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PILOT HILLSIDE AGRICULTURAL PROJECT

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SOUTHERN TRELAWNY JAMAICA

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PILOT-MULCHING
AGRICULTURAL PROJECT

JAMAICA

SOUTHERN TRELAWNY
JAMAICA

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PROJECT DOCUMENT

MINISTRY OF AGRICULTURE OF JAMAICA

INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES

PILOT HILLSIDE AGRICULTURAL PROJECT

SOUTHERN TREELAWNY

OCTOBER 1980

PILOT HILLSIDE AGRICULTURAL PROJECT

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SUMMARY

1. TITLE: PILOT HILLSIDE AGRICULTURAL PROJECT

2. The Beneficiary and the Executing Agency

The beneficiary will be the Government of Jamaica. The Soil Conservation Division of the Ministry of Agriculture (MINAG) was designated to be the executing agency with the support of the:

(i) Western Regional Division of MINAG;
(ii) Production and Extension Department of MINAG;
(iii) Research and Development Department of MINAG;
(iv) The Co-operative Department, of the Ministry of Local Government;
(v) The People's Co-operative Bank (the Christiana Branch); and the
(vi) Jamaica Development Bank

3. The Project and its Objectives

Approximately 80% of Jamaica's topography is characterised by hilly lands, with slopes ranging from 7 - 35 degrees. These lands are used primarily for domestic staple food production. Nevertheless, the traditional production systems used have proven to be highly soil erosive with its consequential low productivity. It has been estimated that under present practices an average of 54 tons soil/acre/year is being lost on a 17° slope. The crop yields and productivity of the land are less than 50% of what can be obtained with appropriate soil conservation measures in association with intensive agricultural practices, as demonstrated in the Allsides project.

This project has therefore been designed on a pilot basis to utilize the experiences gained from the Allsides project as a basis for identifying and introducing appropriate soil conservation measures and multiple cropping practices, capable of: improving incomes of farmers in the project area; improving the nutrient profile of the families; increasing employment, while at the same time reducing soil losses caused by inappropriate production practices.

4 Cost of Project

The cost of the project over the 3-year implementation period is estimated to be approximately US$4,042,000 (=J$7,194,760), using a conversion rate of 1 US$ = 1.78J$), made up as follows:

Soil Conservation Measures	US$1,394,062
Technical Assistance, Vehicles) Training, Equipment	1,027,500
Support Services & Facilities	692,400
Contingencies & Escalation costs	927,960
	US$4,041,922

In addition there are costs of production for crops which have been estimated at US$4,436,000 (=J$7,896,000). The Inter-American Development Bank (IDB) will provide:

(1) Grant	- 75% of Soil Conservations costs	US$1,045,546
	- 100% cost for Technical Assistance Vehicles, Training etc.	1,027,500
	Contingencies & Escalation 29.8%	721,625
		US$2,794,671
(2) Loans	- Production Credit	US$4,436,000
	Loan to farmers to meet 25% Soil Conservation Costs	348,515
		US$4,784,515

The GOJ will provide support services US$692,400. The foreign exchange component of the project cost will be US$3,657,000 (or 43%), all of which the IDB is being requested to provide. The remainder of its provision will be paid in local currency.

The details of cost are shown in the Summary Table which follows:

5. Financial terms suggested for this operation

The country conditions at the present time indicate that this operation should be treated as a mixed package in which the donation of funds to cover the costs of certain items could be obtained from the Special Operations Fund of the Bank. The loan portion of the IDB contribution would be made available on a 'soft' basis at 2%, having a grace period of 8 years and a repayment period of 20 years.

6. Project Execution

The project document is the result of specific technical assistance provided as a non-reimbursable grant by the IDB to the Government of Jamaica (GOJ) for its preparation by the Inter-American Institute of Agricultural Sciences.

The period of time envisaged for the project execution is three years. The project assumes that on the basis of the supportive staff and services being provided by MINAG, and the grant and loan assistance to be provided by the IDB it will be possible to implement the project within a period of 3 years.

7. Project Area

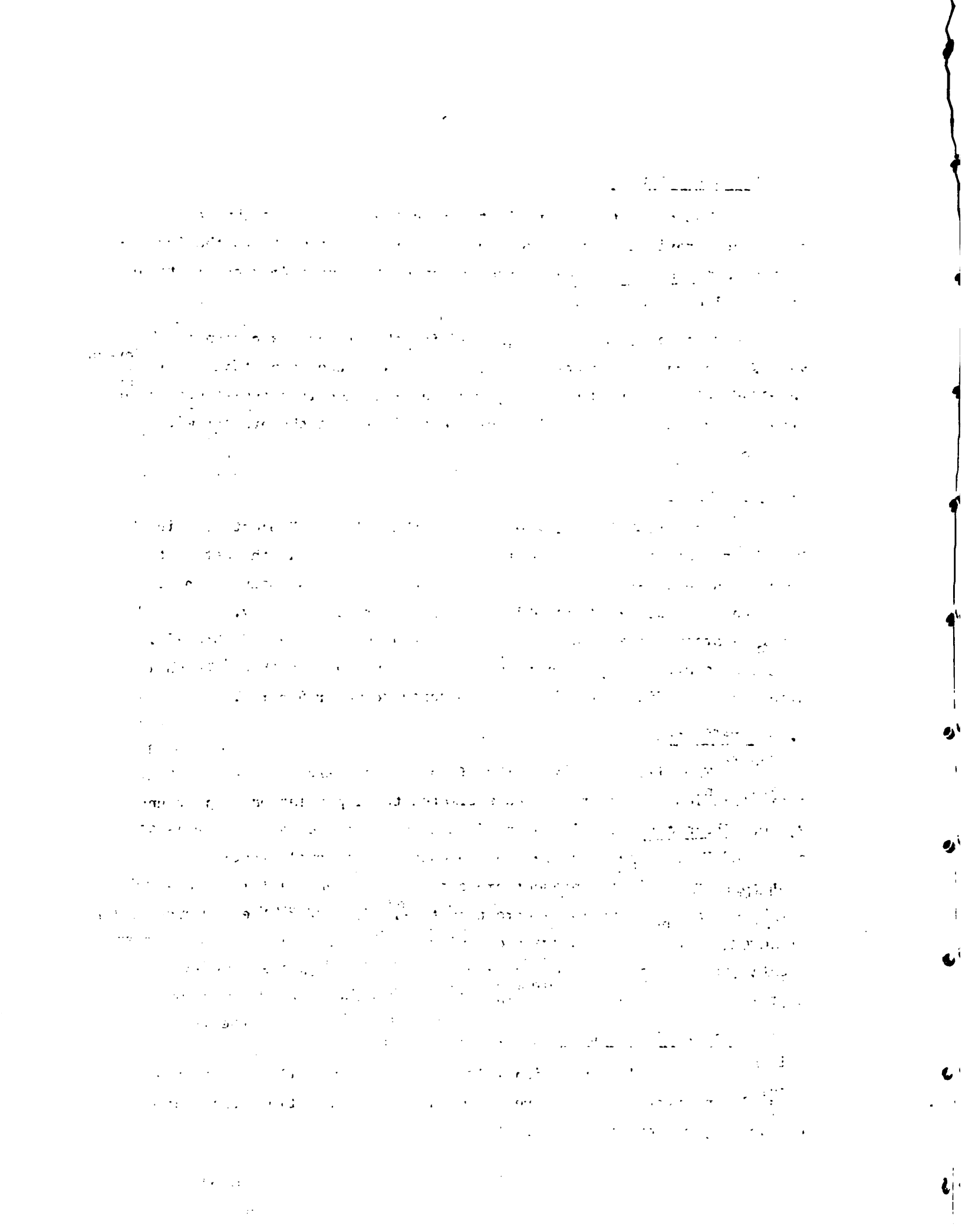
The Pilot Project area adjoins the Allsides Project area in the Parish of Trelawny, and is located approximately 10km north-west of the town in Christiana. It has a total area of 1093 acres, only 854 acres of which are considered suitable for agriculture or forestry. The land has very steep slopes, 60% of the land having slopes greater than 15°. The farmers are small, approximately one-half being less then 3 acres in size, and an additional 28% of size 3 acres to under 5 acres.

8. Beneficiaries

The direct beneficiaries of the project are 287 farmers and their families who constitute an estimated total population of just under 2,000. The net gross value of production per hectare in the area is an estimated US$1470 per hectare under present traditional practices. The systems proposed in the present project have a potential for increasing net benefits to producers by more than two-fold. 70% of the farmers are over 45 years and the average family size is 6.5. They have identified as their major needs improved housing, more land for agricultural purposes, and proper financing for agriculture.

9. Technical Cooperation

Technical cooperation will be needed, primarily in the areas of soil conservation, crop development and seed production, transfer of technology, and credit and marketing.



The Government of Jamaica has expressed an interest in obtaining Technical Assistance from the Inter-American Institute of Agricultural Sciences (IICA) in the areas described in the preceding paragraph. The purpose of the technical cooperation in each of the areas will be to assist the MINAC in strengthening the capabilities of the participating institutions and the executing unit in implementing the project.

This Pilot Project is being undertaken as a precursor to a National Hillside Agricultural Project by which the GOJ proposes to extend the experience gained during the present project. The Pilot aspects of the project will necessarily require adaptive trials and demonstrations to be carried out on sites within the project area itself and particularly on farmers' holdings.

The costs for the technical cooperation over the three year period is estimated to be US$618,000 (103 man-month) equal to 15% of the total project cost of US$4,041,922.

On the basis of the sensitivity analysis carried out using the 8 cropping systems, which gave the best performances, a further elimination was done, leaving the 3 best systems as determined by their economic rates of return. The systems are:

(a) Yam, Irish Potato, Radish and Peanuts;

(b) Yam, Ginger and Red Peas;

(c) Yam, Cowpea and Peanuts

In addition, in terms of the rate of adoption of the recommended practices these systems appear to be the ones most likely to be adopted by farmers during the 3 year project execution period. The weightings used are 40%, 40% and 20%.

The IRR for the improved Yam system grown as a mono-crop ranged from 19 to 12 for the lower to the steeper slopes. By comparison the IRRs for the selected cropping systems ranged between 20 and 50. The fact that a subsidy (in the form of a 75% grant for soil conservation measures) is being provided increases the rate of return to the farmers.

In view of the above the project has been formulated as an integrated agricultural development project with the following sub-projects:

(i) Soil Conservation

(ii) Crop Development and Seed Production

(iii) Transfer of Technology (Extension)

(iv) Marketing and Credit

The provision of some but not all the requirements, as specified for each sub-project will render the efforts in the long run less effective than is desired.

Appropriate allowance has also made for support services as follows:

(i) Administrative Support Services
(ii) Technical Support Services

The project objectives are:

(a) to determine and implement appropriate soil conservation practices, as a basis for establishing intensive cropping system in the area, taking into consideration the relationships between conservation practices and crop production systems;
(b) to increase the level of income of farm families in the area through the introduction of new and more profitable production systems;
(c) to increase the level of employment of farm families in the area through the introduction of technically and economically feasible production systems, that will optimize the use of the labour available to the area; and
(d) to improve the production and productivity of the land subject to soil conservation practices through the identification and introduction of new crops and the improvement of old crops.

10. Achievements

Associated with, and responsible for the significant increase in gross value production of farms will be the increased production which is expected. Current estimated value of production from the area is J$1.9 million. The project is expected to generate foodstuff (short tons) over 3,000 for yams, 1770 for Irish potatoes, 850 ginger, 134 peanuts and 124 for legumes (red peas and cowpeas). The gross value of the expected production is estimated to be of the order of J$6.5 million annually. At the same time land on farms will be more fully used, and increased employment opportunities will be provided.

TABLE I-1 JAMAICA PILOT HILLSIDE AGRICULTURAL PROJECT - COST RESUME BY INVESTMENT CATEGORIES AND BY TYPES OF CURRENCIES (US$ equivalences)

Investment Categories	Year 1		Year 2		Year 3		Total		Total Local & Foreign
	Local $	Foreign $	Local $	Foreign $	Local $	Foreign $	Local $	Foreign $	$
1. Permanent Improvement									
1.1 Soil Conservation Infra. a/	198,919	70,677	311,218	138,008	422,988	252,252	933,125	460,937	1,394,062
Sub-Total	198,919	70,677	311,218	138,008	422,988	252,252	933,125	460,937	1,394,062
2 Other Goods									
2.1 Seed & Planting Materials		5,400		13,400		26,800		45,600	45,600
Sub-Total		5,400		13,400		26,800		45,600	45,600
3. Machinery,Equipment & Vehicles									
3.1 Vehicles & Spare Parts		97,150		13,800				110,950	110,950
3.2 Equipment									
3.2.1 Agricultural		47,000						47,000	47,000
3.2.2 Office,Audio-Vis & Small		47,050						47,050	47,050
3.2.3 Seed Processing		25,000						25,000	25,000
3.2.4 Field		15,600						15,600	15,600
Sub-Total		231,800		13,800				245,600	245,600
4 Associated Costs									
4.1 Technical Assistance		381,000		237,000				618,000	618,000
4.2 Research Trials b/(AgrEng)		7,500		10,000				17,500	17,500
4.3 Training of Staff& Farmers		34,000		33,600		33,200		100,800	100,800
4.4 Support Personnel c/	161,600		161,600		161,600		484,300		484,800
4.5 Support Facilities	115,200		46,200		46,200		207,600		207,600
Sub-Total	276,800	422,500	207,800	280,600	207,800	33,200	692,400	736,300	1,428,700
TOTAL	475,719	730,377	519,018	445,808	630,788	312,252	1,625,525	1,488,437	3,113,962
5. Without Specific Allocation									
5.1 Contingencies (10%)	47,572	73,038	51,902	44,581	63,079	31,225	162,552	148,844	311,396
5.2 Escalation (19.8%) d/	94,192	144,615	102,766	88,270	124,896	61,826	321,854	294,710	616,564
Sub-Total	141,764	217,653	154,668	132,851	187,975	93,051	484,406	443,554	927,960
GRAND TOTAL	617,483	948,030	673,686	578,659	818,763	405,303	2,109,931	1,931,991	4,041,922
6 Production Credit e/	420,000	250,000	877,000	575,000	1,414,000	900,000	2,711,000	1,725,000	4,436,000
7. Overall Total including									
8 Production Credit	1,037,483	1,198,030	1,550,686	1,153,659	2,232,763	1,305,303	4,820,931	3,656,991	8,477,922

See Notes Attached.

NOTES:

(1) All the above costs are quantified in US$.

(2) 1 US$ = 1.78 J($).

(3) Local means that the figure stated must be converted by the factor 1.78 to obtain the local equivalent.

(a) Foreign exchange for soil conservation includes material and machinery costs.

(b) MINAG has indicated that it will be providing appropriate inputs for the experimental work to be done at Allsides, Olive River and in the Research and Development Department.

(c) Based on the staff being provided by MINAG.

(d) In accordance with information from IDB and Bank of Jamaica.

(e) In accordance with instructions from the relevant agencies no escalation costs have been provided for production credit.

II FRAME OF REFERENCE OF PROJECT

General

1.01 Jamaica is the third largest of the Caribbean islands and the largest West Indian island of the British Commonwealth. It is positioned at or around latitude 18°N, and longitude 77°W. It has a land area of 4,000 sq. miles (11,400 Km^2) with a maximum transverse length of 146 miles and width varying, north to south from 22 to 51 miles (35-51 Km). About 80% of the area is rugged to mountainuous. Land with slopes of 20° (36-40%)and more occupy over 50% of the Island.

1.02 The total population was estimated in 1978 as 2,106,000 with 62.2% living in rural centers. In 1978 population density based on arable land was 434 people per square Kilometer, and the rate of population growth was 1.5% (1970-1976). Infant death rate for one thousand born alive (1976) reached 20.4; life expectancy at birth (1975-1980) was 70.6 years. The percentage of literacy (1960) was 62%.

During 1978 the agricultural sector continued to be the main source of employment accounting for 36.6% of the employed labour force in April and 35.9% in October. The Bauxite/Alumina sector accounted for over 13% of the total GDP in 1978. Agricultural activities, the most important in rural areas, accounted for an average of 8.1% of the GDP (1974-1977).

2.01 Performance of the Agricultural Sector

In Jamaica, agriculture is divided into two main sub-sectors: export-oriented activities (sugar, coffee and bananas) and domestic agriculture. Agricultural production and forestry occupy approximately 55% of the total land in Jamaica. Farms of less than five acres represent 78% of the number of farms and account for only 15 per cent of the land in farms. More than one-third of the lands under cultivation are used for sugar cane, bananas, improved pasture and coconuts. During the recent past the performance of the agricultural sector, especially the export-oriented agriculture (i.e. bananas and sugar principally) has not been favourable, in relation to the increasing fluctuations of international prices for these products. On the

other hand, domestic agriculture has increased continuously during the same period. This growth could contribute significantly to reducing the dependence on imports and the drain on scarce foreign exchange reserves. On the other hand, sharp fluctuations in the international prices of export commodities and rising agricultural wages in excess of productivity gains, as well as the continuing escalation in the cost of living in the country have affected the level of increases in the value of agricultural exports. Additionally, Jamaica like many other countries has been severely affected by high fuel costs and the inability to obtain spare parts and replacements for strategic machinery and equipment for agricultural purposes.

2.02 Although Jamaica is essentially an agriculturally-oriented country, the data available indicate that in 1978/79 there was an overall increase of over 80% in the value of imports falling in the Consumer Goods category and amounting to approximately J$84 million. The higher import values recorded are largely monetary increases consequent on the devaluation of the Jamaican dollar as in US Dollar terms food imports increased during the same period by 42%. Food imports increased by J$53.5 million and accounted for the major inflow in total consumer goods, in the form of fish preparations, dairy products and cereal preparations. The value of the chief exports increased from JA$110.7m in 1974 to $158.6m in 1978. Sugar (66%); bananas (12%); and pimento (4%) were the chief sources of export earnings from agriculture (See Annex 1). Where livestock and poultry products are concerned Jamaica imports large quantities of grain annually for its poultry and pig industries in particular. Jamaica exports a small number of high pedigree cattle (dairy and beef).

Basic institutions available for the rural sector

3.01 Many institutions provide services for the rural sector of which agriculture plays the most important role, providing inter alia, food for local consumption, products for export and employment opportunities. Those institutions which relate specifically to the agricultural sector include extension, credit, research and marketing. Others such as health, education and infrastructural services (road-building etc.) support the non-agricultural sectors. The more important institutions are discussed in brief terms in [illegible] follows:

Agricultural Credit

3.02 The most important formal agricultural credit institutions of Jamaica are the Agricultural Credit Board and the People's Cooperative Banks. The overall flow of credit from these institutions decreased from J$129.5 million to J$75.6 million in 1978.

The Self-Supporting Farmers' Development Programme (SSFDP) was created in 1973 to provide loans to small farmers under specific conditions. It is funded by the IDB. Loan funds for this programme were originally administered by the Agricultural Credit Board (ACB) but this responsibility was later transferred to the Jamaica Development Bank (JDB).

The JDB works in close collaboration with MINAG in the administration of this credit programme. In spite of improvements in the loan portfolio for agriculture from this source there remains a gap between actual and potential performance. Prior to this the JDB only handled loans for medium and large-scale farmers and its funding originated largely from international lending agencies. The administration of credit for small farmers by the JDB was thus a monumental departure from its modus operandi. The more commercially oriented loans handled by it attracted interest rates closer to those of the local commercial banks.

The Agricultural Credit Board (ACB) has had a tradition of dealing with small farmers either directly on their own account, or indirectly through the People's Cooperative Banks (PCBs). Interest rates were 6% per annum. The funds available for loan were intended to revolve so as to increase the number of farmers who could receive loan assistance. In many instances this did not materialize. The ACB depended largely on a GOJ subvention for its administration and basic loan provision, and thus, essentially provides a system of subsidized credit. The People's Cooperative Banks while performing a very useful role in providing agricultural credit for small farmers also provide loans which are used for non-farming purposes.

It is generally felt that several problems have resulted in negative effects of most of the agricultural credit programmes, shortages of many agricultural materials needed for farm development plus a low level of economic activity and much uncertainty. Another important factor is the inadequacy of credit provided through failure to take into consideration the loan repayment profile of farmers. Additionally there have been difficulties with the administrative mechanisms associated with agricultural credit, particularly for small farmers. In areas in which supervised credit was used eg. with the first two Land Authorities created in Jamaica, namely the Yallahs Valley and the Christiana Land Authorities in 1951 and 1954 respectively fairly satisfactory results were obtained.

Government subsides under the Subsidy Assistance Scheme were created to enable small farmers to extend production and to obtain socially desirable amenities. There are several projects under this scheme which are mainly for farms of up to 100 acres (or 200 acres where bananas or sugar-cane constitute the principal crop). Subsides are provided inter alia for hillside farming, farm buildings, farm water supplies; eg. for tanks, pasture improvement and installation of equipment.

Agricultural Research

3.03 The Ministry of Agriculture (MINAG) together with the Statutory Bodies under its control is the principal Agricultural Research and Development Agency in the island. Research efforts date back to initial work in the Livestock (cattle) sector in 1912. Over the years several more divisions have evolved - Soil and land use, Crop Research, the Sugar Research Institute, Research units in the Coffee, Cocoa,Banana organizations, as well as supportive research in Agricultural Economics, Plant Protection, Storage and Infestation of Crops. Agricultural Research Units of MINAG are undergoing continuing re-structuring with a view to achieving greater efficiency, coordination and results.

Agricultural Extension

3.04 The MINAG has been re-organized along regional lines, the country being divided into 4 regions for the administration of agricultural pursuits. Extension work as traditionally regarded has now been incorporated into the recently created Production Unit, the main

objectives being to obtain better co-ordination at the field level and improved assistance and guidance to farmers.

3.05 The Production Unit with all-embracing powers has the responsibility for implementation and control of projects with a view to securing better utilization of local and foreign funding and the control of resources related specifically to agricultural production.

Other Institutions

3.06 There are many institutions which, although not agriculturally oriented are designed to improve amenities available and enhance the welfare of communities. Of great importance are the health and education institutions. The Ministry of Local Government in collaboration with the Ministry of Health and Environmental Control is responsible for health at the community levels providing medical and dental clinics as well as paramedical services within the ambit of modest budgeting, GOJ provisions, being J$7 million in 1977/78 and J$8 million in 1978/79.

Education institutions are vital, beginning from the Primary Schools and moving progressively through the Secondary, Technical and Tertiary Institutions. A Rural Secondary Education Project has been launched recently with a view to co-ordinating and improving previous efforts in this important area. It is designed to ensure that all persons engaged in agriculture and Home Economics are used to their fullest potential in which they can be of optimum benefit to the country, by participating in agricultural pursuits. Skilled graduates will also be provided to fill the demand in teaching, food-processing, agricultural agencies, farming practices, and to help in building appropriate institutions.

One new Agricultural/Vocational School is being constructed under this programme, at Passley Gardens in the parish of Portland. This together with the new school just completed at Elim in the parish of St. Elizabeth with assistance from US/AID, will complement the work of the other Agricultural Vocation School at Knockalva in the parish of Hanover, which has existed for several decades. This older institution with two others of its type provided, in the past, the main source of suitably oriented recruits for the Jamaica School of Agricul-

ture. The present programme is designed to increase considerably the number of graduates trained in these institutions.

The Co-operative Input in the Development of the Project Area

3.07 Studies have been undertaken of various forms of association which may be pursued for agricultural production. In the last few years there has been great emphasis on the associative forms of agricultural production in Latin America. These associative forms are based on an entrepreneurial organization with the objective of achieving economies of scale for optimising revenues while managing expenditures carefully. In Jamaica, important characteristics of many rural areas are the very small farms operated by most farmers and the fact that some resources such as the human resources are plentiful while there are marked contraints in terms of capital resources. This situation creates an imbalance for the efficient use of available resources causing undue unemployment and under-employment. It therefore becomes necessary to develop the cooperative aspects. The Cooperative Department formerly a responsibility of the MINAG now resides in the Ministry of Local Government and special arrangements have to be made to ensure collaboration between these institutions and others in MINAG.

Policy Goals for Agricultural Development

3.08 According to the Five Year Development Plan (Agricultural Sector) for 1978-1983, the principal policy goals enunciated are to:

(a) produce as much of the food and raw materials as is feasible to meet requirements for:
  (i) adequate food and nutritional levels of the population;
  (ii) agro-industries; and
  (iii) export markets;
(b) structure production so as to reduce reliance on imports;
(c) ensure that all agricultural land is used to its fullest potential, which will result in optimum economic and social benefits for the country as a whole;
(d) increase rural incomes (particularly farm incomes);

(e) improve rural amenities and social infrastructure as a basis for raising the standard of living of rural people; and

(f) provide more employment opportunities so as to reduce unemployment and under-employment.

Strategies

3.09 The broad strategies for achieving the stated goals include:

(a) payment of reasonable prices to farmers for their commodities in order to provide the needed incentives to bring about increased production, allowing them to earn better incomes and pay better wages, thereby reversing the adverse terms of trade between agricultural and non-agricultural enterprises;

(b) acceleration of the land reform and improved land use programme. In association with this, a number of integrated rural development projects will not only settle farmers and increase agricultural production, but could also improve infrastructure and provide social amenities;

(c) implementation of programmes designed to instill confidence in the farming community in areas such as security of land tenure, etc.

(d) implementaiton of a substantial irrigation programme, thereby removing one of the major constraints to increased agricultural production and productivity;

(e) implementation of a major soil conservation programme to protect the various watersheds and at the same time allow farmers to practise more intensive agriculture in these areas without increasing the risk of erosion;

(f) a reorganized and strengthened Research and Extension Service capable of providing more information and better service to farmers in their various agricultural pursuits;

(g) a major improvement in distribution and marketing of domestic food crops, and the necessary infrastructural inputs. This will be achieved in collaboration with the Agricultural Marketing Corporation, in particular, and the Ministry of Industry and Commerce in general, and the Ministry of Local Government ; and

(h) improvement in the administration of agricultural credit and the provision of more credit to all categories of farmers.

2 Priorities of the Pilot Hillsides Agriculture Project

General

1.01 The Inter-American Development Bank (IDB) in continuance of its policy for assisting Jamaica in its economic development embarked upon a programme of visits to development projects. Among the projects visited in the agricultural sector was the GOJ/IICA Allsides Project. During the course of the visit the IDB obtained information from GOJ officials as to the importance of the project to agricultural development in particular and the overall economy in general. The IDB was convinced that GOJ required assistance in developing hillside agriculture along more efficient and intensive lines.

1.02 On subsequent occasions the Bank received information which led to the preparation of the "Agreement for Non-reimbursable Technical Co-operation" between Jamaica and the Inter-American Development Bank. This Agreement No. ATN/SF-1773-JA which was signed in Montego Bay, Jamaica in May 1979 stipulated that the Inter-American Institute of Agricultural Sciences (IICA) should be contracted to prepare the Project Document for a Pilot Hillside Agricultural Project. The Agreement between the Government of Jamaica and the Inter-American Institute of Agricultural Sciences for the preparation of a Project Document to be called "Pilot Hillside Agricultural Project" was signed on January 7, 1980.

1.03 Through this agreement the IDB made available a sum equivalent to US$49,500 to be used by IICA in the preparation of the project document. This sum would be augmented by the Jamaica dollar equivalent of US$18,200 to be provided by GOJ (through MINAG) to cover local transportation, local counterparts (per diem), soil analyses, secretarial services and office space.

2.01 It was stated that the project document will be designed to:

> "analyse the viability of utilization of hillside lands by means of bench terracing or other soil conservation techniques as a tool for improving agricultural productivity and levels of employment in hillside rural areas of Jamaica".

2.02 The stated objectives of the IDB Technical Assistance were to prepare a project document which would consider the following aspects:

(i) Soil conservation measures such as terracing and/or other appropriate methods;

(ii) intensive utilization of unemployed rural labour, thereby providing an income and better standards of living for this target group; and

(iii) enhancing the production of food for domestic consumption thereby tending to eliminate the need for food imports, and thus assist the Government in its import substitution programme.

2.03 One of the major problems limiting performance in agriculture is the fact that approximately 80% of Jamaica's land area is characterized by hilly land with slopes ranging from 8% to 35%. Much of this land is being used primarily for domestic staple food production.

2.04 The traditional land use practices including soil conservation and cropping systems have proved to be highly soil-erosive. Studies carried out on lands at Smithfield in Hanover having similiar rainfall and land use patterns to those of Allsides indicate that soil loss to the extent of 56 tons per acre/year have been recorded. Additionally the judicious use of terracing can reduce soil loss considerably and appropriate cropping systems (Allsides experiences) can result in successful soil conservation and intensive land utilization patterns. The Pilot Hillside Agricultural Project is predicated on the Allsides experience which has been fully documented. The Pilot project is designed to identify, improve and introduce soil conservation measures and multiple cropping practices capable of:

- increasing incomes of farmers in the project area, through adopting improved techniques;
- improving nutrient intake of the families;
- increasing employment opportunities; and
- preventing soil losses caused by inappropriate production practices

2.05 Its "Pilot" nature implies that although the intention is to develop a commercial approach to farming, there remains much to be done before the project can attain the status of a full-fledged agricultural development project. This makes it necessary to emphasize adaptive research efforts which must use and develop facilities provided at

Allsides and Olive River fully.

Principal Physical Characteristics of the Project Execution Area

3.01 The Pilot Hillside Agricultural Project has an area 1093 acres and is located in the southern part of the Parish of Trelawny in north-west Jamaica. The area is characterised by precipitous hills and sudden depressions. However, favourable temperatures, 64°F to 80°F and annual average rainfall of over 80 inches allow for relatively successfull cultivation of certain crops.

Soils

3.02 The soils of the area bear a close relationship to the parent rock materials from which they were formed. The predominant soil types in the area consist of clay loams and loams derived variously from non-calcareous shales, conglomerates, tuffs and sandstones. The soil types are summarized in the project document. See page II-11(a).

Physical Characteristics of Agriculture and Livestock Sub-Sector

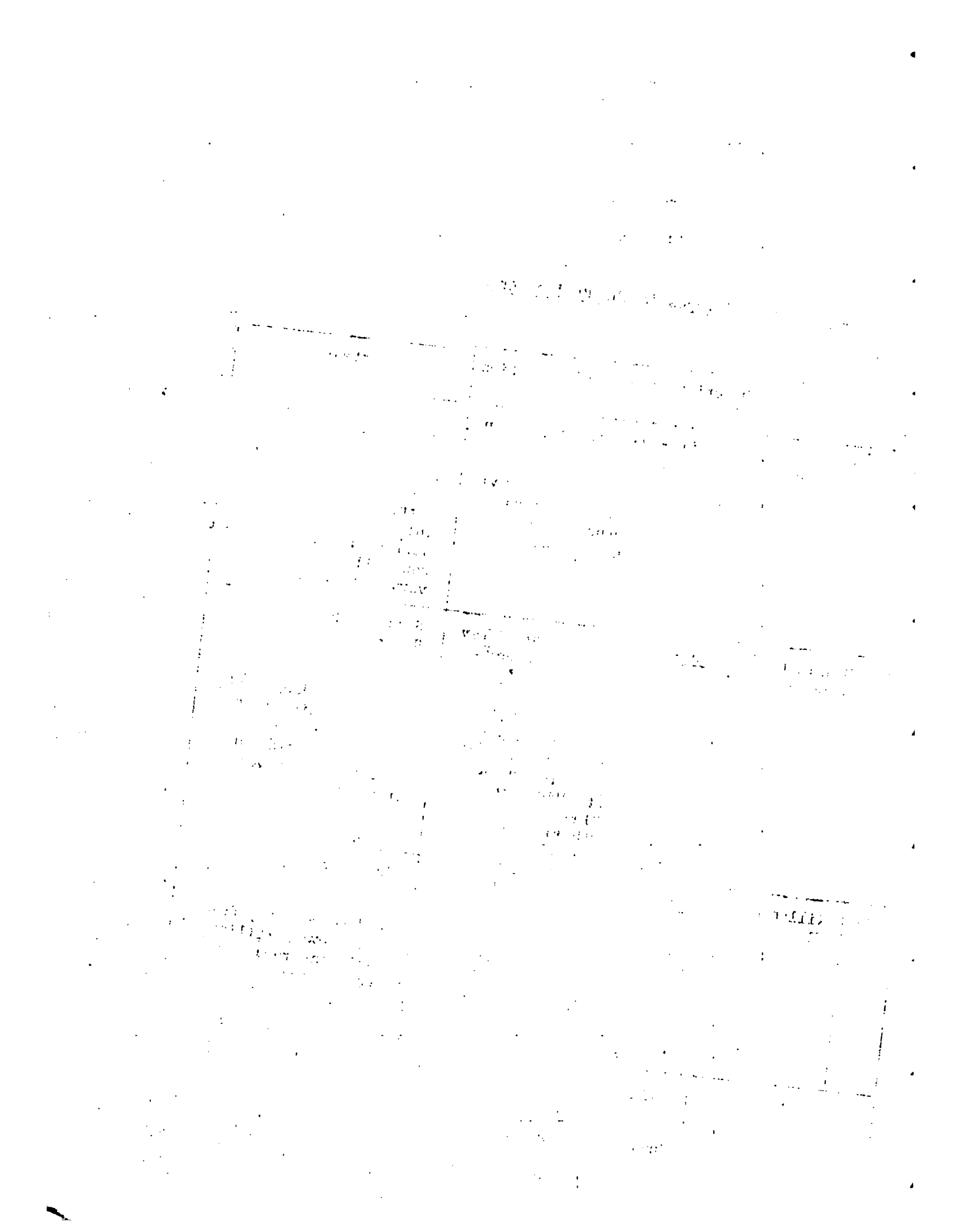
3.03 The agricultural activities in the Project Area are centered mainly around the production of yams, bananas and coco (Zanthosoma Spp). In the recent Agro-Socio-Economic Survey carried out to obtain base-line data for planning the Pilot Project it was found that half of the land was under pure cropping, nearly a quarter under mixed cropping, and slightly less than this was left fallow. In all farm size groups most land was under pure cropping. On farms of 3 or more acres, as much land or more was left to fallow as was under mixed cropping. Most un-cultivated land was in the farms of 5 or more acres.

3.04 In the project area, yams are cultivated on 270 farms. The largest acreage harvested was on farms 5 or more acres. Average production per acre on non-contoured farms increased with farm size (from 3.45 tons in under 1 acre group to 5.15 on farms larger than 5 acres). This trend was not seen in contoured farms. Average value of production per acre was between J$2,345 and J$4,038. Average banana production per acre (3-4 tons) did not vary according to farm size, and the value per acre was between J$ 477 and J$833.

3.05 Eleven farms, all contoured and of 3 or more acres, produced red pea in 1979. Total acreage harvested was 4. Average production

Summary of Soil Types in the Project Area

Soil No.	Soil Type	Description and main location	Important Characterics
32	Wirefence Clay Loam	Topsoil - Dark reddish brown clay loam Subsoil - Dark reddish brown clay over highly weathered tuffs conglomerates	Soil depth more than 90 cm. A deep strongly acidic, low, fertility, fair internal drainage, surface runoff generally rapid, very erodible.
36	Donnington Gravelly Clay Loam	Topsoil - Purple brown, grey brown or brown gravelly loam. Subsoil - Same as topsoil with pebbly conglomerate and fine volcanic ash below. (St. Mary, and Uplands of St. Catherine and Clarendon).	Soil depth more than 90 cm. Moderately deep soil, acidic, medium fertility, rapid internal drainage, rapid surface runoff, a very erodible soil.
91	Killancholly Clay	Topsoil - very dark grey brown clay. Subsoil - brownish yellow to reddish brown clay, marly or chalky limestone below. (All over the Island)	Rocky Area A shallow soil, free lime, low fertility, rapid internal drainage, surface runoff generally good.
94	Carron Hall Clay	Topsoil - Dark brown or dark grey brown clay Subsoil - Brownish yellow clay, soft yellow limestone below (All over the Island)	Soil depth more than 90 cm. part of stone. A moderately deep soil, slight amount of free lime, medium fertility, fair internal drainage, surface runoff generally good.
95	Wait-a-bit Clay	Topsoil - Brown clay Subsoil - Yellow red to yellow brown clay, some reddish and grey mottling as depth increases, rotten shales	Soil depth more than 90 cm. A deep soil, acidic, medium fertility, fair internal drainage, surface runoff fair.



per acre was between J$1,050 and J$1,956. For Livestock, Poultry farms constituted the largest group overall in terms of number of livestock (6,141) but they are only reared on contour farms in the 1 to under 3, and the 3 to under 5 acre size groups.

Pigs form the next largest group (328). They are reared by farmers in all groups and formed the largest portion of animals reared in all except the poultry-rearing groups. Farmers in all size gorups keep a few cattle (totally 43). Only 15 goats were kept in all. In all, the livestock component is not a large one.

Social aspects of the Region

3.06 According to the 1968 Agriculture Census 44% of the farms in the Parish of Trelawny were in the size group 1 to 3 acres; 34% in the size group 3 to under 5 acres and 22% larger than 5 acres. In the Project Area, 37% of the farms are between 1 and 3 acres, 12% are less than 1 acre and 22% over 5 acres. Seventeen (17%) of the land is owned by farmers; 60% is leased or rented.

3.07 In 1970 Population for the Parish of Trelawny was approximately 60,200 of which 51.7% were 15 years of age or older. At that time the population of this parish, represented 3.35% of the total country's population. The population density for the parish was 178 persons per square mile.

3.08 The project area has a population of approximately 2,000 persons. There are 278 farmers. The majority (32%) are between 45 and 55 years old; 12% between 55 and 65; 27%, 65 and over; 6% between 25 and 35 and only just under 2% under 25. In the Agro-Socio-Economic Survey it was found that the largest group (35%) of farm families has 6 to 9 members; 27% has 3 to 5 members; 24% has 1 to 2, and 14% had 10 or more. All farmers with secondary education (2% of all farmers aged 35 to 45) had families of one to two members. Among farmers with primary education, 40% have families of 6 to 9; 2% have 3 to 5; 20% have families of 1 to 3 and 14% have 10 or more. For farmers with no formal education, approximately 39% have families of 3 to 5 members.

3.09 The overall performance of the variable employment was relatively negative in terms of an increase of unemployment seeing that its rate as of April 1979, was 32% which is quite similar to that found especially in rural areas, although detailed data are not available. Seventeen per cent of the farmers in the Project Area work as hired labourers three months off their farms; approximately 93% of the male and 53% of the female dependents are unemployed. There is no reliable information on income distribution in rural Jamaica. Nevertheless, there is some data on the overall distribution of income in the country. According to data obtained from the Inter-American Development Bank, "incomes gained in the 1960's were somewhat more equally shared, at least by the employed labour force upon whose earnings measurements of inequality had been based. In the early 1970's, however, income distribution again became more unequal but was reversed partially as a consequence of the income policies and tax reforms of 1976".

3.10 Improved water supplies and housing were identified as major social needs in the area. The non-existence of piped water in house-
3. holds is a major problem in the area; 72% of the household have electricity; all toilets are pit latrines.

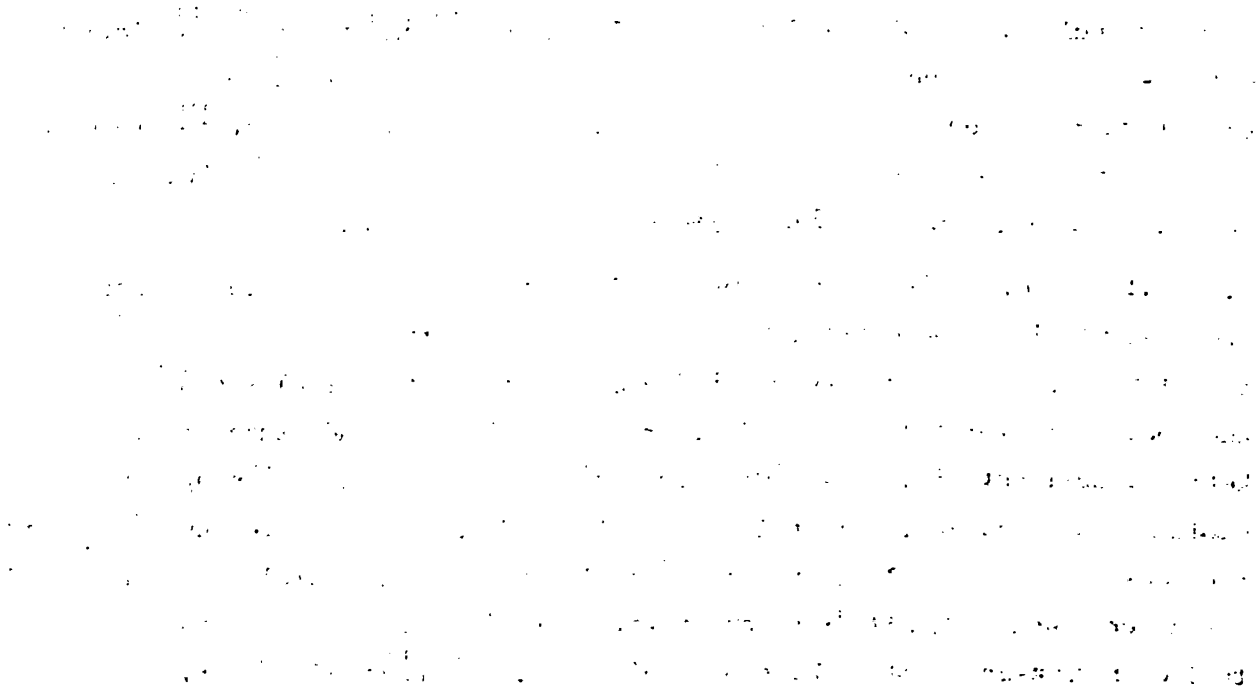
Official and Private Agencies Serving the Region

3.11 The main agencies serving the area are those regarded as official. There is little evidence of private agencies as such. The official agencies include Agriculture - Extension services and Home Economics: Marketing - services of a limited nature provided by the Agricultural Marketing Corporation (AMC), of the Ministry of Commerce and Industry (higgler-provided marketing services may be regarded as private operations, but they are not formally structured). Public Utilities - electricity supplied by the Jamaica Public Service Company: Postal Services provided by the Ministry of Communications: Health Clinic provided by the Ministry of Health & Environmental Control: Schools - mainly primary operating under the aegis of the Ministry of Education and in some instances assisted by Religious Organizations; and Roads and Works' provided by the Ministry of Construction.

