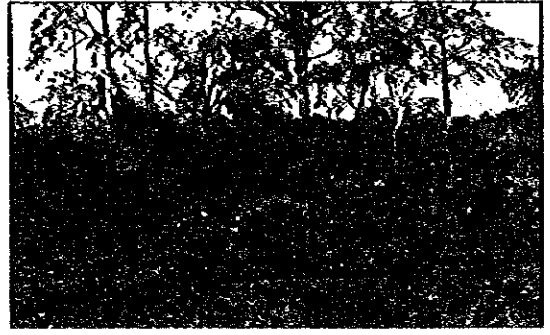
Mainstream of N'Zi River (near Iholie)



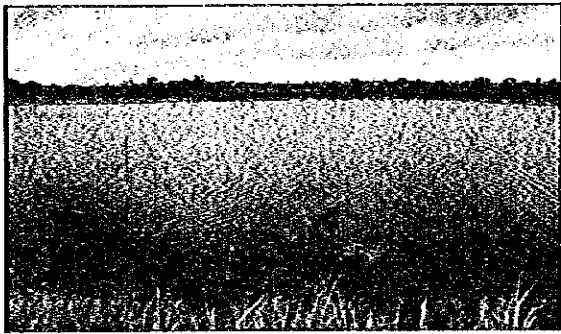
Mainstream of N'Zi River (near M'Bahiakro)



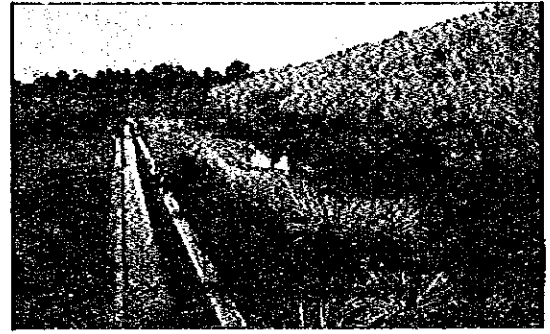
M'Bahiakro Area for Transplanted Paddy Field



Proposed Irrigated Area in Dienzou Area for Coffee Plantation



New Paddy Field Development at Adahou Village : Dam Reservoir



New Paddy Field Development at Adahou Village : Dam-Embarkment and Main Canal



Proposed Irrigated Area in Eholie Area for Oil Palm Plantation



Proposed Irrigated Area in Atofou Area for Upland Paddy Cultivation



Towards Atofou River



Explanation of the Draft Final Report

ABBREVIATIONS

ANADER	Agence Nationale d'Appui au Développement Rural. Rural Development Supporting Agency
ADRAO	Association pour le Développement de la Riziculture en Afrique de l'Ouest (WARDA). West Africa Rice Development Association
ANAM	Agence Nationale des Aérodrômes et de la Météorologie. National Meteorology Agency
BAD	Banque Africaine de Développement. African Development Bank
BIRD	Banque Internationale pour la Reconstruction et le Développement. International Bank for Reconstruction and Development
BNDA	Banque Nationale pour le Développement Agricole. National Bank for Agricultural Development
BOAD	Banque Ouest Africaine de Développement. West African Development Bank
CGPP	Caisse Générale de Péréquation des Prix des produits de Grande Consommation. General Treasury in charge of the Pricing of highly consumed products
CIDT	Compagnie Ivoirienne pour le Développement des Textiles. Textiles Development Public Corporation
CIDV	Compagnie Ivoirienne pour le Développement des Vivriers. Food Crops Development Public Corporation
CIRES	Centre Ivoirien de Recherches Economiques et Sociales. Socio-Economic Research Public Centre
COOPEC	Coopérative d'Epargne et de Crédit. Loan Cooperatives
CREP	Caisses Rurales d'Epargne et de Prêt. Rural Saving Fund
CSSPPA	Caisse de Stabilisation et de Soutien aux Prix des Produits Agricoles. Treasury for the Stabilization and Support of Agricultural Products Price
CTFT	Centre Technique Forestier Tropical. Tropical Forest Technical Centre
DCGTx	Direction et Contrôle des Grands Travaux. Management and Control of Detailed Designs and Works

ABBREVIATIONS (CONTINUED)

DD	Direction Départementale, MINAGRA. Departmental Directory, MINAGRA
DDETT	Direction Départementale de l'Équipement, des Transports et des Télécommunications. Telecommunications, Transports and Equipment Departmental Directory
DMC	Direction de la Mutualité et de la Coopération. Directory in charge of Mutual Aid and Cooperation
DME	Direction de la Modernisation des Exploitations. Directory for the Modernization of Operations
DR	Direction Régionale, MINAGRA. Regional Directory, MINAGRA
GI	Groupement Informel. Informal Group
GVC	Groupement à Vocation Coopérative. Cooperative Group
IDESSA	Institut des Savanes. Savanna Institute
INS	Institut National des Statistiques. National Institute of Statistics
IRAT	Institut de Recherche en Agronomie Tropicale. Tropical Agriculture Research Institute
JICA	Agence Japonaise de Coopération Internationale. Japan International Cooperation Agency
LBTP	Laboratoire de Bâtiment et des Travaux publics. Building and Public Works Laboratory
MEIT	Ministère de l'Équipement, des Transports et des Télécommunications. Ministry of Telecommunications, Transports and Equipment
MFPF	Ministère de la Famille et de la Promotion de la Femme. Ministry of Women Promotion and Family
MINAGRA	Ministère de l'Agriculture et des Ressources Animales. Ministry of Agriculture and Animal Resources
OCPV	Office d'aide à la Commercialisation des Produits Vivriers. Support to Commercialization of Food Crops
OMS	Organisation Mondiale de la Santé. World Health Organization