3.12 In addition there is a number of farmer associations which operate in the interests of farmers. These include the Jamaica

Agricultural Society (27%), the All Island Banana Growers' Association (47%) and Coffee Group (20%). The survey showed that 32% of the farmers do not belong to any farmers' organization. As yet few farmers are members of the centrally based Allsides pre-Cooperative but 75% of farmers have indicated a willingness to participate.

3.13 Where credit is concerned, many of the farmers obtain loans from the People's Cooperative Banks, shopkeepers, higglers. In this context the farmers of the general area serving both the Allsides project and the Pilot Hillside project prefer higglers to undertake their marketing functions. These higglers are small traders, who engage in wholesale as well as retail activities. Some, however are super-higglers and operate on a larger scale of business. On the overall their activities often include transportation, reaping or harvesting of the crops with their own labour and the supply of credit to the small farmer.



III THE BORROWER AND OTHER PARTICIPATING AGENCIES

1.01 The Borrower

The borrower will be the Government of Jamaica through its Ministry of Agriculture. Within the Ministry, the bulk of the work will fall to the Soil Conservation Service.

2.01 Institutions or Units participating directly in the Execution of the Project

The following units of the Ministry of Agriculture will be involved in the project:

a) Agro-Forestry Division and Soil Conservation;

b) Research and Development Department;

c) Production and Extension Department (Western Region-Trelawny)

Outside the Ministry of Agriculture, there will be:

i) The Jamaica Development Bank;

ii) The Cooperative Department - Ministry of Local Government

2.02 Description of the Executing Units

The Ministry of Agriculture (MINAG) is at this time going through a substantial technical and administrative reorganization. The national budget is likely to suffer cutbacks which could affect the GOJ resource contribution to the project. However, MINAG has indicated the level of staffing, equipment, materials and financing which it considers necessary for the project.

2.03 Ministry of Agriculture

(1) Organization of the Ministry:

The present structure of MINAG which came into effect on April, 1980 replaces that which existed in 1977. The major changes between the old and the new arrangements are the following:

i) The Extension Service has been transformed into a Production/ Extension Service.

ii) Creation of a Central Administrative Region thereby increasing the number of Regions to 4.

iii) Creation of a Marketing Development Division, using as a nucleus those activities previously performed by the Agricultural Planning Unit;

iv) Restructuring of the former Planning and Policy Review Division into a new unit called Programming, Budget and Planning Division, to include the Planning and Review Policy Unit, the Management Review Branch and a new Budget Analysis and Control Branch;

v) Creation of a Legal Affairs Branch to take care of the legal matters of the Ministry formerly related to the Lands unit;

vi) Consolidation of all the matters concerning land advice and information into the Land Administration Division;

vii) Consolidation of the forestry and soil conservation activities into one division called Agro-Forestry and Soil Conservation;

viii) Enhancement of the functions of research and development through the creation of the Research and Development Units;

ix) Strengthening of the field operations through the four regions in which the island is divided for administering agricultural sector activities;

x) Creation of a standing Ministerial Committee on Agricultural Research and Development.

This new organization began in January 1980 when the Prime Minister Hon. Michael Manley assumed responsibilities for the duties of Minister of Agriculture. The total political administrative responsibilities of the Ministry of Agriculture (MINAG) are divided as follows:

Prime Minister and Minister of Agriculture - in charge of the Production Unit

Minister of State in charge of export crops, sugar, rice, fisheries, extension, in Northern and Western regions, lands, land reform programmes and projects, Lands Department, Land utilization, land valuation

and sugar co-operatives.

Minister of State, export crops, spices, coffee, cocoa, bananas, and non-traditional crops, forestry and soil conservation, livestock, research and development, marketing, Jamaica Agricultural Society, extension in Central andSouthern regions, projects.

The Permanent Secretary has responsibility for overall staff administration, financing, planning and engineering.

The subjects of irrigation and Co-operatives, which for a long time were the responsibility of the Ministry of Agriculture have now been assigned to the Ministry of Local Government.

2.04 Operational Regions of the Ministry

For administrative purposes, the island is divided into four agricultural regions specifically to decentralize certain functions of the MINAG.

These regions are:

(1) Northern Region, which covers the parishes of Saint Mary, Portland and Saint Ann.
(2) Central Region, which covers the parishes of Clarendon, Manchester and Saint Elizabeth
(3) Western Region, which covers the parishes of Saint James, Hanover, Westmoreland and Trelawny
(4) Southern Division, which covers the parishes of Saint Catherine, Saint Thomas, Kingston and Saint Andrew.

Each parish is divided into four divisions and each division into four areas. The Pilot Project is located in the Western Region, in the Parish of Trelawny.

2.05 Accounting, Auditing and Procurement Systems of the Ministry of Agriculture

The accounting and auditing procedures of the Ministry generally follow the procedures set by the Jamaica Government for the Central Administration of the Nation's Budget and its executing units.

In the case of the Ministry of Agriculture, however, the existence of the regional concept creates a special control dimension, by providing a certain degree of operational decentralization. Budgetary exercises are first initiated in the Ministry by appropriate units. These are rationalized within the Ministry before scrutiny by the Ministry of Finance and Planning which determines the budgetary limits for each Ministry (and its various Statutory Bodies). Thereafter, these must be submitted to, debated by, and finally accepted by Parliament. The financial year lasts from April 1, to March 31st. of the following year. Special accounting, auditing and procurement systems are provided by government to ensure control over expenses, the adoption of proper procedures and accountability for funds voted by Parliament. The Ministry has its own internal Audit System in addition to theexternal Audit System provided by the Auditor General's Department.

2.06 Financial aspects of the Ministry

The economic problems of the past few years have created critical conditions in the country. Nevertheless, Jamaica has seriously tried to create conditions conducive to rural development. The Budget assigned to MINAG varies with sectoral priorities as determined by Cabinet.

Foreign exchange constraints have seriously limited productive performance of the Agriculture Sector, for which the MINAG has political administrative responsibility.

The agency performance in terms of the budget execution on the average has been roughly close to 100% when recurrent and capital expenditures are considered together. Budget limitations will continue to be one of the most important constraints to programme development in the foreseeable future.

2.07 Soil Conservation Service
Organization and functions

The Soil Conservation Division has as its main objectives:

- Operation of demonstration areas
- Carrying out soil conservation activities within the parishes
- Serving as a technical and operational support unit to the second Integrated Rural Development Project

2.08 Functions

The functions of the Soil Conservation Division are to:

- Operate the national demonstration areas
- Conduct the regional soil conservation operations
- Operate the major Regional Hillside Farming Projects
- Conduct Soil Conservation Research and Planning
- Conduct Soil Conservation Training
- Operate the following major externally-funded projects:
  - (i) TNPP/MINAG - National Soil Conservation Programme
  - (ii) FAO/TCP/JAY/MINAG - Project Planning Project
  - (iii) MINAG/IICA - Hillside Farming Project
- Conduct Soil Conservation Survey Needs
- Conduct Watershed Management Work
- Advise the Ministry on Soil Conservation Policy and Legislation
- Coordinate with other Ministries on matters of Watershed Management and Protection of Natural Resources

2.09 Financial Aspects of the Soil Conservation Division

An examination of the service budget for the division indicates that the division's work has been affected by financial limitations. The budget also shows an execution rate of approximately 87% which is largely associated with the shortages of trained and experienced personnel in an area as technical as soil conservation.

2.10 Cooperative Department

(1) Objectives

The objectives of the Department are:

(a) Promotion of Cooperatives;

(b) Cooperative education in Pre-cooperatives and Registered Societies;

(c) Regulation of Cooperatives through inspections following visits, inquires, arbitrations and dissolutions; and

(d) Conducting annual audits of each Registered Society

The Department which was originally the responsibility of the Ministry of Agriculture is now placed within the Ministry of Local Government. This means that special arrangements will need to be made between the two Ministries - Agriculture and Local Government in order to obtain concurrence in providing cooperative inputs for farming projects such as the Pilot Hillside Agriculture Project.

(2) The Allsides Pre-Cooperative

This organization was created by the efforts of IICA/Jamaica with the assistance of the Cooperative Department as an adjunct to the Allsides project. It was designed in the first instance to help the small farmers of the Allsides Project Area to obtain farming inputs, especially fertilizers, seeds and pesticides at lower costs than their small individual businesses allow. Ultimately through training and motivation it is hoped to have it develop into a full-fledged Cooperative managed by the farmers themselves. Its functions will be extended to include marketing, using more economic methods through cooperative effort.

The cooperative would provide a means for farmer representation, cooperative purchasing and develop participation in social activities designed to improve the standard of living of the people in the area. Because of the relatively small population, while the organization's efforts would be extended beyond the two project areas (Allsides and the Pilot Hillside Agriculture Project) within the parish of Trelawny, it will still be possible to identify the performance by persons in the project through an appropriately designed recording system.

2.11 People's Cooperative Banks

The origin of these banks dates back to the decade of the forties, when the extension service and the Jamaica Agricultural Society decided that in order to expedite their work and increase their coverage the farmers needed to be organized into groups. Out of these groups, created and promoted by the agricultural institutions of those days, grew the Agricultural Cooperative Loan Banks, which developed into the People's Cooperative Banks. PC Banks have an island-wide coverage

and usually obtain funds from the Agricultural Credit Board at an interest rate of 3% for on-lending to farmers at a rate of 6%. This rate has an element of subsidy to farmers since the interest rates charged by the other sections of the banking system sometimes exceeds 14%.

The PC Banks provide loans for agricultural and non-agricultural purposes. Many factors have contributed to the varying degrees of success achieved by these banks. However, on the basis of measures taken by GOJ to upgrade them they have improved their performance and many are now able to serve as a vehicle for disbursing loans to small farmers. GOJ policy is that the Jamaica Development Bank (JDB) should administer loans for small farmers through the PC Banks.

3.12 The Agro-Socio-Economic study carried out by IICA/Jamaica to provide supporting information for the preparation of the Pilot Hillside Agricultural Project document indicated that approximately 32% of the farmers interviewed obtain their loans from the Christiana People's Cooperative Bank, the other most important source being the Crop Lien Programme from which approximately 22% obtained their loans.

3.13 Additionally, the Second Integrated Rural Development Project (US/AID loan-financed) which is in close proximity to the Pilot project area disburses farm loans through the Christiana PCB. All these factors make the Christiana PCB the obvious medium for disbursing loans for the Pilot Hillside Agricultural Project.

IV THE PROJECT, ITS COST AND FINANCING

The Project

1.01 Purpose

The project is to be utilized by the Ministry of Agriculture (MINAG) and the IDB, after their approval of the project document for the financing and execution of a pilot soil conservation and food production project to be carried out on approximately 1,000 acres of land.

1.02 Location

The project area is located in Southern Trelawny near to the Allsides Project area.

1.03 The Project Area

The site for the project was identified and described by the Permanent Secretary in January 1980. It covers an area of 1093 acres of which only 854 acres (=346 hectares) can be used for agriculture or forestry due to the existence of rocky outcrops or large boulders. A detailed study of the slopes and soils of the project site indicate that only 636 acres (=258 hectares) can be used for food production, 114 acres (= 46 hectares) for orchard crops and 104 acres (= 42 hectares) for forestry. It has 287 farmers and a population of about 2,000.

2.01 Specific Objectives of the Pilot Project

The specific objectives of the project are to:

(i) increase the level of income of the farmers and their families in the area, through the introduction of new and more profitable production systems;

(ii) increase the level of employment of the farm families in the area through the introduction of technical and economically feasible production systems, that will optimize the use of the labour available in the area;

(iii) improve the production and productivity of the land, subject to the adoption of proper soil conservation measures, through selection and

testing of crops and the adoption of improved practices; and

(iv) improve and implement appropriate soil conservation practices taking into consideration the relationship between these practices and improved (intensive) crop production systems.

3.01 Socio-Economic Considerations

The Pilot project by agreement and design is based on the Allsides experiences. It is intended to use improved and appropriate soil conservation measures and utilize cropping systems which will lead to an enhancement of the human and physical resources of the project area. Given the provision of the soil conservation measures, the cropping systems provide the means of generating farm incomes which are significantly greater than existing levels.

Against the background of low standards of living for many small farmers who exploit these hilly lands under conditions which are prone to accelerated soil erosion, Government's policy is to assist farmers in reducing this high and unchecked degree of soil loss. The Smithfield experiences followed by those of the current Allsides Project have provided a basis for a nationwide soil conservation programme. The high cost of providing such soil conservation measures as bench terracing has been a deterrent to their adoption by farmers. Present GOJ policy is to subsidize the cost of soil conservation measures to a level of 75%.

The work done at Allsides has shown that the use of appropriate cropping systems can cover the costs of the soil conservation measures and leave a balance which is still higher than incomes which most farmers now obtain by using traditional methods.

3.02 Historical base of Cropping Systems

Several systems ranging from mono-cropping to multiple-cropping are used by small farmers. The term multiple-cropping or mixed cropping is not a new one. The purpose is to use to advantage the beneficial aspects of the "system" for improving land use and increasing returns to farmers. The intensive nature of these 'systems' require that as a first step the land should be appropriately soil-conserved.

The implementation of soil conservation measures (largely bench-terracing) and the high incomes obtained on these lands from multiple cropping systems, as opposed to mono-cropping has obtained the support of and adoption by a number of farmers. The rate of adoption has been slow but is increasing.

3.03 Experimentation started with some 22 cropping systems at Allsides, first on small micro-plots and progressively increasing to larger plots. This number has been systematically reduced to 8 systems, which have demonstrated a potential for economic success. These 8 cropping systems have been subjected to further examination on commercial type operations designed to simulate the size of plots now used by many farmers. In the interim some farmers have been adopting a number of changes based on demonstrations, discussions, field days, training days through which they have come to recognize the more effective use of time and land, the increase in incomes and the reduction in soil loss.

The residual 8 systems are as follows: (See page IV-3(a)).

System 1 Yam as the sole crop (improved cultural practices) YASO)
System 2 Yam, Irish Potato, Radish, Peanut (YIRAPP)
System 3 Yam, Peanut, Red Peas (YPPPPP)
System 4 Yam, Cow Peas and Peanuts (YCOPE)
System 5 Yam, Ginger, Red Peas (YGIPPP)
System 6 Yam, Sweet Potato (YSWAP)
System 7 Yam, Grain Corn (Maize), Cabbage (YCOGCAP)
System 8 Yam, Red Pea and Cow Peas (YRPPCO)

Systems 6 and 8 were excluded for economic reasons and the other 6 have been retained for further evaluation.

CROPPING SYSTEMS ESTABLISHED
AT ALLSIDES DURING PERIOD MARCH 1979 TO FEBRUARY 1980

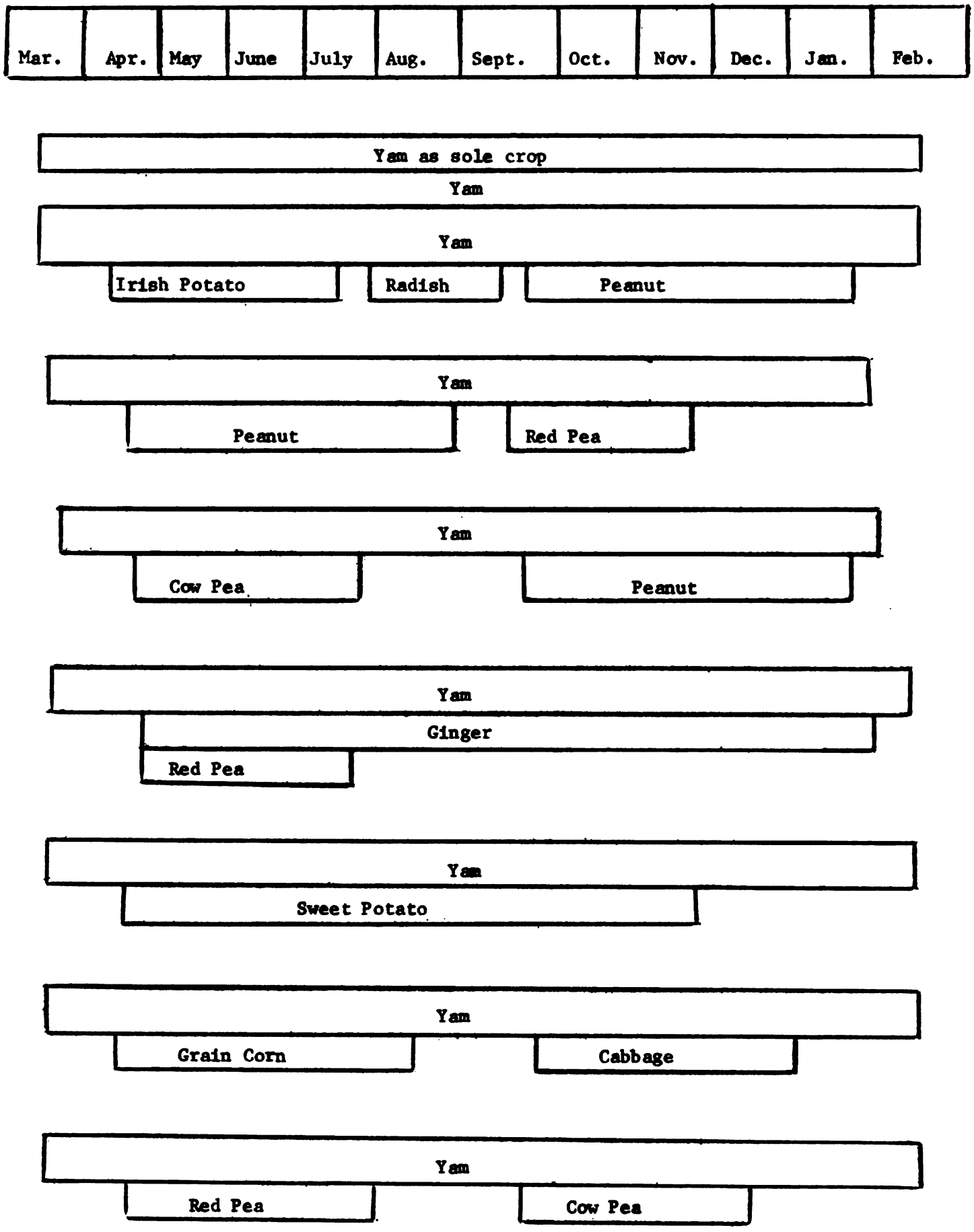
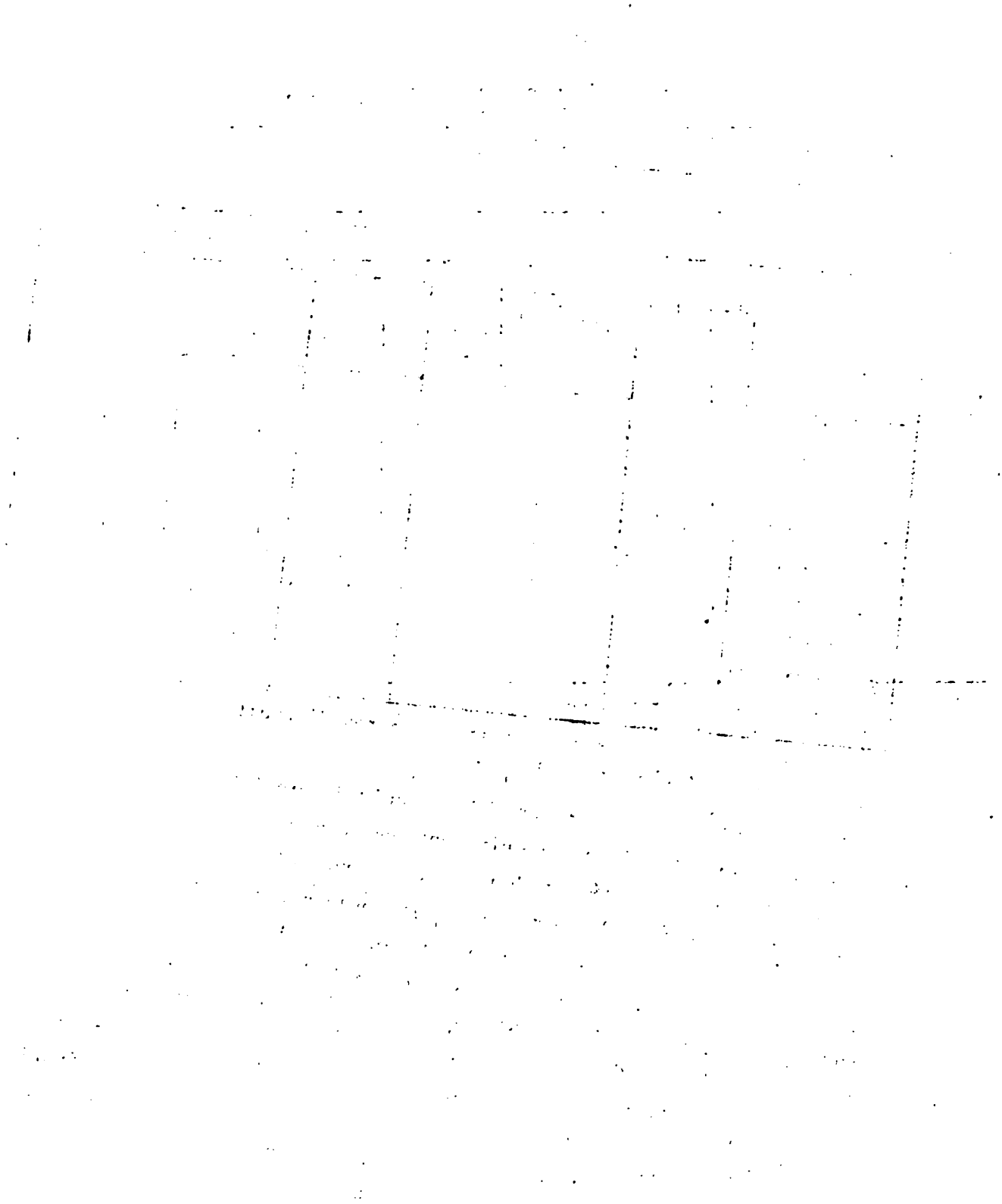


TABLE Comparative Labour Requirements and Net Returns from 8 Selected Cropping Systems

Systems	Labour Requirements (Man-days) Actual	Increase over System	% Increase	Net Income JA$ Actual	% Increase over system
1 - (YASO)[1/]	320	- -		5,550	--
2 - (YIPAPF)	639	319	100	11,720	111
3 - (YPFPPF)	702	382	119	3,315	-40
4 - (YCOPF	590	270	84	5,850	5
5 - (YGIPPF)	497	177	55	10,517	89
6 - (YSWAP)	357	37	12	(3,190)	-151
7 - (YCOGCAB)	376	56	18	4,698	-15
8 - (YPPECO)	707	387	12	1,040	-81

1/ Yam as the sole crop grown under improved conditions was used as the basis for comparison.

3.04 Every system other than YASO required more labour than the YASO system. This extra labour requirement was spread out over the year. To the extent that this was further subjected to the test of providing increased net income it meant that this would not necessarily create a problem to the farmer from a point of finding labour which was external to the farm family. In the context of availability of adequate credit and the existence of a sizeable unemployed population this implies that the development of the cropping systems will improve the socio-economic status of the pilot area. The data presented above provide the justification for discarding systems 6 and 8. Although the other systems are being continued, systems 3 and 7 appear to be doubtful starters. The most promising of the systems in order are:



No. 2 - Yam, Irish Potato, Radish, Peanut
No. 3 - Yam, Ginger and Red Peas
No. 4 - Yam, Cow Peas and Peanuts
No. 1 - Yam, as the sole crop

Yam as the sole crop - System 1 (YASO) does not qualify as a multiple-cropping system, since it is a single crop, and with time and the adoption of the development strategies proposed should be replaced by a multiple-cropping system. Its continuation is retained for comparative purposes, and as such, it is not being recommended to farmers.

During the initial stages of the Pilot project farmers will be encouraged to adopt one of 3 systems. On the basis of the preferences shown by farmers themselves a 40%, 40%, 20% mix will be used. The fact that farmers may opt to change from one system to another with the passage of time indicates problems facing all pilot projects of this nature in terms of applying procedures normally adopted for full-fledged development projects.

4.01 Project Components

For this Pilot Hillside Agricultural Project emphasis is placed on soil conservation and on the introduction of diversified agricultural production systems. It is a spin-off of the joint efforts by the Government of Jamaica and the Inter-American Institute of Agricultural Sciences (IICA), which resulted in the development of viable crop production systems for terraced lands at the Allsides demonstration centre, and the subsequent adoption of this improved technology by the target group.

4.02 The idea of developing systems of production that would lead to increased productivity, income, employment, and improved nutritional quality for the residents in the area became a major concern. The Allsides project's performance over the three year's of its operations have made it possible to emphasize the necessity for including a number of sub-projects in the proposed Pilot project to ensure success. Additionally, the high cost for constructing bench terraces and the corresponding high subsidy payment by government has led to the examination of cheaper soil conservation measures. This exercise is at present

being actively pursued at the sub-station at Olive River which is also located in the parish of Trelawny about 5 miles from Allsides.

4.03 A clear differentiation is made between services related to agricultural production and those related to the social services, both of which are necessary. Where the social services are concerned two very important components relate to the provision of drinking water and roads. For technical reasons these two components could not be assessed in precise terms. The agricultural development components are grouped for convenience into those which are:

(a) directly productive; and

(b) those which are indirectly productive.

The lines of demarcation between these two groups are not always precisely determinable. The two groups are broken down into components which will be regarded as the Project Components, and which are presented in a diagramatic form in Fig. IV-1 page 6(a).

A - Directly Productive Components

(i) Soil Conservation;

(ii) Crop Development and Seed Production

B - Indirectly Productive Components

(i) Extension (Transfer of Technology); and

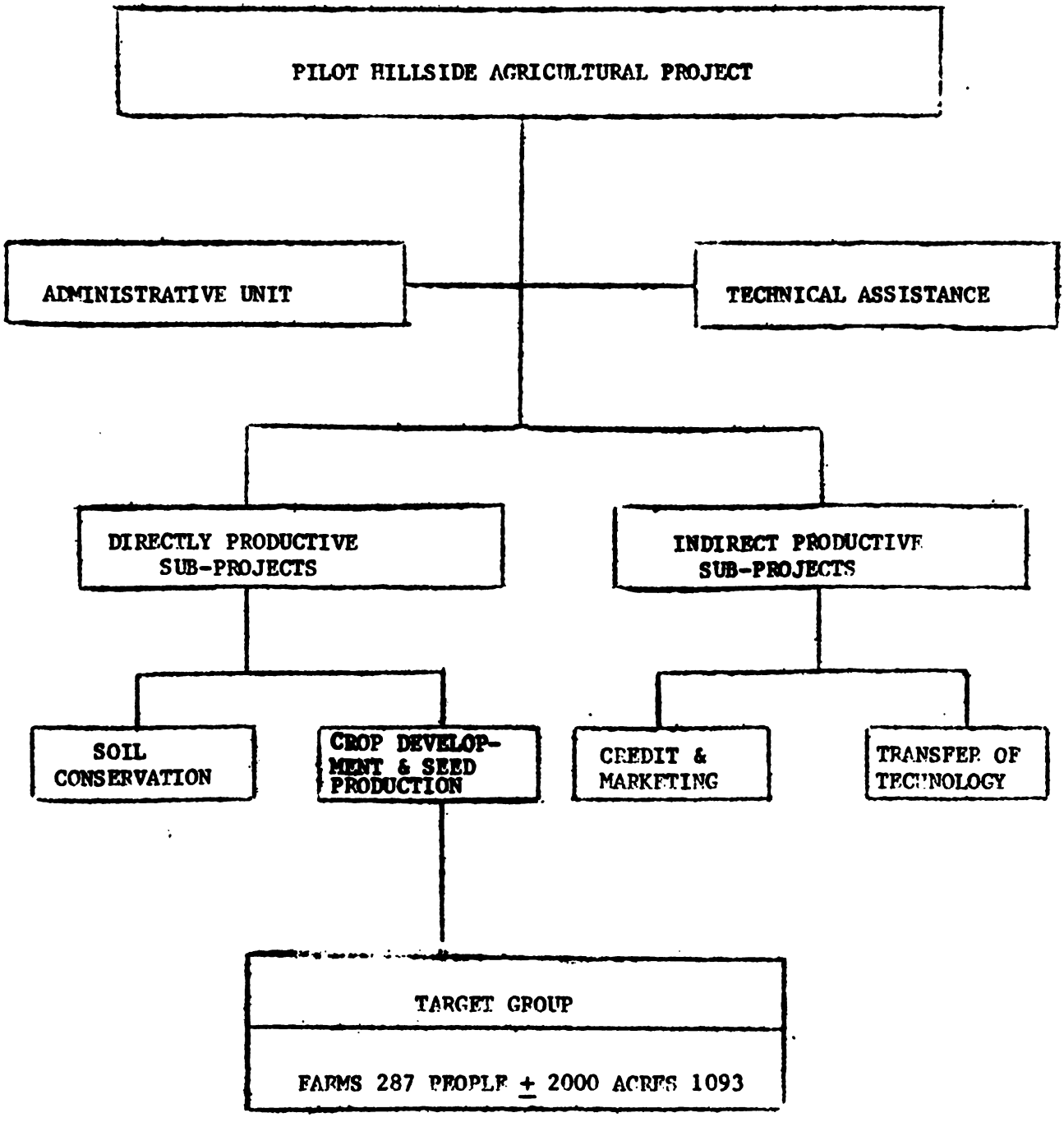
(ii) Marketing and Credit

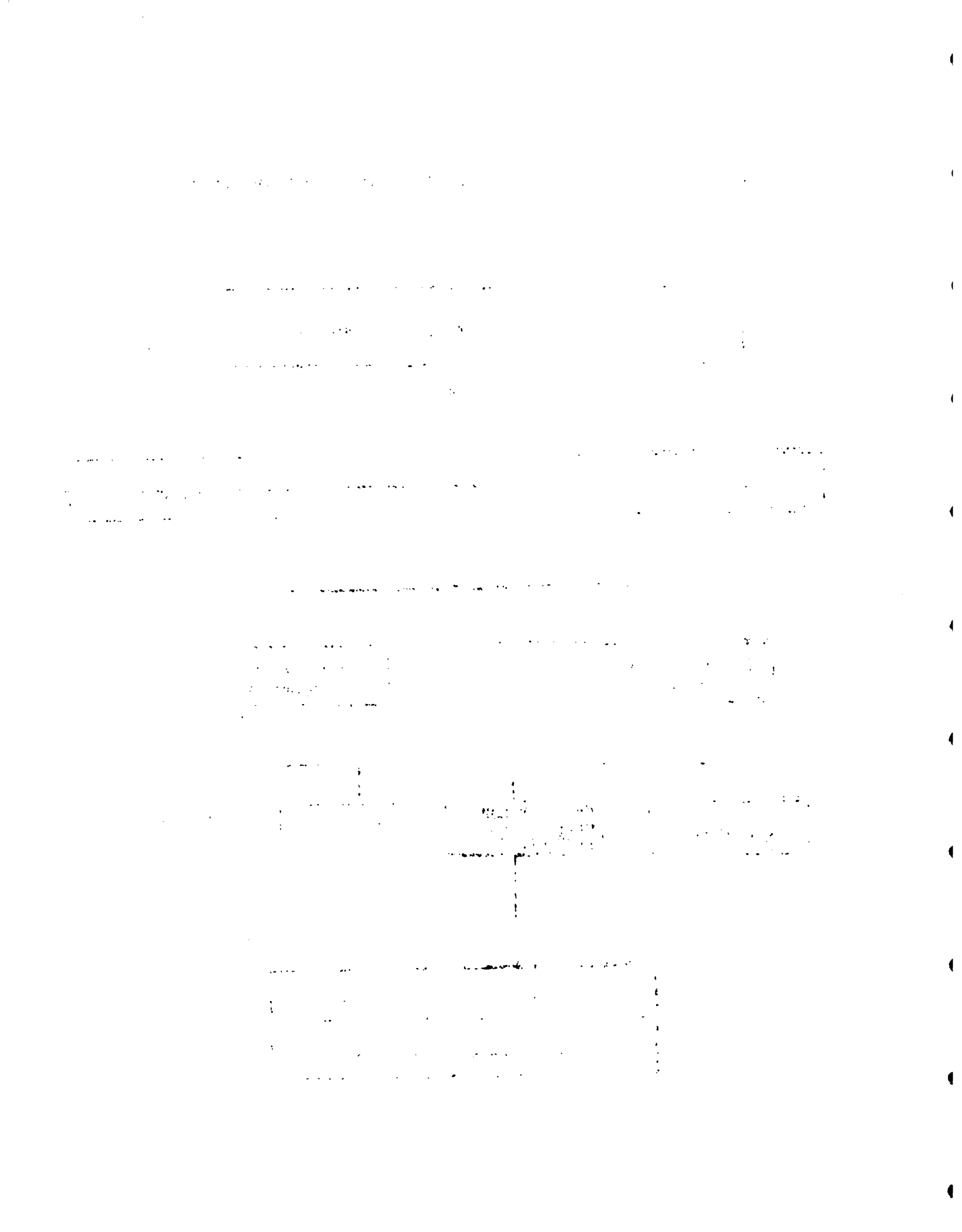
In addition to these, provision is made for Support Services (Technical and Administrative) which will be funded entirely by the GOJ, and which will therefore be discussed in the Section which deals with Project Execution. A detailed discussion of the Sub-projects follows.

4.04 Project Design

Against this background, the project has been designed to simulate an integrated agricultural development project, although it must still be viewed in the context of a pilot project; and as such will be expected to be investigatory and fact finding in some respects.

Fig. IV-1 ADMINISTRATIVE RELATIONSHIP OF SUB-PROJECT TO PROJECT





5.01 Soil Conservation Sub-project

Soil erosion and sedimentation have been identified as the major watershed problems in Jamaica. They have been a major cause of the low productivity of sloping lands which have been cultivated without the benefit of proper soil conservation measures and land use practices.

5.02 Background Information and Problem Definition

Over the past five years, the Government of Jamaica has been re-emphasizing the importance of conserving its limited natural resources. The Ministry of Agriculture, as a matter of policy re-initiated work on a more permanent basis in the area of conservation and management of land, particularly that used by the thousands of small farmers who farm these steep slopes and produce the bulk of the locally grown food crops. Based on findings from the Smithfield project, and with a view to pursuing its work on a larger scale on the hilly lands MINAG sought the cooperation of IICA. This culminated in the implementation of the GOJ/IICA project at Allsides. This project serves as an intermediate stage in the national programme which aims to increase proper utilization of rehabilitated areas, through the development of agricultural production systems for hilly lands.

5.03 Research efforts, studies and field experiences gathered from the Allsides project over the last 3 years, together with a knowledge of farmers' capabilities have been used as the main basis for preparing the project document. In particular, they provide information as to how land which has been terraced at high costs can be utilized in an economic manner and in a way which is profitable to the small farmers involved. Some small farmers in the Allsides project area are already adopting these improved practices with satisfactory results. Once the existing limitation of lack of credit and planting materials are redressed and appropriate marketing arrangements are made, small tools provided and appropriate farmer organizations are developed, returns to farmers will be even more significant.

5.04 Executing Agency

The executing agency for this sub-project will be the Soil Conservation Division of the newly created Agro-Forestry and Soil Conservation Department.

5.05 Objectives of the Sub-project

The objectives of the Sub-project are to:

- develop and/or adopt systems of soil conservation which can be economically applied in the area and its surroundings;
- assist in improving the institutional capabilities in the Soil Conservation Division for accommodating future expansion of its efforts in similar ecosystems; and
- increase the level of income and employment of the farmers in the area through the promotion of conservation measures which allow more intensive land use by improved cropping systems.

5.06 Technical Considerations

Limitations set by the amount of arable land available for agriculture and an increasing demand for agricultural products has forced greater attention on the development of an improved and expanded soil conservation programme.

The Pilot Hillside Agricultural Project area is characterized by very steep slopes and high intensity rainfall which averages over 80 inches per annum. The improper land use practices traditionally pursued by farmers combine with those characteristics to create significant soil erosion and its consequential ill effects.

5.07 Appropriate soil conservation practices have been selected for dealing with these problems. They include:

Bench terraces
Orchard terraces
Hillside ditches
Waterways and gully control
Grassing and tree-cropping
Afforestation
Road Construction

5.08 The break-down of the area according to slopes is set out below:

Slopes	Area (Ha)	Area (Acres)	% of Area
0° - < 7°	28	69.2	8.09
7° - <15°	131	323.6	37.86
15° - <20°	59	145.7	17.05
20° - <25°	40	98.8	11.56
25° - <30°	46	113.6	13.30
Over 30°	42	103.7	12.14
All Slopes	346	854.6	100.00

5.09 Soil Conservation Measures

Bench Terraces

(i) The principal purposes for the construction of bench terraces are to substantially reduce erosion, store water in the water-table and provide land which can be mechanically tilled, thereby reducing the drudgery of hillside farming. This terraced land must and can be used for intensive cropping (with reasonable safety) to justify the high expenditure involved. These terraces should be done on slopes less than 25° physical characteristics of the land and the soil. These terraces can be machine made.

Orchard Terraces

(ii) These are less expensive to construct than bench terraces and are used for food tree crops on steep slopes from 25° to 30° and will be done by hand labour due to their steepness. In the steep watersheds of Jamaica orchard terraces are very important due to:

(a) Many lands having slopes 25° to 30° are presently under poor cultivation practices which require appropriate soil protection.

(b) Small farmers with their limited land and financial resources will not ordinarily plant forest trees on this slope category.

Hillside Ditches

(iii) A series of V-Shaped flat-bottomed ditches running across the hillside slope, the spacing for which depends on the conditions found. These ditches will be placed on the slopes.

(iv) Waterways are strategically located to ensure water run-off in a manner which will reduce the rate of soil loss.

(v) Gully Control is carried out by means of check dams or other simple measures such as loose-rock check dams, or fence-rock check dams.

(vi) Farm Road construction is necessary not for soil conservation as such but to facilitate the movement of materials and farm products.

(vii) Associated with these structures is the grassing of the risers of bench terraces and of the waterways. Additionally, economic trees are used for protecting land especially in the steeper slopes. Food tree crops will be used in the areas which are orchard-terraced (slopes 25° to 30°) and forest trees on slopes above 30°

5.10 It is important for a number of reasons to refer to the loss of land which results from providing bench terraces. Most important is the farmers' reaction to the land area lost. Farmers are gradually being convinced that gains from increased production and other advantages such as ease of cultivation more than offset the losses due to the reduction in the effective land area remaining for cultivation after the land is terraced.

5.11 The information which follows shows a schedule for providing soil conservation measures for the Pilot project area. The schedule has been predicated on 4 hypotheses, 2 of which are based on a 5 year implementation period and 2 on a 3 year period. The question of selection of the particular option to adopt must depend heavily on the ability of the Soil Conservation Division to provide the totality of the measures required for the Pilot-area in the first instance. Secondly, and on the assumption that the soil conservation measures are provided there remain the important aspects of adoption by farmers and the role which will be played by Extension staff in achieving the programmed rate of adoption. Constraints in these aspects in the Allsides project have prompted the provision of additional staff as one means of endeavouring to achieve a faster rate of adoption.

5.12 For these reasons, detailed cost data are presented for the two assumption which are related to an implementation of the soil conservation measures during a period of 3 years. Hypothesis No. 4 is preferred due to its more gradual rate of implementation.

5.13 The costs for providing the soil conservation measures were determined from detailed field work, complemented with current information available from other soil conservation projects now in operation in Jamaica. They have been prepared in collaboration between GOJ and IICA technicians and are regarded by both groups as being appropriate for use in the project.

Specific Needs of the Soil Conservation Division

5.14 The Soil Conservation Division's capabilities for carrying out the sub-project, in relation to staffing at its disposal is a major determinant of the successful execution of the project. This relates to the quality of the work to be done and the ability to complete it within the implementation period. Support has been proposed by MINAG in the form of technical personnel, support staff as well as maintenance and operating expenses.

5.15 The Sub-Project will be assigned staff on a full-time basis as shown in the Organization Chart, and will consist of:

1 Soil Conservationist (University Graduate)

2 Soil Conservation Assistant Officers (Graduates - Jamaica School of Agriculture

3 Field Assistants (Vocational or High School Graduates)

It will also obtain assistance from the Technical Support Services and the Administrative Support Services to be provided by MINAG.