ABBREVIATIONS (CONTINUED)

ONG	Organisation Non-Gouvernementale. Non Governmental Agency
OPA	Organisation Professionnelle Agricole. Agricultural Professional Organization
ORSTOM	Office de la Recherche Scientifique et Technique d'Outre-Mer. Office for Overseas Technical and Scientific Research
PASA	Programme d'Ajustement Structurel Agricole. Agricultural Structural Adjustment Program
SATMACI	Société d'Assistance Technique pour la Modernisation de l'Agriculture en Côte d'Ivoire. Coffee and Cacao Development Public Corporation
SDTPT	Service Départemental des Travaux Publics et des Transports Departmental Office of Public Works and Transports
SODECI	Société de Distribution d'Eau en Côte-d'Ivoire. Water Distribution Public Corporation
SODEPALM	Société pour le Développement des Palmerais. Palm Trees Farming Development Public Corporation
SODEPRA	Société de Développement de la Production Animale. Animal Production Development Public Corporation
SODERIZ	Société pour le Développement de la Riziculture. Rice Farming Development Public Corporation
SODESUCRE	Société de Développement du Sucre. Sugarcane Farming Development Public Corporation
SOPAGRI	Société pour la Promotion de l'Agriculture. Public Corporation for the Promotion of Agriculture
SOPRORIZ	Société pour la Promotion de la Riziculture. Public Corporation for the Promotion of Rice Farming
SORIZCI	Société des Rizeries de Côte-d'Ivoire. Rice Mills Public Corporation
UTEXI	Union Industrielle de Textile de Côte-d'Ivoire. Côte d'Ivoire Textile Industry Union

PROBABILITY DISTRIBUTIONS

1. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} kx^2 & \text{for } 0 \leq x \leq 2 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k such that $f(x)$ is a probability density function.

2. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} kx & \text{for } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k such that $f(x)$ is a probability density function.

3. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} kx^2 & \text{for } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k such that $f(x)$ is a probability density function.

4. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} kx & \text{for } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k such that $f(x)$ is a probability density function.

5. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} kx^2 & \text{for } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k such that $f(x)$ is a probability density function.

6. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} kx & \text{for } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k such that $f(x)$ is a probability density function.

7. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} kx^2 & \text{for } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k such that $f(x)$ is a probability density function.

8. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} kx & \text{for } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k such that $f(x)$ is a probability density function.

9. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} kx^2 & \text{for } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k such that $f(x)$ is a probability density function.

10. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} kx & \text{for } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k such that $f(x)$ is a probability density function.

11. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} kx^2 & \text{for } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k such that $f(x)$ is a probability density function.

12. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} kx & \text{for } 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the value of k such that $f(x)$ is a probability density function.

MEASURES

mm	millimeter
cm	centimeter
m	meter
m²	square meter
m³	cubic meter
m³/s	cubic meter per second
km	kilometer
km²	square kilometer
MCM	Million of cubic meter
g	gram
kg	kilogram
t	metric ton
l	liter
ha	hectare
t/ha	ton per hectare
meq/l	milliequivalent per liter
°C	degree Centigrade
%	percentage
sec	second
F	Franc
F. CFA	Franc of the French-speaking communities of Africa
US\$	U.S. dollar
μS or micro S	micro Siemens

SUMMARY

[INTRODUCTION]

In response to the request of the Government of the Republic of Côte d'Ivoire, Japan International Cooperation Agency (hereinafter the final report of the Study) cial agency responsible for the implementation of technical cooperation programs of the Government of Japan, concluded the scope of work in February 1993 and the supplementary scope of work in September 1993 on the Master Plan Study on the Integrated Rural Development Project in the N'Zi River Middle Basin (hereinafter referred to as "the Study") with the Côte d'Ivoire side. Based on this scope of work, a team to conduct the Study (hereinafter referred to as "the Study Team") was dispatched to Côte d'Ivoire by JICA for the phase I field work from September 5 to November 3, 1993 and for the phase II field work from August 6 to October 11, 1994. After each phase, the Study Team conducted office work and formulated the Draft Final Report compiling the overall results of the Study. The Study Team made the final visit to Côte d'Ivoire to submit and explain the Draft Final Report to the Côte d'Ivoire side. The Study Team finally completed this Final Report taking into consideration the comments from the Côte d'Ivoire side.

The objectives of the Study are as follows;

- (1) to work out a master plan on the integrated rural development for approximately 150 thousand ha of the study area lower than about 120 m in altitude in the N'Zi river middle basin,
- (2) to conduct a feasibility study for approximately 1,000 ha of the development priority area selected in the Master Plan Study area, and
- (3) to carry out technology transfer to the counterpart personnel of the Côte d'Ivoire side in the course of the Study.

[BACKGROUND]

Côte d'Ivoire is situated in the south central part of West Africa facing the Gulf of Guinea and has a land area of 322,000 square kilometers and a population of 12,460,000. More than half (55%) of the total population consist of farmers, and 46% of the gross national income in 1992 was generated by the agricultural sector. Agricultural products accounted for 62% of the total export in 1991. These figures indicate that agriculture is the foundation of the country's economy.

Of the total planted acreage of 5.7 million hectares, 55% is occupied by such perennial crops as cacao and coffee, 41% is by such food crops as yam, cassava, banana, corn, rice and other vegetables, and 4% is by cotton and other industrial crops. While some cacao, coffee and other perennial/industrial crops are cultivated in modernized plantations, those in traditional rural villages are grown rather extensively in nearby forests and woods, and most of the food crops are produced with slash-and-burn method. Due to such circumstances, overall agricultural production of Côte d'Ivoire remains low compared to international standard.

Since her independence in 1960, Côte d'Ivoire has enjoyed steady economic growth throughout the most part of the 1970s supported by the production and export of cacao, coffee, and lumbers. However, the rapid growth period ended in the late 1970s due to sluggish trading of cacao and coffee beans in the international market, poor harvest caused by drought, etc., and the exhaustion of timber resources and subsequent production decline. Now the country's economy is having a difficult time.

Although the cacao and coffee still hold an important position in the agricultural sector, covering more than 50% of the total planted acreage, it can no longer be the driving force of the country's economy due to the recent slump as explained above. As for food crops, the population growth in recent years especially that in urban areas has led to an increase in the consumption of wheat and other grain products, importation of which is worsening the trade deficit. Although annual domestic rice production steadily increased from about 400,000 tons around 1980 to 700,000 tons around 1990, the self-sufficiency rate has remained at some 60% as the demand for rice also has increased.

Under such circumstances, the Government of Côte d'Ivoire formed the "Agricultural Development Master Plan" in 1993 to establish basic policies for agricultural affairs, which are to be actualized by the year 2015. For the production of cacao and coffee, the Master Plan calls for the implementation of measures that would focus on the restoration of weakened production capacity and the structural adjustment. In order to cope with the increasing population that grows at an annual rate of 3.7%, the Plan stresses the importance of increasing production of food crops especially that of rice, demand for which is growing faster than any other food crops. The Plan is quite ambitious to aim at increasing the rice production almost six times as much from 680,000 tons in 1990 to 3,990,000 tons in 2015 at an annual growth rate of 9.0%, the highest rate among the crops cultivated in the country.

[MASTER PLAN STUDY AREA]

The Master Plan Study Area covers approximately 150,000 ha in the N'Zi river middle basin between M'Bahiakro and Dimbokro. Administratively, the Study area is related to sub-prefectures of Dimbokro, Bocanda and Kouassi-kouassikro in Dimbokro department, sub-prefectures of Bongouanou and M'Batto in Bongouanou department, Ouelle sub-prefecture in Daoukro department and M'Bahiakro sub-prefecture in M'Bahiakro department. Dimbokro city, which is situated in the most southern part of the Study area, is 160 km linear distance to the north-north-west from Abidjan and 237 km transportation distance via trunk roads.

The Côte d'Ivoire Government attaches importance to increasing production of food, especially of rice in its agricultural policy, as mentioned previously. The current rice production in this country considerably depends on rain-fed cultivation, whose annual cropped area is reportedly around 530 thousand ha, compared with the irrigated cultivated area as small as 23 thousand ha. (1990, CIDV and CIDT). Because the rain-fed cultivation of rice is very unstable and low in productivity influenced by the conditions of rainfall, which varies a great deal from year to year in distribution and quantity, it is an important issue to promote development of the irrigated agriculture of stable and high productivity. While the irrigated agriculture mainly for rice production has been developed to a considerable extent in the western and northern areas of the Bandama river basin, to which the study area belongs, the study area remains underdeveloped on the irrigated agriculture despite of its vested conditions on climate and land and water resources which are almost the same level as those of irrigation-developed areas. Accordingly, the study area is noted as an important area to be developed from now on for the irrigated agriculture. On the other hand, as described later, coffee and cacao production, which had once significantly supported growth of agriculture and economy in the Study area, has remarkably declined for recent over 10 years, which has brought about decreased cash income of farmers and outflow of young people. Under the circumstances, how to restore and encourage agriculture and economy has become a key issue to be resolved in the Study area. Considering the above-mentioned issues, Côte d'Ivoire Government planned to conduct this Master Plan Study for the integrated rural development in the Study area.

[MASTER PLAN]

Basic concept

The term of the Master Plan is set from 1995 to 2015, so that its targeted termination of 2015 accords to that of "The Agricultural Development Master Plan" for the whole nation formulated by the Ministry of Agriculture and Animal Resources.

The Master Plan is formulated to present a strategy on the integrated rural development in the area of 150,000 hectares of the N'Zi river middle basin. The purposes of the integrated rural development are as follows:

- (1) to contribute to the national governmental policy to promote food self-sufficiency of the nation through increased production of food crops including rice,
- (2) to upgrade income, nutritious condition and living standard of rural population,
- (3) to encourage regional economy and to increase employment opportunities through vitalized production, processing and marketing of agricultural products, and
- (4) to contribute to environmental conservation

The Master Plan is to be formulated taking into consideration the national policies including the above-mentioned "The Agricultural Development Master Plan", suitability of land and climate, availability of water and manpower, environmental conservation and viability from technical, economical and social viewpoints.

With regard to agricultural development in the study area, it is justified to focus on the irrigated food production, particularly irrigated rice production, rationally combined with rain-fed upland crop cultivation, considering that (1) according to the national policy, importance is attached to increasing rice production to achieve the national food self-sufficiency, and (2) the study area has suitable climatic conditions as well as a considerable extent of available land and water resources for irrigated rice production, and (3) it is being explored among farmers and people concerned to introduce or to expand production of rice as a cash crop replacing cacao and coffee, whose production has recently declined a great deal.