Project Technical Assistance will be provided by:

1 Soil Conservation Expert for 24 man-months

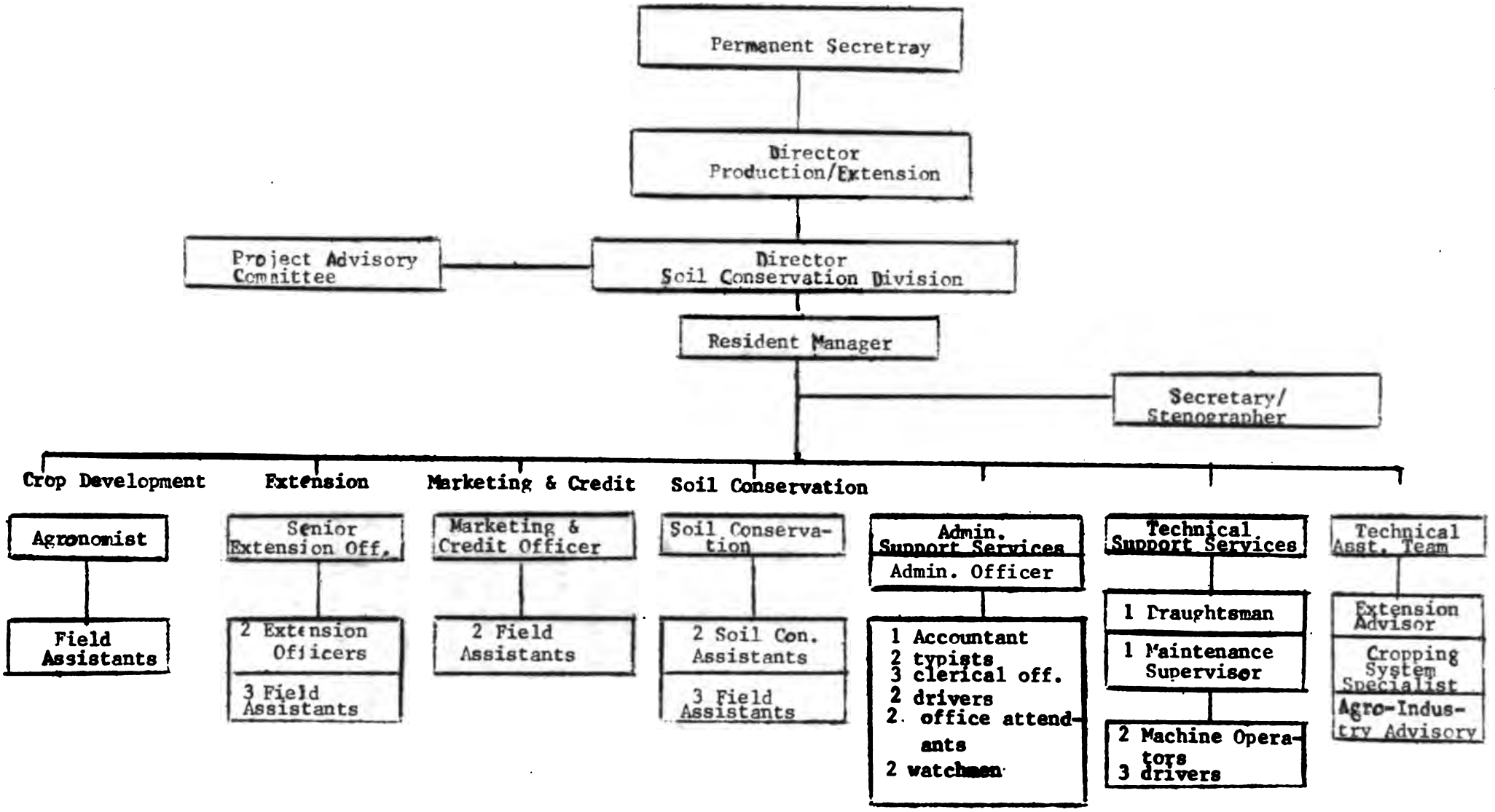
The Soil Conservation Sub-project will also work closely with the other Sub-projects, particularly those of Extension, and Crop Development and Seed Production.

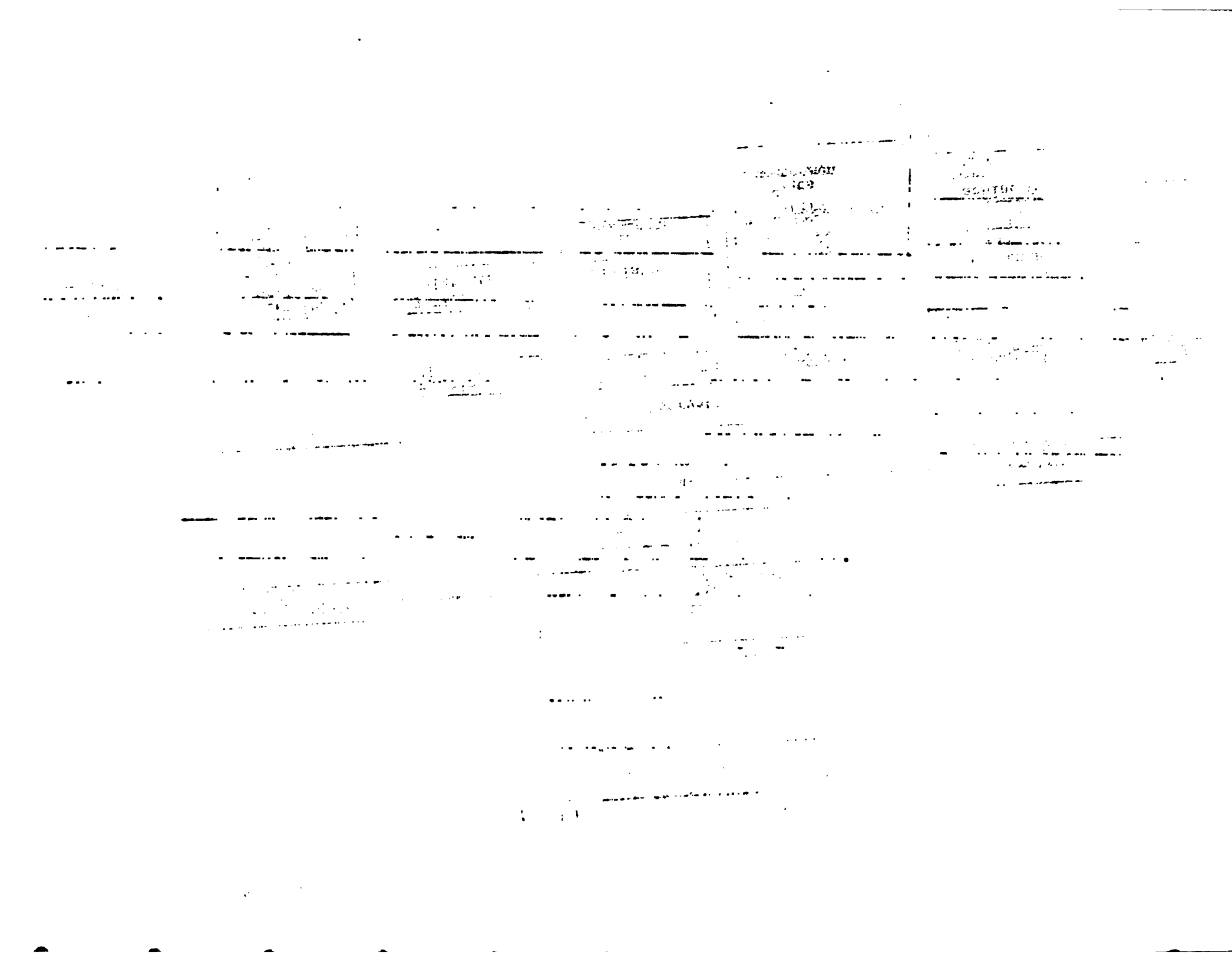
5.16 The Project will provide an appropriate vehicle as well as machinery and equipment. Maintenance and operational costs will be borne by MINAG (Details in Table).

5.17 The timetable for undertaking the work is shown in the schedule which follows. (Tables).

Fig. IV-2

PILOT HILLSIDE AGRICULTURAL PROJECT ORGANIZATION CHART





Costs for Undertaking the Soil Conservation Measures

5.18 These costs were determined through detailed surveys and analyses undertaken on the spot, using local experiences as well as those derived from similar situations. These have been worked out in conjunction with the Soil Conservation Division of MINAG and have drawn to some extent on the Smithfield and Allsides experiences.

5.19 Arising from the analytic work undertaken it has been possible to determine quantities and attach costs for the various structures to be undertaken. The nature of the analyses has been such that should there be elements of over-estimation in costs this would merely make the project a more feasible proposition.

5.20 On the technical side any problems which are likely to arise are capable of resolution between the Soil Conservation Division with its experience in this area and the Specialist in Soil Conservation to be provided through the Technical Assistance element of the IDB grant financing.

5.21 The total cost for undertaking the Soil Conservation measures is projected to be US$1,394,062, 75% of which will be borne by an IDB grant and 25% by farmers through suitable credit arrangements. The cost for the Soil Conservation Sub-project inclusive of the soil conservation measures will be US$1,620,312 and this will be funded almost entirely by the IDB, either as a grant or as a loan in relation to the provision of credit to cover the farmers' 25% share of the costs of the conservation measures. All the foreign exchange requirements will be met from IDB funds.

5.22 GOJ support will be provided in terms of technical and administrative support staff and facilities and the project will fall under the direct responsibility of the Director of Soil Conservation.

Table IV-2 Assumptions based on Different Rates of Implementation of Soil Conservation Measures

YEARS	Hypothesis 1			Hypothesis 2			Hypothesis 3			Hypothesis 4		
	Hectares	Cum*	%	Hectares	Cum*	%	Hectares	Cum*	%	Hectares	Cum*	%
1	108	108	31.2	53	53	15.3	63	63	18.2	79	79	22.8
2	124	232	67.1	100	153	44.2	113	176	50.9	119	198	57.2
3	37	269	77.7	120	173	78.9	170	346	100.0	148	346	100.0
4	37	306	88.4	43	316	91.3	346	346	100.0	346	346	100.0
5	40	346	100.0	30	346	100.0						
All years	346	346	100.0	346	346	100.0						

* Cum=Cumulative

Table IV-3 Hypothesis No. 3 - Adoption Rate for Soil Conservation Measures and Costs for providing Measures (US$)

(Hectares)

		Slope	Year 1	Year 2	Year 3	All
		0°- ∠ 7°	7	21	—	28
		7°- ∠ 15°	20	33	78	131
		15°- ∠ 20°	5	22	32	59
		20°- ∠ 25°	4	8	28	40
		25°- ∠ 30°	15	15	16	46
		Over 30°	12	14	16	42
		All Slopes	63	113	170	346
Slopes	Items	Unit Cost	Year 1	Year 2	Year 3	Total
0° - ∠ 7°		$	$	$	$	$
(Hectares)			(7)	(21)	-	(28)
	Materials	16	112	336	-	448
	Machines	243	1,701	5,103	-	6,804
	Labour	67	469	1,407	-	1,876
Sub Total		326	2,282	6,846	-	9,128
7° - ∠ 15°						
(Hectares)			(20)	(33)	(78)	(131)
	Materials	95	1,900	3,135	7,410	12,445
	Machines	1,424	28,480	46,992	111,072	186,544
	Labour	2,628	52,560	86,724	204,984	344,268
Sub Total		4,147	82,940	136,851	323,466	543,257
15°- ∠ 20°						
(Hectares)			(5)	(22)	(32)	(59)
	Materials	95	475	2,090	3,040	5,605
	Machines	1,249	6,245	27,478	39,968	73,691
	Labour	2,753	13,765	60,566	88,096	162,427
Sub-Total		4,097	20,485	90,134	131,104	241,723
20°- ∠ 25°						
(Hectares)			(4)	(8)	(28)	(40)
	Materials	95	380	760	2,660	3,800
	Machines	4,290	17,160	34,320	120,120	171,600
	Labour	2,727	10,908	21,816	76,356	109,080
Sub-Total		7,112	28,448	56,896	199,136	284,480
25°- ∠ 30° (Hectares) Orchard Terrace			(15)	(15)	(16)	(46)
Sub-Total		5,127	76,905	76,905	82,032	235,842
7 30° (Hectares) Forestry			(12)	(14)	(16)	(42)
Sub-Total		1,896	22,752	26,544	30,336	79,632
GRAND TOTAL			233,812	394,176	766,074	1,394,062

Table IV-4 Hypothesis No. 4 Adoption Rate for Soil Conservation Measures and Costs for providing Measures (US$)

(Hectares)

		Slope	Year 1	Year 2	Year 3	ALL
		0°- ∠ 7°	15	13	—	28
		7°- ∠ 15°	28	39	64	131
		15°- ∠ 20°	5	30	24	59
		20°- ∠ 25°	4	8	28	40
		25°- ∠ 30°	15	15	16	46
		Over 30°	12	14	16	42
		All Slopes	79	119	148	346
Slopes	**Items**	**Unit Costs**	**Year 1**	**Year 2**	**Year 3**	**Total**
		$	$	$	$	$
0° -∠ 7° (Hectares)			(15)	(13)	—	(28)
	Materials	16	240	208	—	448
	Machines	243	3,645	3,159	—	6,804
	Labour	67	1,005	871	—	1,876
Sub-Total		326	4,890	4,238	—	9,128
7° - ∠ 15° (Hectares)			(28)	(39)	(64)	(131)
	Materials	95	2,660	3,705	6,080	12,445
	Machines	1,424	39,872	55,536	91,136	186,544
	Labour	2,628	73,584	102,492	168,192	344,268
Sub-Total		4,147	116,116	161,733	265,408	543,257
15° - ∠ 20° Hectares)			(5)	(30)	(24)	(59)
	Materials	95	475	2,850	2,280	5,605
	Machines	1,249	6,245	37,470	29,976	73,691
	Labour	2,753	13,765	82,590	66,072	162,427
Sub-Total		4,097	20,485	122,910	98,328	241,723
20° - ∠ 25° (Hectares)			(4)	(8)	(28)	(40)
	Materials	95	380	760	2,660	3,800
	Machines	4,290	17,160	34,320	120,120	171,600
	Labour	2,727	10,908	21,816	76,356	109,080
Sub-Total		7,112	28,448	56,896	199,136	284,480
Total	Materials		3,755	7,523	11,020	22,298
	Machines		66,922	130,485	241,232	438,639
	Labour		99,262	207,769	310,620	617,651
GRAND TOTAL			169,939	345,777	562,872	1,078,588
25° - ∠ 30° (Hectares) Orchard Terrace			(15)	(15)	(16)	(46)
Sub-Total		5,127	76,905	76,905	82,032	235,842
7° 30° (Hectares) Forestry			(12)	(14)	(16)	(42)
Sub-Total		1,896	22,752	26,544	30,336	79,632
GRAND TOTAL			269,596	449,226	675,240	1,394,062

TABLE IV - JAMAICA PILOT HILLSIDE AGRICULTURAL PROJECT COST RESUME OF SUB-PROJECT, SOIL CONSERVATION - Additional Costs to be incurred during the project period

(US$)

Cost Categories	Year 1	Year 2	Year 3	Total
	$	$	$	$
Technical Assistance	72,000	72,000		144,000
Office Equipment	26,300			26,300
Vehicles and Spare Parts	40,350			40,350
Field Equipment	15,600			15,600
Soil Conservation Works	269,596	449,226	675,240	1,394,062
Total	423,846	521,226	675,240	1,620,312

Details are shown in Table IV - page IV - 16

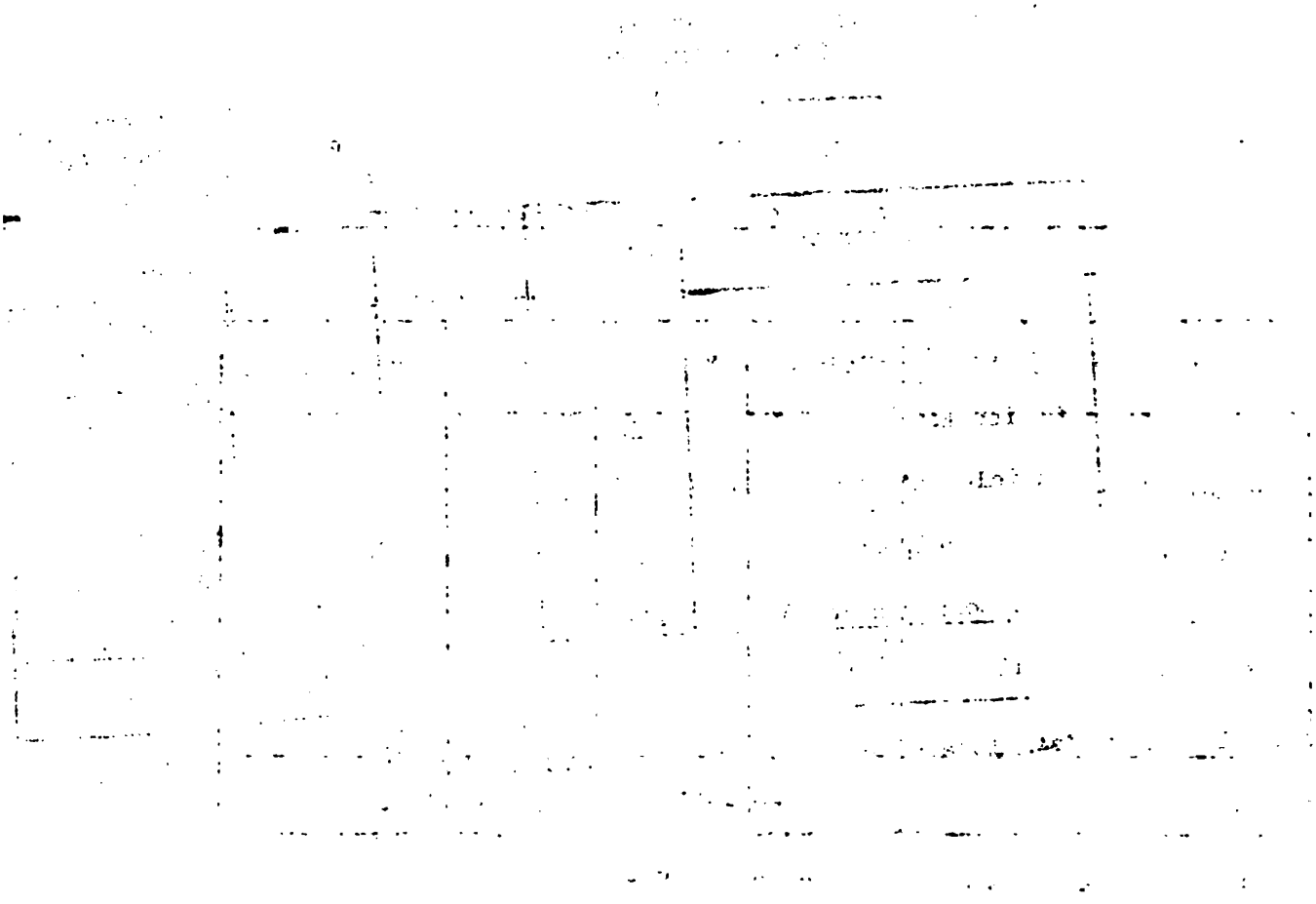


TABLE IV - JAMAICA PILOT HILLSIDE AGRICULTURAL PROJECT - SOIL CONSERVATION SUB-PROJECT
Resumé of Additional Costs for Execution Period

(US$)

Investment Categories	Physical Unit Requirement	Unit Cost Price	Year 1		Year 2		Year 3		Total
			No.	Cost	No.	Cost	No.	Cost	
		$		$		$		$	$
1 Soil Conservation Specialist	24 Months	6,000	12	72,000	12	72,000			144,000
Sub-Total				72,000		72,000			144,000
2 Soil Conservation Infrastructure									
2.1 Slope 0° - L 7°	28 hectares	326	15	4,890	13	4,238			9,128
2.2 7° - L 15°	131 "	4,147	28	116,116	39	161,733	64	265,408	543,257
2.3 15° - L 20°	59 "	4,097	5	20,485	30	122,910	24	98,328	241,723
2.4 20° - L 25°	40 "	7,112	4	28,448	8	56,896	28	199,136	284,480
2.5 25° - L 30°	46 "	5,127	15	76,905	15	76,905	16	82,032	235,842
2.6 over 30°	42 "	1,896	12	22,752	14	26,544	16	30,336	79,632
Sub-Total	346 "		79	269,596	119	449,226	148	675,240	1,394,062
3 Vehicles and Spare Parts									
3.1 Vehicles-Four wheel drive Jeeps	3	12,000	3	36,000					36,000
	3	1,450	3	4,350					4,350
Sub-Total				40,350					40,350
4 Equipment									
4.1 Field Equipment									
4.1.1 Dumpy Level	6	900	6	5,400					5,400
4.1.2 Abney Level	10	110	10	1,100					1,100
4.1.3 Rodo (complete)	10	110	10	1,100					1,100
4.1.4 Tapes	10	90	10	900					900
4.1.5 Soil Sample Cans	250	2	250	500					500
4.1.6 Planimeters	3	2,200	2	6,600					6,600
4.2 Office Equipment									
4.2.1 Executive Desk	10	1,000	10	10,000					10,000
4.2.2 Junior Desk	4	750	4	3,000					3,000
4.2.3 Typist Desk	2	250	2	500					500
4.2.4 Typewriter	3	1,000	3	3,000					3,000
4.2.5 Chairs	30	90	30	2,700					2,700
4.2.6 Filing Cabinet	6	250	6	1,500					1,500
4.2.7 Plane Tables	2	2,800	2	5,600					5,600

Costs for Providing Soil Conservation Measures

Detailed costs of providing the soil conservation measures are presented below. For each slope category the total cost estimates previously estimated were reduced to a per hectare basis and the cost of soil-improving agronomic practices were added. These costs were determined through a technical study undertaken specifically for this purpose.

(1) Slope Category $0^{o} - 7^{o}$ (Machine Built)

Investment Cost (Per Hectare)

Hillside Ditch		
Cutting & Filling	134.10	
Grassing ditches	31.39	
Waterway Construction		
Earth Excavation	298.55	
Grassing of waterway	87.55	
Liming		
2 tons of marl	28.00	
Total	JA$ 579.59	= US$326

(2) Slope Category $7^{o} - \angle 15^{o}$ (Machine Built)

Investment Cost (Per Hectare)

Bench Terrace		
Cutting & Filling with replacement of top soil	2,470.20	
Establishment of Grass on risers	725.74	
Waterway Construction		
Earth Excavation	65.26	
Grassing of Waterway	20.64	
Supplying Concrete Structure and Installation	3,933.31	
Liming		
2 tons of marl	28.00	
Manuring		
Poultry manure (2 tons)	140.00	
Total	JA$7,383.15	= US$4,147.00

(3) Slope Category 15° - ∠ 20° (Machine Built)

Investment Cost (Per Hectare)

Bench Terrace

Cutting & Filling with replacement of top soil	2,158.80	
1.1 Establishment to grass on risers	947.39	
Waterway Construction		
Earth Excavation	65.26	
Grassing of Waterway	20.64	
Supplying concrete structure and Installation	3,933.31	
Liming		
2 tons of marl	28.00	
Manuring		
Poultry manure (2 tons)	140.00	
Total	JA$ 7,293.40	= US$4,097.00

(4) Slope Category 20° - ∠ 25° (Hand Built)

Investment Cost (Per Hectare)

Bench Terrace

Cutting & Filling	7,570.24	
Establishment of grass on risers	901.45	
Waterway Construction		
Earth Excavation	65.26	
Grassing of waterway	20.64	
Supplying concrete structures and Installation	3,933.31	
Liming		
2 tons of marl	28.00	
Manuring		
Poultry manure (2 tons)	140.00	
Total	JA$ 12,658.90	= US$7,112.00

(5) Slope Category 25^{o} - / 30^{o} (Hand Built)

Investment Cost (Per Hectare)

Orchard Terrace

Cutting & Filling		3,096.72
Establishment of Grass in Spaces between terraces		1,613.95
Waterway Construction		
Earth Excavation		91.20
Grassing of waterway		27.06
Supplying Concrete structure and Installation		4,297.59
Liming		
None		
Manuring		
None		
Total	JS$	9,126.52 = US$5,127.00

(6) Slope Category Over 30^{o}

Afforestation

Investment Cost

Approximately $3 per plant, 1,125 per hectare for materials and planting = $3,375 per ha = US$1,896

On the basis of the above costs it is necessary to keep in mind two very important factors concerning the determination of the costs.

(i) Although the slope category 0^{o} - 7^{o} requires soil conservation measures these are less stringent than those for the other slope categories; and

(ii) land with slopes greater than 25^{o} are not processed with machines due to the physical characteristics.

It should be observed that with the exception of the over 30^{o} slope category there is a tendency for structural costs to increase as slopes increase.

TRANSFER OF TECHNOLOGY SUB-PROJECT

Introduction

6.01 The Allsides experience confirms the fact that technology transfer is a key element in getting farmers to adopt new and improved practices. It cannot be done in isolation but as part of an integrated package of agro-services. As is the case with the Allsides project unless specific arrangements are made the rate of transfer of technology will be much slower than that projected.

Background Information and Problem Definition

6.02 The "bench mark" survey conducted to support the preparation of this project showed that 33% of all farmers in the project area relied on the agricultural instructor for information and that for the age group between 35 to 45 years the impact of the agricultural instructor was higher than 42%. Capital unavailability was cited by all farmers as their most urgent need, followed by shortages of chemicals and tools, where farming even at existing low levels is concerned. Transfer of technology and improved practices are tied closely to the timely availability of funds. Farmers in the project area have observed and are aware of the importance of the "new technology" and 90% of all farmers have indicated a willingness to adopt this new technology provided they are helped technically and financially.

6.03 Experiences in the area indicate that although the technology transfer process is already underway facilities to speed it up should be accompanied by a package of services and appropriate incentives. The rate of transfer and adoption of new technology in the Allsides area is the result of a combination of factors. Its effectiveness can be traced to factors originating on both the farmer's side as well as on the side of the Ministry of Agriculture and the sector agencies.

6.04 Problems stated by farmers themselves as affecting technology transfer are related to:

(a) suggestions that their individual farm units are too small for the application of advanced technology;

(b) unavailability of inputs required for achieving technological change, due to high prices, import constraints, etc;

(c) lack of financial resources to embark on the "adventure" of adopting new technology;

(d) income threshold too low to feel any degree of assurance in adopting the practices;

(e) land characteristics which provide a very low probability of success, without adequate soil conservation and improved agronomic practices; and

(f) the views of some farmers that they are too old to adopt the new technology.

6.05 The institutions IICA and MINAG have had a number of limitations which have not been conducive to a faster transfer of technology. These include, inter alia:

(i) frequent re-organization within short periods to which the Ministry of Agriculture has been subjected;

(ii) unavailability of suitably trained personnel;

(iii) inadequacy of appropriate training on the part of some extension agents assigned to the project;

(iv) the limited availability of agricultural research information relevant to the development of production systems for hillsides (with the possible exception of that available from Allsides and Smithfield very little was done elsewhere);

(v) relatively low overall resource availability in the past due to financial constraints;

(vi) staff changes (MINAG's resource constraints and IICA's during the first year of the project affected project development and also the transfer of technology. MINAG has been endeavouring to improve its extension component and IICA is in the process of providing an Extension Specialist; and

(vii) the limited integration and co-ordination in the past of the relevant agencies in cases where their united efforts would have led to successful results.

Objectives of the Technology Transfer Sub-project

General Objectives

6.06 The Technology Transfer sub-project will have as its general objective the communication of and adoption by farmers in the project area of the improved practices and new technology developed, as well as supportive socio-economic improvements.

Because of the important role played by the farm family in general and the women in the farm households in particular, it is of paramount importance that the family be involved in an integrated approach in matters covering production and marketing.

Specific Objectives

6.07 On the basis of the two general objectives the specific objectives which arise are:

(a) to seek the acceptance and adoption by the farmers in the area of the technological and agronomic improvements arising from the execution of the crop development component;

(b) to seek the acceptance and adoption of farm management practices as a way to optimize the use of physical and economic resources by farmers in the area;

(c) to promote the acceptance and organization of farm groups in order to facilitate input provision, technology adoption and communal integration;

(d) to develop mechanisms of integration and participation by the farm family in the production, marketing and general decision-making unit at the farm level; and

(e) to cooperate with the other technical components of the project in order to serve as an integrated mechanism for solving farmers' problems.

Executing Unit

6.08 The executing unit of this component will be the Production and Extension Department of the Ministry of Agriculture through its Western Region and its Parish Management Unit in Falmouth (Trelawny).

The Parish Manager of Trelawny is responsible for controlling the activities of the Parish within the Project area. The Western Region has through its Parish Manager assigned to the Allsides Research Unit a Field Extension Officer on a full-time basis and a second officer on a part-time basis. Also available on a full-time basis is a Project Land Lease (PLL) officer who covers aspects related to the PLL inputs of the land which is a PLL property.

The provision of field services for the Pilot project area will be the responsibility of the GOJ/IICA Field Officer located at Allsides. At the present time, the Allsides Extension Officer performs this duty at the site and the proposal is to add one more full-time Extension Officer. It is generally believed that in order to increase the rate of technology transfer it is necessary to reduce by one half the number of farmers served by an extension officer.

6.09 Activities of the Transfer of Technology Sub-Project

- Establishment of demonstration plots on farms where terracing, other conservation measures and multiple cropping systems have been carried out.
- Residential training courses for a specific number of farmers in subjects determined from time to time as being critical to the needs of farmers.
- Field days and tours, at the Allsides and Olive River research sites and at Smithfield Soil Conservation Research Unit.
- Special school courses and seminars for senior grades of the local primary and secondary schools as well as round table seminars and field days for selected students of the Jamaica School of Agriculture from whose graduates Extension Staff are mainly recruited.
- Farm Plans - Development of plans with farmers, and follow through of farm management and planning activities as a basis for determining the agricultural credit component, and arrangements for marketing of produce.
- Farm "leaders" Seminars - The basic reason being that of exchange of ideas on agronomic, economic and community problems so that they can be tackled appropriately. These Seminars will also serve as a

community integrative exercise.

- The availability of research personnel and technical experts from MINAG in the area will facilitate the use of the human resources for consultation on specific problems at farm and farmers' levels.
- Farms visits - The permanent contact of the Extension Agent and Home Economicst will be programmed and scheduled in order to provide appropriate coverage for the Farm Family needs in the technical and production aspects.
- Material Development and Preparation - These activities should be the technical responsibility of personnel involved in adaptive research and extension.
- The extension officer will serve as the medium in a two way traffic between farmer and Project with a view to obtaining solutions to problems.

6.10 The Sub-project will be assigned staff on a full-time basis as shown in the Organization Chart, consisting of:

1 Senior Extension Officer (University Graduate)
2 Extension Officers (Graduate of the Jamaica School of Agriculture JAS)
3 Field Assistants (Vocational or High School Graduates)

It will also obtain assistance from the Technical Support Services and the Administrative Support Service to be provided specifically by MINAG for the project.

6.11 The Extension Sub-project will provide the main link between the farmer and the project and must liaise freely with the Soil Conservation Sub-project, the Crop Development and Seed Production Sub-project and the Marketing and Credit Sub-project.

6.12 The Project will provide Technical Assistance for 24 man-months. In addition the project will provide an appropriate vehicle, machinery, and equipment. Operational and maintenance costs will be borne by MINAG (See details on page IV-57).

6.13 The timetable for undertaking the work is shown in the schedule which follows (Table IV-9 page IV-24).

TABLE IV- JAMAICA PILOT HILLSIDE AGRICULTURAL PROJECT COST RESUME OF SUB-PPOJECT, TRANSFER OF TECHNOLOGY (EXTENSION) - Additional cost to be incurred during the project period

(US$)

Cost Categories	YEARS				
	1	2	3	4	Total
	$	$	$	$	$
Technical Assistance	72,000	72,000			144,000
Office, Audio-Visual and Small Equipment	12,800				12,800
Vehicles and Spare Parts a/	13,800				13,800
Training for Farmers and Staff*	23,200	25,500	30,500		79,200
Total	121,800	97,500	30,500		249,800

* Includes Demonstrations on selected farmers holdings
Details are shown in Table IV- Page IV- 23

a/ See notes on page IV-15

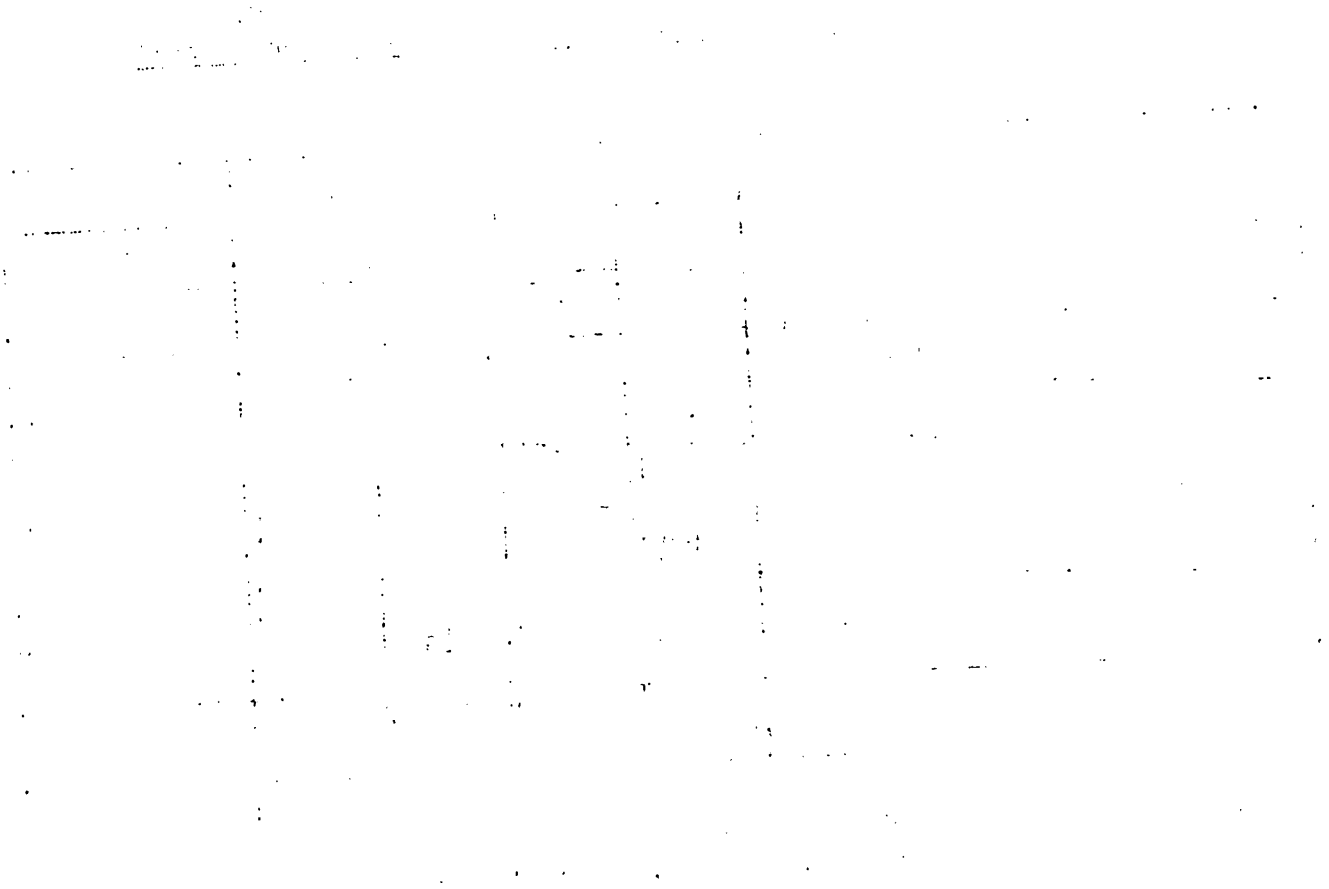


TABLE IV JAMAICA HILLSIDE AGRICULTURAL PROJECT - EXTENSION SUB-PROJECT
Resume of Additional costs for Execution Period

(US$)

Investment Categories	Physical Unit Requirement	Unit Cost Price	Year 1		Year 2		Year 3		Total
			No	Cost	No	Cost	No	Cost	Total
		$		$		$		$	$
1. Extension Specialist	24 months	6,000	12	72,000	12	72,000	-	-	144,000
Sub-total				72,000		72,000			144,000
2. Training of Staff and Farmers'									
2.1 Residential Training Courses	16	2,700	6	16,200	5	13,500	5	13,500	43,200
2.2 Field Days	6	500	2	1,000	2	1,000	2	1,000	3,000
2.3 Seminars	6	500	2	1,000	2	1,000	2	1,000	3,000
2.4 Demonstration plots on Farmers' holdings	120	250	20	5,000	40	10,000	60	15,000	30,000
Sub-total				25,200		25,500		30,500	79,200
3. Vehicles and Spare Parts									
3.1 Jeep - 4 wheel drive	1	12,000	1	12,000					12,000
3.2 Spare Parts	1 set	1,800	1	1,800					1,800
Sub-total				13,800					13,800
4. Office, Audio-visual and Small Equipment									
4.1 Audio-visual aids	1 set	10,000	1	10,000					10,000
4.2 Desks	2	1,000	2	2,000					2,000
4.3 Chairs	2	250	2	500					500
4.4 Filing Cabinets	2	150	2	300					300
Sub-total				12,800					12,800
Total				121,800		97,500		30,500	249,800

Chronogram of Activities envisaged for the transfer of Technology

	YEARS 1				2				3			
	QUARTERS 1	2	3	4	1	2	3	4	1	2	3	4
Acceptance and Adoption of New Technology												
- Demonstration Plots at farm level		X				X				X		
- Residential farm training courses			X				X				X	
- Field days and tours	X	X		X	X	X		X	X	X		X
- Farm Visits	X	X	X	X	X	X	X	X	X	X	X	X
Farm Management												
- Residential training courses		X		X				X				X
- Farm Visits	X	X	X	X	X	X	X	X	X	X	X	X
- Farm plans design (credit contribution)	X	X	X	X	X	X	X	X	X	X	X	X
Marketing												
- Collecting information; crop forecasting	X	X	X	X	X	X	X	X	X	X	X	X
Promotion of Organization												
- Residential training courses			X			X					X	
- Farm Visits	X	X	X	X	X	X	X	X	X	X	X	X
Development of the Farm Family System												
- Residential training courses	X		X		X		X		X		X	
- Farm Visits	X	X	X	X	X	X	X	X	X	X	X	X
- Special School Courses and Seminars	X	X			X	X		X	X			
Liaison with other Sub-Projects 1/												
- Farm "leaders" seminar			X				X				X	
- Technical field visits 2/	X	X	X	X	X	X	X	X	X	X	X	X
Material Development and Preparation 3/												

1/ Continuous liaison for integrative approach to problem solving.

2/ Permanent activity as special problems are detected and the need arises.

3/ Permanent type of work based on the needs of the Project and in coordination with the Agricultural Information Service

Crop development and seed production sub-project

Introduction

7.01 Soil conservation measures per se provide a basis for using steep lands more intensively and effectively and with a greater degree of safety. Once these measures are provided reasonable assurance is required that the farmers who are the main beneficiaries will use the land in an appropriate manner.

The necessity for the Crop Development Sub-project is based on the fact that the development of economically and otherwise successful systems results in an increase in farmers' income, thereby creating necessary, though perhaps not sufficient, incentives for the adoption of improved technology.

7.02 During the first phase of the GOJ/IICA Allsides Pilot Development Project the major thrust was in the development of appropriate intercropping systems. The intercropping systems use moisture and other production inputs more efficiently than monocultures, because of greater crop coverage and their ability to exploit available soil moisture. Furthermore, in cases where soils are inherently infertile the influence of legume intercrops on the improvement and maintenance of soil fertility is significant. This is especially important in economic terms when the high costs of chemical fertilizers are considered.

7.03 The better intercropping systems developed at Allsides have shown that significant increases in food production per unit of land can be achieved. Complementary work indicates the significant increases which have been achieved through the application of simple practices such as those used in reducing the level of damage done by nematodes to yam 'heads' and yam production in general. Increased employment opportunities have been generated due to the fuller use of land and the increased labour requirements needed to produce the intercrops over a stated period, say, one year. This facilitates a more even distribution of on-farm employment. Essentially there is an increase in income potential both from increased employment and from land out-put. Additionally it has been shown that these lead to enhanced nutritional profiles.

7.04 Another significant feature is its decreased risk compared with that from mono-cropping. This is extremely important as an incentive for participation by small hillside farmers who are totally dependent on rainfed agriculture. Intercropping systems provide assurance that investments in production factors such as labour and capital input will receive greater protection. Crop mixes are also:

(i) more dynamic biologically than a mono-crop system; and

(ii) able to survive much better the adversities of weather, pests and diseases.

Background Information and Problem Definition

7.05 In the developmental phase of the intercropping systems at Allsides, selection of crop varieties was restricted by expediency to only those for which it was possible to obtain planting material even of poor quality. It will be necessary to undertake field trials to determine, inter alia, varieties and strains of higher genetic potential than those now in use, with a view to developing the potential for increasing farmers' incomes.

7.06 Variety selection and plant improvement constitute areas in which adaptive research can significantly improve on traditional intercropping with little increased cost. Screening for varieties and crop species that will perform best under competitive cropping conditions is expensive in terms of time and money, and requires know-how and dedication on the part of the technicians.

7.07 Crops and varieties selected will take into account:

- maturity time;
- photoperiod sensitivity;
- ability of the crop species to perform well under competitive condition; and
- ability of the crop species to withstand diseases and pests as much as possible.

7.08 Adaptive research should also be undertaken to determine optimum crop density and row spacing. These activities must be specifically programmed and for this reason emphasis will be placed on

continuing and improving the work at Allsides and at Olive River. The latter station is sited on leased land, the lease for which started February 1, 1980 and lasts for 5 years, with an option for renewal.