With regard to basic approach for agricultural development, there are two different ways, namely a large scale development and a piling-up of small scale projects. In the study area, both the two ways are considered to be technically feasible. The large scale development is to develop the available water and land resources as much as possible in the study area through water control of the N'Zi river main stream by building a large dam on

the N'Zi upper stream. The other small scale type development is to develop resources step by step mainly through irrigated agriculture development by constructing small dams in tributaries and by utilizing the N'Zi main stream's existing water. Compared with the large scale type development, the small scale type development is considered to be relatively effective and efficient for the first stage systematic development of irrigated agriculture like that in the study area because it will bear earlier return of investment (early realization of production benefit), demand lower cost and be easily financed, be more simple on the project management and make it viable to mobilize traditional village communities.

Measures necessary for development should comprehensively be planned for successful implementation. This is very important for the modernized agriculture development in the study area, where the traditional shifting cultivation is still dominant and farmers are not at all familiar with modernized irrigated agriculture. Organization of farmers for water management and products marketing, supporting services for extension of advanced technology and input supply to farmers and installation of post-harvest facilities should comprehensively accompany irrigation and improved farm land development. Regarding rural infrastructure, roads are the most important and to be improved to respond transportation for increased production and communication for better living conveniences of villagers. Village water supply should also be studied to satisfy basic needs for living of villagers.

Development area

The development area is planned to be 4,613 hectares, comprised of sites supplied with water from tributary dams and those supplied with water lifted by pumps from the N'Zi main stream. Development sites were selected based on the study regarding their respective economical viability, soil suitability, existence of potential participants in the neighborhood and environmental aspects among technically feasible sites along tributary valleys and along the N'Zi main stream. The number of direct beneficiary farmers is estimated to be 9,300 and the number of beneficiary population including their families 58,000.

As for rain-fed agriculture, which is widely found in the study area, measures to improve its productivity are planned comprehensively. Measures to encourage animal and fish breeding are also studied.

<u>Development sites</u>	<u>Development area (hectares)</u>
17 districts of tributary dams	3,685
2 districts of pump irrigation along the N'Zi main stream	953
Total	4,638

Construction works

- Irrigation systems: dams in tributaries, low dams in the minor bed of the N'Zi main stream, pump stations to intake water from the N'Zi, canals
- On-farm works: 4,638 ha
- Post-harvest facilities: storehouses and rice mills
- Agricultural machinery: walking type tractors and threshers
- Rural roads: 47.9 km
- Water supply for villages (drilled wells with manual pumps): 44 sets

Supporting services

- Organization of farmers: producers' groups at field level (mostly of big families, cooperatives (GVC) at village level and associations of GVCs at department or sub-prefecture level will be established for cooperative activities including production, collection and storage of products, milling and sales
- Extension and training of farming technology and water management: Supporting units composed of ANADER and other organizations concerned will be established to be engaged in extension service and training for farmers. Farmers will be trained on agricultural machinery at Grand-Lahou Agricultural Machinery Training Center.
- Agricultural credit: Farming fund will be arranged for short term credit for production input such as seed and fertilizers and for medium term credit for machinery and milling equipment.

Project costs (Investment costs)

Items	Unit mil. F.CFA	
	Non Taxed Amount	Total
Irrigation and drainage facilities		
-17 tributary dam sites	48,679	60,809
-2 N'Zi main river pump-irrigated sites	12,281	15,351
Sub-total	60,960	76,160
Storehouses & milling equipment	647	872
Agricultural machinery	994	1,381
Rural roads 47.9 km	1,053	1,316
Village water supply 44 drilled wells	300	375
Detailed design & supervision 10% of construction costs	6,296	7,870
Project administration & supporting services	507	507
Fund for farming credit (production expenditure)	1,200	1,200
(machinery & equipment)	(1,362)	(1,362)
Total	71,957	89,681
Contingency 10% of the total investment cost	7,195	8,968
Grand-total	79,152	98,649

Note; Exchange rate (as of August 1994); 1 US\$ = 100.18 yen = 5.29 F (France) = 529 F.CFA.
1 F.CFA is, therefore, calculated at 0.19 yen.

Implementation Period

The construction works will be carried out from 1995 to 2015. A part of assistance projects will be continued after 2015.

Project Evaluation

The internal rates of return for the 19 sites selected in the Master Plan are as follows:

Development site		Area of development (ha)	Internal rate of return (%)
Tributary dam irrigation	17 sites	3,685	3.2 - 11.4
Main stream pump irrigation	2 sites	953	7.5 - 8.3
Total		4,638	

As for the financial standing of farming households, it is assessed sound and sustainable if they have an access to appropriate agricultural assistance.

Carrying out the rural development project according to the Master Plan is expected to (1) contribute to the government's plans to secure food and improve self-sufficiency in order to cope with the growing population, (2) play an significant role in restoring and enhancing the agriculture and economy of this area that have been in a slump due to the decline in cacao and coffee production, and (3) contribute greatly to alleviating the efflux of young laborers by upgrading the income-level and living standard of rural population and by creating more employment opportunities.