7.09 Experience gained from the Allsides Project has indicated the need to reduce the costs incurred on variable inputs for producing the intercrops. Specifically, studies should be focussed on:

- using facilities more efficiently for land preparation, land tillage, sowing and harvesting of individual crops; and
- increasing the efficiency and efficacy of chemical inputs.

These improvements are necessary in order to obtain real benefits from intercropping. Included as an integral component of the farming systems on bench terraces is the raising of livestock. Cattle and goats may be zero-grazed using Napier grass (Pennesetum purpureum) forage produced on the bench terrace risers. While preliminary data suggest that these animals are adequately nourished, consideration should be given to identifying the most compatible forage legume species for intercropping with the Napier grass. The project should therefore endeavour to determine and demonstrate the best grass/legume association for possible adoption by farmers.

7.09 The three-year period for which the Allsides project has been in operation is much too short for providing answers to the many problems which require investigation of an adaptive nature. To this end MINAG has indicated that it is providing appropriate resources on a structured basis (See proposals, pages IV-58-61).

In addition, IICA/Simon Bolivar has supported MINAG's request for an 18-months extension for Phase 1 of the Project which will now expire in December 1981.

Seed Production

7.10 Experiences gained at Allsides, but which also apply elsewhere on the island, indicate very clearly the problems which face farmers in obtaining seeds and other planting materials (cultivars). Limitations relate to quantity, quality and the timeliness of availability. The problem is worse for crops which, although not commonly grown in the project area, have a real potential for increasing farmers' incomes.

A critical problem concerning yams, the major crops produced in the area, is the poor quality of planting material available, largely due to nematode infestation and the considerable loss in the quantity which is effectively utilized in planting. In money terms this results in considerable loss to the farmers in many ways.

A partial solution to the problems relating to shortage of seeds and pest-free planting material in the Allsides Project was effected through:

(a) seed multiplication, whereby desirable germplasm material was bulked on the demonstration plots and distributed to interested farmers;

(b) adaptability trials of various legume cultivars, whereby good performers were screened;

(c) yam nematode trials aimed at ascertaining the economic benefits of seed sanitation; and

(d) distribution, wherever possible, of seed material to farmers especially for those crops which have performed well under the conditions at Allsides.

Objectives of the Crop Development and Seed Production Sub-project

7.12 This sub-project will have as its general objectives the further generation of information on intercropping systems to ensure the continued viability of this method of production by small farmers (especially those farming soil-conserved land), and the production of good quality seeds and cultivars for their use in adequate quantities. Additionally it will assist local technicians through appropriate training programmes to acquire skills in these areas. Measures will be taken to develop tillage equipment for reducing the drudgery and improving efficiency in land preparation on hillside farms.

Specific Objectives for Crop Development

7.13 The specific objects are to:

(a) select varieties and crop species which are compatible with yam intercropping and which have demonstrated high yielding potentials, and determine the seed and other planting materials required;

(b) determine optimum crop density and row configuration of all associated crops to be included in the intercropping systems;

(c) improvise and determine the suitability of appropriate machinery for completing manual operations in the:

- preparation of continuous mounds on bench terraces;

- construction of furrows for planting of intercrops and;
- harvesting of associated crops;

(d) determine optimum rates and frequency of application of appropriate fungicides and pesticides for the cropping systems under the special conditions which obtain in the project area;

(e) determine the suitability of legume/grass forage production on risers and steep slopes for ruminants; and

(f) conduct additional training programmes for farmers and for national technicans in the areas of:

- farming systems;
- crop and soil management; and

(g) liaise very closely with the Soil Conservation and Extension sub-projects.

Technical Considerations

7.14 To achieve the specific objectives detailed above the following aspects should be considered:

- Adequate technical staff for the Allsides and Olive River sub-project
- Demonstrating the agronomic and economic viability of growing selected crops in association with yam;
- Agricultural engineering trials aimed at developing appropriate land tillage and harvesting equipment for hillside farming;
- Testing forage legume species for their compatibility with Napier (or other potentially suitable) grass for use on bench terrace risers;
- Training and demonstration programmes for farmers and national technicians using the two Sub-stations at Allsides and Olive River

Training activities will be oriented towards:

(i) intercropping systems, with their accompanying soil and crop management techniques;

(ii) skills necessary for ensuring the harvest of marketable produce; and

(iii) using farms of early adopters for demonstration purposes for other farmers, and as incentives to these early adopters

Executing Unit

7.15 The executing unit of this sub-project as expressly indicated by MINAG will be under the direct supervision of the Director of GOJ/IICA Allsides Project.

The Director will be assisted by experts from the Research and Development Division of MINAG and the technical assistance provided in this project in the area of crop development, in very close coordination with the Soil Conservation Research Officer of the Soil Conservation Division of the Department of Forestry and Soil Conservation. The officer specifically responsible to the Director will be an Agronomist with appropriate experience.

Objectives of the Seed-Production Sub-Project

7.16 The general objective of this sub-project is to ensure the availability on a timely basis of seed material of acceptable quality and in adequate quantities of the crop species which are to be promoted.

Technical Considerations

7.17 Specifically, production of the following seeds and/or propagating material will be undertaken:

(a) Peanut seed material of the Valencia spp (Spanish type);
(b) Cowpea (Vigna spp) seed material of the African red variety;
(c) Phaseolus spp, seed material of the locally developed varieties of Miss Kelly, Tom Red and Round Red and of the introduced ICA/DIVA variety; and
(d) Relatively nematode and disease-free "yam heads" of the Cayenensis and Rotundata species.

Proposed Activities for Accomplishment of Specific Objectives

7.18 It is important that cognizance be taken of the need to produce seed material at locations other than those where commercial production takes place. This is one of the reasons for flat lands on the newly acquired 1.5 hectare plot at Olive River (situated about six Kilometers South-East of the Allsides Project Area), being used principally for Seed Production. The Pilot Project will also endeavour to secure additional lands by contracting appropriate sites from selected farmers for commercial Seed Production. Where possible there should be collaboration with the Research and Development Division of MINAG with particular reference to planting material being produced by that agency.

Specific Activities

7.19 The specific activities of the Seed Production Sub-Project are:

(a) production of peanut seed material on three effective crop hectares (1.5 hectares cropped twice per year) in the first year followed by six and twelve effective hectares during the second and third year respectively;
(b) production of cowpea (African red), seed material on 1,5, 2 and 3 effective crop hectares during the first, second and third years respectively of the Project;

c. production of Phaseolus spp, seed material of the varieties Tom Red, Miss Kelly, Round Red and ICA/DUVA on effective hectarages of 2, 4 and 6 during the first, second and third years respectively of the project; and

d. production of relatively nematode and disease free "yam heads" through Seed Sanitation and soil treatment with nematocides. "Yam heads" will be disinfested in situ. A major goal is to have disease free "yam heads" in three years. Measures should be taken to ensure the provision of clean planting material by including these practices in the package of technological practices to be prepared for farmers, and demonstrating to farmers the benefits to be gained. This will entail close working relationships with the Plant Protection Division of MINAG.

Operational Characteristics

7.20 The Seed Production sub-project will be operated in association with, and by the technician in charge of the Crop Development and Sub-Production sub-project.

The arrangements for Seed Multiplication will consist of:

a. selection of participating farmers;

b. Government support for financing the operation on commercial lines especially in relation to the paying of rental for land which is leased;

c. guaranteed purchase of the production by the project for sale to farmers; and

d. providing participating farmers with the technical assistance and supervision required to guarantee that the material produced will be of high quality.

Expected Achievements

7.21 The provision of propagating and planting material obtained through this arrangement, while not constituting a highly sophisticated seed production effort is intended to guarantee that planting material to be used by farmers will:

i) be produced under at least minimum acceptable sanitary conditions;

ii) be clean and uniform;

iii) have an acceptable germination rate;

iv) be available when needed, at reasonable prices;

v) other things being equal, produce increased yields; and

vi) provide a basic need until a more sophisticated process is developed by MINAG.

The provision of quality "seeds" in the final analysis will play a crucial role in the viability of the project. It is therefore proposed that land be secured for the sub-project as follows: two hectares for the first year; five hectares for the second and ten hectares for the third year. This land will be used according to the schedule shown in Table IV-14 .

7.22 The Sub-project will be assigned staff on a full-time basis as shown in the Organization Chart, and will consist of:

1 Agronomist (University Graduate)

2 Field Assistants (Vocational or High School level)

It will also obtain assistance from the Technical Support Services and the Administrative Support Services to be provided by MINAG.

Project Technical Assistance will be provided for 37 man-months by:

1 Agronomist for 18 man-months

1 Seed Production Specialist for 7 man-months

1 Agricultural Engineer for 12 man-months

As indicated this work will be undertaken in close collaboration with the Extension Sub-product.

7.23 In addition, the Project will provide an appropriate vehicle, machinery and equipment. The costs for operation and maintenance will be borne by MINAG (See details in page IV-57).

The timetable for undertaking the work is shown in the schedule which follows (Table IV-12).

7.24 The overall cost of this sub-product will be US$386,300

TABLE IV- JAMAICA PILOT HILLSIDE AGRICULTURAL PROJECT COST RESUME OF SUB-PROJECT CROP DEVELOPMENT AND SEED PRODUCTION - Additional Costs to be incurred during the Project Period

(US$)

Cost Categories	Year 1	Year 2	Year 3	Total
	$	$	$	$
Technical Assistance				
- Agronomist	72,000	36,000		108,000
- Agricultural Engineer	72,000			72,000
- Seed Production Specialist	21,000	21,000		42,000
Agricultural Engineering Trials	7,500	10,000		17,500
Agricultural Tractors and attachments	47,000			47,000
Seed Processing Equipment	25,000			25,000
Seeds and Planting Materials	5,400	13,400	26,800	45,600
Vehicles and Spare Parts	29,200			29,200
Total	279,100	80,400	26,800	386,300

Details are shown in Table IV - page IV-34

TABLE IV - JAMAICA PILOT HILLSIDE AGRICULTURAL PROJECT - CROP DEVELOPMENT AND SEED PRODUCTION SUB-PROJECT
Resume' of Additional Costs For Execution Period

(US$)

Investment Categories	Physical Unit Requirement	Unit Cost Price	Year 1		Year 2		Year 3		Total
			No	Cost	No	Cost	No	Cost	Total
		$		$		$		$	
1. Technical Assistance									
1.1 Specialist - Agronomist (Farming System)	18 months	6,000	12	72,000	6	36,000	-	-	108,000
1.2 Specialist - Agricultural Engineer	12 months	6,000	12	72,000					72,000
1.3 Specialist Seed Production	7 months	6,000	3.5	21,000	3.5	21,000			42,000
Sub-total				165,000		57,000			222,000
2. Agricultural Engineering Trials				7,500		10,000			17,500
3. Vehicles and Spare Parts									
3.1 Vehicles	1	15,000	1	15,000					15,000
3.1.1 Diesel Truck (1½ tons)	1	11,000	1	11,000					11,000
3.1.2 Four Wheel Drive Jeep									
3.2 Spare Parts	1	1,750	1	1,750					1,750
3.2.1 For Diesel Truck	1	1,450		1,450					1,450
3.2.1 For Jeep									
Sub-total				29,200					29,200
4. Equipment									
4.1 Agricultural Tractor and attachments*									
4.1.1 Tractor	1	20,000		20,000					20,000
4.1.2 Cultivator	1	4,500		4,500					4,500
4.1.3 Chisel Plough	1	3,500		3,500					3,500
4.1.4 Tipping Tractor	1	2,500		2,500					2,500
4.1.5 Spare Parts	1	1,500		1,500					1,500
4.2 Seed Processing	1 Unit(complete)	25,000	1	25,000					25,000
4.3 Miscellaneous Agricultural (Rotolitters, fertilizer spreaders, hand held tractors etc)	1 Unit (complete)	15,000	1	15,000					15,000
Sub-total				72,000					72,000
5. Seeds and Planting Materials				5,400		13,400		26,800	45,600
Sub-total				5,400		13,400		26,800	45,600
Total				279,100		80,400		26,800	386,300

TABLE IV-12 CHRONOGRAM OF CROP DEVELOPMENT ACTIVITIES ENVISAGED

Activities	YEARS 1				2				3			
	1	2	3	4	1	2	3	4	1	2	3	4
1. Variety trials		X		X		X		X				
1.1 Peanut		X		X		X		X				
1.2 Red Peas		X		X		X		X				
1.3 Cow pea		X		X		X		X				
2. Crop Introductions												
2.1 Vegetables		X		X		X		X				
2.2 Fresh Flowers		X		X		X		X				
2.3 Inter-cropping trials		X		X		X		X		X		X
3. Agronomic Trials												
3.1 Population	X	X			X	X						
3.2 Row Spacing	X	X			X	X						
4. Agricultural Engineering												
4.1 Tillage equipment	X	X		X								
4.2 Sowing equipment		X	X									
4.3 Harvesting equip.		X		X								
5. Grass/Legume Trials												
5.1 Introduction of legumes		X	X									
5.2 Adaptation						X		X				
6. Training												
6.1 Method of Development	X	X										
6.2 Residential			X	X	X	X	X	X	X	X	X	X
6.3 Seminars and Conferences		X	X	X	X	X	X	X			X	X

TABLE IV-13

Land Requirements for Seed Production

	PEANUT Ha	COWPEA Ha	PHASEOLUS Ha	YAMS Ha	TOTAL Ha
First Year	0.5	0.5	0.5	0.5	2
Second Year	1.25	1.25	1.25	1.25	5
Third Year	2.50	2.50	2.50	2.50	10
Total Hectare	4.25	4.25	4.25	4.25	17

TABLE IV-14

Chronogram of Activities of Seed Productions activities envisaged

Activities	Years											
	1				2				3			
	1	2	3	4	1	2	3	4	1	2	3	4
1. Production of Peanut Seed Material		X	X	X		X	X	X		X	X	X
2. Production of Cowpea Seeds		X	X	X		X	X	X		X	X	X
3. Production of Phaseolus spp		X	X	X		X	X	X		X	X	X
4. Sanitation of Yam Propagating Material	X	X	X	X	X	X	X	X	X	X	X	X

8 Credit and Marketing

8.01 Credit and marketing are two important aspects of the overall agri-business. The former is associated with the provision of inputs without which production is impossible, while the latter deals with the disposal of produce which will pay for the credit applied. In sequential terms it is therefore logical to deal first with credit.

Credit

Background and Problem Definition

8.02 The provision of credit for Jamaican small farmers has been a problem over the years for many reasons. Some of the traditional ones are:

- The small size of farm operated by small farmers;
- The unbusinesslike way in which they operate (originally largely on a subsistence basis, but now the scene is changing);
- lack of control over main production inputs, thereby contributing to subsistence operations and underutilized resources, mainly land;
- rates of interest on loans claimed to be beyond their reach; as well as security and other collateral for supporting loan applications;
- many small farmers in addition do not possess legal entitlement to the land which they operate; and
- credit made available to them has often been used for other than agricultural purposes - a situation not confined to small farmers alone.

8.03 In more general terms, lack of security, lack of credit-worthiness, the relatively high cost of administering (including recovering) credit for the small farmers were the prime problem areas. Many measures have been pursued to provide credit for small farmers. These include such measures as the Facilities for Title Law (1957) which enable farmers, without legal entitlement to land but who had squatted undisturbed on their holding for periods of over 7 years, to receive credit and other facilities available to land operators who possessed legal tenure ownership or appropriate rental agreements.

8.04 The People's Cooperative Banks (PCBs) were developed, inter alia, to provide loans for small farmers, both for agricultural and for non-agricultural purposes. The rates of interest were subsidized and this remains the case. Supervised credit first started in the Yallahs Valley Land Authority in 1952 and spread to other areas. The type of credit has assisted in improving credit management.

8.05 More recently there has been the development of a crop lien programme, particularly in relation to small farmers obtaining land to lease under GOJ's Project Land Lease (PLL) programme. Success here is also variable.

8.06 Many farmers in the Allsides project have regarded the lack of credit as one of the major reasons which limit their adoption of the improved practices. In the Agro-Socio-Economic Survey of the Pilot project area 70% of farmers indicated that they were unable to obtain credit, one reason why a sizeable portion of their land is left idle (fallow) every year.

Objectives of the Credit sub-project

8.07 The general objectives of the credit aspect of the Credit and Marketing sub-project are to:

i) ensure that small farmers in the programme can obtain credit for their intensive farming programmes;

ii) develop farm planning procedures as a basis for determining credit needs of individual farmers;

iii) develop loan administration and disbursement procedures in collaboration with the IDB and the PC Banks;

iv) develop and implement supervisory credit control procedures; and

v) work closely with the Allsides Cooperative to assist farmers in obtaining economies of scale in securing farm inputs and eventually in marketing their produce.

Technical Considerations

8.08 These relate to the planning of overall credit needs based on the cropping systems being adopted. Since small farmers individually use small quantities of key inputs, it is proposed that the Cooperative (venture) initiated at the request of farmers be formally and legally structured. Additionally there should be close collaboration between this sub-product (Credit and Marketing), Extension and Crop Development.

Credit Profile

8.09 Since the Project is being requested to provide 75% of the costs for soil conservation, the farmer will be required to bear the cost of the remainder. The total credit needs will thus include:

i) 25% of the Soil Conservation costs, where this becomes entirely necessary;

ii) production credit for individual farmers' farm plans as determined between the farmer and the extension agent.

Porduction Credit Pequirements

Assuming the adoption of Hypothesis 4 for the implementation of the Soil Conservation measures (in this instance exclusive of Afforestation), and on the further assumption that all the production credit provided will be recovered at the end of each year of the project, the production credit needs will be as follows:

	Year 1	Year 2	Year 3
Hectares	67	105	132
Credit @ US$10,000	670,000	1,050,000	1,320,000

The total credit needed would thus be US$3,040,000. Due to the rate of loan recovery, and based on the assumptions used data presented in Table IV-15 show that the loan requirement under an average 50% loan recovery situation would be US$4,436,000 for Hypothesis No. 4

Loan for Soil Conservation

The projected cost for soil conservation works including and excluding afforestation are shown below:

	Year 1 US$	Year 2 US$	Year 3 US$	Total US$
Including Forestry (Total)	269,596	449,226	675,240	1,394,062
Excluding Forestry	246,844	422,682	644,904	1,314,430
Farmers' Cost 25%				
Including Forestry	67,399	112,306	168,810	348,515
Excluding Forestry	61,711	105,670	161,226	328,607

The proposal is to obtain IDB credit for this 25% to be made available to farmers. This loan should be repaid on a long term basis 20 years, on the same basis as the IDB loan, allowing a grace period of 8 years.

Table Production Credit Projections for the Pilot Hillside Agricultural Project, using Hypotheses 3 & 4

Years	Hypothesis 3	Hypothesis 4
	(US) $	(US) $
1	510,000	670,000
2	1,296,000	1,452,000
3	2,392,000	2,314,000
4	1,604,800	1,651,000
5	2,077,000	2,049,000
6	1,793,700	1,811,600
7	1,963,800	1,954,000
8	1,861,700	1,868,000
9	1,923,000	1,920,000
10	1,886,000	1,888,000

Notes (i) Credit inputs based on weighted average input costs for the three best cropping systems - estimated at J$18,000 = US$10,000

(ii) The assumptions are made that loan recoveries at the end of the first and second years will be 40% and 50% and thereafter 60%. Loan recovery rates lower than these will increase the annual credit requirements

(iii) There is little significant difference in terms of production credit needs on the basis of the two Hypotheses used.

Marketing

Background and Problem Definition

8.10 Existing problems in the area of marketing are likely to be magnified with increased production in the Pilot project area unless proper safeguards are made. Many of the issues concern yellow yam which is the major crop produced, but apply to a lesser extent to the other crops. The problems relate largely to:

- Reaping and Assembly
- Sorting and grading
- Storage
- Transportation and Distribution

8.11 Most of these problems are related to:

- the steep terrain of the production area which makes it difficult to move produce from the field to the selling point;
- inability of yellow yams to store for longer than 5 days because of its very perishable nature. This factor is often attenuated by nematode damage, which is widespread in the yam-growing area;
- the laborious nature of work involved in getting the crop out to market;
- a number of problems which arise in connection with the main channels of distribution, namely
  - the higglers; and
  - the Agricultural Marketing Corporation (AMC).

8.12 The higglers are small traders who provide a service to farmers by reaping the crop and selling same. This is not a "gratis" situation since the prices paid by the higglers take into consideration their services for reaping. In addition, the higgler is often the benefactor where the unit weights are concerned, since these weights (usually referred to as "hundred weight") vary anywhere between 100 and 140 lbs - 45 to 64 kilos. Although this arrangement does not always work to the financial advantage of the farmer, most farmers prefer to utilize the services provided by the higglers, since the latter also relieve the farmers of problems associated with storage.

8.13 A minority of farmers prefer the AMC although they have to transport their yams and other produce to a convenient spot where they can be collected in the AMC trucks. This is often an additional cost to the farmer. However, the farmers claim that the payment by the AMC is more reliable even though the level of AMC rejections is "high", especially during periods of high production.

8.14 A combination of the higgler system and the AMC operations results in yams from the Allsides area and that selected for the Pilot project being widely distributed. There are distribution problems, however, in that there are often simultaneous periods of gluts and shortages which affect prices and thus the ultimate return to farmers.

8.15 Transportation rates keep escalating much to the disadvantage of consumers, but the prices which consumers pay are considerably out of line with the farm gate prices paid to farmers. In addition, yams are damaged during transportation, thereby also reducing farmers' income.

8.16 Generally speaking, the increased production of yams envisaged, as a result of implementing the project, will create greater pressures on the existing inadequate marketing system.

Objectives

8.17 The main objectives of the marketing section of the Credit and Marketing Sub-project are:

i) to improve knowledge and information concerning quantities of yam available and time of availability, through improved production forecasting, working in close collaboration with farmers, extension staff and the Data Bank Section of MINAG;

ii) to demonstrate to farmers the benefits to be gained from proper sorting and grading of their produce, and to provide appropriate training in this respect;

iii) to explore measures which are known to be able to increase the storage life of yellow yams in particular, working in collaboration with the Storage and Infestation Division of the Ministry of Industry and Commerce;

iv) to utilize facilities for cool storage of yams at the Coleyville Station in Manchester. This station has a capacity for 4,000 tons

and using the techniques now available in Jamaica can increase the storage life from 5 to 40 days; and

v) to improve the feeder road system, to facilitate transportation of the larger quantities of yams anticipated.

Technical Considerations

8.18 Farmers should be relieved of the necessity to market their own crops, leaving them free to concentrate on production. Since each farmer produces relatively small amounts of produce individually it becomes necessary not only to know how much is likely to be produced through the proposed improved crop forecasting system, but also to use cooperative effort to achieve the benefits of economies of scale. Failure to improve the technical and other aspects of marketing will create a disincentive for farmers to increase production. On the basis of prices paid by consumers there is little doubt that farm gate price can be increased and consumer prices reduced if there is an improvement in the marketing system.

Staffing

8.19 The Credit and Marketing Sub-sector will be administered by:

1 - Marketing and Credit Officer (University Graduate)

2 - Field Assistants (Vocational or High School Graduates)

The Marketing and Credit Officer will work through the Resident Manager for the Pilot project and will laise with technicians from the following agencies:

- Jamaica Development Bank;
- People's Cooperative Banks (Christiana Branch;in particular);
- Cooperative Department;
- Marketing Development Division of MINAG; and
- Agricultural Marketing Corporation (AMC)

It will also obtain assistance from the Administrative Support Services being provided by MINAG.

Project Technical Assistance will be provided by

1 Marketing and Credit Expert for 18 man-months

The Project will provide an appropriate vehicle, machinery and equipment as required. Maintenance and operational costs will be borne by MINAG (See details in Table IV-22)

The time table for undertaking the work is shown in the schedule which follows. (Table IV-16).

TABLE IV-16

Chronogram of Activities envisaged for the Credit and Marketing

	1				2				3			
	1	2	3	4	1	2	3	4	1	2	3	4
Objective 1:												
Beneficiaries selection and credit needs	X	X	X		X	X	X		X	X	X	
Farm Planning Procedures	X	X	X		X	X			X	X		
Loan Administration at the Co-operative Level			X	X	X	X			X	X		
Objective 2:												
Supervisory & Control procedures	X	X	X	X								
Co-operative Credit Agency Operation procedures	X	X	X	X	X	X			X		X	
Objective 3:												
Collection of Data and Information for Market Intelligence & Forecasting	X	X	X	X	X	X	X	X	X	X	X	X
Objective 4:												
Residential training courses on credit procedures	X	X				X		X	X			
Objective 5:												
Developing training materials and procedures for credit and marketing	X	X				X	X			X	X	
Objective 6:												
Training in preparation handling and storing procedure	X	X						X	X			
Development of procedures consistent with credit and marketing	X	X	X	X		X				X		
Objective 7:												
Development of co-operative procedures and mechanism of farmers, participation in decisions of the co-operatives	X	X	X	X		X			X		X	

TABLE IV - JAMAICA PILOT HILLSIDE AGRICULTURAL PROJECT COST RESUME' CREDIT AND MARKETING SUB-PROJECT: Additional Costs to be incurred during the Project Period

US$

Cost Categories	Year 1	Year 2	Year 3	Total
	$	$	$	$
Technical Assistance	72,000	36,000		108,000
Office Equipment	7,950			7,950
Training of Staff and Farmers	10,800	8,100	2,700	21,600
Vehicles and Spare Parts	13,800	13,800		27,600
Production Credit	670,000	1,452,000	2,314,000	4,436,000
Total	774,550	1,509,900	2,316,700	4,601,150

Details are shown in Table IV - on page IV-46

TABLE IV - JAMAICA PILOT HILLSIDE AGRICULTURAL PROJECT - CREDIT AND MARKETING SUB-PROJECT

Resume of Additional Costs for Execution Period

(US$)

Investment Categories	Physical Unit Requirement	Unit Cost Price	Year 1		Year 2		Year 3		Total
			No.	Cost	No.	Cost	No.	Cost	
		$		$		$		$	$
1 Technical Assistance									
1.1 Specialist in Credit & Marketing	18 months	6,000	12	72,000	6	36,000			108,000
Sub-Total									108,000
2. Training of Staff & Farmers									
2.1 Residential Training Courses	8	2,700	4	10,800	3	8,100	1	2,700	21,600
Sub-Total				10,800		8,100		2,700	21,600
3. Vehicles and Spare Parts									
3.1 Vehicle									
3.1.1 Four Wheel Drive Jeep (Diesel)	1	12,000	1	12,000		12,000			24,000
3.2 Spare Parts									
3.2.1 I Set Spare Parts	1 set	1,800	1	1,800		1,800			3,600
Sub-Total				13,800		13,800			27,600
4 Office Equipment									
4.1 Desks	3	1,000	3	3,000					
4.2 Chairs	3	250	3	750					
4.3 Filing Cabinets	3	150	3	450					
4.4 Typewriters	2	1,000	2	2,000					
4.5 Calculators	3	250	3	750					
4.6 Cardex	1	1,000	1	1,000					
Sub-Total				7,950					7,950
5 Production Credit				670,000		1,452,000		2,314,000	4,436,000
6 TOTAL				774,550		1,509,900		2,316,700	4,601,150

Region Selected for the Project

9.01 The Project is located in the southern part of the Parish of Trelawny, in an area which is contiguous to the Allsides Project, and falls within the Western Administrative Region of the MINAG. The description of the Project area is given in Annex 3. The total area is 1093 acres. The topography and slope are similar to and characteristic of the steep lands on which small farmers pursue agriculture. Climatic conditions are similar to those of the Allsides Project area.

9.02 The area has a population of approximately 2000 persons, and a population density of approximately 1200 per square mile, which is nearly 7 times greater than that for the Parish of Trelawny. Many of the 278 farmers who make up this population do not utilize their lands fully, and many seek off-farm employment as a mode of living. On the basis of the findings of the agro-socio-economic survey of the project area average incomes in the area are very low in comparison with that for the island taken as a whole. Per capita income for Jamaica in 1979 was about $900 while the estimated per capita income for the project area was less than $400. This should also be considered in the context of the high level of unemployment in the area. Services provided by Government include those in the field of Agriculture, P.C. Banks, 4-H Clubs, Jamaica Agricultural Society, Cooperative Department, and various farmers' associations. These taken together have a potential for greatly assisting development once farmers are able to improve their production profiles.

9.03 Housing, roads, water supplies are factors identified by the farmers of the region, as requiring improvement which if achieved will play a supportive role in the development of the area.

Intermediate or Labour Intensive Technology

9.04 Multiple cropping systems result in a more intensive land use than the traditional mono-cropping patterns. Additional labour inputs, even if more evenly distributed over a cropping year, will be required, particularly for land preparation, planting of crops and some cultural practices.

9.05 The services of an Agricultural Engineer requested under the Crop Development and Seed Production Sub-Project are being provided to develop tillage and associated equipment designed to assist farmers

with intermediate technology which is necessary for over-coming drudgery and increasing efficiency of specific farming operations. In view of the dearth of this facility in Jamaica the activity will support work to be undertaken by the Research and Development Department of MINAG. Success in developing appropriate equipment will have immense significance for hillside farming on a national scale.

Beneficiaries of the Project

10.01 The potential and immediate beneficiaries of the project are the 278 farmers. The population is approximately 2,000 persons, most of whom depend mainly on agriculture for a living. The benefits will include increased production, increased farm incomes, and ultimately lead to an improved standard of living. The realization of these benefits will depend largely on the extent to which farmers adopt the new practices and the availability of resources to assist farmers in participating. Results of the Agro-Socio-Economic Survey carried out specifically to provide relevant data and information indicated that at least 70% of farmers are willing to participate in the project, if certain assistance is provided.

10.02 In the same manner that farmers in the Project are benefitted from similar work pursued in the Allsides Project are, it is expected that the experience developed in the Pilot Hillside Agricultural Project Area will benefit farmers in adjacent areas. Additionally, the Pilot Project staff, many of whom will be relatively new to some of the key aspects of the Project proposed, will gain invaluable experience in the development of multi-cropping systems on appropriately soil-conserved hillside lands.

10.03 On a national basis, in addition to the above benefits, opportunities will be created for increased employment, increased local food production, and as a result savings in foreign exchange reserves due to a reduction in food imports. There should also be a general improvement in the standard of living of the entire community served by the Pilot Project.

Marketing Outlets

11.01 Existing outlets are Christiana (12 miles), Kingston (80 miles) and Montego Bay (70 miles), distribution being mainly through higglers and the Agricultural Marketing Corporation (AMC). Additional production

will require improvement in the storage and distribution systems. The unfilled high and unfilled demand for yams produced in the Project area poses no threats, especially since they attract premium prices on a national scale.

Personnel Training

12.01 Intensive land use on hillside farms using multicropping systems on a structured basis departs considerably from the traditional methods of farming. The various sub-projects formulated on a multi-disciplinary basis requires additional training and in some instances re-training of technical personnel. Provision has been made for Technical Assistance to the extent of 103 man-months. Local counterpart staff will also benefit from involvement with these activities.

Cost of the Project by Sub-Projects *

(US$)

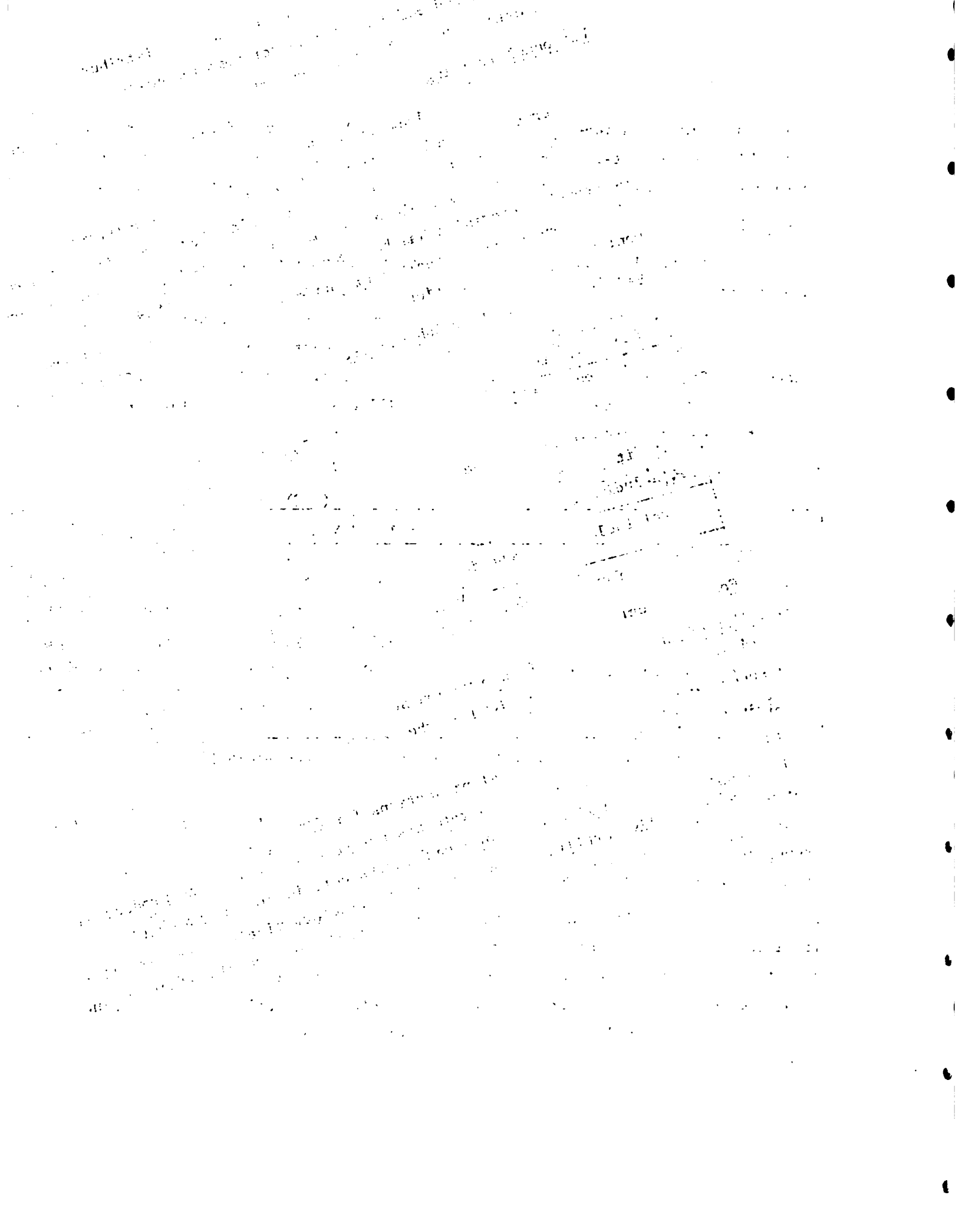
Sub-Projects	Year 1	Year 2	Year 3	Total
Soil Conservation	423,846	521,226	675,240	1,620,312
Extension	121,800	97,500	30,500	249,800
Crop Development & Seed Production	279,100	80,400	26,800	386,300
Credit & Marketing	774,550	1,509,900	2,316,700	4,601,150
(Including Production Credit)	(670,000)	(1,452,000)	(2,314,000)	(4,436,000)
Total Including Production Credit	1,599,296	2,209,026	3,049,240	6,857,562

* The above excludes GOJ contribution for Support Services (See)

Cost of Escalation

13.01 On the basis of information supplied by the local IDB office and on supporting information provided by the Central Bank (of Jamaica) an escalation rate of 19.8% is used.

13.02 In determining the cost projections for the project, on the advice of local policy makers an escalation rate has not been applied to the production credit. This has implications for quantitative deficiencies in production inputs, especially fertilizers, pesticides and other chemicals. However, it is possible that this could be accommodated on the basis of loan disbursements and recoveries.



Project Financing

14.01 Assumptions used in Quantifying the Financial Data

The basic assumptions for the project financing calculations were:

(1) The labour and material inputs of the soil conservation costs were calculated on the basis of conservation measures allocated for each year of the 3-year implementation period - using Hypothesis 4 (pages IV-51 & 52) See also IV-12.

(2) The production credit needs were calculated on the weighted average input costs for the 3 systems (models) being recommended for early adoption by farmers, namely: YIRAPE (40%), YGIRPE (40%); and YCOPE (20%). Other models and other weightings will give different results. A further assumption was made to the effect that by using a system of supervised credit it may be possible to achieve a loan recovery rate of 50%.

(3) Labour was taken to mean a possible local currency use, and materials to mean the imported components.

(4) The charges per man-month for technical assistance were estimated to include all costs as well as the overhead and administrative costs to be incurred by IICA in supplying it.

(5) Following local advice the credit component does not include escalation costs, however, the costs of materials are subject to such behaviour.

(6) The escalation coefficient was calculated at 19.8% and contingencies at 10% in consultation with the IDB office in Jamaica and the

Table W-19 Hypothesis No. 3 - Adoption Rate for Soil Conservation Measures and Costs for providing Measures (US$)

(Hectares)

		Slope	Year 1	Year 2	Year 3	ALL
		0°- ∠ 7°	7	21	—	28
		7°- ∠ 15°	20	33	78	131
		15°- ∠ 20°	5	22	32	59
		20°- ∠ 25°	4	8	28	40
		25°- ∠ 30°	15	15	16	46
		Over 30°	12	14	16	42
		All Slopes	63	113	170	346
Slopes	**Items**	**Unit Cost**	**Year 1**	**Year 2**	**Year 3**	**Total**
0° - ∠ 7°		$	$	$	$	$
(Hectares)			(7)	(21)	-	(28)
	Materials	16	112	336	-	448
	Machines	243	1,701	5,103	-	6,804
	Labour	67	469	1,407	-	1,876
Sub Total		326	2,282	6,846	-	9,128
7° - ∠ 15°						
(Hectares)			(20)	(33)	(78)	(131)
	Materials	95	1,900	3,135	7,410	12,445
	Machines	1,424	28,480	46,992	111,072	186,544
	Labour	2,628	52,560	86,724	204,984	344,268
Sub Total		4,147	82,940	136,851	323,466	543,257
15°- ∠ 20°						
(Hectares)			(5)	(22)	(32)	(59)
	Materials	95	475	2,090	3,040	5,605
	Machines	1,249	6,245	27,478	39,968	73,691
	Labour	2,753	13,765	60,566	88,096	162,427
Sub-Total		4,097	20,485	90,134	131,104	241,723
20°- ∠ 25°						
(Hectares)			(4)	(8)	(28)	(40)
	Materials	95	380	760	2,660	3,800
	Machines	4,290	17,160	34,320	120,120	171,600
	Labour	2,727	10,908	21,816	76,356	109,080
Sub-Total		7,112	28,448	56,896	199,136	284,480
25°- ∠ 30°						
(Hectares) Orchard Terrace			(15)	(15)	(16)	(46)
Sub-Total		5,127	76,905	76,905	82,032	235,842
7 30°						
(Hectares) Forestry			(12)	(14)	(16)	(42)
Sub-Total		1,896	22,752	26,546	30,336	79,632
GRAND TOTAL			233,812	394,176	766,074	1,394,062

Table IV-20 Hypothesis No. 4 Adoption Rate for Soil Conservation Measures and Costs for providing Measures (US$)

(Hectares)

		Slope	Year 1	Year 2	Year 3	ALL
		0°- ∠ 7°	15	13	—	28
		7°- ∠ 15°	28	39	64	131
		15°- ∠ 20°	5	30	24	59
		20°- ∠ 25°	4	8	28	40
		25°- ∠ 30°	15	15	16	46
		Over 30°	12	14	16	42
		All Slopes	79	119	148	346
Slopes	**Items**	**Unit Costs**	**Year 1**	**Year 2**	**Year 3**	**Total**
		$	$	$	$	$
0° -∠ 7° (Hectares)			(15)	(13)	—	(28)
	Materials	16	240	208	—	448
	Machines	243	3,645	3,159	—	6,804
	Labour	67	1,005	871	—	1,876
Sub-Total		326	4,890	4,238	—	9,128
7° - ∠ 15° (Hectares)			(28)	(39)	(64)	(131)
	Materials	95	2,660	3,705	6.080	12,445
	Machines	1,424	39,872	55,536	91,136	186,544
	Labour	2,628	73,584	102,492	168,192	344,268
Sub-Total		4,147	116,116	161,733	265,408	543,257
15° - ∠ 20° Hectares)			(5)	(30)	(24)	(59)
	Materials	95	475	2,850	2,280	5,605
	Machines	1,249	6,245	37,470	29,976	73,691
	Labour	2,753	13,765	82,590	66,072	162,427
Sub-Total		4,097	20,485	122,910	98,328	241,723
20° - ∠ 25° (Hectares)			(4)	(8)	(28)	(40)
	Materials	95	380	760	2,660	3,800
	Machines	4,290	17,160	34,320	120,120	171,600
	Labour	2,727	10,908	21,816	76,356	109,080
Sub-Total		7,112	28,448	56,896	199,136	284,480
Total	Materials		3,755	7,523	11,020	22,298
	Machines		66,922	130,485	241,232	438,639
	Labour		99,262	207,769	310,620	617,651
GRAND TOTAL			169,939	345,777	562,872	1,078,588
25° - ∠ 30° (Hectares) Orchard Terrace			(15)	(15)	(16)	(46)
Sub-Total		5,127	76,905	76,905	82,032	235,842
7° 30° (Hectares) Forestry			(12)	(14)	(16)	(42)
Sub-Total		1,896	22,752	26,544	30,336	79,632
GRAND TOTAL			269,596	449,226	675,240	1,394,062

official reports of the Bank of Jamaica.

(7) Government commitments in the areas of field and support personnel are as given by MINAG.

(8) Salary scales used are those of the Civil Service, rounded to the nearest hundred dollars.