[DEVELOPMENT PLAN FOR THE DEVELOPMENT PRIORITY AREA]

Selection of development priority area

The scope of work provides that the development priority area of 1,000 ha be selected and a feasibility study for that be conducted. Five schemes of the development priority area were selected based on the study of development scale, economic viability, soil suitability, existence of participating farmers, environmental aspect, access and experience of rice cultivation of related farmers. The development area is planned to be 973 ha and the number of direct beneficiary farmers is estimated to be 1,340 and the number of beneficiary population 8,340.

Schemes	Sub-prefecture	Development area (ha)	Irrigated area (ha)	Rain-fed area (ha)
M'Bahiakro	M'Bahiakro	453	432	21
Dienzou	Dimbokro	110	90	20
Yanmon	Bocanda	80	65	15
Eholie	Bongouanou	130	105	25
Atofou	M'Balto	200	190	10
Total		973	882	91

Construction works

- Irrigation & drainage facilities:

M'Bahiakro; a low dam on the minor bed of the N'Zi, 2 pump stations to lift irrigation water from the N'Zi and canals

Dienzou, Yanmon, Eholie and Atofou; a tributary dam to supply water by gravity and canals for each scheme

- On farm works: 973 ha for 5 schemes
- Post-harvest facilities: storehouses and rice mills
- Agricultural machinery: Walking type tractors and threshers
- Rural roads: 28.9 km
- Village water supply: 13 drilled wells with manual pumps for 10 villages

Supporting services

- Organization of farmers: producers' groups at field level (mostly of big families), cooperatives (GVC) at village level and associations of GVCs at department or sub-prefecture level will be established for cooperative activities including production, collection and storage of products, milling and sales
- Extension and training of farming technology and water management: Supporting units composed of ANADER and other organizations concerned will be established to be engaged in extension service and training for farmers. Farmers will be trained on agricultural machinery at Grand-Lahou Agricultural Machinery Training Center.
- Agricultural credit: Farming fund will be arranged for short term credit for production input such as seed and fertilizers and for medium term credit for machinery and milling equipment.

Investment costs

Items	Unit ; 1000 F.CFA				
	Foreign C.	Local C.	Non Taxed Amount	Taxes	Total
Irrigation & drainage facilities					
-M'Bahiakro District	4,144,049	1,596,989	5,741,038	1,435,260	7,176,298
-Dienzou District	1,352,931	779,278	2,132,209	529,971	2,662,180
-Yannou District	1,136,494	644,330	1,780,824	444,868	2,225,692
-Eholie District	1,697,915	959,631	2,657,546	663,627	3,321,173
-Atofou District	2,091,679	1,266,167	3,317,846	825,645	4,143,491
Sub-total	10,423,068	5,206,395	15,629,463	3,899,371	19,528,834
Post-harvest facilities	148,726	34,754	183,480	63,728	247,208
Agricultural machinery	140,580	15,620	156,200	60,745	216,945
Rural roads	409,361	220,502	629,863	157,466	787,329
Village water supply	61,191	27,560	88,751	22,188	110,939
Detailed design & supervision	1,074,551	578,605	1,653,156	413,289	2,066,445
Project administration & supporting services	98,550	35,430	133,980	0	133,980
Fund for credit, production expenditure	-	246,534	246,534	0	246,534
machinery & equipment		(284,780)	(284,780)	0	(284,780)
Total	12,356,027	6,365,400	18,721,427	4,616,787	23,338,214
Contingency	1,234,973	636,600	1,871,573	461,679	2,333,821
Grand total	13,591,000	7,002,000	20,593,000	5,078,466	25,672,035

Note 1 ; The figures calculated into "Post-harvest facilities" and "Agricultural equipment" are listed again in the cost for "Agricultural equipment, etc." under "Farm management fund."

Note 2 ; Exchange rate (as of August 1994); 1 US\$ = 100.18 yen = 5.29 F(France) = 529 F.CFA.
1F.CFA is, therefore, calculated at 0.19 yen.

Implementation Period

Construction works will be executed over a period of four years. However, agricultural supporting services will be continued after the completion of the construction works.

Project Evaluation

The internal rates of return for all of the development priority area and each site are as follows:

Name of site	Irrigation method	Area of development (ha)	Internal rate of return (%)
Total for priority areas		973	5.9
M'Bahiakro	Water-pumps along the main stream	453	7.5
Dienzou	Dam irrigation along tributaries	110	4.6
Yanmon	"	80	3.8
Eholie	"	130	4.3
Atofou	"	200	6.0

The internal rates of return slightly exceed the opportunity cost of 5% (according to Ministry of Agriculture and Animal Resources) in some sites, but fall short in others. Financial standing at household level is assessed sound and sustainable if they have an access to appropriate agricultural assistance. Although the internal rate of return of the site adopting the main-stream pump method is higher than those of sites adopting the dam irrigation method along the tributaries, it is difficult to conclude which method is more economical because drawing water by the force of gravity from small dams built along the tributaries is much easier to operate and manage and requires significantly less maintenance cost. Implementation of this project (1) is consistent with the primary goals of the government plan for securing food and improving self-sufficiency in order to cope with the growing population, (2) will play a leading role in restoring and enhancing the agriculture and economy of this area that have been in a slump due to the decline in cacao and coffee production, and (3) is expected to contribute greatly to alleviating the efflux of young people by upgrading the income level and living standard of rural population and by creating more employment opportunities.

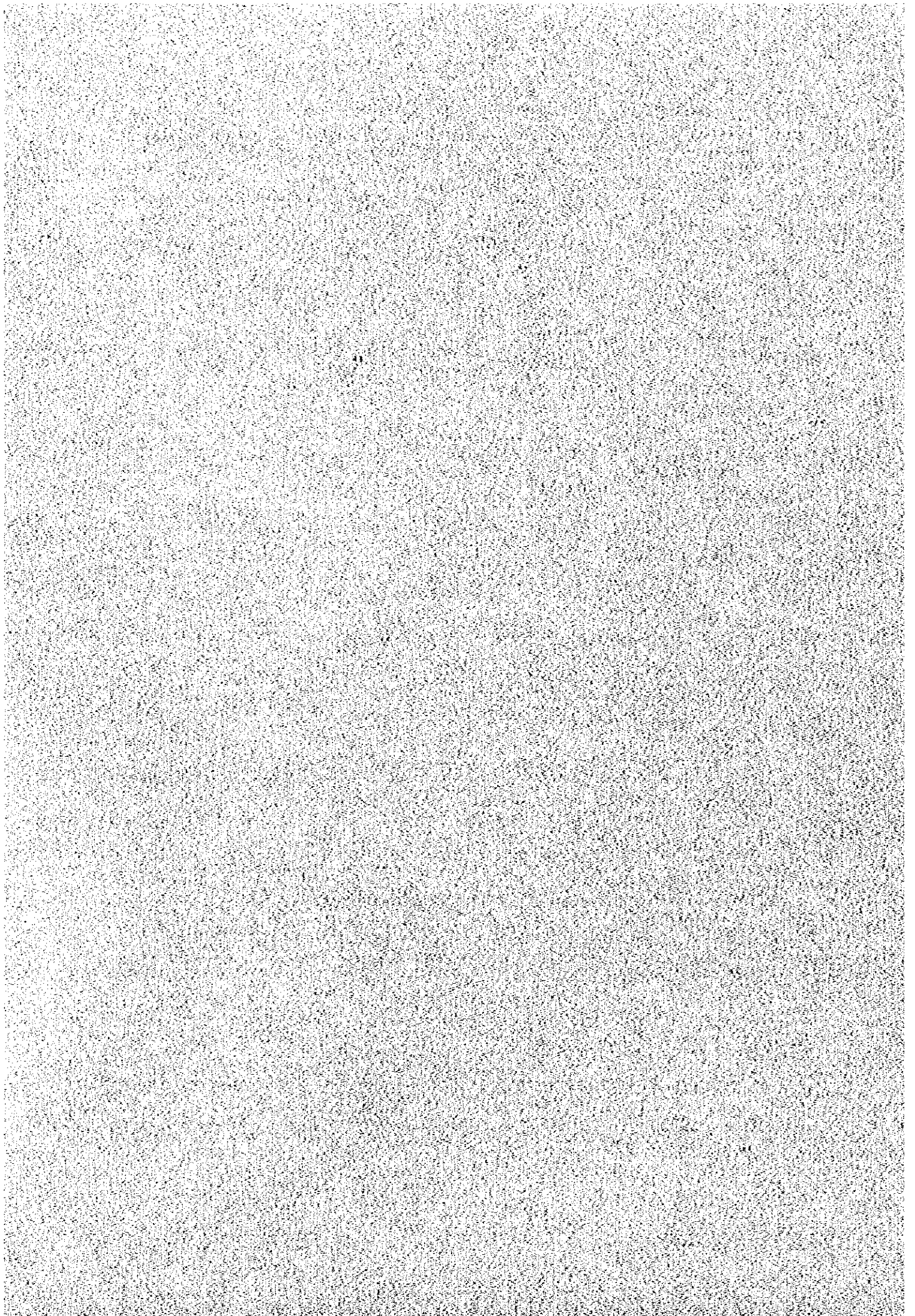
[RECOMMENDATIONS]

(1) After examining the current situation and the potential for rural development of the 150,000-hectare study area in the middle basin of the N'Zi River from various standpoints, we have worked out the Master Plan for the integrated rural development project targeting an area of 4,638 hectares, whose size is deemed appropriate for a project to be completed by the year 2015. Development priority sites with a total area of 973 hectares were selected, and feasibility study was conducted for these sites in order to make a development plan which is technically, economically, and socially viable.

(2) Carrying out the integrated rural development project, which focuses on increasing the production of rice and other food crops by utilizing the land, water, and other resources in the study area according to the Master Plan, will contribute to the government's agricultural policy for achieving self-sufficiency, will restore the agriculture of this area that has been in a slump due to the recent decline in cacao and coffee production, and is expected to contribute greatly to alleviating the efflux of younger generation and building up the local economy by increasing the income of farming households and creating more employment opportunities. Thus, it is recommended that the Government of Côte d'Ivoire implement the project in the development priority area of the study area that are established as model sites to acquire experience and then carry out the works laid out in the Master Plan one by one.

(3) In the Master Plan and the development plan for the development priority area, it is recommended to implement the project by integrating the construction of warehouses and rice mills, procurement of agricultural equipment, improvement of access roads, establishment of farmer's organization, education and training, establishment of a farm-management fund along with the development of irrigation and drainage systems and farm land. In order for the farmers and farmers' organizations in the study area who are inexperienced in modern irrigated farming to become successful in farming and operating an agricultural cooperative, it is important to integrate all components and implement them simultaneously. Organizing farmers' associations and providing education and training in farming techniques are especially crucial for smooth maintenance of irrigation and drainage facilities, cultivation of crops, and sales of farm products as well as giving sufficient consideration to establishing a fund to cover the cost for starting irrigated farming and purchasing agricultural equipment for the farmers, who currently have no access to effective agricultural credit. Also, it is desirable to develop rural road and village water-supply systems while building infrastructure for farming in order to assist the settlement of people in the villages.