Financing the Project

14.02 The different elements of cost are: (See p. IV-53(a))

(i) Soil Conservation measures

(ii) Services, Technical Assistance

(iii) Agricultural Production Credit

(iv) GOJ contribution for supports services

(i) Soil Conservation

75% of the Soil Conservation measures will be financed as a grant by the IDB while the remaining 25% will be financed by the farmer through credit.

The total cost for providing these conservation measures is projected at US$1,394,062. It is proposed that the IDB should provide the total amount, 75% (US$1,045,547) as a grant, and 25% (US$348,515) as a loan. The Soil Conservation Division is responsible for undertaking the soil conservation measures and all the funds should eventually be passed to it, the loan portion being debited to each farmer's account with the loan agency agreed on (The People's Co-operative Bank - Branch, Christiana. This loan would be short term in nature, and following existing GOJ policy would be made to the IDB for on-lending to farmers through the PC Bank.

IV-21

TABLE Project cost according to sub-projects and major groups of items

Sub-Projects	Year 1	Year 2	Year 3	Total
				US$
1. Soil Conservation				
Technical Assistance	72,000	72,000		144,000
Office Equipment	26,300			26,300
Vehicles and Spare Parts	40,350			40,350
Field Equipment for Conservation Works	15,600			15,600
Soil Conservation Works (Hypothesis 4) *	269,596	449,226	675,240	1,394,062
Sub-Total	423,846	521,226	675,240	1,620,312
2. Extension				
Technical Assistance	72,000	72,000		144,000
Office, Audio-visual and Small Equipment	12,800			12,800
Vehicles and Spare Parts	13,800			13,800
Training for Farmers and Personnel	23,200	25,500	30,500	79,200
Sub-Total	121,800	97,500	30,500	249,800
3. Crop Development and Seed Production				
Technical Assistance-Agronomist	72,000	36,000		108,000
-Agricultural Engineer	72,000			72,000
-Seed Production Specialist	21,000	21,000		42,000
Agricultural Engineering Trials	7,500	10,000		17,500
Agricultural Tractor and Attachments	47,000			47,000
Seed Processing Equipment	25,000			25,000
Vehicles and Spare Parts	29,200			29,200
Seeds and Planting Materials	5,400	13,400	26,800	45,600
Sub-Total	279,100	80,400	26,800	386,300
4. Credit and Marketing				
Technical Assistance	72,000	36,000		108,000
Office Equipment	7,950			7,950
Vehicles and Spare Parts	13,800	13,800		27,600
Training of Staff and Farmers	10,800	8,100	2,700	21,600
Production Credit	670,000	1,452,000	2,314,000	4,436,000
Sub-Total	774,550	1,509,900	2,316,700	4,601,150
GRAND TOTAL	1,599,296	2,209,026	3,049,240	6,857,562
SUMMARY BY ITEMS				
Soil Conservation Measures	269,596	449,226	675,240	1,394,062
Technical Assistance	381,000	237,000		618,000
Equipment (Agriculture)	47,000			47,000
Vehicles and Spare Parts	97,150	13,800		110,950
Office, Audio-visual Equipment, etc.	47,050			47,050
Seed Processing Equipment	25,000			25,000
Field Equipment	15,600			15,600
Training and Demonstrations	34,000	33,600	33,200	100,800
Seeds and Planting Materials	5,400	13,400	26,800	45,600
Agricultural Engineering Trials	7,500	10,000		17,500
Production Credit	670,000	1,452,000	2,314,000	4,436,000
TOTAL	1,599,296	2,209,026	3,049,240	6,857,562

* 25% to be provided as Credit to Farmers

(ii) All services costs, accommodation, maintenance etc., will be financed by MINAG. Details are shown in the section dealing with Organization structure and MINAG financing. (pp 57-61).

(iii) Technical Assistance and the purchase of vehicles and imported strategic items would be provided by the IDB.

(iv) Agricultural production credit will be provided by the IDB under conditions to be determined, particularly with respect to quantum. Because of the special conditions involved the IDB loan profile for the project is presented in some detail.

Foreign Exchange

14.03 The IDB will provide the foreign exchange component of the project. Grant funds will cover items related to soil conservation and technical assistance, while loan funds will be sought to cover production credit. A part of the credit funds will be required to cover the foreign exchange aspects.

IDB Loans for the Project

14.04 It is possible that the project will attract soft term loan at 2% interest to be disbursed through the JDB which agency and the PCB would operate the loan on the 7% differential between the 2% interest charged by the IDB and the 9% which the farmer is required to pay. The JDB would obtain the funds from the IDB and would be responsible for its collection, but its agent for this purpose will be the PC Bank. It is suggested that the 25% loan aspect of the soil conservation measures be treated in the same manner. The JDB will have an 8-year grace period and a further 20-years in which to repay the loan.

14.05 The production credit is the most difficult to determine since it depends on so many considerations, such as the farms which will be ready (i.e. soil_conserved), the cropping systems which will be used, and the farmers who will be ready to adopt the changes.

14.06 For the 3 cropping systems which farmers will be encouraged to adopt the variable cost inputs are as follows:

YIRAPE	JA$17,050	per hectare
YGIRPE	19,970	per hectare
YCOPE	15,415	per hectare

14.07 Using a weighted average (40:40:20) on the basis of the percentages of farms likely to adopt each of these systems the resultant cost is approximately $18,000 per hectare. This figure is used as the basis for determining credit needs. Where 67 hectares would be treated during the first year the amount is US$677,500 - Say $700 000. During the third year the amount would be determined largely on the extent to which farmers had repaid existing loans, providion having to be made for new loans as well as the un-repaid ones.

14.08 Repayment rates for similar projects in Jamaica continue to be very low, in some instances as low as 10%. Even if the loan recovery rate is increased to 60% the need for re-financing remains sizeable and for the last year the credit requirement for old and new loans would be of the order of US$4.5 million using these assumptions. Estimates which come closer to reality for a pilot project far exceed (US) $5 million for production loans alone. The use of supervised credit should assist in improving the recovery rate. However, on the basis of this analysis the degree of recycling which can be achieved remains a difficult projection to be made. In the final analysis the success of the project must depend on the provision of the credit needed at given points in time, and appropriate arrangements for controlling the use of credit and ensuring repayment.

14.09 The summarized loan portfolio of the IDB for the first 3 years of the Project would thus be:

US$

Purpose of Loan	Year 1	Year 2	Year 3	Year 4
Production Credit (Farmers)	670,000	1,452,000	2,314,000	4,436,000
Soil Conservation Credit (Farmers)	67,399	112,306	168,810	348,515
Total	737,399	1,564,306	2,482,810	4,784,515

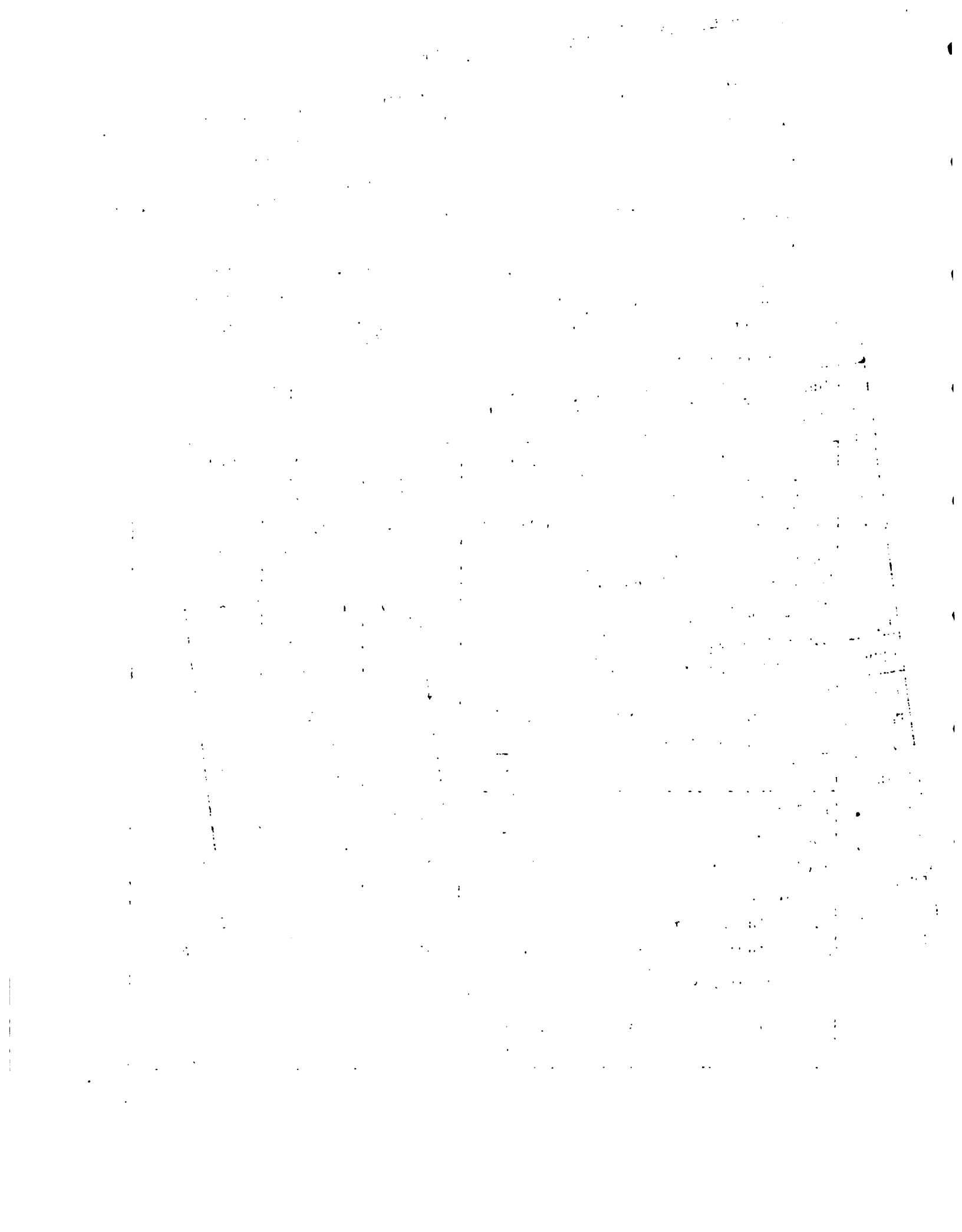
Financing the Soil Conservation Sub-Project

14.10 GOJ's present policy is to provdie a subsidy for soil conservation measures. This practice is being adopted in the Integrated Rural Development Project (IRDP) which is close to the Pilot project area. A subsidy of 75% is provided except where a total soil conservation practice has to be provided, as is the case for gully protection works. On these bases the allocation of costs of providing the Soil Conservation measures between the Project (IDB grant) and the farmers is presented in the following Table based on hypotheses 3 and 4.

Summary Comparisons between Costs for Hypothesis 3 and 4

US$

Hypothesis 3	Year 1	Year 2	Year 3	Total
Including Forestry	233,812	394,176	766,074	1,394,062
Forestry	22,752	26,544	30,336	79,632
Excluding Forestry	211,060	367,632	735,738	1,314,430
Adjustment to 75% Subsidy*				
a. Including Forestry	58,453	98,544	191,519	348,516
b. Excluding Forestry	52,765	91,908	183,934	328,607
* 75% Subsidy to be borne by project				
a. Including Forestry	175,359	295,632	574,556	1,045,547
b. Excluding Forestry	158,295	275,724	551,803	985,822
Hypothesis 4	**Year 1**	**Year 2**	**Year 3**	**Total**
Including Forestry	269,596	449,226	675,240	1,394,062
Forestry	22,752	26,544	30,336	79,632
Excluding Forestry	246,844	422,682	644,904	1,314,430
Adjustment for 75% Subsidy*				
a. Including Forestry	67,399	112,307	168,810	348,516
b. Excluding Forestry	61,711	105,670	161,226	328,607
* 75% Subsidy to be borne by project				
a. Including Forestry	202,197	336,920	506,430	1,045,547
b. Excluding Forestry	185,133	317,012	483,678	985,823



Cost of Support Services and Facilities

14.11 Services and facilities will be required for the project in terms of staffing, accommodation, public utilities, general maintenance, and the maintenance and operation of vehicles. Other costs of an indirect nature will be involved, particularly in relation to the collaboration with other agencies which fall outside the responsibility of the Ministry of Agriculture. Direct costs are presented in the Table which follows:

Table IV- Summarized costs for Project Support Services and Facilities

JA$

Item	Year 1	Year 2	Year 3	Year 4	Year 5
Staffing	287,540	301,917	317,013	332,863	349,507
Accommodation	70,000	1,000	1,500	1,500	2,000
Public Utilities	8,000	8,800	9,680	10,648	11,713
General Maintenance	3,000	3,300	3,630	3,993	4,392
Maintenance & operation of Vehicles	34,200	37,620	41,382	45,520	50,072
Contingencies	2,000	2,500	3,000	3,500	3,500
All Items	404,740	355,137	376,205	398,024	421,184

J$ 1.78 = 1 US $

14.12 Initial estimates of costs for the first year have been provided by MINAG. Annual salary increases for government paid staff vary with salary scales, and points in salary scales for each category of employee involved. These are separate and distinct from annual increments attached to each salary scale and which are earned on a merit basis. On these bases a 5% annual increase is used for projecting costs due to salaries. Presentation of projections beyond a 5-year period would be very academic and so are not included. For the items listed in the Table a 10% annual increase is projected. Other costs should be covered by a contingency factor. (However, these are negated by the 19.8% escalation costs used in the preparation of total project costs).

14.13 The details concerning the support services and facilities are presented on the pages which follows:

Support Services

The Ministry of Agriculture under whose portfolio the project falls proposes to provide support staff, project accommodation as well as maintenance and operational services.

The Organization Chart prepared by MINAG is attached. It is broken down into 6 sections, under a Resident Manager as follows:

1 Resident Manager

1 Secretary stenographer

Crop Development (inclusive of Seed Production)

1 Agronomist (University Graduate)

2 Field Assistants (Vocational or High School Graduates)

Extension

1 Senior Extension Officer (University Graduate)

2 Extension Officers (Graduates of Jamaica School of Agriculture,JSA).

3 Field Assistants (Vocational or High School Graduates)

Marketing and Credit

1 Marketing and Credit Officer (University Graduate)

2 Field Assistants (Vocational or High School Graduates)

Soil Conservation

1 Soil Conservationist (University Graduate)

2 Soil Conservation Assistant Officers (Jamaica School of Agriculture Graduates)

3 Field Assistant (Vocational or High School Graduates)

Technical Support Services

1 Draughtsman (Diploma of College of Arts Science and Tech.(CAST)

1 Maintenance Supervisor

2 Machinery operators

3 Drivers

Administrative Support Services

1 Accountant

2 Typists

3 Clerical Officers

2 Drivers

2 Office Attendants

2 Watchmen

Project Staffing (Summarized)

1 Resident Manager

1 Agronomist

1 Senior Extension Officer

1 Marketing and Credit Officer

1 Soil Conservationist

1 Secretary Stenographer

2 Extension Officers

2 Soil Conservation Assistant Officers

10 Field Assistants

1 Administrative Officer

1 Accountant

2 Stenographers/Typists

3 Clerical Officers

1 Maintenance Supervisor

1 Draughtsman

2 Machine Operators

5 Drivers

2 Office Attendants

2 Watchmen

Project Accommodation

Refurbished and enlarged GOJ building

Furniture and Equipment

Public Utilities

General Maintenance and Services

Maintenance

Petrol

Lubrication oils

Tyres

Repairs and Maintenance

Vehicles - one each for:

Project Management

Crop Development and Seed Production

Soil Conservation

Extension

Technical Support Service

Agricultural Tractor, complete with Trailer, Plough and appropriate attachments

Project Staffing - Salaries

1	Resident Manager	JA$	16,000	per year
1	Agronomist (University Graduate)	JA$	12,000	" "
1	Senior Extension Officer (University Graduate)	JA$	12,000	" "
1	Marketing and Credit Officer (University Graduate)	JA$	12,000	" "
1	Soil Conservationist (University Graduate)	JA$	12,000	" "
1	Secretary/Stenographer	JA$	8,000	" "
2	Extension Officers (JSA Graduates)	JA$	9,500	" " each
2	Soil Conservation Assistants Officers (JSA Graduate)	JA$	9,500	" " "
10	Field Assistants (Vocational or High School Graduate)	JA$	6,000	" " "
1	Administrative Officer	JA$	12,000	" "
1	Accountant	JA$	8,000	" "
2	Stenographers	JA$	6,000	" " "
3	Clerical Officers	JA$	5,500	" " "
1	Maintenance Supervisor (CAST Diploma)	JA$	9,000	" "
1	Draughtsman	JA$	7,000	" "
2	Machine Operators	JA$	6,240	" " "
5	Drivers	JA$	5,200	" " "
2	Office Attendants	JA$	3,640	" " "
2	Watchmen	JA$	3,640	" " "

15. Technical Co-operation

15.01 Many technical disciplines will be necessary for the successful development of the project. The technical inputs required for the project have been conveniently grouped into 4 main Sub-Projects namely:

Soil Conservation
Extension
Crop Development and Seed Production
Credit and Marketing

15.02 For each of these 4 Sub-Projects Technical Assistance is being provided as part of the IDB contribution to the project. The counterpart staff identified by MINAG as necessary for the project will work in close collaboration with the specialists provided through technical assistance from the project to ensure that there will be appropriate transfer of technologies to the leaders of the various disciplines for the continuation of the work after the cessation of the technical assistance grant.

15.03 Associated with the pilot nature of the project is the fact that unlike the situation with a project which has less experimental implications much will depend on the work carried out on the stations, the demonstrations, both on the stations at Allsides and Olive River and on farmers' own holdings themselves. The process of testing cropping systems on farmers' holdings and solving problems which occur must be given the highest priority attention by the technical team. This implies the necessity for a close co-ordination between the disciplines involved and appropriate mechanisms for obtaining a list of problems to be technically analysed, for transferring improvements to the farmers. The Extension Sub-project must play a key role in this continuum and it is important that the Extension Specialist selected be of the highest calibre.

15.04 The details concerning technical co-operation, relative to work schedules, training programmes and cost have been included in the information presented for each sub-project. The counterpart staff proposed by MINAG includes a graduate officer for each sub-project and it is further expected that within the constraints which currently affect staffing in the MINAG it will be possible to obtain suitable local technicians for working on the project. A number of seminars have been included for staff and opportunities will be created for local technicians to participate in appropriate short-term fellowships.

15.05 Ecological and Environmental Aspects

The current levels of production and productivity in the project area are low in relation to the potential. These are low due to reduced fertility on soil eroded lands, inadequate production inputs and inappropriate methods of production. Some 75% of the farmers have indicated an interest in participating in the project, but they regard inadequate financing as one of their main obstacles to participating. They indicate that this has been a major reason for so much of their land (over 50% on average) being idle on an annual basis.

15.06 Additionally because of the small size of farm business in which each farmer is involved the prices paid for farm inputs are proportionately high. For this reason many farmers have expressed a desire to become involved in co-operative activities which will create economics of scale, both in terms of purchasing inputs and disposing of marketable produce. It is envisaged that with the collaboration of the Co-operative Department it will be possible to develop a strong Co-operative at Allsides from the pre-co-operative which has been recently created.

15.07 The impact of the multi-disciplinary approach - involving land protection (soil conservation); structured cropping systems, and

the provision of good quality seeds; as well as an improvement in the extension coverage, and the provision of appropriate credit and marketing facilities will assist in securing the involvement of farmers in the project. Farmer participation is a sine qua non for the success of the project and thus farmer participation through institution building must ensure that farmers develop a self-reliant approach to their farm businesses.

15.08 The development programme is being designed to provide incentives for selected farmers who indicate a willingness and a potential to become early adopters of improved systems. Additionally, a system of supervised credit is being pursued essentially to ensure that farmers participate in the planning of their holdings and that credit is made available only on the basis of credit requirements calculated on pre-determined farm planning. Training courses are provided for farmers and technicians in a wide ranging area. For Technical personnel the subjects included are soil conservation, production systems, farm management, farmers' organization, home improvement and nutrition, home administration, credit and marketing organization, transfer of technology and seed production. Farmers' courses will be practically oriented and will include on-farm training and exposure to demonstrations inside and outside the area.

V PROJECT EXECUTION

TECHNICO - ADMINISTRATIVE ORGANIZATION

1.01 Currently no integrated technico-administrative organization for the project exists. However, there is such a structure for the Allsides project. The Pilot Project can derive considerable benefits from the experiences gained from the Allsides project on which it is being based. That organization consists of Central Coordination and Field Execution and Coordination).

1.02 The Central Coordination, which is otherwise called the Coordinating Committee is represented by participants from the main diaciplines involved in the project - MINAG (Director, Western Region whose Department is the Coordination between MINAG and the project; Director Soil Conservation; the Parish Manager for Trelawny, and the Director of the IICA/Jamaica Office). This Committee has helped to clarify and iron out areas of conflict, and to resolve bottlenecks.

1.03 Field Execution Coordination is the responsibility of a unit working under the co-director of the Director of Soil Conservation, MINAG, and the Agricultural Research Specialist of IICA/Jamaica. The Soil Conservation research crew of the project works in close liaison with the extension arm of the project, which works in collaboration with the Manager of the Research Station.

1.04 MINAG is creating a similar organization for the Pilot project and in addition a Project Advisory Committee which will consist of:

- The Director, Production/Extension Department of MINAG (Chairman)
- Director, Soil Conservation Division, MINAG (Vice Chairman)
- Director, Western Region, MINAG
- Parish Manager (Agriculture) Trelawny
- Representative of IDB, Jamaica

- Director, IICA/Jamaica Office
- Project Manager (Resident), Secretary
- Representative for the local lending agency
- Two Farmers' Representatives
- One Member, Allsides Cooperative

1.05 The Ministry of Agriculture proposes to provide a staff complement of 40 persons (See details in Section IV pp IV). In addition, MINAG will be administratively and financially responsible for office accommodation as well as the maintenance and operation of vehicles (to be provided from the IDB grant).

1.06 It is expected that at the end of the first 5 years of the life of the project the achievement will be such as to enable a reduction in staff concentration for redeployment to similar GOJ projects.

1.07 The Executive arm of the project will be under the direction of the Resident Project Manager, who will coordinate the work of the technical officer in charge of each of the 4 technical sub-projects, namely:

- Soil Conservation
- Crop Development and Seed Production
- Extension; and
- Marketing and Credit

1.08 A Project Coordinating Committee has been named by MINAG and is expected to ensure the implementation and execution of the project in the first place, and also to provide appropriate liaison with those agencies such as cooperatives and credit whose major functionaries reside and operate outside of the ambit of MINAG, which has over-all responsibility for the project.

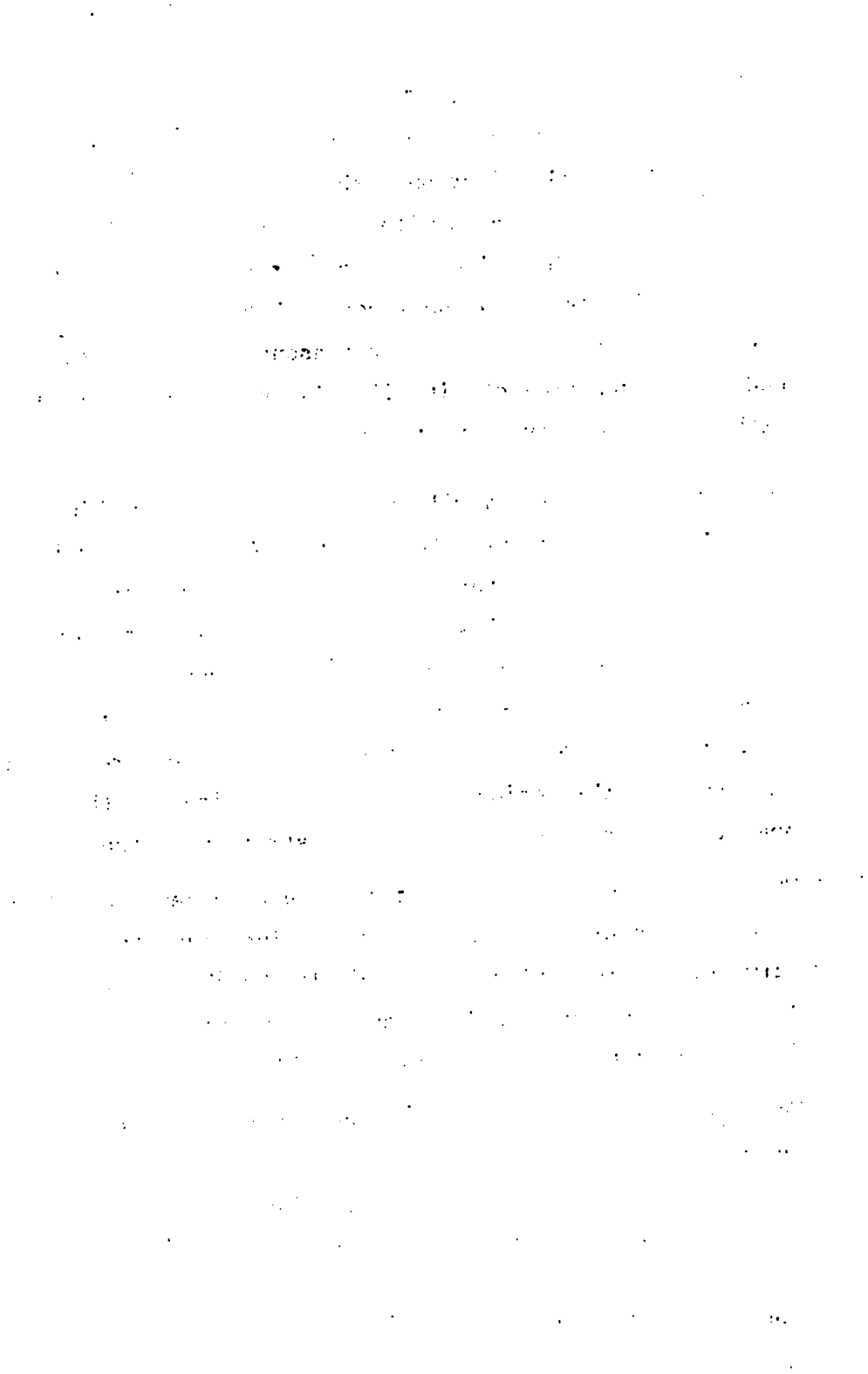
1.09 Of particular importance is the aspect which deals with the disbursement of credit. In accordance with current MINAG policy, credit from the lending agency - IDB in this instance - will be made available to the Jamaica Develop-

ment Bank (JDB) for on-lending to farmers through the PC Banks. The Extension component of the Project working in close liaison with the Crop Development and Seed Production component will determine, on a timely basis, the actual credit needs of farmers. These will be based on the Cropping System selected by the particular farmer(s) and worked out in collaboration with them. This information will then be coordinated with the Credit and Marketing sub-project which will have major responsibilities for administering technical services on behalf of farmers in these two specific areas. For reasons already described under this sub-project, it will also serve as a main link with the Cooperative Department.

1.09 The Extension Officers will assist farmers in working more precisely in structuring the Allsides Cooperative which is intended to serve farmers of both the Allsides Project area and the Pilot Hillside Agricultural Project area, as well as other farmers in Southern Trelawny. This will entail the eventual creation of a structure Executive Committee for the Cooperative which will also work in close liaison with the Regional Cooperative Officer of the Co-operative Department and the Administration of the PC Bank.

1.10 Through the mechanism suggested above arrangements will be made for disbursing loans and recovering payments from farmers. Assistance will be provided by the Technical and Administrative Support Services being provided by MINAG. (See Organization Chart provided by MINAG on page IV-11(a)).

1.11 The pilot nature of the Project necessitates constant evaluation of performance, and the making of appropriate adjustments to ensure that project objectives are met. For this reason a structured recording system should be provided at the very outset. It should be set up to obtain assessments on agro-economic aspects, as well as farmers' achievements and reactions.



1.12 The decisions taken by MINAG in terms of the Project Advisory Committee and of the staffing which provided the main basis for determining the GOJ component of the project set the stage for the execution of the project. As soon as there is agreement between all parties concerned a small team should be selected to initiate the implementation of the pilot project, with particular reference to staffing, draw-down of IDB funds (grant and loan) other GOJ financing and the selection of Technical Assistance personnel. It is necessary that these arrangements be concluded to coincide with the time when farmers begin preparations for their cropping year, i.e. late February to early March.

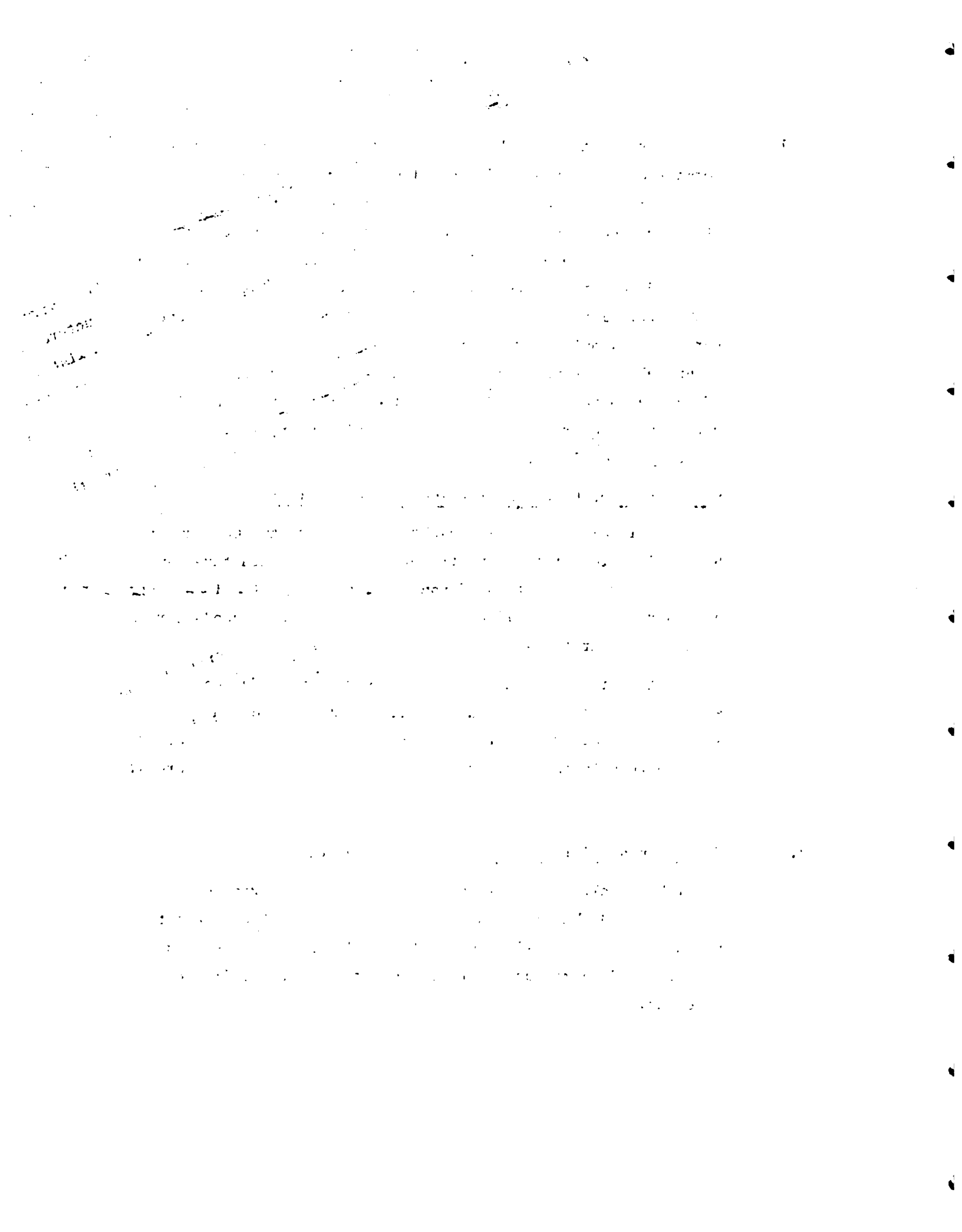
2.01 Procedures for Procurement of Goods and Services

Goods of local origin must be obtained through the Government Supply Division of the Ministry of Finance. A structured system of invoicing, preparation of vouchers, and payment exists. Structured procedures are also followed for obtaining foreign goods through the Trade Administrator's Department.

2.02 In specific instances contracts are used to provide goods or services, in which cases tenders are invited. These are then subjected to scrutiny for decision. If the applications are unsatisfactory further applications are sought through the press.

3.01 Investments prior to approval of IDB financing

The IDB has already provided a non-reimbursable grant of US$49,500 and the MINAG has provided support to facilitate the procurement of base-line surveys' - Soils, Land Slopes, and Agro-Socio-Economic used for the preparation of the Project Document.



3.02 There have been no additional investments in the Pilot project. However, Extension staff is provided on an on-going basis by MINAG, as well as assistance to the Allsides Cooperative venture which serves the two project areas now operating in the area.

3.03 MINAG has a building located in the Project Area, which is to be refurbished for accommodating the office and staff of the project.

4.01 Availability of Suppliers and Construction Contractors

The soil conservation work will be planned and designed by the Soil Conservation Section of the project. The work will be contracted to the farmer and payments made to him on the satisfactory completion of the job. Materials required for the construction work will be available. Those of local origin will be obtained through standard procedures used by MINAG, while others which have to be imported will be secured by the project through the Trade Administrator's Department following standard procedures. Essentially, since this is a GOJ project these procedures will assist in the procurement of the supplies with limited problems from suppliers and contractors.

1. SOCIO-ECONOMIC EVALUATION

1.01 The earlier sections of this project document discussed the sub-projects which will be involved in the execution of the project. Also presented were relevant costs, and how their various activities will be financed. The conclusion drawn was that the project has a potential for development which will enhance the improvement of the standard of living of the real project beneficiaries who are the farmers and their families.

1.02 This section deals more specifically with the methodological procedures used in assessing the value of the project in quantitative terms. Production statistics and the internal rates of return are two important considerations, and associated with these are the employment potential as a consequence of implementing the project.

1.03 The main strategy being used in the formulation of this project document is the development of a pilot project which uses the Allsides experience in developing similar cropping systems for farmers in the pilot project area. Through a specially designed Agro-socio-economic survey a wide range of pre-project information including production profiles was collected. The soil types of the area were defined (see list attached).

1.04 By design the Allsides project data have been used as the targets for the potential production due largely to the similarity of ecological and edaphic conditions and the capabilities and orientation of the farmers. The achievement of the potential depends on many factors. The pilot nature of the project anticipates and will depend for success on the conduct of adaptive trials carried out along lines similar to those used in the Allsides area. The sub-projects have been formulated with these considerations in mind. They relate specifically to farmers - their attitudes, capabilities, problems and willingness to change - and the productive capacity of the land.

1.05 The land has been categorized into its relevant slope categories. Cost information has been derived specifically for the provision of soil conservation measures on the terrain covered by the project. The cost of production data and yields are derived from the Allsides Project (experimental, as well as that from actual farming situations).

1.06 Given the potential for production which exists, the expressed willingness of farmers (75%) to participate in the project, and the provision of production inputs on a timely basis, as well as staffing, support services and facilities and technical assistance, the project has a sound basis for achieving the success projected. The main constraints will be human ones relating to staffing and farmers, hence the emphasis placed on training and on the Extension sub-project.

1.07 Assumptions have been made covering a wide range of project activities. These are based largely on the survey findings and on other available information. These have led to the decisions used in formulating the project. The pivotal decision relates to the implementation period. This period has been set by MINAG at 3 years to coincide with the period over which the IDB grant would be disbursed. The Soil Conservation Division which will be responsible for implementing the soil conservation measures has indicated that the work can be accomplished within the 3-year period, and staff has been projected for the achievement of such an adoption rate.

2. METHODOLOGICAL PROCEDURES FOR DETERMINING THE FINANCIAL EVALUATION OF THE PROJECT.

2.01 The results gained from the work carried out at Allsides provide the basis for setting the goals of the potential achievement for each of the cropping systems used in the analysis. The input-output data on yams produced by farmers in the project area, complemented by similar information obtained from farm costing obtained from the MINAG, and verified by work done by the project team in the field was used to provide the "now" situation for farmers in the project area.

2.02 A number of sensitivity analyses were carried out, based on different adoption rates, that is to say whether adoption of the improved practices could be achieved in 1, 2, 3, or 4 years. The analyses were stabilized beyond this period, however, in order to obtain rates of return over minimal periods of 10 years.

2.03 Each cropping system has its own input-output relationships. Each farmer, however, has certain costs which are maintained regardless of the system used. These would include land rental for example, a factor which existed "with" and "without" the project, or "before" and "after" the project started i.e. year "0". Therefore using the incremental concept there is no relevance in actually recording their values. There are other variables which had to be computed and these vary over time, for example the charges which must be made for the use of small tools.

2.04 Additionally there are investment costs which are treated as being relatively fixed and these relate specifically to the determined average costs for providing the soil conservation measures.

The list of statistics used is as follows:

i) variable costs used in production "before" and "after" project
ii) value of outputs from cropping systems before and after project
iii) variable costs for small tools determined over a period of ten years
iv) the fixed costs for soil conservation
v) input - output relationships of the traditional yam system
vi) the computations have been abbreviated by using the net of gross revenue over input costs.

2.05 <u>For the traditional yam system</u> (based on data collected)

Variable costs	J$ 8,673.40	per hectare
Gross returns	10,113.34	
Difference	J$ 1,439.94	say $1,440

This figure of $1,440 represents the income foregone in the usual parlance of project analysis, and which must then be used in determining the net benefit stream (output less input) for discounting the cash flows. Other costs include:

2.06 Cost of Small Equipment and Tools

Year 1	J$ 148
Year 2	10
Year 3	83
Year 4	10
Year 5	148
Year 6	10
Year 7	83
Year 8	10
Year 9	83
Year 10	75

2.07 Investment Costs for Terraces

These cover:

i) construction of soil conservation measures - namely hillside ditches for slopes of 0 - 7°; bench terracing for slopes 7° to 25°; orchard terraces for slopes 25° to 30°; and forestry for slopes above 30°.

ii) construction of waterways;

iii) grassing of risers and waterways;

iv) other soil amendment measures used, such as liming and the application of organic matter.

On these bases the investment costs worked out for the conditions found in this Pilot project area are as follows:

Slopes	Costs per hectare (J$)
0 - $\angle$ 7°	580
7° - $\angle$ 15°	7,385
15° - $\angle$ 20°	7,295
20° - $\angle$ 25°	12,660
25° - $\angle$ 30°	9,130
Over 30°	3,375

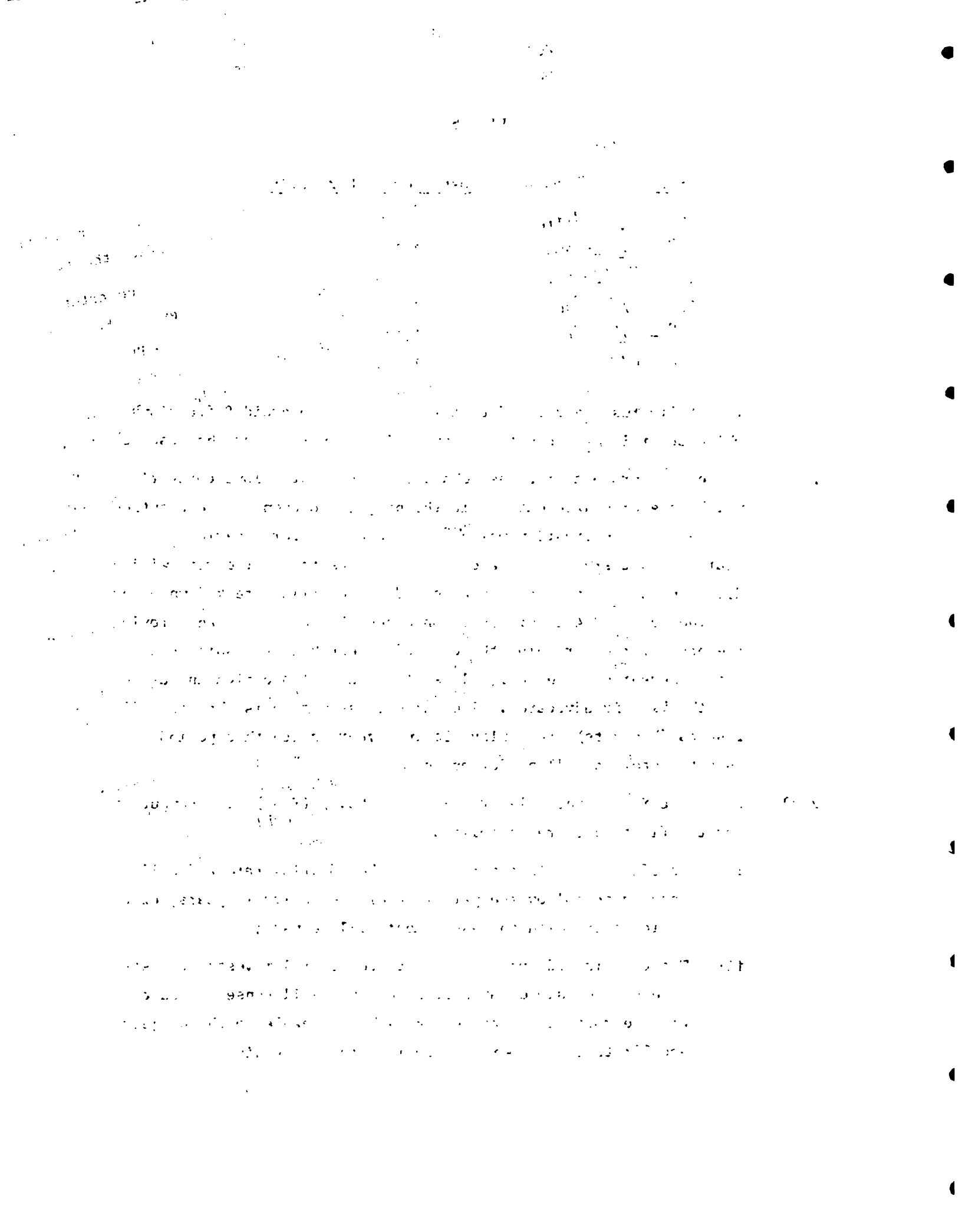
(The $ figures are rounded to the nearest $5 to avoid $ fractions which occur in the computation but which do not affect the results).