(4) In order to smoothly implement the project while integrating various components as mentioned earlier, it is recommended that the Ministry of Agriculture and Animal Resources, the executing agency of the project, should establish an effective implementing system, in which the relevant organizations of the central government and the study area can cooperate closely. As for the farmers related to the development districts, it is recommended to (1) confirm their willingness to participate in the project before implementing the project in the district, (2) thoroughly explain about the project, and (3) employ the farmers in the construction works so that they can develop a sense of participation in the project and earn funds for future farming.



REPUBLIC OF COTE D'IVOIRE

**STUDY
ON
THE INTEGRATED RURAL DEVELOPMENT PROJECT
IN
THE N'ZI RIVER MIDDLE BASIN**

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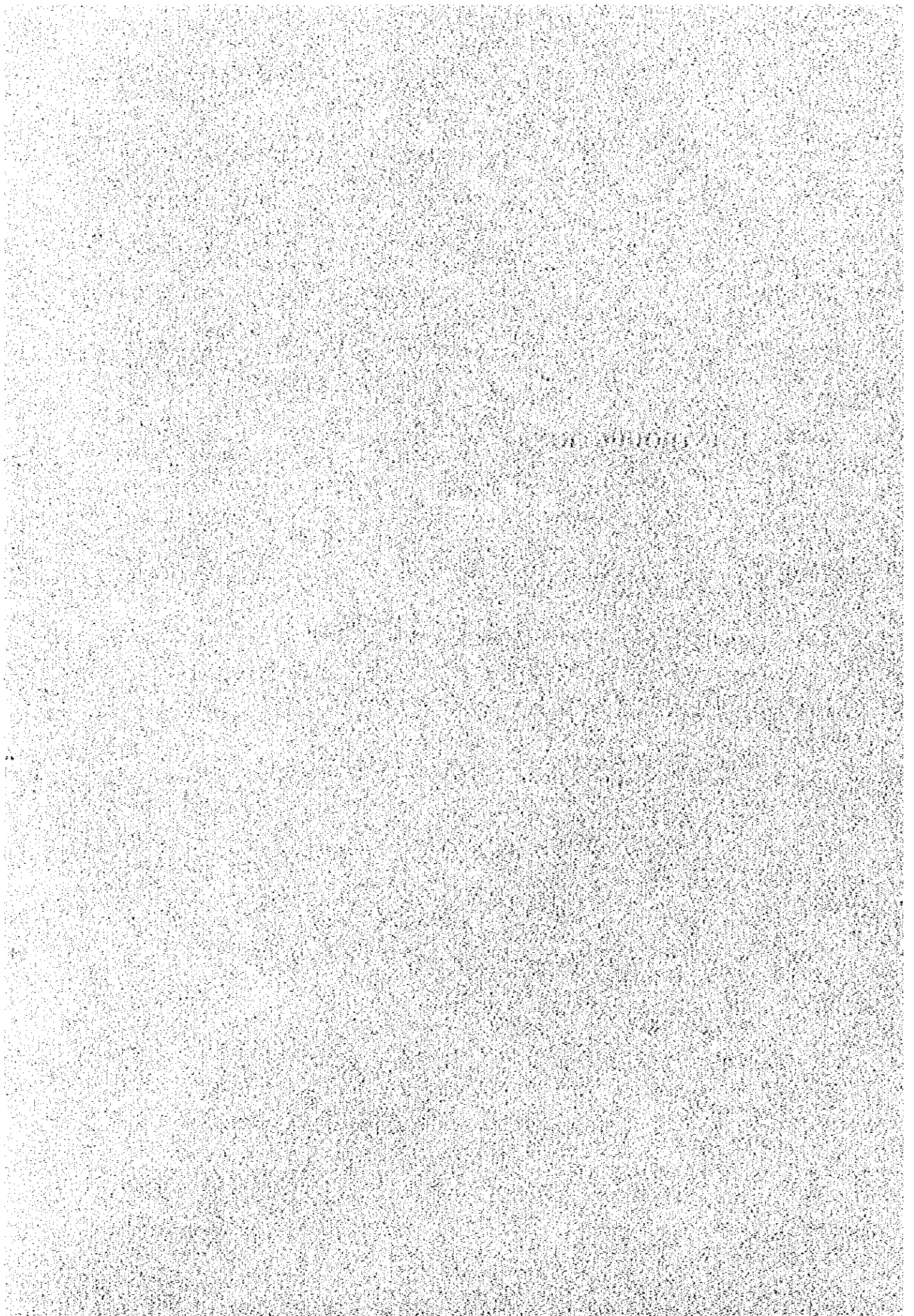
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1. INTRODUCTION



CHAPTER 1 Introduction

1-1 General

In February, 1993, in response to the request of the Government of the Republic of Côte d'Ivoire, Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programs of the Government of Japan, dispatched a preliminary survey team to Côte d'Ivoire to discuss and conclude the scope of work regarding the Master Plan Study on the Integrated Rural Development Project in the N'Zi river middle basin (hereinafter referred to as "the Study") with the Côte d'Ivoire side. In addition, in September, 1993, the advisory team on the Study dispatched by JICA concluded the supplementary scope of work to conduct the feasibility study for the development priority area selected in the Study area in the course of the Master Plan Study. Based on the scope of work, the team to conduct the Study (hereinafter referred to as "the Study Team") was dispatched to Côte d'Ivoire by JICA for the phase I field work from September 5 to November 3, 1993. After returning to Japan, the Study Team analyzed the results of the phase I fieldwork, studied the development concept, selected the development priority area and consequently formulated the Interim Report.