2.08 The entire project area has been broken down into slope categories which were presented earlier in the project document. The adoption of the Soil Conservation measures has been set for a period of 3 years, thus there must be a determination as to how the work will be distributed over this adoption period. A detailed break down using Hypotheses 3 and 4 is presented on pages VI-4 and VI-5, and provides the basis for determining the cost of undertaking the soil conservation measures. Due to its less steep rate of adoption the use of Hypothesis 4 is advocated. The further assumption is that the Allsides results (benefits) are achievable in 3 years since this period must be used to determine all performances.

2.09 Using the Yam as the Sole crop - System No. 1 (YASO), the computations for the first year are as follows:

i) Benefit stream is determined by the adoption rate and will be assumed to follow the pattern over the period 10 years, or the period over which the assessment will be made;

ii) The cost is made up of: (a) those capital investment costs depending on slope variations and this soil conservation cost will be modified so as to make 75% chargeable to the project and 25% to the farmer for use in determining his IRR.



iii) Given a variable cost for yam production of (J)$11,730 per hectare as obtained from the Allsides work (a figure which has an element of sensitization since it is somewhat high) and a slope category of 0 - $\angle 7^{o}$, during the first year the cost stream would be made up of:

$11,730	variable cost
148	for small equipment cost (See data on page VI-)
145	for soil conservation for this slope category (25% of the slope costs for this specific slope)
(J)$12,023	per hectare

iv) In computing the IRR the benefits start with those determined for the farmers in the project area and are then increased to those obtained in the Allsides project over the implementation period of 3 years. The net benefit of $1,440 'before' the project, based on farmers' experiences is used as the basis for calculation of the IRR.

The farmer's financing responsibility consists of:

The 25% of the Soil Conservation works - $145, as well as the credit needed for the particular system being adopted by him, and for which an appropriate repayment period must be worked out, with interest charged at the going rate for the particular lending arrangements made.

The nature of the project is such that sensitivity analyses are usually needed in terms of the volume of soil conservation which will actually be done, during any one year, the number of farmers who will adopt and the number of farmers adopting who will meet their repayment schedules.

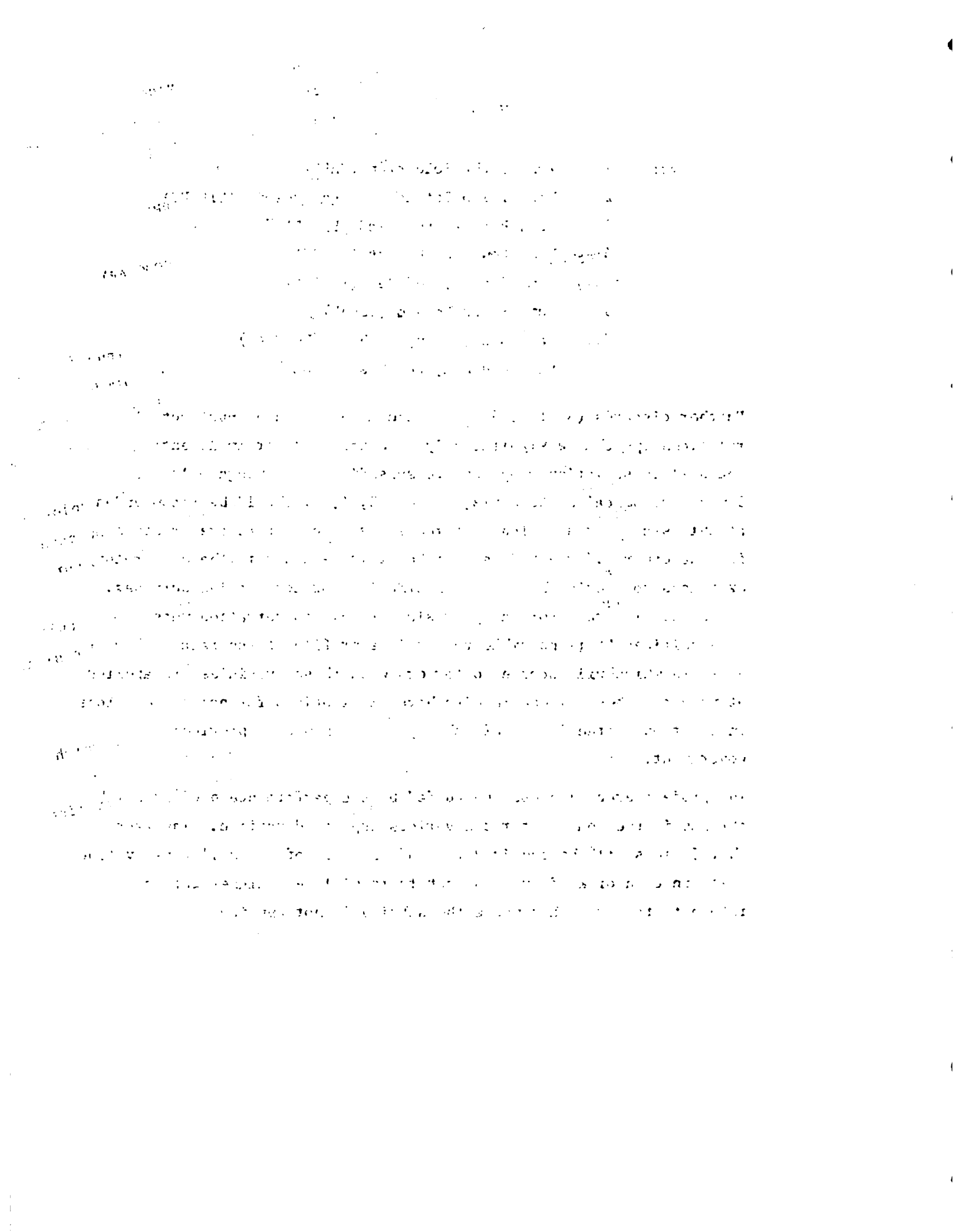
2.10 <u>The Systems or Models used for Financial Analysis</u>

The 8 production systems remaining after discarding those which appeared to be uneconomical and which are shown in Figure 1 are:

System	1	Yam as the Sole crop (YASO)
	2	Yam, Irish Potato, Radish, Peanut (YIRAPE)
	3	Yam, Peanut, Red Pea (YPERPE)
	4	Yam, Cow Pea, Peanut (YCOPE)
	5	Yam, Ginger, Red Pea (YGIRPE)
	6	Yam, Sweet Potato (YSWAP)
	7	Yam, Green Corn, Cabbage (YCOGCAB)
	8	Yam, Red Pea, Cow Pea (YRPECO)

Further discards (Systems 6 and 8) are made although input/output relationships change significantly when the cost for implementing the soil conservation measures are subsidized. Although only the 3 most economical systems viz, Numbers 2, 4, 5, should be recommended at this stage for adoption by farmers, rates of return are presented for the other 3. The YASO system No. 1 is retained in the exploratory exercises to provide base line information for comparative purposes. If the subsidy rate for the provision of soil conservation measures is sensitized it is possible to obtain a profile of the relative benefits which will accrue to farmers when these subsidies are applied at varying rates. These results have implications for policy decisions in relation to the levels of subsidy which should be provided by government.

The project execution must be guided by the performance profile which obtains in the country for the various aspects described. The fact that farmers will be required to fund only 25% of the soil conservation costs in cash or kind implies that there will be a higher rate of return to farmers, than where the subsidy is not applied.



2.11 Variable Costs

The variable cost material was derived through a detailed system of farm records kept covering physical and financial considerations. The investment costs were derived from the field experience and a detailed study conducted by IICA Office.

The cost and return figures cover only Yellow Yams, since almost all of the proposed area produces this commodity, and it is the contention that any improvements are going to be evaluated against the results obtained in the Yellow Yams-Analysis.

Variable Costs Considerations (J$ per hectare)

(1) System I Yam as the sole crop (YASO)

Production Costs

Labour	J$	3,230 per hectare
Materials		8,500 per hectare
Total inputs		11,730 per hectare

Outputs

Fresh marketable tubers	J$	8,600
'New head' revenue		8,680
Total	J$	17,280
Net return from system		5,550 per hectare

(2) System 2 Yam grown in association with Irish Potato, followed by Radish and Peanut (YIRAPE)

Production Costs

Labour	J$	6,520
Materials		10,530
Total	J$	17,050

Outputs

Yam Fresh marketable tubers	J$	6,460
'New head' revenue		8,705
Total	J$	15,165

Irish Potato		
Marketable tubers	J$	8,745
Non-saleable tuber value		365
Total	J$	9,110
Radish - marketable tuber revenue	J$	2,800
Peanuts - marketable pod revenue	J$	1,690
Total value of Output	J$	28,765
Net revenue	J$	11,715

(3) System 3 Yam, Peanuts, Red Peas (YPPRPF)

Production Costs		
Labour	J$	7,160
Materials		9,900
Total	J$	17,060
Outputs		
Yam - Fresh marketable tuber	J$	4,970
'New head' revenue		7,675
Peanuts - marketable unshelled pod		5,535
Red peas - marketable grain		2,195
Total	J$	20,375
Net revenue		3,315

(4) System 4 Yam, Cow Pea (African Ped variety) and Peanut (YCOPE)

Production Costs		
Labour	J$	6,020
Materials		9,125
Total	J$	15,145
Outputs		
Yam - Fresh tubers (marketable)	J$	5,425
'New head' revenue		7,980
Cow Pea - marketable grain		6,600
Peanut- marketable, unshelled pods		985
Total	J$	20,990
Net revenue		5,845

(5) System 5 Yam, Red Pea (Tom Red variety) and Ginger (YGIRPE)

Production Costs

Labour	J$	5,075
Materials		14,900
Total	J$	19,975

Outputs

Yam - Fresh marketable tubers		6,270
'New head'		7,065
Red Peas - marketable grain		1,880
Ginger - marketable, 'green' unpeeled		15,270
	J$	30,485
Net revenue	J$	10,510

(6) System 6 Yam and Sweet Potato (YSWAP)

Production Costs

Labour	J$	3,640
Materials		9,470
Total	J$	13,110

Outputs

Yam - Fresh marketable tuber	J$	4,840
'New head' revenue		4,510
Sweet Potato		580
Total	J$	9,930
Net revenue		3,180

(7) System 7 Yam, Grain Corn, Cabbage (YCOGCAB)

Production Costs

Labour	J$	3,835
Materials		8,965
	J$	12,800

Outputs

Yam - Fresh marketable	J$	8,630
'New head' revenue		8,740
Corn - Grain		125
Cabbage - none		-
Total	J$	17.495
Net revenue		4,695

(8) System 8 Yam, Red Peas and Cowpeas (YPPECO)

Production Costs

Labour	J$	7,210
Materials		10,240
Total	J$	17,450

Outputs

Yam - marketable Fresh tubers	J$	5,245
'New head'		7,270
Red Peas - marketable grain		4,005
Cow Peas		1,885
Total	J$	18,405
Net revenue		955

(9) Costs (Retail Prices of materials

See two pages which follows:

(10) Cost of Materials and Supplies 1/

Costs (retail prices) of materials and supplies such as yam planting heads, yam stakes, seed material, chemical fertilizers, pesticides and fungicides are listed as follows:

Yam planting heads	$ 881/metric ton
Yam stakes	$ 30/100 stakes
Cowpea Seed Material	$ 4.40/kg
Red Pea Seed Material	$ 5.50/kg
Ginger Seed Material	$ 1.32/kg
Irish potato-Seed Material	$ 61.67/100kg
Radish Seed Material	$ 11/kg
Peanut Seed Material	$ 2.20/kg
Chemical Fertilizers:	
- Urea	$ 57.03/100kg
- Sulphate of Ammonia	$ 41.30/100kg
- Triple Super Phosphate	$ 51.00/100kg
- Muriate of Potash	$ 43.27
- Sweet Potato planting slips	$ 1.000/kg
- Grain corn Seed material	$ 2.64/kg
- Cabbage Seed material	$ 45/100 gms
Fungicides:	
- Benlate	$ 55.08/kg
- Cupravit Blue	$ 12.34/kg
- Daconil	$ 22.03/kg
- Karathane	$ 6.00/kg
- Kocide	$ 9.10/kg

1/ Unless otherwise specified all figures are quoted in J$.

Pesticides:

- Chlordane	$ 65.00/kg
- Diazinon HDW	$ 15.09/kg
- Dipterex	$ 18.79/kg
- Malathion E.M.S.	$ 25.85/gallon
- Sevin	$ 11.90/kg
- Perfekthion	$ 18.00/liter
- Rat bait	$ 2.20/kg

Farm gate prices received for products grown at Allsides for period March 1979 - February 1980.

YAM	J$/1000kg (J$/metric ton)
Marketable tubers	660.00
Saleable planting "heads"	881.00
RADISH	
Marketable tubers	2,203.00
IRISH POTATO	
Marketable tubers	660.00
Non-saleable tubers	110.00
PEANUT	
Saleable unshelled pods	2,203.00
COWPEA var. (African Red)	
Marketable Seeds	4,400.00
RED PEA var. (Miss Kelly Tom Red, ICA/DUVA	
Marketable Seeds	5,500.00
GINGER	
Saleable rhizomes	1,101.00
SWEET POTATO	
Saleable tubers	441.00
GRAIN CORN	
Saleable grains	441.00

TABLE V-1 COST OF PRODUCTION - YELLOW YAMS (PER ACRE) FARMERS ALLSIDES AREA

February, 1980

	Man/Days	Costs $	Cost [1]
A. OPERATIONS			
Land Preparation			
Weeding bush & Clearing Land (1.5 M/days per sq. chain)	15	120.00	
Digging holes (2 M/days per sq. chain)	20	160.00	
Forking (1 M/day per sq. chain)	10	80.00	
Planting			
Planting (2 M/days per acre)	2	16.00	
Culture			
Staking - including sharpening and transporting to site (2 M/days per sq. chain)	20	160.00	
Applying fertilizer (0.5 M/days per sq. chain)	5	40.00	
Weeding - 3 times (1 M/day per sq. chain)	30	240.00	
Twining vines (8 M/days per acre)	8	64.00	
Harvesting			
Cutting vines and reaping (2 M/days per sq. chain)	20	160.00	
	130.00	1,040.00	

Cost of Production - Yellow Yams (Cont'd)

	Man/ days	Cost $	(Cash) Cost $
MATERIALS			
Yam heads 1,000 hills at 4 lb/hill = 4,000 lb/acre		1,000.00	500.00
Stakes 1,000 25¢ x 1/2 replaced		187.50	125.00
Fertilizer - 1/2 bag/sq. chain $26 per bag - twice		260.00	260.00
		1,447.50	885.00
OTHER CHARGES			
Rent		35.00	35.00
Interest 6% - 11% (use 10%)		260.00	92.00
Management & Risk (5% on A & B)		125.00	-
Depreciation (10% on A)		140.00	-
Contingencies (7% of B)		112.00	100.00
		636.50	227.00
TOTAL		3,124.00	1,112.00
YIELDS			
11,000 lbs edible (25¢/lb)		2,750.00	2,750.00
22,000 lbs 'Yam head' (35¢/lb)		700.00	700.00
		3,450.00	3,450.00
BALANCE		360.00	
Add back $104.00		104.00	2,338.00

2.12 Analytical Procedures

Once the results were organized four major forms of socio-economic analysis were conducted each one related itself to a major component contribution of the project and its objectives:

(a) Improved Nutrition
(b) Increased Employment
(c) Improved Income
(d) Return on Investment

In each of the four elements the idea was to observe the results of the improved systems over the normal practice or what the farmers are doing with its non terrace lands in the area.

1. Nutritional Evaluation

The analysis indicated, that nutritionally, System No. 2 (Yams - Irish Potatoes - Radishes and Peanuts) far exceeds the other systems. This system in the other analyses proved to be also very outstanding. and for these reasons it has been ranked as the best system.

2. Employment Evaluation

Table · indicates that 3 of the seven systems almost double the labour requirements, with increases of 121, 119, 100 and 84 per cent over the amount normally used in the improved Yam Monocrop System. It is important to note that the nutritionally best system is also among the top three system with a 100 per cent increase over the improved monocrop. (See details on page VI-15)

3. Income Evaluation

From the socio-economic survey conducted it was estimated that the Gross Value of Productions per hectare stands at J$5,355.00 and that the net benefits above variable cost at around J$2,619.00.

4. Financial and Economic Evaluation

The financial and economic evaluation conducted was performed on the basis of assumptions and information included in data for costs and benefits presented in this section pp. VI-8 - VI-13.

TABLE VI-2 Manual labour required (man-days) for the establishment maintenance and harvest of eight cropping systems tested at Allsides, Trelawny, during the 1979-1980 crop year.

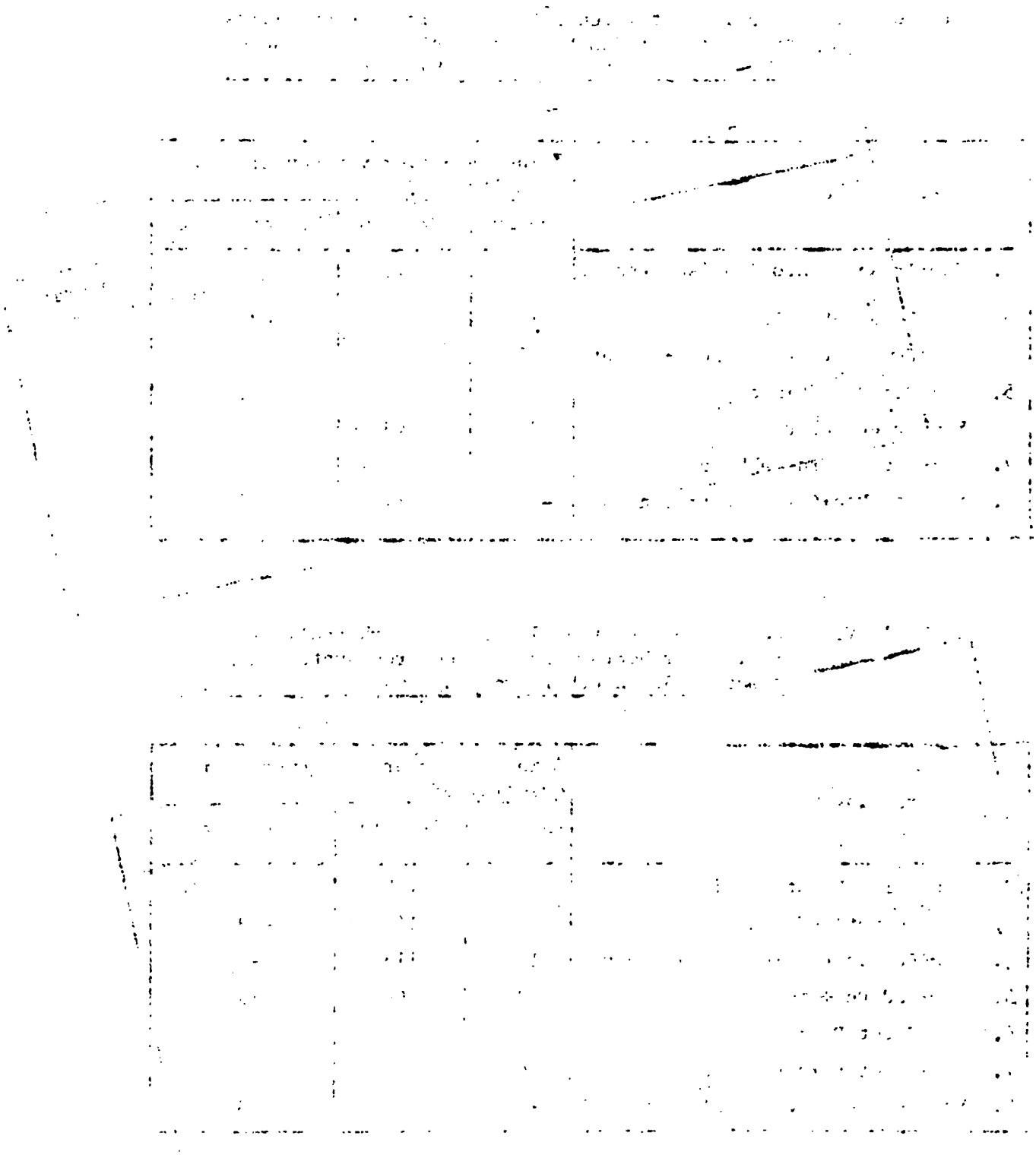
Cropping System	Man-days	Increase over yam monocrop	% Increase over yam monocrop
1. Yam as Sole Crop	316	-	-
2. Yam & Irish Potato, Radish & Peanut	639	323	102
3. Yam & Peanut & Red Pea	702	386	222
4. Yam & Cow Pea & Peanut	590	274	87
5. Yam & Red Pea & Ginger	497	177	57
6. Yam & Sweet Potato	357	37	13
7. Yam & Green Corn & Cabbage	376	56	19
8. Yam & Red Pea & Cow Pea	707	387	124

Table VI-3 Comparing Nutritional Value of Total Crop Yields per hectare of Yam Monocrop System with those of Seven other Cropping Systems

Cropping System	% increase over yam monocrop in quantity of:		
	Energy	Protein	Carbohydrate
2. Yam+Irish Potato +Radish +Peanut	52	73	50
3. Yam+Peanut+Red Pea	17	69	-20
4. Yam+Cowpea+(African Red)+Peanut	5	55	-9
5. Yam+Red Pea +Ginger	6	27	1
6. Yam+Sweet Potato	-38	-43	-39
7. Yam+Sweet Corn+Cabbage	4	7	4
8. Yam+Red Pea+Cowpea (African Red)	-16	-14	-20

Table VI-4 Comparing Nutritional Value of Marketable Crop Yields per hectare of Yam Monocrop System with those of Seven other Cropping Systems

Cropping System	% increase over yam monocrop in quantity of:		
	Energy	Protein	Carbohydrate
2. Yam+Irish Potato+Radish+Peanut	78	118	76
3. Yam+Peanut+Red Pea	46	143	-23
4. Yam+Cowpea (African Red)+Peanut	19	113	-7
5. Yam+Red Pea+Ginger	29	68	19
6. Yam+Sweet Potato			
7. Yam+Sweet Corn+Cabbage	4	6	4
8. Yam+Red Pea+Cowpea (African Red)	-9	45	-23



On the basis of information obtained for the Agro-Socio-Economic Survey a farm size of 1 hectare has been used for determining the financial rates of returns.

The net benefits for each of the systems over variable cost were calculated with the following results:

1.	YASO	17,230	-	11,730	= 5,550
2.	YIRAPE	28,765	-	17,050	= 11,715
3.	YPERPE	20,375	-	17,060	= 3,315
4.	YCOPE	20,990	-	15,145	= 5,845
5.	YGIRPE	30,485	-	19,975	= 10,510
6.	YSWAP	9,930	-	13,110	= (3,180)
7.	YCOGCAR	17,495	-	12,800	= 4,695
8.	YRPECO	18,405	-	17,450	= 955

Based on the results systems 6 and 8 were discarded, the yams-sweet potatoes and the yam - red peas - cow peas - hence only 6 systems remain for the remaining rounds.

The rates of return were calculated for each of the eight systems for the five slope categories (0 -<7°);(7°-<15°); (15°-<20°); (20°<25°); and (25°<30°), assuming a 3-year adoption period.

The analysis of the results is as set out in Table

Table VI -
Internal Rates of Return (IRR) by Slopes for 8 Cropping Systems

	CROPPING SYSTEMS							
Slopes	(1) YASO	(2) YIPAPE	(3) YPERPE	(4) YCOPE	(5) YGIRPE	(6) YCOGCA	(7) YSWAP	(8) YRPECO
0° - / 7°	30.4	50 +	- ve	24	47.5	18.4	- ve	- ve
7° - / 15°	25.1	50 +	- ve	20.3	42.5	14.6	- ve	- ve
15°-/ 20°	25.2	50 +	- ve	20.3	42.6	14.7	- ve	- ve
20°-/ 25°	21.8	50 +	- ve	17.8	39.2	12.2	- ve	- ve
25°/ 30°	24.0	50 +	- ve	19.4	41.4	13.8	- ve	- ve

- ve = negative

(Computer Print-outs of this information is available for scrutiny)

The above rates of return are based on a 3 year adoption/implementation period. Where implementation occurred in 2 years the rates were higher. The information shows clearly that systems Nos. 2, 5 and 4 are the best, in that order. (Yam is not regarded as a system for these purposes).

The IRRs assume that a single slope category is used for the calculation. However, as presented on page VI-5 the implementation cannot be undertaken on such a basis. Regardless of the combination of slopes used, Systems 2 (YIRAPE), (Yam, Irish Potato, Radish and Peanut) and 5 (Yam, Ginger and Red Peas - YGIRPE), would be very profitable under these circumstances, while on avarage System 4 (Yam, Cow Pea and Peanut) would have an IRR of about 20%, assuming that all slopes were involved.

Those are the underlying reasons for recommending that farmers should use systems No. 2, 5 and 4. Since farmers usually make a choice, one mixed of the 3 recommended cropping systems could be:

System 2 - 40% of land to be cultivated
System 5 - 40% of land to be cultivated
System 4 - 20% of land to be cultivated

This mix has been used in assessing the input cost, and thus the production credit needs. Using the Cropping System - Yam, Irish Potato and Peanuts (YIPAPE), the appropriate costs for small machinery, the basic production costs of $17,050 per hectare, and 25% of the soil conservation costs, to determine the cost stream and the revenue (achieved over the execution period on the basis of 1/3 per year - using a 3 year period) the position for slope 1 (0°-/ 7°) is as follows:

	Benefits ($)	Costs ($) Ja/hectare
Year 1	9,588	17050 + 148 + 145 = 17,343
2	19,176	17050 + 10 + 145 = 17,205
3	28,765	17050 + 83 + 145 = 17,278
4		17050 + 10 + 145 = 17,205
5		17050 + 148 + 145 = 17,343
6		17050 + 10 + 145 = 17,205
7		17050 + 83 + 145 = 17,278
8		17050 + 10 + 145 = 17,205
9		17050 + 83 + 145 = 17,278
10		17050 + 75 + 145 = 17,270

Small equipment includes cutlasses, shovels, hoes, forks, knapsack sprayers etc. The IRR for this particular slope exceeds 50, and is therefore able to accommodate charges for interest etc. These calculations result in the IRRs shown in the previous Table.

ECONOMIC, PRODUCTION EXPORT AND IMPORT STATISTICS

Table I shows the economic structure of the country and indicates the relative contribution of the various economic sectors to the Gross Domestic Product during the period 1974-1978.

Table I Gross Domestic Product by Economic Activity in Purchasers' Value at Current Prices

(J$) million

Industry		1974	1975	1976	1977	1978
Agriculture, Forestry and Fishing	..	162.6	202.0	226.3	260.2	316.1
Export Agriculture	..	36.5	46.6	52.9	39.5	47.3
Sugar Cane	..	22.2	31.9	33.4	24.0	26.2
Other Main Exports	..	14.3	14.7	19.5	15.5	21.2
Domestic Agriculture	..	70.2	84.8	93.7	128.8	151.6
Root Crops	..	40.4	48.4	47.2	63.5	68.7
Other Primary Products	..	29.8	36.4	46.5	65.3	83.0
Livestock and Hunting	..	37.2	47.4	53.2	60.9	79.0
Fishing	..	16.2	20.3	23.2	27.4	35.0
Forestry and Logging	..	2.7	3.0	3.2	3.5	3.3
Mining and Quarrying	..	297.3	269.0	236.9	308.3	498.1
Bauxite and Alumina	..	287.6	261.6	230.1	301.8	491.4
Quarrying incl. Gypsum	..	9.7	7.4	6.8	6.5	6.7
Manufacture	..	386.8	442.6	490.3	541.5	626.8
Construction & Installation	..	213.5	252.4	211.9	181.2	245.4
Electricity and Water	..	22.2	36.6	54.3	61.6	84.4
Transportation, Storage & Communication	..	137.0	156.1	171.5	190.8	224.7
Distributive Trade (Wholesales and Retail)	..	409.2	517.1	432.3	472.0	633.5
Financial Institution	..	93.4	109.0	111.1	115.1	143.2
Real Estate	..	204.6	252.4	279.2	299.0	319.8
Producers of Government Service	..	251.3	316.9	367.3	420.9	497.7
Miscellaneous Services	..	119.6	132.7	141.4	151.7	172.5
Household and Private Non-Profit Institutions	..	38.0	40.1	49.5	53.2	50.4
Less Imputed Service Charge	..	65.8	79.6	73.2	84.7	99.6
Total Gross Domestic Product	..	2269.9	2647.3	2698.8	2970.9	3713.1

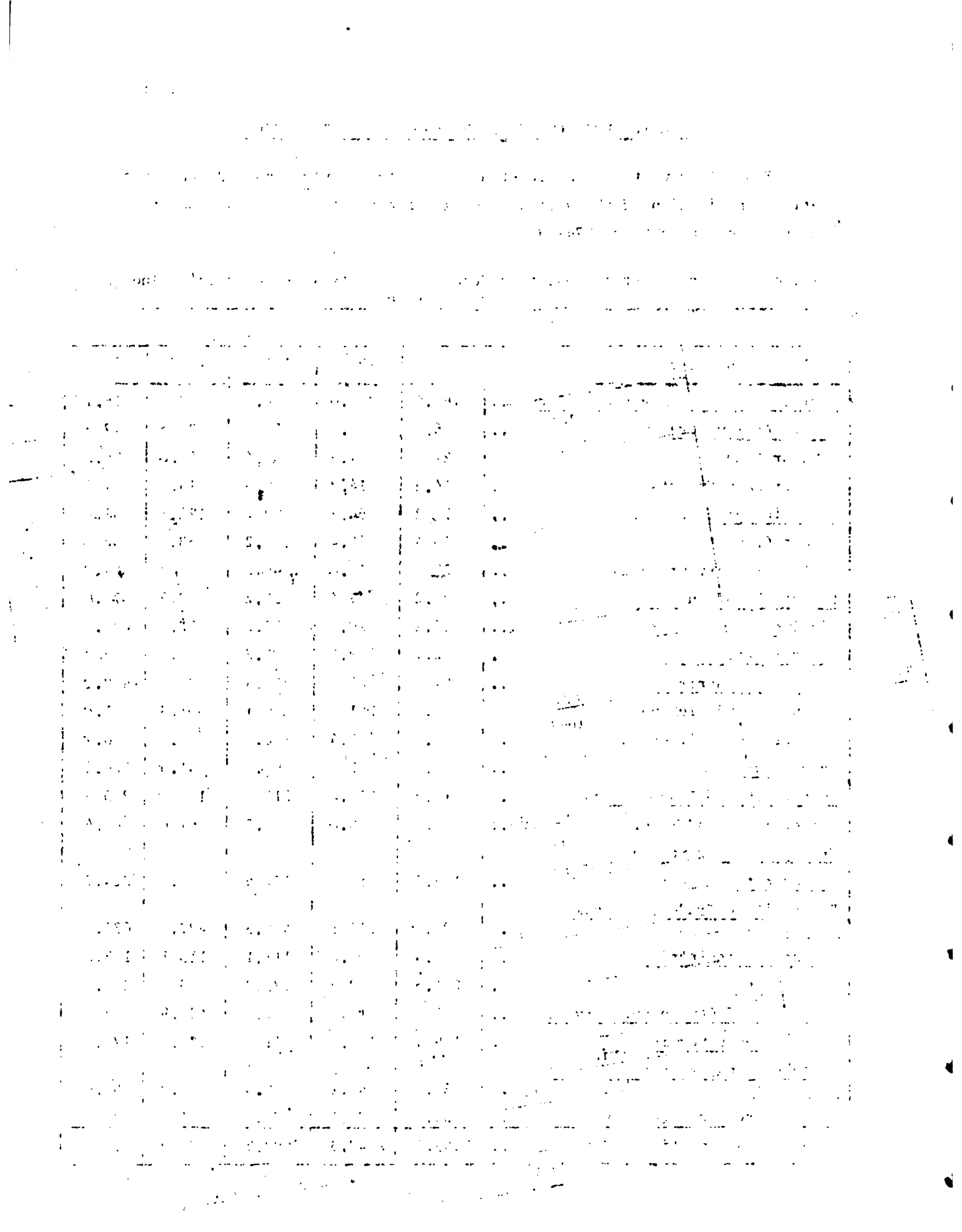


Table 2 Volume of Agricultural Production, 1974-1978

Item	1974	1975	1976	1977	1978
Sugar Cane (000 tons	3,785	3,524	3,571	3,177	3,515
Sugar (000 tons Commercial	367	355	357	288	288
Bananas * (000 boxes)	72	68	77	80	75
Citrus ** (000 boxes)	1,007	1,028	946	666	886
Pimento (tons)	3,949	2,151	4,181	1,989	2,502
Cocoa * (tons)	1,593	1,771	1,573	1,614	1,300
Coffee ** (000 boxes)	240	381	230	312	179
Ginger (short tons)	857	930	995	423	687
Rum (000 proof gal.)	5,735	6,455	4,475	5,005	4,278
Molasses (tons)	121	120	118	117	133
Copra (short tons)	8,901	6,308	5,624	3,406	2,124
Meat (million lb)	89	103	102	1 111	111
Fish (million lb)	36	36	36	37	37
Egg (million)	139	147	162	152	240
Milk (million quarts)	43	43	42	41	43
Root Crops *** (million lb)	443	400	408	517	656
Vegetables *** (million lb)	215	2003	223	276	356

* Exports

* Exports

** Deliveries to packaging and processing plants

*** Selected items

NOTE: Production figure for citrus, cocoa, pimento, sugarcane, rum and coffee are for the crop year.

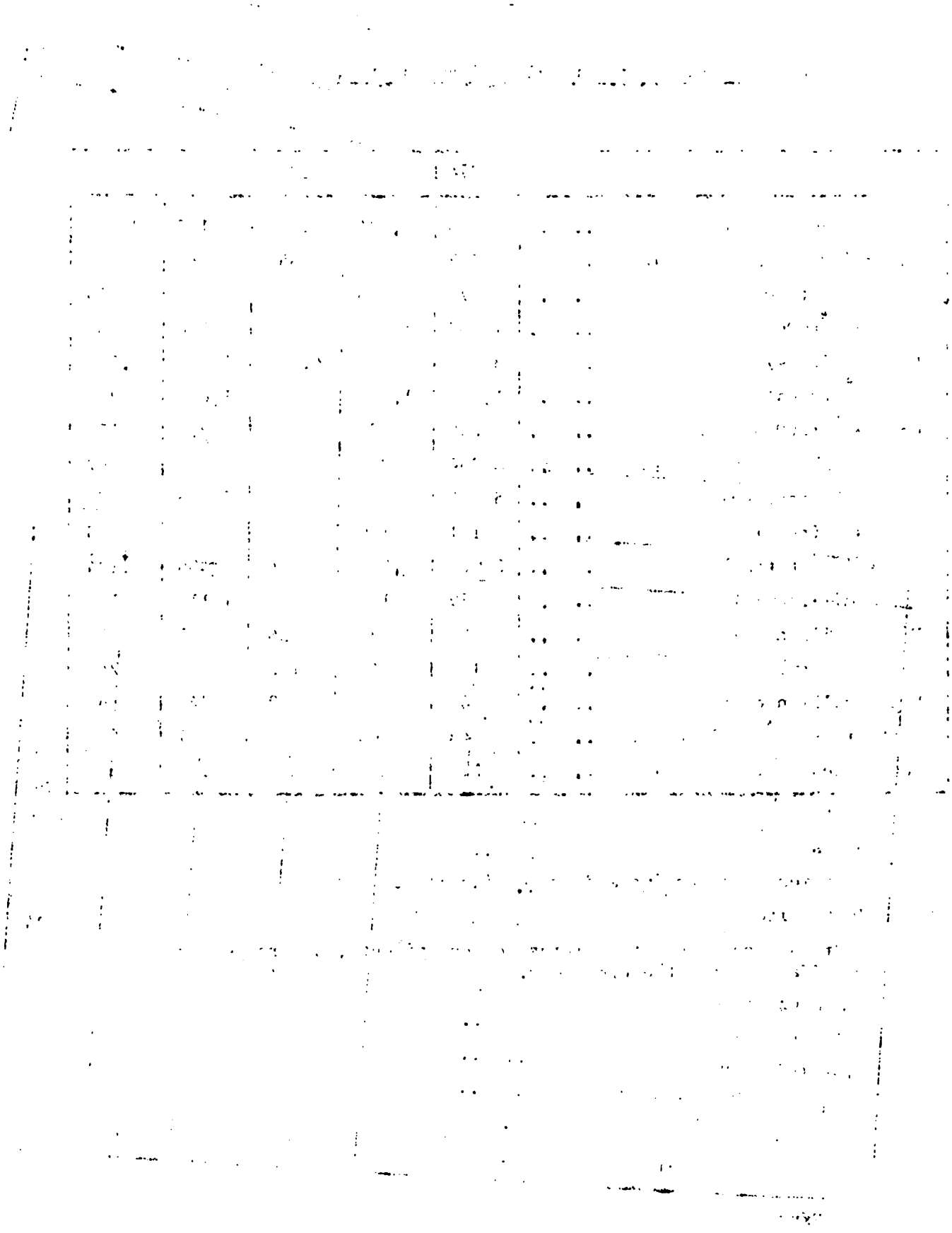


Table 3 Estimated Production of Selected Agricultural Commodities 1969-1977

Item	Unit	QUANTITY								
	('000)	1969	1970	1971	1972	1973	1974	1975	1976	1977
Sugar Cane	Tons	4,004	4,214	4,041	4,069	3,584	3,786	3,524	3,570	3,177
Estates	Tons	1,988	2,129	2,057	2,125	1,765	1,826	704	765	717
Farmers	Tons	2,016	2,085	1,984	1,944	1,819	1,960	2,820	2,805	2,460
Bananas	Stem	16,231	15,540	19,180	18,480	12,207	8,754	9,350	10,346	11,502
Citrus	Boxes	3,522	3,566	3,943	3,930	2,207	2,474	2,481	2,488	1,972
Sweet Oranges	Boxes	1,904	1,692	1,800	2,160	791	1,020	1,061	1,071	1,092
Grapefruit	Boxes	827	679	759	550	826	761	746	769	664
Limes and lemon	Boxes	388	388	393	355	395	416	416	443	n.a.
Other variety incl. sour oranges	Boxes	403	807	901	865	195	276	208	205	216
Coconut	Nuts	120,301	120,500	144,625	117,719	98,541	102,573	89,478	86,205	122,314
Cocoa-wet	Lb	10,236	11,922	10,321	12,132	10,770	8,915	9,813	9,160	9,327
Coffee-Cherry	Boxes	350	398	299	229	253	328	261	405	3,273
Pimento	Lb	7,297	4,925	5,600	5,546	4,164	8,493	5,221	8,980	4,459
Tobacco Leaf	Lb	2,793	2,600	2,500	2,500	n.a	n.a	n.a	n.a	n.a
Ginger	Lb	675	832	912	1,314	1,498	1,714	1,860	1,990	846
Annatto	Lb	353	411	458	85	n.a	129	42	119	n.a
Honey	Gal.	28	42	47	50	n.a	5	15	-	n.a
Kolanuts	Lb	909	728	813	1,009	n.a	1,073	873	819	n.a
Rice Paddy	Lb	2,883	1,404	820	570	538	640	4,043	4,374	12,282
Sarsaparilla	Lb	69	105	117	104	n.a	69	33	80	n.a
Turmeric	Lb	602	828	924	462	n.a.	n.a	99	132	n.a

* 1 Box = 60 lb

Table 4 Value of Agricultural Exports, 1974-1978

JA ($000)

Item	1974	1975	1976	1977	1978
Sugar	74,422	139,688	55,860	71,517	92,510
Bananas	11,497	14,654	11,921	16,703	24,907
Citrus	3,934	4,717	3,955	3,124	5,684
Pimento	5,011	4,325	4,593	4,979	8,132
Cocoa	2,879	3,496	3,557	3,177	8,270
Coffee	3,336	3,116	4,129	6,585	4,350
Ginger	597	303	660	526	843
Rum	5,655	5,801	5,981	6,370	7,687
Molasses	2,117	....	2,339	1,203	3,291
Root Crops	1,200	900	830	887	2,958
Total	110,708	177,000	93,825	115,071	158,632
Increase		(60%)	(-47%)	(23%)	(38%)