From August 6 to October 11, 1994, the Study Team again visited Côte d'Ivoire to conduct the phase II field work. After having a meeting for the discussion on the Interim Report with the Côte d'Ivoire side, the Study Team collected data, conducted field surveys regarding respective sectors and worked out concepts for both the Master Plan and the development plan of the development priority area. At the end of the field work, the Progress Report (II) was formulated summarizing the results of the phase II field work. After coming back to Japan, the Study Team analyzed the results of the phase II field work, worked out the Master Plan, conducted the feasibility study for the development priority area and formulated the Draft Final Report compiling the overall results of the phase I and the phase II works. The Study Team made the final visit to Côte d'Ivoire from March 12 to 23, 1995 to submit and explain the Draft Final Report to the Côte d'Ivoire side. Finally, the Study Team completed this Final Report taking into consideration the comments from the Côte d'Ivoire side.

1-2 Objectives and Area of the Study

The objectives of the Study are as follows; to formulate a Master Plan for the integrated rural development in the N'Zi river middle basin and to conduct a Feasibility Study for the development priority area selected in the course of the Master Plan Study, and

to carry out technology transfer to the counterpart personnel of the Côte d'Ivoire side in the course of the Study.

The Master Plan Study Area covers approximately 150,000 ha area lower than the altitude of around 120 m in the N'Zi river middle basin between M'Bahiakro and Dimbokro, in which the development priority area of about 1,000 ha is to be selected for the Feasibility Study. Administratively, the Study area is related to sub-prefectures of Dimbokro, Bocanda and Kouassi-kouassikro in Dimbokro department, sub-prefectures of Bongouanou and M'Batto in Bongouanou department, Ouelle sub-prefecture in Daoukro department and M'Bahiakro sub-prefecture in M'Bahiakro department.

The Côte d'Ivoire Government attaches importance to increasing production of food, especially of rice in its agricultural policy, as mentioned later in the section of 2-3. The current rice production in this country considerably depends on rain-fed cultivation, whose annual cropped area is reportedly around 530 thousand ha, compared with the irrigated cultivated area as small as 23 thousand ha. (1990, CIDV and CIDT). Because the rain-fed cultivation of rice is very unstable and low in productivity under the conditions of rainfall, which varies a great deal from year to year in distribution and quantity, it is an important issue to promote development of the irrigated agriculture of stable and high productivity. While the irrigated agriculture mainly for rice production has been developed to a considerable extent in the western and northern areas of the Bandama river basin, to which the study area belongs, the study area remains underdeveloped on the irrigated agriculture despite of its vested conditions on climate and land and water resources of almost the same level as those of irrigation-developed areas. Accordingly, the study areas noted as an important area to be developed from now on for the irrigated agriculture.

On the other hand, as described later in the sections of 3-2-1 and 3-3, coffee and cacao production, which had once significantly supported growth of agriculture and economy in the Study area, has remarkably declined for recent over 10 years, which has brought about decreased cash income of farmers and outflow of young people. Under the circumstances, how to restore and encourage agriculture and economy has become a key issue to be resolved in the study area.

Considering the above-mentioned issues, the Côte d'Ivoire Government planned to conduct this Master Plan Study for the integrated rural development in the study area.

1-3 Outline of the Study

The Study Team conducted the Study composed of the phase I study from August, 1993 to February, 1994 and the phase II study from August, 1994 to June, 1995 as follows.

1) Preparatory work in Japan

- Working out an operation plan
- Formulation of the Inception Report
- Preparation of materials and equipment for the Study

2) Phase I field work

- Collection of data and information
- Review of related investigations, plans and projects
- Field surveys on respective sectors and surveys through sub-contracts on soil and farm household economy
- Preliminary analyses on development potentials and constraints
- Study on the concept for integrated rural development
- Preliminary study for selection of the development priority area
- Aerial photograph taking (1/20,000 scale)
- Formulation of the Progress Report (I) and discussion on it with Côte d'Ivoire side

3) Phase I home work

- Analyses of results of the phase I field work
- Study on the development concept
- Selection of the development priority area
- Formulation of the Interim Report
- Working out topographical maps (1/5,000 scale) based on the aerial photographs for the development priority area

4) Phase II field work

- Explanation and discussion on the Interim Report with Côte d'Ivoire side
- Supplementary field surveys and data collection for the Master Plan Study
- Field surveys for the development priority area
- Surveys through sub-contracts on topography, geology and soil mechanics for the development priority area
- Study on the concept of integrated rural development for the development priority area
- Formulation of the Progress Report (II) and discussion on it with Côte d'Ivoire side

5) Phase II home work

- **Analyses of results of the phase II field work**
- **Study and completion of the master plan for integrated rural development**
- **Feasibility study and completion of the integrated rural development plan for the development priority area**
- **Formulation of the Draft Final Report**

6) Explanation and discussion on the Draft Final Report with Côte d'Ivoire side

7) Formulation of the Final Report

8) Technology transfer

The Study Team carried out technology transfer to the counterpart personnel of the Cote d'Ivoire side in the course of the Study.