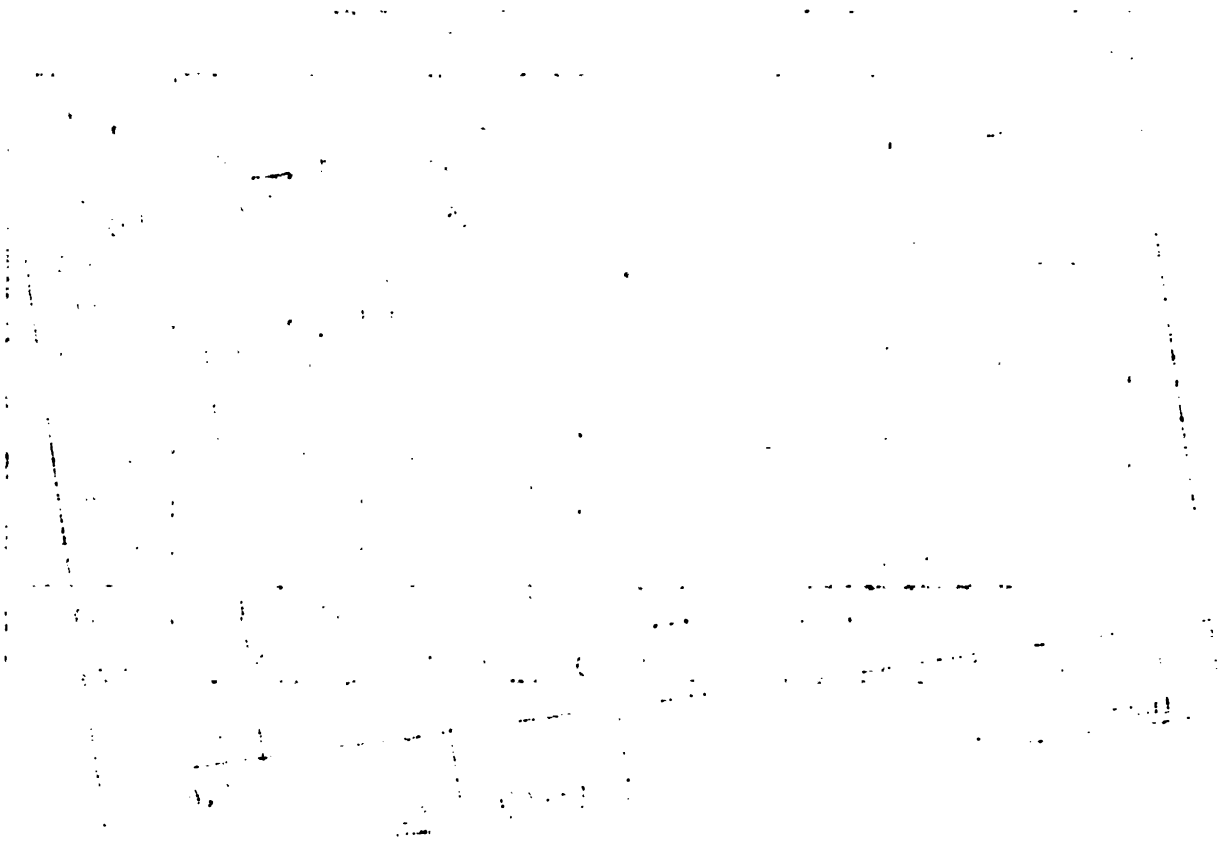


Table 5 Imports of Consumer Goods, 1977-1978

(US$) million

Category	1977	1978
FOOD	53.6	76.1
Dairy Products	12.3	16.1
Meat and meat preparations	17.6	24.9
Fish and fish preparations	8.3	14.4
Cereal and cereal preparations	11.1	14.2
Fruits and Vegetables	1.4	1.5
Sugar and sugar preparations	0.4	0.5
Coffee, Tea, Cocoa, Spices	0.5	0.8
Beverages	0.5	1.7
Other	1.5	2.0
OTHER NON-DURABLES	23.0	28.2
Medicinal and Pharmaceutical products	7.2	8.3
Textiles	2.8	3.7

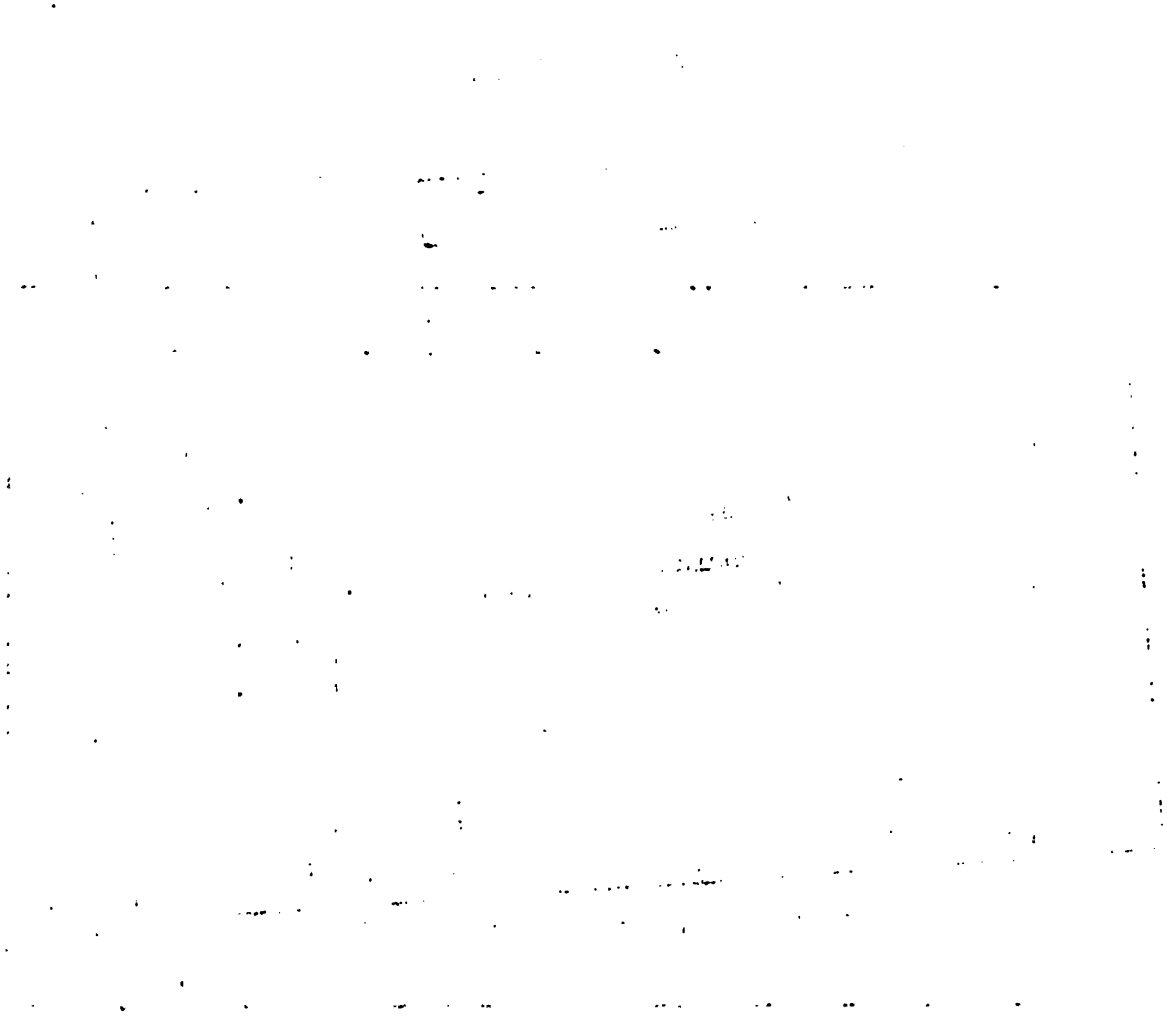


Table 7 Persons Employed and Per Cent Unemployed by Industry and Sex 1978

	APRIL 1978						OCTOBER 1978					
	Both Sexes		Male		Female		Both Sexes		Male		Female	
	Numbers Employed ('000)	Per Cent Unemployed	Numbers Employed ('000)	Per Cent Unemployed	Numbers Employed ('000)	Per Cent Unemployed	Numbers Employed ('000)	Per Cent Unemployed	Numbers Employed ('000)	Per Cent Unemployed	Numbers Employed ('000)	Per Cent Unemployed
Total Classifiable Labour Force	714.8	17.2	434.4	10.3	280.4	26.0	702.1	18.8	425.0	11.4	277.1	28.0
Agriculture, Forestry & Fishing	261.6	6.4	193.4	3.7	68.2	13.3	252.3	5.8	186.0	3.6	66.3	11.5
Mining, Quarrying & Refining	6.2	8.8	5.2	8.6	1.0	10.0	5.7	12.5	5.1	12.3	0.6	14.3
Manufacture	79.7	19.3	60.1	12.5	19.6	34.9	78.2	21.1	58.8	16.0	19.4	33.5
Construction & Installation	30.8	33.2	29.7	32.3	1.1	50.0	35.0	30.3	34.0	30.7	1.0	23.1
Transport, Communication & Public Utilities	27.8	11.7	20.9	10.6	6.9	15.0	30.8	13.2	22.9	12.9	7.9	14.3
Commerce	95.0	13.9	35.0	10.9	60.0	15.5	91.5	14.7	32.4	8.2	59.1	17.9
Public Administration	114.3	19.7	57.0	13.4	57.3	25.1	103.2	22.5	48.3	15.6	54.9	27.8
Other Services	96.6	33.1	30.9	8.9	65.7	40.0	99.5	36.6	33.8	12.0	65.7	44.6
Industry not Specified	2.8	26.3	2.2	27.6	00.6	22.2	5.9	24.7	3.7	20.8	2.2	30.3

Table 6 Distribution of Labour Force by Industry Groups, Levels of Employment by Industry 1975-1978

('000)

	1975			1976			1977			1978		
	Annual Average	April	October	Annual Average	April	October	Annual Average	April	October	Annual Average	April	October
Total Classifiable Labour Force	682.2	680.2	684.3	685.9	692.6	679.1	689.8	680.3	699.2	708.5	714.8	702.1
Agriculture, Forestry & Fishing	226.8	219.6	234.1	243.9	249.9	237.9	244.0	239.6	248.3	257.0	261.6	252.3
Mining Quarrying & Refining	7.4	7.6	7.3	7.8	7.3	8.4	7.4	7.2	7.5	6.0	6.2	5.7
Manufacture	74.0	75.2	72.7	75.6	76.1	75.0	76.2	77.6	74.9	79.0	79.7	78.2
Construction and Installation	44.6	45.4	43.8	38.0	39.6	36.3	33.0	33.7	32.2	32.9	30.8	35.0
Transport, Communications and Public Utilities	31.6	31.9	31.2	31.5	30.6	32.4	29.6	27.7	31.4	29.3	27.8	30.8
Commerce	81.7	82.3	81.1	80.7	76.8	84.6	88.4	86.6	90.1	93.2	95.0	91.5
Public Administration	98.4	100.8	96.1	106.4	106.1	106.7	111.3	110.8	111.8	108.8	114.3	103.2
Other Services	114.5	113.6	115.4	98.5	103.1	93.9	96.0	93.5	98.5	98.0	96.6	99.5
Industry not Specified	3.2	3.8	2.6	3.5	3.1	3.9	4.0	3.6	4.5	4.4	2.8	5.9

DESCRIPTION OF AREA: PILOT HILLSIDE AGRICULTURAL PROJECT

The extensions identified as A and B on the map adjoins the existing Allsides Project area at the North and Eastern boundaries respectively.

In respect of section 'A' the boundary starts at the intersection of the GAMBI and Wait-A-Bit to Stettin main Road, continuing in a slightly South Westerly direction and along the ridge up to the top of the forest plantation from where it follows the main track in a westerly direction down to the Wirefence to Warsop USAID/GOJ feeder Road.

It continues from this point along the said road in a westerly and northerly direction down to a point in Arcadia, which is west of the Mouth River Bridge. Still following the road, it passes over the Mouth River Bridge and continues in a north easterly direction up the hill.

The boundary then deviates from the Mouth River Road and follows a main track and ridge in a north easterly then a slight east south easterly direction up to the near summit at 2550 feet near Wirefence. From this point it travels in an almost north easterly direction down to the main road leading to Stettin, and intersecting it at a very deep corner. It continues in the same direction, almost parellel to a tributary of the Quashies River and also along a main ridge straight to the Quashies River. From here, it follows the River in a south easterly direction and straight up to the Gambi Bridge. From the Gambi Bridge it follows the road in a south westerly direction back to the Wait-A-Bit/Stettin main road.

In respect of Area 'B' the main road going through Wait-A-Bit serves as the southern boundary line for this area at approximately 200 feet beyond the post office, going towards Litchfield. There is a secondary road which leads to Joe Hut and which also serves as the boundary line.

SOIL CONSERVATION CHARACTERISTICS, PRACTICES & TECHNICAL FEATURES

A special analytical survey was undertaken to determine the inputs necessary for providing a number of soil conservation practices determined as being necessary for the conditions found in the project area. The information collected was designed to provide answers relating to:

(i) the land available for agricultural purposes after the soil conservation measures were provided;

(ii) the cost for providing each measure - differentiated into material, labour and machine costs; and

(iii) the overall costs of providing the soil conservation measures.

The measures identified by slope categories are:-

Slope Categories		Areas (hectares)
0^{o} - $\angle$ 7^{o}	Hillside Ditches	28
7^{o} - $\angle$ 15^{o}	Bench Terraces	131
15^{o} - $\angle$ 20^{o}	" "	59
20^{o} - $\angle$ 25^{o}	" "	40
25^{o} - $\angle$ 30^{o}	Orchard Terraces	46
Over 30^{o}	Forestry	42
		346

In determining the net area of land to be treated the items surveyed included house lots, present areas which have some form of soil conservation measure, rocky areas, forest areas, rivers and other limiting factors (as roads, shallow soil ditches, etc.) As a prelude to undertaking this survey soil types and slope categories were determined.

The Soil Conservation measures identified for use were:

- Hillside Ditches
- Bench Terraces
- Orchard Terraces
- Waterways
- Afforestation

With regard to net areas to be treated by soil conservation measures, all areas were measured by planimeter and recorded as listed in Table 2 - (2) Each conservation measure has the dimensions of the cross-sections and the diagrams of the treatments shown in Figures 2 - (1) and 3 - (2), Tables 3 - (2) and 3 - (3).

(1) Hillside Ditches

A series of V-Shaped, flat bottomed level ditches running across the hillside slope. Their spacing depends upon local conditions.

Table 3-(1) P The net areas to be treated for Pilot Hillside Agricultural Project

Locations	Slope (degrees)	Soil Conservation Treatments & Symbols	Acres		Acres		Per cent	
			Hectares	Acres	Hectares	Acres	%	%
A	0°- 7°	Hillside ditches (H_1)	15.75	38.90	15.75	39.90	7.3	7.3
R	7°- 15°	Bench terraces (BT_2)	46.50	114.86			21.6	
E	15°- 20°	Bench terraces (BT_3)	47.75	117.94	126.75	313.07	22.2	58.9
A	20°- 25°	Bench terraces (BT_4)	32.50	80.28			51.1	
	25°- 30°	Orchard terraces (OT_5)	45.25	111.77	45.25	111.77	21.0	21.0
"A"	30°	Forest (F)	27.50	67.93	27.50	67.93	12.8	12.8
		Total	215.25	531.67	215.25	531.67	100	100
A	0°- 7°	Hillside ditches (H_1)	11.85	29.27	11.85	29.27	9.1	9.1
P	7°- 15°	Bench terraces (BT_2)	83.50	206.25			63.9	
	15°- 20°	Bench terraces (BT_3)	11.75	29.02	102.75	253.79	9.0	78.6
E	20°- 25°	Bench terraces (BT_4)	7.50	18.53			5.7	
A	25°- 30°	Orchard terraces (OT_5)	1.00	2.47	1.00	2.47	0.8	0.8
"B"	30°	Forest (F)	15.00	37.05	15.00	37.05	11.5	11.5
		Total	130.6	322.58	130.6	322.58	100	100

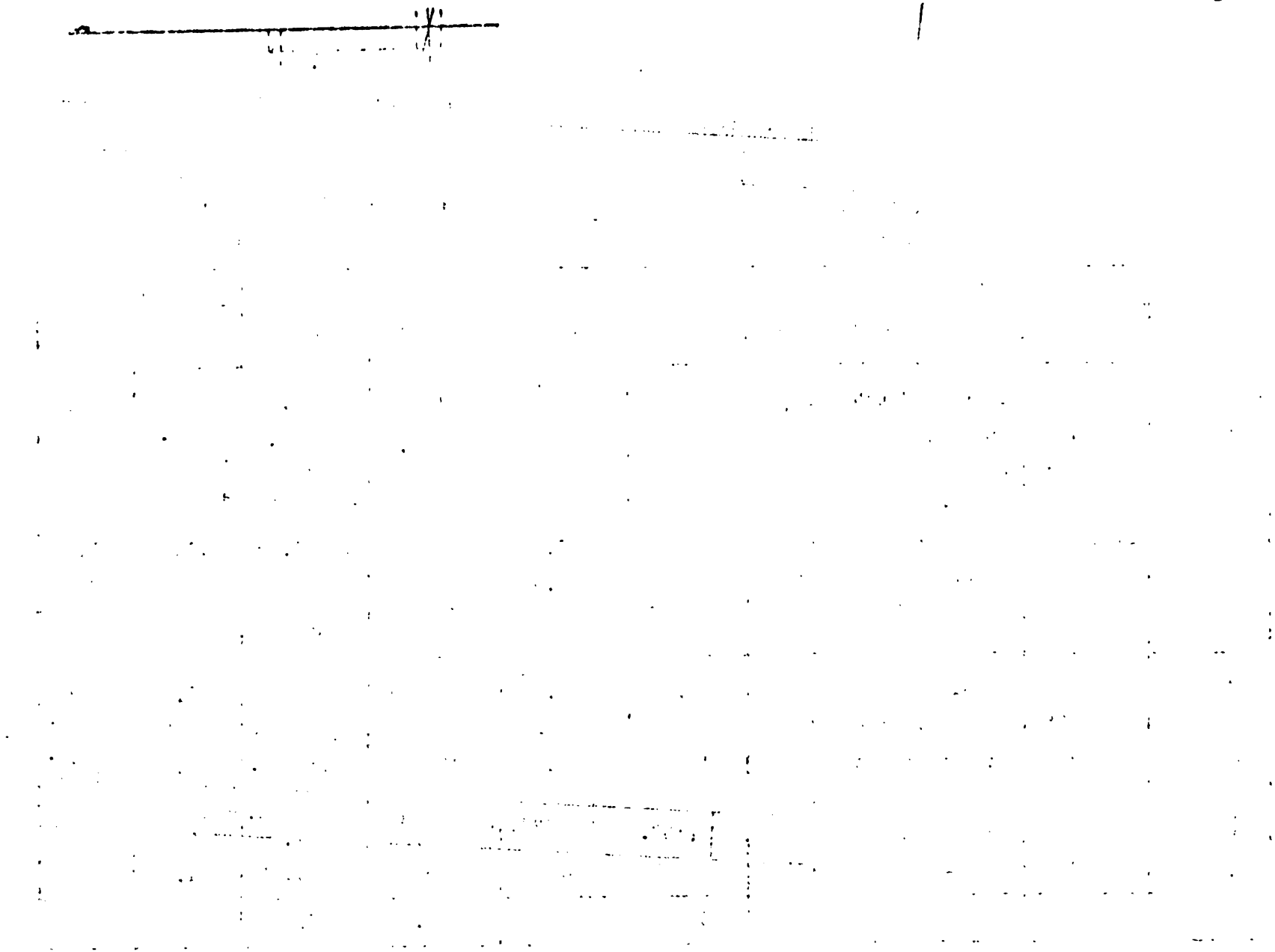
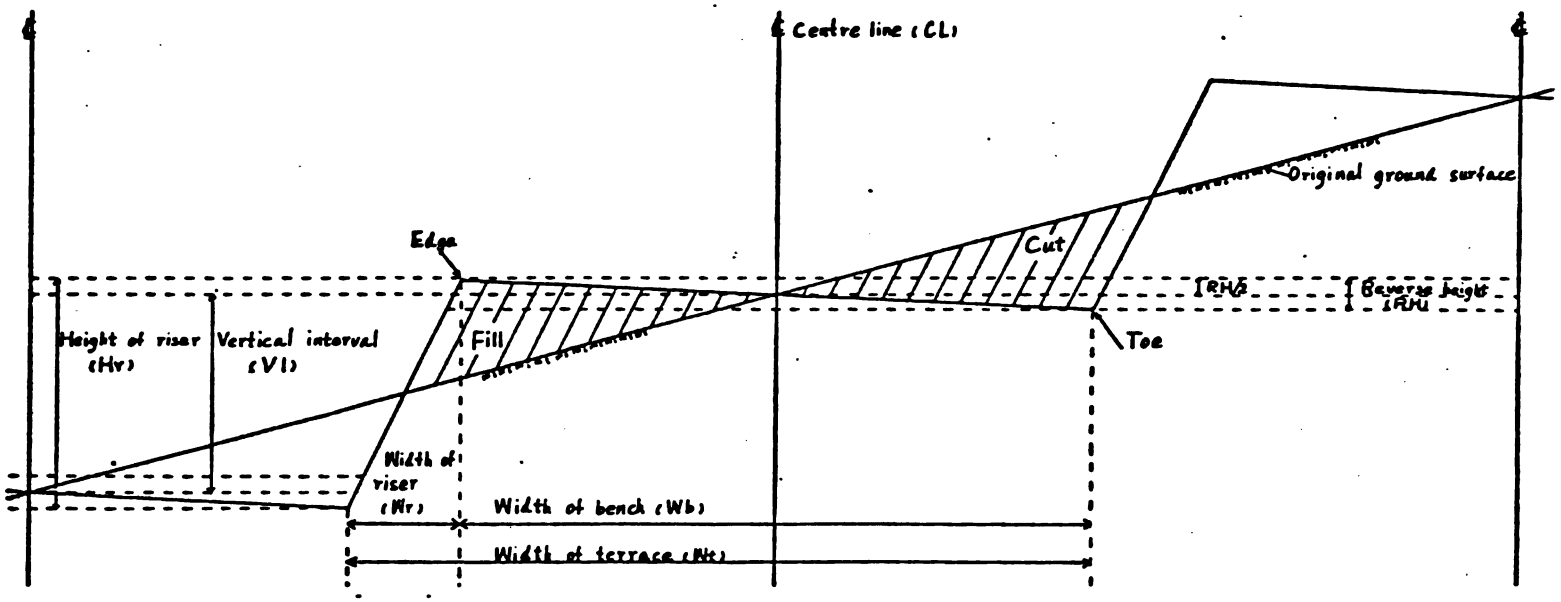


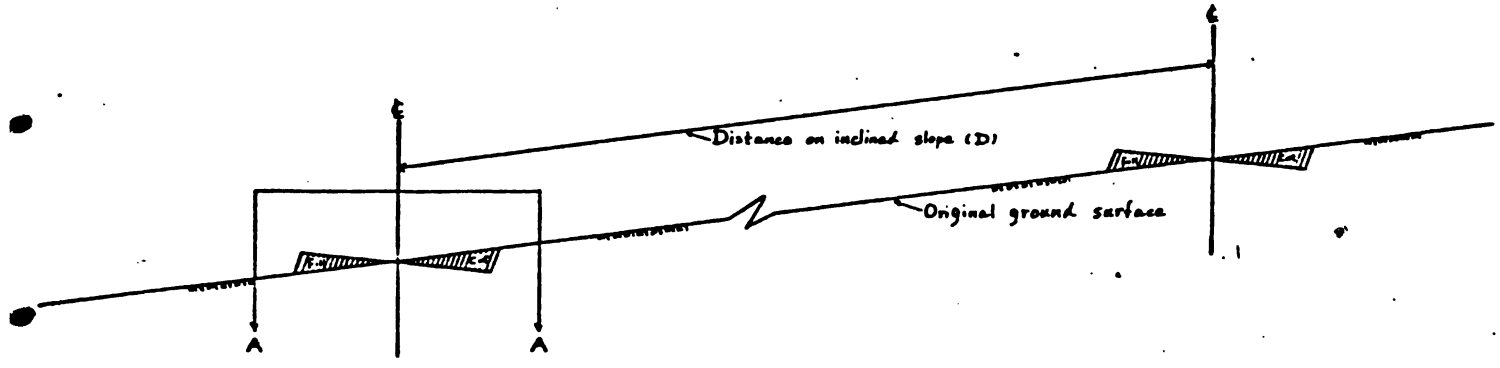
Fig. 3-(1)

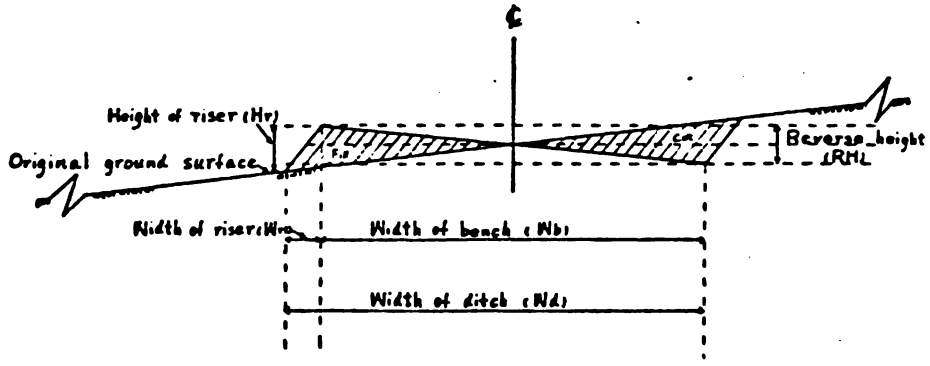
CROSS-SECTION OF BENCH TERRACES



Slope = 15°
VI = 2.4 m
Wb = 6.6 m
Wr = 2.7 m
Wt = 9.3 m
Hr = 2.7 m
RH = 0.3 m

Fig. 3(2) CROSS-SECTION OF HILLSIDE DITCHES

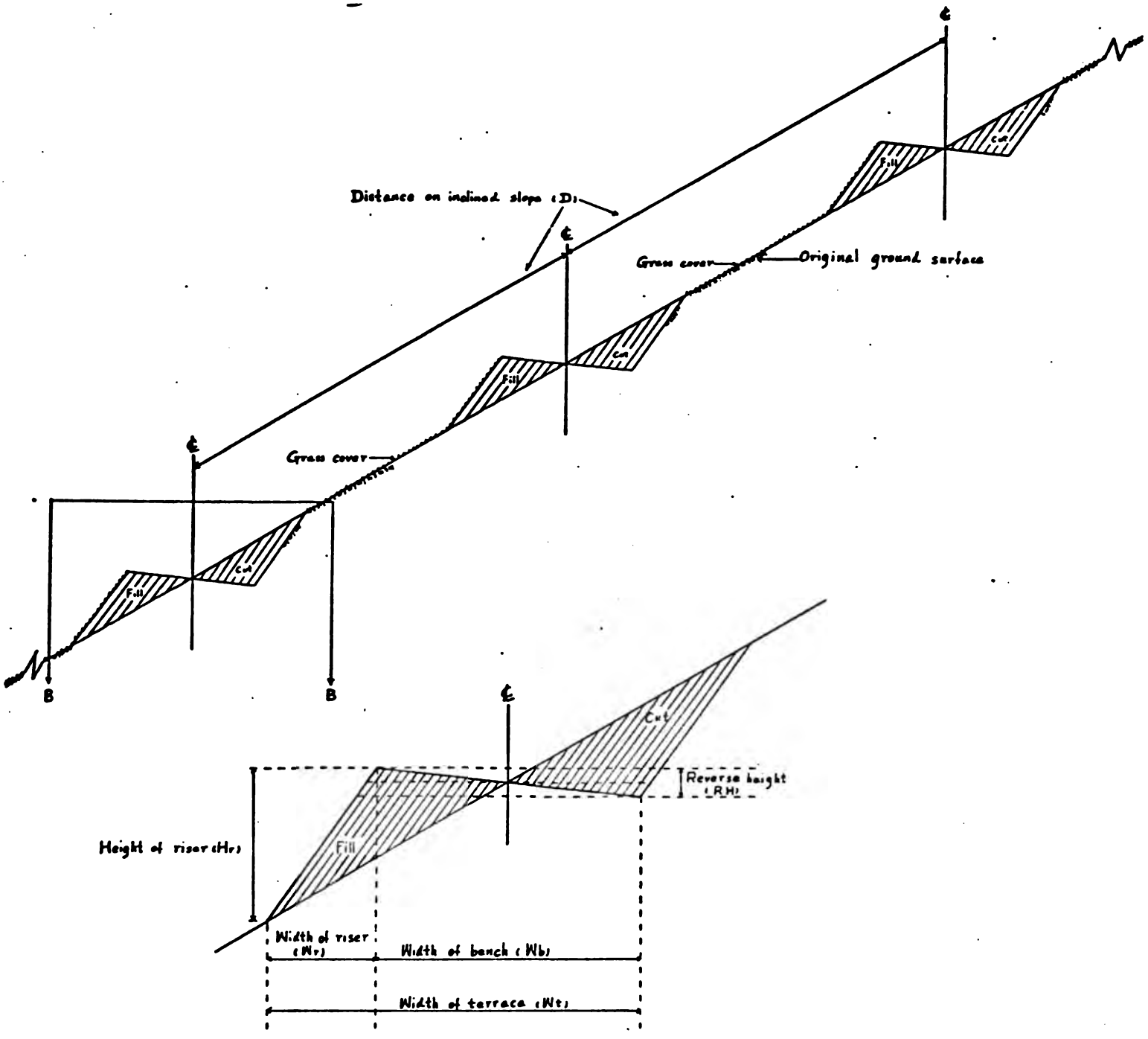




A-A Section

Slope = 7°
Wb = 2.0 m
Wr = 0.12 m
Hr = 0.33 m
Vit (Theoretical vertical interval) = 0.26 m
Wt = 3.1 m
RH = 0.3 m
D = 14 m

Fig. 3-3 CROSS-SECTION OF ORCHARD TERRACES



B-B Section

Slope	= 30°	Vlt (Theoretical vertical interval)	= 1.86 m
Wb	= 1.83 m	Wt	= 2.60 m
Wr	= 0.77 m	RH	= 0.18 m
Hr	= 1.02 m	D	= 6.10 m

TABLE 3 -(2) The design of Soil Conservation measures for Areas "A" and "B" of the PHILAGRIP* Project

	Slope Category	Soil Conservation measure and Symbols	Vertical Interval (VI) m	Theoretical Vertical Interval (VIT) m	Width of Benches (Wb) m	Width of Terraces (Wt) m	Width of riser (Wr) m	Height of riser (Hr) m	Linear Length of terraces or ditches in a hectare (L) m/ha	Distance on incli-stope (D) m	Earth volume to be cut and filled $(V)_{m^3/ha}$	Reserve Slope (Rs)	Reserve height (Rh) m	slope or riser
1	0°- 7°	Hillside ditches (H_1)	-	0.27	2.00	2.18	0.18	0.24	719.40	14.00	84.70	10	0.20	0.75
2	7°-15°	Bench terraces (BT_2)	2.42	-	6.60	9.35	2.75	2.75	1069.98	-	2513.40	5	0.33	1.00
3	15°-20°	Bench terraces (BT_3)	2.06	-	3.60	5.84	2.24	2.24	1712.33	-	1785.60	5	0.18	1.00
4	20°-25°	Bench terraces (BT_4)	2.51	-	3.50	5.51	2.01	2.68	1814.39	-	2164.70	5	0.18	0.75
5	25°-30°	Orchard terraces (OT_5)	-	1.86	1.83	2.60	0.77	1.02	1893.90	6.10	885.52	10	0.18	0.75
6	<30°	Forest (F)	-	-	-	-	-	-	-	-	-	-	-	-

* = Pilot Hillside Agricultural Project

Table: 3 -(3)

The cultivation areas for the Pilot Hillside Agricultural Project (Area "A" and Area "B")

Locations	Slope Category		Soil Conservation measures & symbol	Area	Benches or ditches		Risers		The space between the terraces	
				Ha	(Pb)	For all/ areas Ha	Pr %	For all/ areas Ha	Ps %	For all/ areas Ha
Area "A"	1	0° 7°	Hillside ditches (H_1)	15.75	14.39	2.27	1.27	0.20++	84.34	13.28+
	2	7° 15°	Bench terraces (BT_2)	46.50	70.62	32.84**	29.38	13.66++	-	-
	3	15° 20°	Bench terraces (BT_3)	47.75	61.64	29.43**	38.36	18.32++	-	-
	4	20° 25°	Bench terraces (BT_4)	32.50	63.50	20.64**	36.50	11.86++	-	-
	5	25° 30°	Orchard terraces(OT_5)	45.25	34.66	15.68**	-	-	65.34	29.57++
			Total	187.75	-	100.86	-	44.04	-	42.85
Area "B"	1	0° 7°	Hillside ditches (H_1)	11.85	14.39	1.71*	1.27	0.15++	84.34	9.99+
	2	7° 15°	Bench terraces (BT_2)	83.50	70.62	58.97**	29.38	24.53++	-	-
	3	15° 20°	Bench terraces (BT_3)	11.75	61.64	7.24**	38.36	4.51++	-	-
	4	20° 25°	Bench terrace (BT_4)	7.50	63.50	4.76**	36.50	2.74++	-	-
	5	25° 30°	Orchard terrace(OT_5)	1.00	34.66	0.35**	-	-	65.34	0.65++
			Total	115.60	-	73.03	-	31.93	-	10.64

* Area of ditches
** Area of benches
\+ For crops cultivation
++ For cover crops or grass planting

The gradient of the Hillside ditch should be 1% towards the waterway in the case of ditches having 2m in width. If the ditches slope in only one direction, they should be no more than 100m in length. The length of a ditch may be more than 100m if the drainage runs in two directions. Bahia grass (Paspalum notatum) should be planted on the newly-cut upper and lower slopes of the ditches and on the ditch bottom for protecting the soil against erosion.

(b) Bench Terraces

A series of benches having a reverse slope of 5%, running across the slope at suitable spacings. The length of the bench should not exceed 100m in cases where water runs in only one direction. On inward type benches the depth of the toe below the heel should be 10-20 cm following construction and soil stabilization. The risers should be planted to grass for protection and production. The species of grass found suitable under Jamaica conditions is Napier grass (Pennisetum purpureum).

(c) Orchard Terraces

Orchard terraces are a series of discontinuous bench terraces spaced at varying distances depending on the gradient of the land. Their width determines the tree crops to be planted. They are specially used on steep slopes and for the growing of food forest. Grasses (Pangola) should be well maintained in the space between the orchard terraces.

The top soil treatment should be used for all soil conservation measures except the Hillside ditches at the Allsides Project even if it entails a 20% construction cost higher than non top soil treatment. Bench terraces usually expose the infertile sub-soil which results in lower productivity in the first few years unless top soil treatment and other soil improvement measures are adopted.

The calculation of earth volumes for soil conservation measures

Earth volumes to be cut and filled for soil conservation measures are calculated in Table 3-(6). Usually, bulldozers (D-5 or D-6) can be employed for terracing slopes from 7° to 15° and a smaller tractor with an 8 feet blade can be used for terrace construction from 15° up to 20°. Manual labour is preferable for slopes exceeding 20°.

The design of waterways

Aerial photographs and topographical maps were used for the waterway design. Approximate location and density of waterways have been done and are shown in Fig. 3-(4). The density of waterways is usually 100 linear meters per hectare. Grassed waterways are built on the gentle slopes (less than 7°) and prefabricated concrete structures (P.C.S.) should be combined with grassed side slopes for economical reasons.

One used oil drum can be cut longitudinally into three even pieces and used as the moulds for the prefabricated concrete structure. The dimensions are shown in Fig. 3-(5). The sizes of waterways are calculated from the following formulae:

(1) Time of concentration

$$i = \frac{R}{24} \left(\frac{24}{t} \right) 0.6$$

where R24 = rainfall for 24 hours

t = time of concentration

i = rainfall intensity

(2) Estimation of runoff

$$Q = \frac{i}{360} CiA$$

Where Q = runoff

C = runoff coefficient

i = rainfall intensity

A = Area

(3) Determination of the cross-sections of the waterways

(A) Grass waterway

$$R = \frac{t^2 d}{1.5\ t^2 + 4\ d}$$

Where R = hydraulic radius

t = width of flow

d = depth of flow

$$V = \frac{i}{n} R^{2/3} S^{1/2}$$

Where V = velocity of flow

n = roughness coefficient

R = hydraulic radius

S = Slope

Q = AV

Where Q = discharge in waterway

V = velocity

A = cross-section parabolic area

(B) Prefabricated concrete structure:

The same procedures as grass waterway.

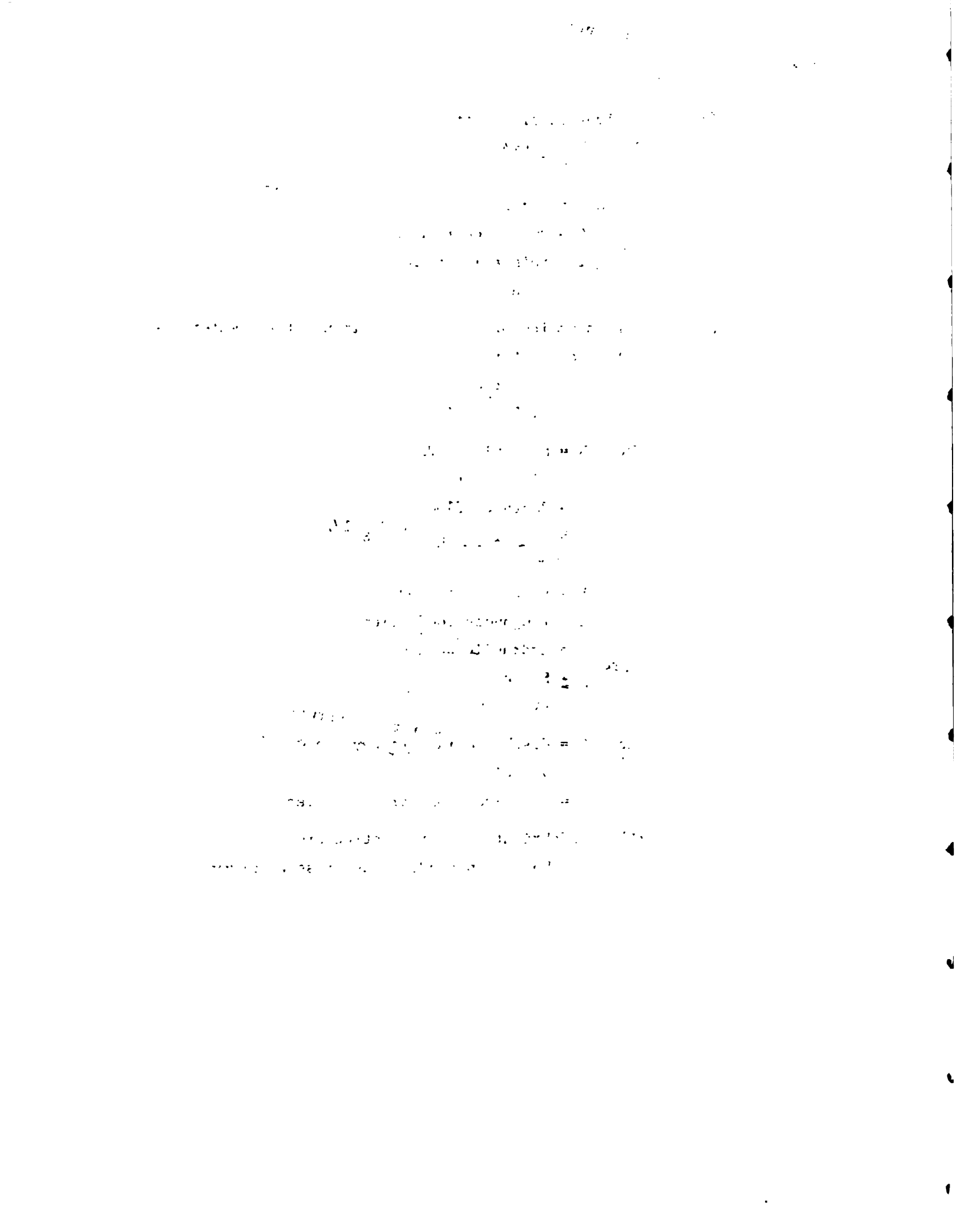


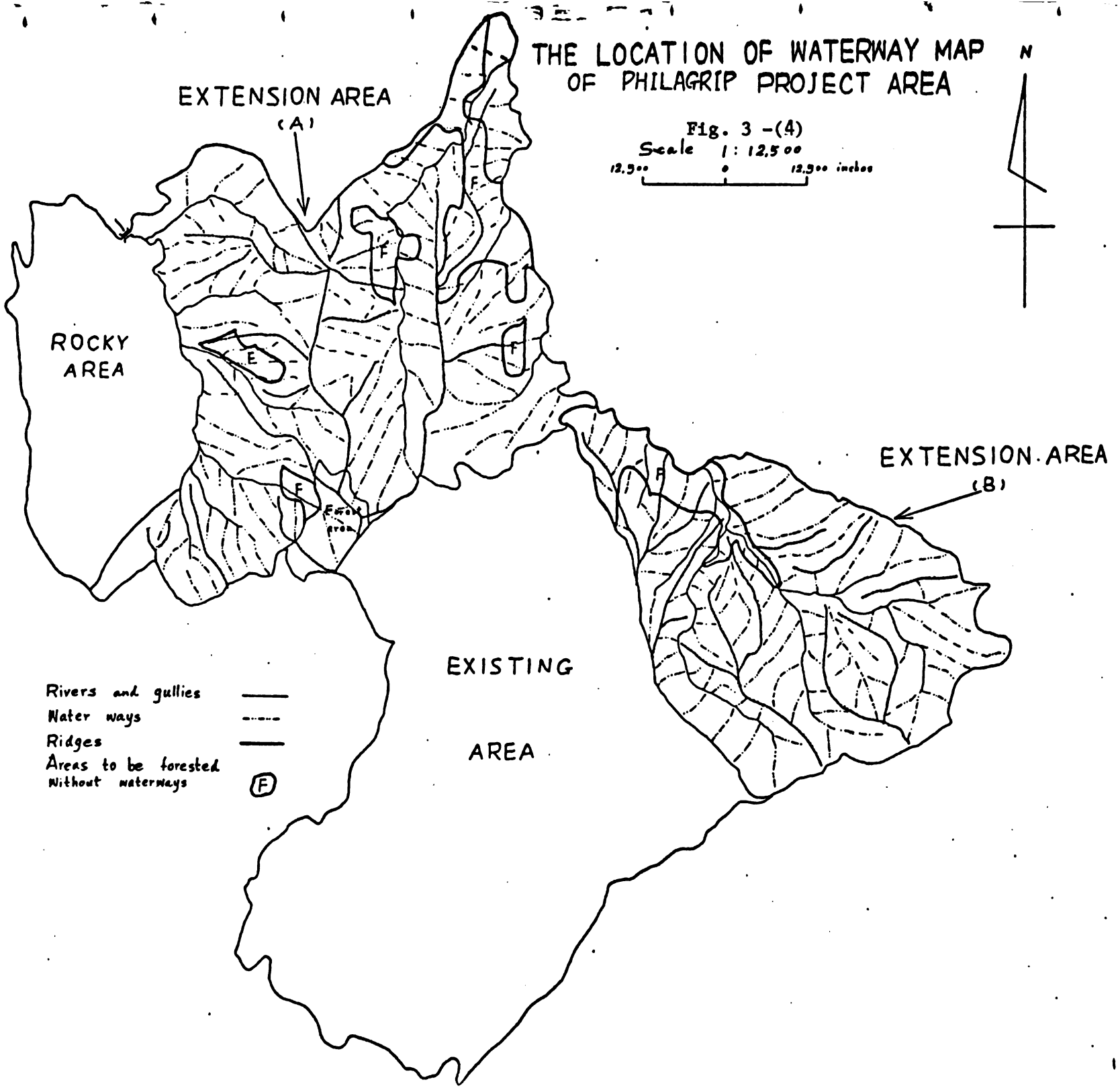
TABLE 3-(4) The earth volumes for Area "A" and Area "B" of the PHILAGRIP Project ***

Location	Slope Category		Soil Conservation Measures and Symbols	Area Ha	Width of benches or width of ditches (Wb) (Wd) m	Earth volume to be cut and filled without top soil treatment for each hectare m^3/ha	Earth volume to be cut and filled with top soil treatment for each hectare m^3/ha	Earth volume to be cut and filled with top soil treatment for for each hectare m^3/ha	Earth volume to be cut and filled for all areas without top soil treatment	Earth volume to be cut and filled with or without top soil treatment for all areas	Machine-built (MB)/ Hand-made (HM)
Area "A"	1	0°- 7°	Hillside ditches (H_1)	15.75	2.00	84.7	-	-	1,334:025	1,334.025*	M B
	2	7°-15°	Bench terraces (BT_2)	46.50	6.60	2513.4	502.68	3016.08	116,873:100	140,247.720**	M B
	3	15°-20°	Bench terraces (BT_3)	47.75	3.60	1785.6	357.12	2142.72	85,262:400	102,314.880**	M B
	4	20°-25°	Bench terraces (BT_4)	32.50	3.50	2164.7	432.94	2597.64	70,352:750	84,423.300**	M B
	5	25°-30°	Orchard terraces (OT_5)	45.25	1.83	88.55	177.10	1062.60	40,068:875	48,082.650**	M B
			Total	187.75	-	-	-	-	313,891.150	376,402.575	
Area "B"	1	0°- 7°	Hillside ditches (H_1)	11.85	2.00	84.7	-	-	1,003:695	1,003.695*	M B
	2	7°-15°	Bench terraces (BT_2)	83.50	6.60	2513.4	502.68	3016.08	209,868:900	251,842.680**	M B
	3	15°-20°	Bench terraces (BT_3)	11.75	3.60	1785.6	357.12	2142.72	20,980:800	25,176.960**	M B
	4	20°-25°	Bench terraces (BT_4)	7.50	3.50	2164.7	432.94	2597.64	16,235:250	19,482.300**	M B
	5	25°-30°	Orchard terraces (OT_5)	1.00	1.83	88.55	177.10	1062.60	885:500	1,062.600**	M B
			Total	115.60	-	-	-	-	248,974.145	298,568.235	

* Without top soil treatment
** With top soil treatment

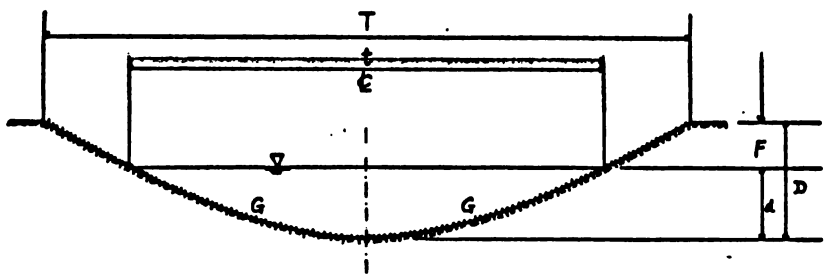
*** Pilot Hillside Agricultural Project

SAM YAWATERWAY OF NOITACOL THE


THE LOCATION OF WATERWAY MAP
OF PHILAGRIP PROJECT AREA
Fig. 3 -(4)
Scale 1 : 12,500
12,500 0 12,500 inches
N
EXTENSION AREA
(A)
ROCKY
AREA
EXTENSION AREA
(B)
EXISTING
AREA
Rivers and gullies
Water ways
Ridges
Areas to be forested
Without waterways
F
E

THE CROSS SECTION OF PARABOLIC GRASS WATERWAY

Fig. 3-(5)



Slope (S) = 12.3% or 7°

Overall topwidth (T) = 2.7 m

Width of flow (t) = 2.0 m

Overall depth (D) = 0.5 m

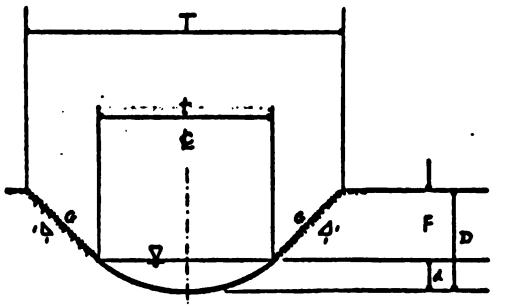
Depth of flow (d) = 0.3 m

Freeboard (F) = 0.2 m

Grassed areas (G)

Central line (℄)

THE CROSS SECTION OF PREFABRICATED WATERWAY WITH GRASSED SIDES



Slope (S) = 58% or 30°

Overall topwidth (T) = 1.06 m

Width of flow (t) = 0.46 m

Overall depth (D) = 0.43 m

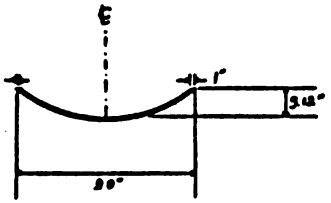
Depth of flow (d) = 0.13 m

Freeboard (F) = 0.30 m

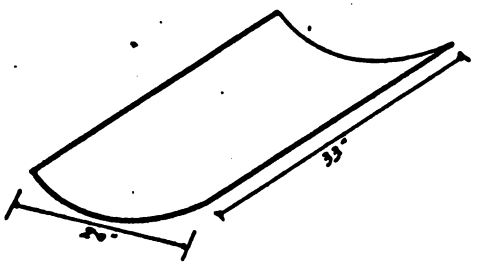
Grassed areas (G)

Central line (℄)

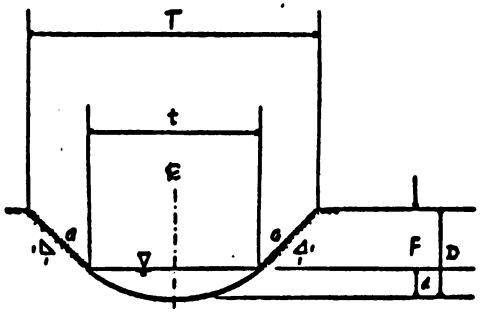
THE DIMENSION OF PREFABRICATED WATERWAY



Front view



Isometric view



Slope (S) = 36% or 20°

Overall topwidth (T) = 0.96 m

Width of flow (t) = 0.46 m

Overall depth (D) = 0.33 m

Depth of flow (d) = 0.13 m

Freeboard (F) = 0.20 m

Grassed areas (G)

Central line (℄)

Other measures recommended for the soil conservation

(a) Gully Control

It is necessary to build check dams or other simple methods such as the loose-rock check dam, the wire-bound check dam, the fence rock check dam, etc. for gully control.

(b) Farm Road Construction

For produce and material transportations, the farm road should be considered.

Technical Consideration

With a limit on the amount of areable land available and an increasing demand for the products of the soil, certainly Jamaica cannot afford to waste its most limited physical resource, the soil. The situation is becoming more acute year by year and is particularly acute in the more densely populated areas.

Design of soil conservation programmes depends upon the degree of the land problems involved and the intensiveness of conservation practices necessary. The project area, is characterized by very steep slopes, high intensity rainfall, highly erodible soils, and thus significant amounts of soil loss. To alleviate these specific problems appropriate soil conservation practices based on the above mentioned principles are needed.

Hillside Ditches

From observation, on large field tests on sugar cane plantations in Taiwan and hydraulic model tests of the hillsides ditches, the following conclusions were drawn:

(a) Fields with hillside ditches, on the average, yield about 10% more sugar cane than fields with trapezoidal ditches.

(b) The erosion hazard is greater in the case of trapezoidal ditches, because of scouring and instability of the ridges downslope. Hillside ditches require the movement of greater earth volumes but maintenance costs are less than in the case of trapezoidal ditches.

(c) They also provide an in-field road network for mechanized farming operation.

Bench Terraces

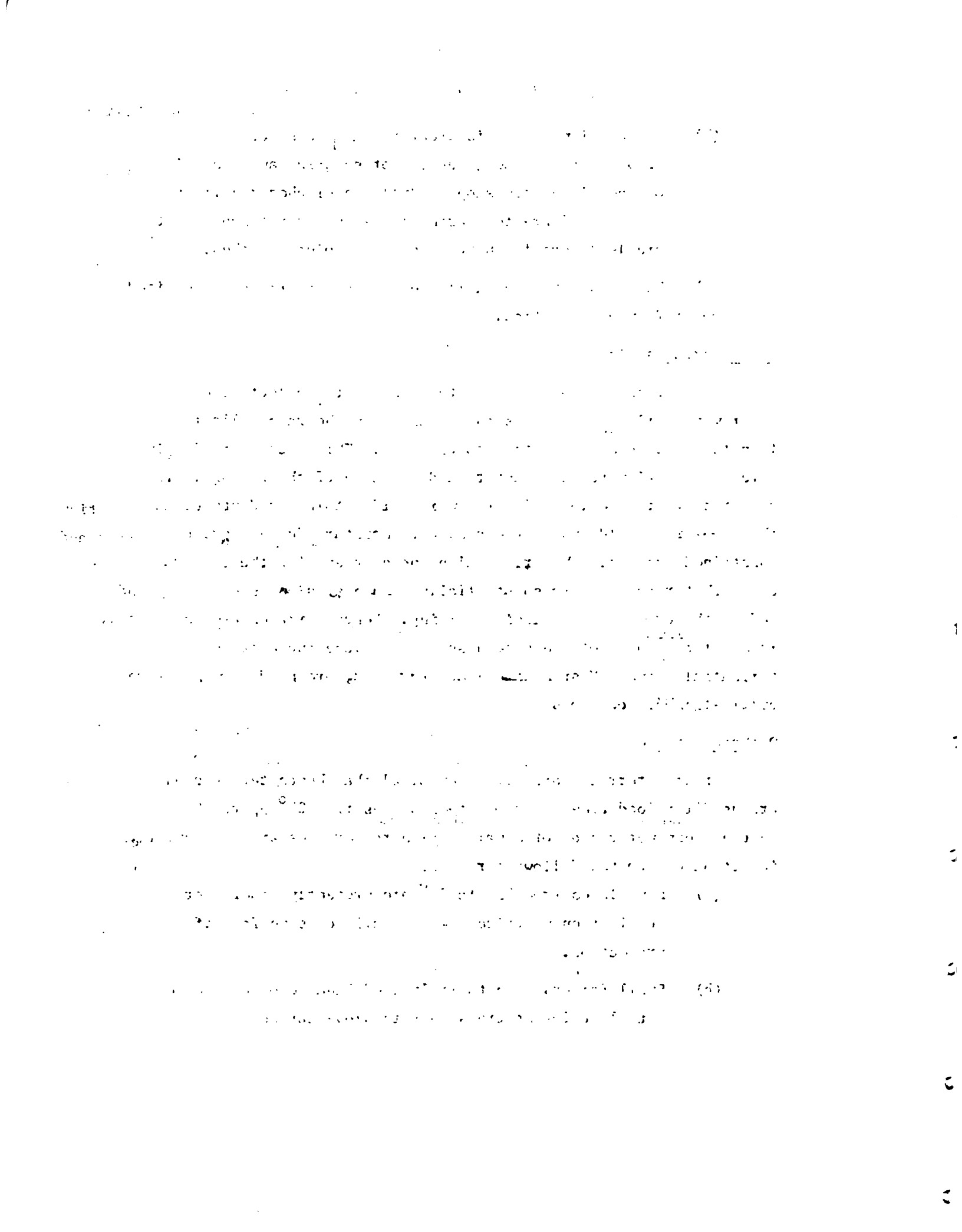
The purpose of making bench terraces is to collect surplus water which will run off of sloping land when the rain falls faster than the water can percolate into the soil. This causes erosion in direct proportion to the quantity and velocity of the run-off. It also results in the loss of water which, if retained and stored in the sub-soil, would supply the crop with moisture during periods of substained drought. The principal purposes then, for the construction of bench terraces are to substantially reduce erosion, store water and reduce the drudgery of hillside farming. Bench terraces are used mostly in Jamaica because of the steepness of the slope and because of the torrential rains. Most of the lands terraced, are used for intensive cultivation of row crops.

Orchard Terraces

Orchard terraces are more economical than bench terraces and are used for food tree crops on steep slopes from 25° up to 30°. In the steep watersheds of Jamaica, orchard terraces are particularly important due to the following reasons:

(a) Many lands from 25° to 30° are presently under poor cultivation practices, which call for some form of protection.

(b) Small farmers with their limited land resources would not plant forest trees in this slope category.



(c) Food trees or fruit trees present a recognized form of agricultural land use in Jamaica.

Technically speaking the suggested conservation practices can be implemented and should, if so done, help substantially in the improvement of productivity and natural resource preservation in the area of the project.

Financial Consideration

Terracing Cost

The technical study conducted and presented in previous sections represented the more technical considerations. In this section the cost considerations of the proposed conservation practices are indicated.

The cost considerations here presented operate under the following assumptions:

(a) The $0^{\circ} - 7^{\circ}$; $7^{\circ} - 15^{\circ}$; and $15^{\circ} - 20^{\circ}$; slope categories will be machine built because of the physical characteristics of the land.

(b) The slopes $20^{\circ} - 25^{\circ}$; and $25^{\circ} - 30^{\circ}$; will be done by hand labour due to the steepness of the slope.

(c) The entire area will be put under some form of conservation practice.

On the basis of the above consideration the cost study resulted in the figures presented on Tables 3-(6), 3-(7) and 3-(8). It is important to note that the figures cited on such Tables only represent a part of the terracing cost. The complementary figures are as follows:

Risers Cost

The second highest cost component after terracing is the cost associated with the stabilization of the risers of the terraces. Table 3-(8), presents the cost estimates.

Waterway Construction

The third cost component of terracing construction is the construction of the waterways. In this particular case in order to avoid excessive costs the intention is to design a waterway system that will maximize the drainage system of the area. On that basis, the topographic features of the area, as well as its soil conditions, were studied.

Fig. IV-24 shows the overall waterways systems proposed for the areas A and B. Tables IV-24, IV-25, IV-26, IV-27 and IV-28 present the cost components and inputs required for waterway construction.

TABLE 3 -(5) The construction cost of machine-built Conservation Measures for Area "A" and Area "B" of the PHILAGRIP Project*

Location	Slope Category		Soil conservation Measures and Symbols	Area	width of benches or width of ditches (Wb) (Wd)	Earth volume to be cut and and filled with or without top soil treatment for all areas	The production of the D-5 or the D-6 bulldozer per hour	Machine hours for grass building for all areas	Machine hours for final grading and smoothing for all areas	Machine hours to complete a hectare	Hours required to complete all areas	The construction cost of machine-built for a Ha. (J$30 machine hr)	The Construction cost of machine built for all areas (J$30 machine hr)
				Ha	m	m^3	M^3/hr	Machine/hr	Machine/hr	Machine/hr	Machine/hr	J$/ha	J$
Area "A"	1	0°- 7°	Hillside ditches (H_1)	15.75	2.00	1,334.025	43	31.02	39.38	4.47	70.4*	134.10	2,112.00*
	2	7°-15°	Bench terraces (BT_2)	46.50	6.60	140,247.720**	39	3,596.10	232.50	82.34	3,828.6**	2,470.20	114,858.00*
	3	15°-20°	Bench terraces (BT_3)	47.75	3.60	102,314.880**	32	3,197.34	238.75	71.96	3,436.09**	2,158.80	103,082.70*
			Total	110.00	-	243,896.625	-	6,824.46	510.63	-	7,335.09	-	220,052.70
Area "B"	1	0°-7°	Hillside ditches (H_1)	11.85	2.00	1,003.695*	43	23.34	29.63	4.47	52.97*	134.10	1,589.10*
	2	7°-15°	Bench terraces (BT_2)	83.50	6.60	251,842.680**	39	6,457.50	417.50	82.34	6,875.00**	2,470.20	206,250.00*
	3	15°-20°	Bench terraces (BT_3)	11.75	3.60	25,176.960**	32	787.78	58.75	71.96	845.53**	2,158.80	25,065.90*
			Total	107.10	-	278,023.335	-	7,267.62	508.88	-	7,773.50	-	233,205.00

*Without top soil treatment

**With top soil treatment

***Extra 2.5 hr/ha. for Hillside ditches and 5 hr/ha. for bench terrace.

* Pilot Hillside Agricultural Project

TABLE 3 -(6) The construction cost of man-made for Area "A" and Area "B" of the PHILAGRIP* Project

Locations	Slope category		Soil Conservation	Area	Width of benches or width of ditches (Wb) (Wd)	Earth volumee to be cut and filled with or without top soil treatment for all areas	The production per man-day	Man-days required to complete a Ha.	Man-days required to complete all areas	The construction of man-made for a hectare at J$10.20 man-day	The construction cost of man-made
				Ha	m	m^3	m^3/man-day	man-days/ha	man-days	J$/ha	J$
Area "A"	4	20° - 25°	Bench terraces (BT_4)	32.50	3.50	84,423.20**	3.5	724.18**	24,120.94	7,570.24	246,030.80**
	5	25° - 30°	Orchard terraces (OT_5)	45.25	1.83	48,082.65**	3.5	303.60**	13,737.9	3,096.72	140,126.58**
			Total	77.75	-	132,505.95	-	-	37,858,84	-	386,159.38
Area "B"	4	20° - 25°	Bench terraces (BT_4)	7.50	3.50	19,482.30**	3.5	724.18**	5,566.37	7,570.24	56,776.80**
	5	25° - 30°	Orchard terraces (OT_5)	1.00	1 83	1,062.60	3.5	303.60**	303.60	3;096.72	3,096.72
			Total	8.50	-	20,544.9	-	-	5,869.97	-	59,873.52

**With top soil treatment

* Pilot Hillside Agricultural Project

Table 3 -(7)

The cost of forestation on the steepslopes (greater than 30^{o}) for Area "A" and Area "B" of the Pilot Hillside Agricultural Project

Location	Slope Category		Soil Conservation Measures and Symbols	Area Ha.	The cost of forestation for one hectare * J$/ha.	The cost of forestation for all areas J$
Area "A"	6	$>30^{o}$	Forest (F)	27.50	3,375.00	92,812.50
Area "B"	6	$>30^{o}$	Forest (F)	15.00	3,375.00	50,625.00

* Caribbean pine is planted on the steep land at a density of 1125 seedlings (6-9 months old)/hectare. Two cost of materials and planting is approximately $3.00/seedling or $3,375.00/ha.

TABLE 3 -(8) The cost of operations, material, nurseries etc, for Pangola grass or Napier* grass planting using hand labour for Area "A" and Area "B" of the PHILAGRIP Project

Locations	Slope Category		Soil Conservation measures and Symbols	Area Ha	Area of risers to be planted by grass* m^2/ha	Area of risers to be planted for all areas m^2	Cost per m^2 J$	The cost of planting for all areas J$
Area "A"	1	0° - 7°	Hillside ditches (H_1)	15.75	127.1	2,001.825	0.247	494.45
	2	7° - 15°	Bench terraces (BT_2)	46.50	2,938.2	136,626.300	0.247	33,746.70
	3	15° - 20°	Bench terraces (BT_3)	47.75	3,835.6	183,149.900	0.247	45,238.04
	4	20° - 25°	Bench terraces (BT_4)	32.50	3,649.6	118,612.000	0.247	29,297.16
			Total	142.50	10,550.5	440,390.025	-	108,776.34
Area "B"	1	0° - 7°	Hillside ditches (H_1)	11.85	127.1	1,506.135	0.247	372.02
	2	7° - 15°	Bench terraces (BT_2)	83.50	2,938.2	245,339.700	0.247	60,598.91
	3	15° - 20°	Bench terraces (BT_3)	11.75	3,835.6	45,068.300	0.247	11,131.87
	4	20° - 25°	Bench terraces (BT_4)	7.50	3,649.6	27,372.000	0.247	6,760.88
			Total	114.60	10,550.5	319,286.135	-	78,863.68

*Napier grass planted

	Slope		Soil conservation Measures and Symbols	Area Ha.	Area of cover crops or grass** m^2/ha	Area of cover crops or grass for all areas** m^2	cost per J$	The cost of planting for all areas J$
Area "A"	5	25° - 30°	Orchard terraces (OT_5)	45.25	6,534.2	295,672.55	0.247	73,031.12
Area "B"	5	25° - 30°	Orchard terraces (OT_5)	1.00	6,534.2	6,534.20	0.247	1,613.95

** Pangola grass planted

* Pilot Hillside Agricultural Project

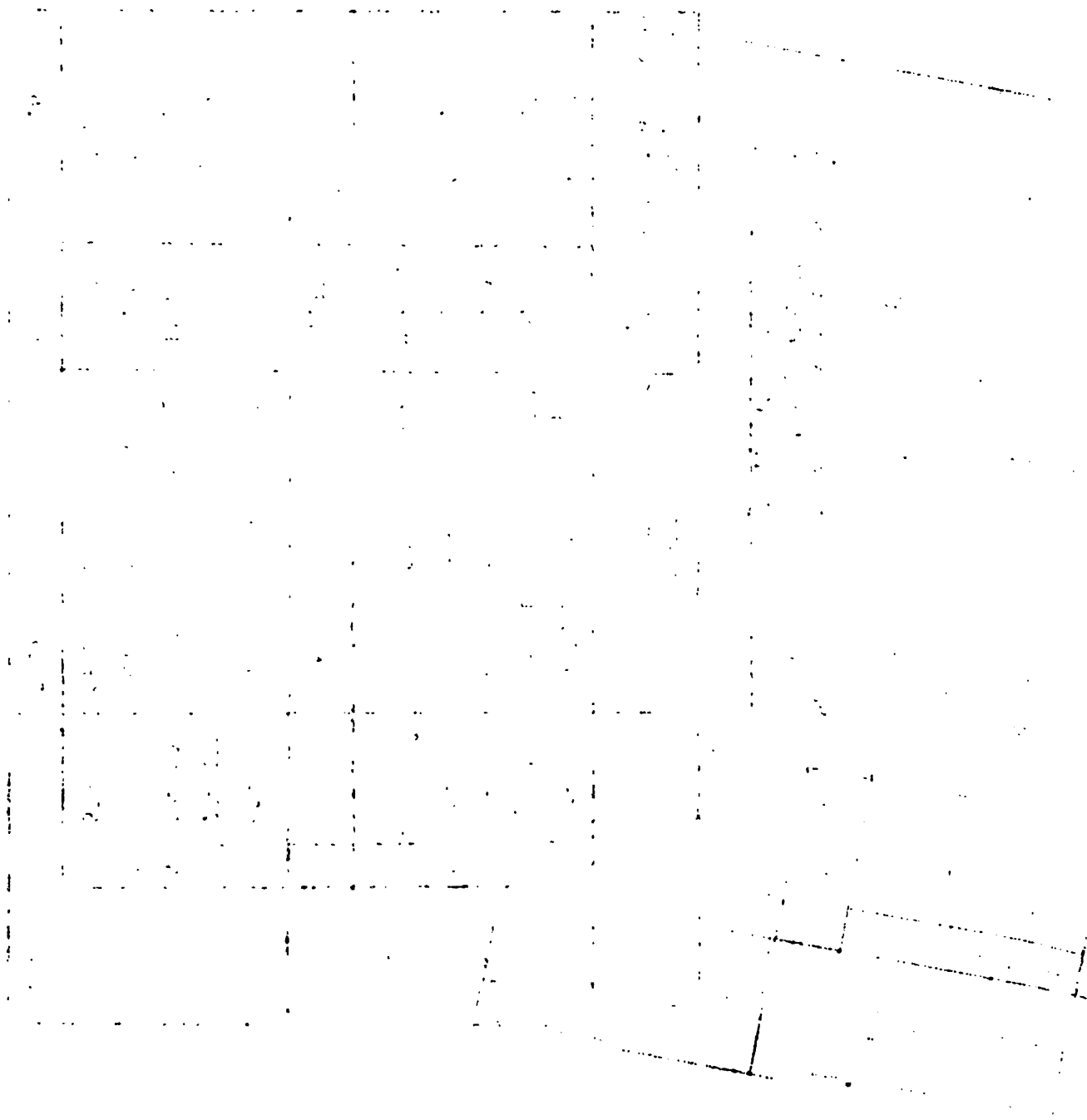
Table 3(9) The length of waterways on various slopes for Area "A" and Area "B" of the Pilot Hillside Agricultural Project

Locations	Slope Category		Soil Conservation Measures and Symbols	Area Ha.	Length of waterway for all areas m
A	1	0°- 7°	Hillside ditches (H_1)	15.75	1,773.2
R	2	7°- 15°	Bench terraces (BT_2)	46.50	5,352.5
E	3	15°- 20°	Bench terraces (BT_3)	47.75	5,619.0
A	4	20°- 25°	Bench terraces (BT_4)	32.50	4,004.6
"A"	5	25°- 30°	Orchard terraces (OT_5)	45.25	5,841.8
			Total	187.75	22,591.1
A	1	0°- 7°	Hillside ditches (H_1)	11.85	1,329.9
R	2	7°- 15°	Bench terraces (BT_2)	83.50	9,566.2
	3	15°- 20°	Bench terraces (BT_3)	11.75	1,404.7
E	4	20°- 25°	Bench terraces (BT_4)	7.50	970.8
A	5	25°- 30°	Orchard terraces (OT_5)	1.00	127.0
"B"			Total	115.60	13,398.6

Table 3 - (10) The amount of materials for waterway for Area "A" and Area "B" of the Pilot Hillside Agricultural Project

Locations	Slope	Types of waterway	Length of waterways (meters)	No. of prefabricated concrete structures (numbers)	Grassed areas with the carpet grass for all waterways m^2
Area "A"	0° - 7°	Grassed waterway	1,773.2	0	5,582.4**
	7° - 25°	Prefabricated waterway (Freeboard 0.25m)	14,976.1	18,044	10,591.1***
	25° - 30°	Prefabricated waterways (Freeboard 0.30m)	5,841.8	7,038	4,975.4****
	Total		22,591.1	25,082	21,130.9
Area "B"	0° - 7°	Grassed waterway	1,329.9	0	4,186.8
	7° - 25°	Prefabricated waterway (Freeboard 0.25m)	11,941.7	14,388	8,445.2***
	25° - 30°	Prefabricated waterway (Freeboard 0.30m)	127.0	153	107.8****
	Total		13,398.6	14,541	12,739.8

* The length of each prefabricated concrete structure is 0.83m
** 3.1482 m^2/liner meter
*** Length of two sides is 0.7072m
**** Length of two sides is 0.8486m



of materials for waterway for Area "A" and Area "B"

Table 3 - (10) **The amount of materials for waterway for Area "A" and Area "B" of the Pilot Hillside Agricultural Project**

Locations	Slope	Types of waterway	Length of waterways (meters)	No. of prefabricated concrete structures (numbers)	Grassed areas with the carpet grass for all waterways m^2
Area "A"	0° - 7°	Grassed waterway	1,773.2	0	5,582.4**
	7° - 25°	Prefabricated waterway (Freeboard 0.25m)	14,976.1	18,044	10,591.1***
	25° - 30°	Prefabricated waterways (Freeboard 0.30m)	5,841.8	7,038	4,975.4****
	Total		22,591.1	25,082	21,130.9
Area "B"	0° - 7°	Grassed waterway	1,329.9	0	4,186.8
	7° - 25°	Prefabricated waterway (Freeboard 0.25m)	11,941.7	14,388	8,445.2***
	25° - 30°	Prefabricated waterway (Freeboard 0.30m)	127.0	153	107.8****
	Total		13,398.6	14,541	12,739.8

* The length of each prefabricated concrete structure is 0.83m
** 3.1482 m^2/liner meter
*** Length of two sides is 0.7072m
**** Length of two sides is 0.8486m

Table 3-(2) The cost of the earth volume to be excavated for waterway for Area "A" and Area "B" of the Pilot Hillside Agricultural Project

Location	Slope	Types of waterway	Length of waterway m	Earth volumes to be excavated in waterway m^3	Man-days required for excavating earth for all waterways ($3.5m^3$/man-day) man/days	Cost of one man-day J$	The cost of excavating earth volume for all waterway J$
AREA "A"	0°- 7°	Grass Waterway	1,773.2	1,613.6*	461.0	10.20	4,702.20
	7° -25°	Prefabricated waterway (Free-broad 0.25m)	14,976.1	2,836.0**	810.9	10.20	8,271.18
	25° -30°	Prefabricated waterway (Free-board 0.30m)	5,841.8	1,416.1**	404.6	10.20	4,126.92
		Total	22,591.1	5,867.7	1,676.5	-	17,100.30
AREA "B"	0° - 7°	Grass Waterway	1,329.9	1,210.2*	345.8	10.20	3,527.16
	7° -25°	Prefabricated waterway (Free-broad 0.25m)	11,941.7	2,263.0**	646.6	10.20	6,595.32
	25° -30°	Prefabricated waterway (Free-broad 0.30m)	127.0	30.0**	8.8	10.20	89.76
		Total	13,398.6	3,504.0	1,001.2	-	-

* Earth volumes from all waterways Area of parabolic cross-section = $0.91m^2$

** Earth volumes from above prefabricated concrete structures-area of trapezoidal cross-section for 0.25 free-broad is $0.1895m^2$.

Table 3(13) The cost of areas to be grassed for waterway for Area "A" and Area "B" of PHILAGRIP Project

Locations	Slope	Types of waterway	Length of waterway m	Grassed areas with the carpet grass for all areas m^2	Cost of grass planting for $1m^2$ J$	Grass planting cost for all waterways J$
AREA "A"	0°- 7°	Grassed waterway	1,773.2	5,582.4	0.247	1,378.90
	7°-25°	Prefabricated waterway (Freeboard 0.25m.)	14,976.1	10,591.1	0.247	2,616.00
	25°-30°	Prefabricated waterway (Freeboard 0.25m.)	5,841.8	4,957.4	0.247	1,224.50
		Total	22,591	21,130.9	-	5,219.40
AREA "B"	0°- 7°	Grassed waterway	1,329.9	4,186.8	0.247	2,086.00
	7°-25°	Prefabricated waterway (Freeboard 0.30m.)	11,941.7	8,445.2	0.247	26.60
	25°-30°	Prefabricated waterway (Freeboard 0.30m.)	127.0	107.8	0.247	26.60
		Total	13,398.6	12,739.8	-	3,146.70

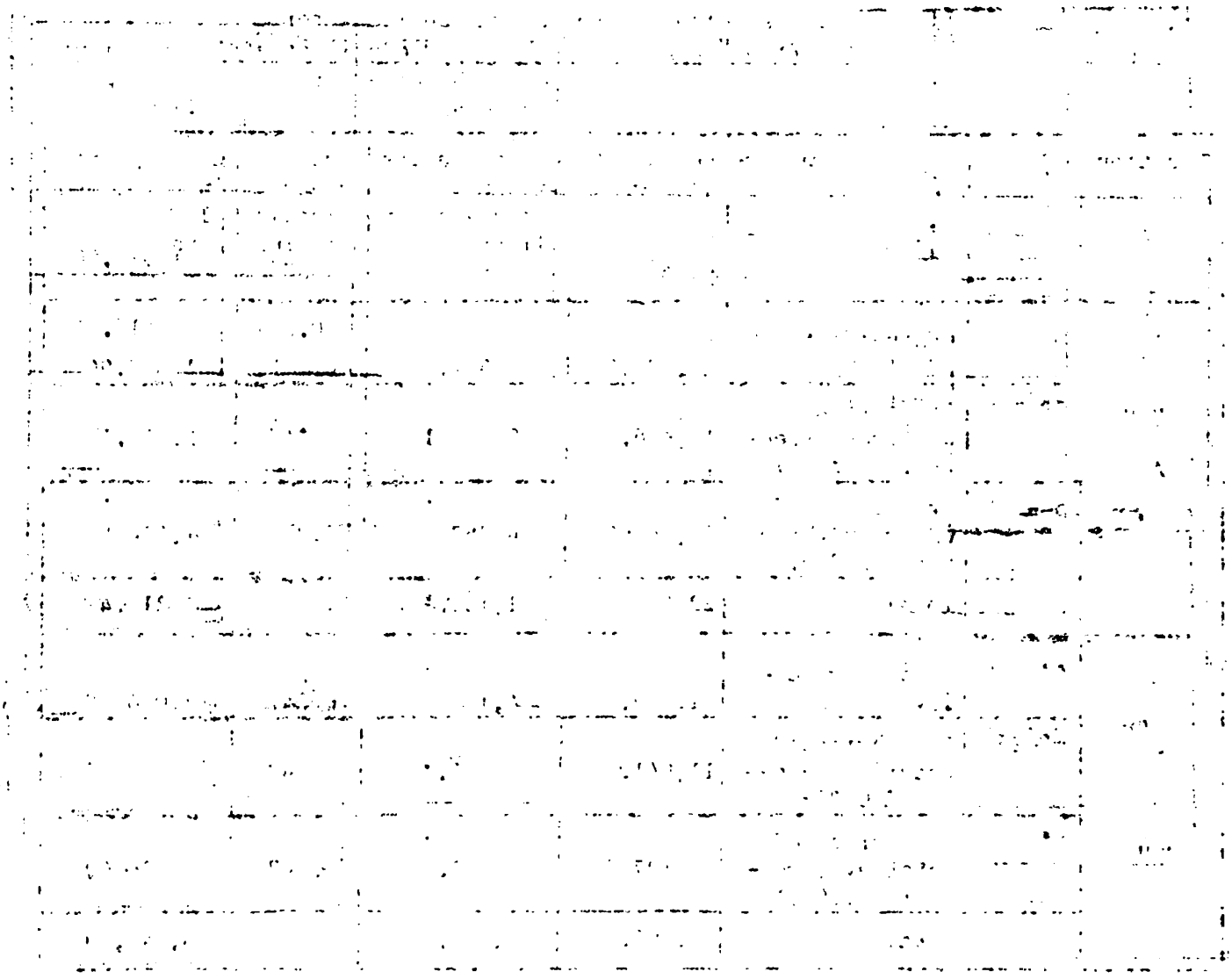


TABLE 2-(14) The cost of prefabricated concrete structures for waterway for Area "A" and Area "B" Pilot Hillside Agricultural Project

Locations	Slope	Types of Waterway	Length of Waterway	No. of pre-fabricated concrete structures (p.c.s.)*	Cost of pre-fabricated concrete structures for all water-ways (J$10.00 each)	Cost of transportation, installation and construction of p.c.s. for all water-ways (J$21.00/m.)	Cost of transportation, installation and construction for cut-wall for all waterways **
			m	Numbers	J$	J$	J$
AREA "A"	7°-25°	Prefabricated water-way (Freeboard 0.25m)	14,976.1	18,044	180,440.00	314,498.10	3,609.00
	25°-30°	Prefabricated water-way (Freeboard 0.30m)	5,841.8	7,039	70,380.00	122,677.80	1,408.00
	Sub-Total		20,817.9	25,082	250,820.00	437,175.90	5,017.00
	TOTAL		-	-	-	-	693,012.90
AREA "B"	7°-25°	Prefabricated water-way (Freeboard 0.25m)	11,941.7	14,388	143,880.00	250,775.70	2,878.00
	25°-30°	Prefabricated water-way (Freeboard 0.)	127.00	1,531	1,530.00	2,667.00	31.00
	Sub-Total		12,068.7	14,541	145,410.00	253,442.70	2,909.00
	TOTAL		-	-			401,761.70

* The length of each prefabricated concrete structure is 0.83m.

** Every one cutwall has - prefabricated concrete structures. One cutwall cost J$1.00

TABLE 3-(15) Total costs of soil conservation measures for Area "A" and Area "B" of PHILAGRIP* Project

J($)

Locations	Hillside ditches and Bench terraces 7°-20° (Machine-built)	Bench terraces and orchard terraces 20°-30° (Man-made)	Forestation	Grass planted on the riser of benches	Cover crops grass planted on the space between terraces	Earth Volume to be excavated in the waterway	Grass planted for waterways	Cost of prefabricated concrete structures (p.c.s.) for waterways	Transportation installation and construction of p.c.s. for waterways	Transportation installation and construction for cut-wall for waterway
Area "A"	220,052.70	386,159.38	92,812.50	108,776.34	73,031.12	17,100.30	5,219.40	250,820.00	437,175.90	5,017.00
Area "B"	233,205.00	59,873.52	50,625.00	78,863.68	1,613.95	10,212.24	3,146.70	145,410.00	253,442.70	2,909.00
TOTAL	453,257.70	446,032.90	143,437.50	187,640.02	74,645.07	27,312.54	8,366.10	396,230.00	690,618.60	7,926.00
GRAND-TOTAL				2,435,466.30						

* Pilot Hillside Agricultural Project

Total Cost Consideration

On the basis of the previous assumptions total cost of the conservation work to be done in the area was calculated and presented in Table IV-29.

For each slope category the total cost estimates previously estimated were reduced to a per hectare basis and the cost of soil-improving agronomic practices were added to them:

0^{o} - 7^{o} (Machine Built)

INVESTMENT COST (Per Hectare)

Hillside Ditch

Cutting & Filling		134.10	
Brassing ditches		31.39	
Waterway Construction			
Earth Excavation		298.55	
Grassing of waterway		87.55	
Liming			
2 tons of marl		28.00	
Total	JA$	579.59	= US$326

7^{o} - 25^{o} (Machine Built)

INVESTMENT COST (Per Hectare)

Bench Terrace

Cutting & Filling with replacement of top Soil		2,470.20	
Establishment of Grass on risers		725.74	
Waterway Construction			
Earth Excavation		65.26	
Grassing of Waterway		20.64	
Supplying Concrete Structure and Installation		3,933.31	
Liming			
2 tons of marl		28.00	
Manuring			
Poultry manure (2 tons)		140.00	
Total	JA$	7,383.15	= US$4,148.00

15^{o} - 20^{o} (Machine Built)

INVESTMENT COST (Per Hectare)

Bench Terrace

Cutting & Filling with replacement of of top Soil		2,158.80	
1.1 Establishment to grass on risers		947.39	
Waterway Construction			
Earth Excavation		65.26	
Grassing of Waterway		20.64	
Supplying concrete structure and Installation		3,933.31	
Liming			
2 tons of marl		28.00	
Manuring			
Poultry manure (2 tons)		140.00	
Total	JA$	7,293.40	= US$4,097.00

20^{o} - 25^{o} (Hand Built)

INVESTMENT COST (Per Hectare)

Bench Terrace

Cutting & Filling		7,570.24	
Establishment of grass on risers		901.45	
Waterway Construction			
Earth Excavation		65.26	
Grassing of waterway		20.64	
Supplying concrete structures and Installation		3,933.31	
Liming			
2 tons of marl		28.00	
Manuring			
Poultry manure (2 tons)		140.00	
Total	JA$	12,658.90	= US$7,111.70

25^{o} - 30^{o} (Hand Built)

INVESTMENT COST (Per Hectare)

Orchard Terrace

Cutting & Filling		3,096.72
Establishment of Grass in Spaces between terraces		1,613.95
Waterway Construction		
Earth Excavation		91.20
Grassing of waterway		27.06
Supplying Concrete structure and Installation		4,297.59
Liming		
None		
Manuring		
None		
Total	JA$	9,126.52 = US$5,127.00

Slope Category Over 30^{o}

Afforestation

Approximately $3.00 per seedling

1125 seedlings per hectare

for materials and planting $3,375/hectare = US$1,896