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STAFF APPRAISAL REPORT

THE BLACK BUSH IRRIGATION PROJECT

GUYANA

May 19, 1978

Projects Department
Latin America and the Caribbean Regional Office

CURRENCY EQUIVALENTS

Currency Unit	=	Guyana Dollar (G$)
G$ 1.00	=	US$0.39
G$ 1.0 million	=	US$390,000

US$1.00 = G$ 2.55 at time of appraisal and as used in this report.

MEASURES

ac	-	acre (43,560 square feet)
acft	-	acre foot (43,560 cubic feet)
bag	-	bag of paddy rice (140 pounds) or milled rice (180 pounds)
cusec	-	cubic feet per second (1 cusec = 2 acft in 24 hours)
cuyd	-	cubic yard (1 cuyd = 27 cubic feet)
ha	-	hectare (1 ha = 10,000 square meters = 2.47 ac)
mi	-	mile (5,280 feet)
msl	-	mean sea level (average tide level)
sq mi	-	square mile (640 acres)
ton	-	long ton (2,240 pounds)

ABBREVIATIONS

AGBANK	-	Agricultural Cooperative Development Bank
CARICOM	-	Caribbean Common Market
D & I Board	-	Drainage and Irrigation Board
GMC	-	Guyana Marketing Corporation
GRB	-	Guyana Rice Board
GUYSUCO	-	Guyana Sugar Company
IRRI	-	International Rice Research Institute
LDD	-	Land Development Division
MAG	-	Ministry of Agriculture
MARDS	-	Mahaicony Abary Rice Development Station

GOVERNMENT OF GUYANA

FISCAL YEAR

January 1 - December 31

GUYANA

APPRAISAL OF THE BLACK BUSH IRRIGATION PROJECT

STAFF APPRAISAL REPORT

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This report is based on the findings of an appraisal mission which visited Guyana in March-April 1977. This mission comprised Messrs. W.A. Lucas (Consultant); and G. Soto, A. Cornejo, M. Fireman, P. Aklilu (Young Professional) of the Bank; and R.S. Baskett (Consultant).

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I. INTRODUCTION

1.01 The Government of Guyana has requested IDA assistance in financing rehabilitation and improvement of irrigation and drainage systems and other agricultural improvements for rice production on about 75,500 ac of presently cultivated land in the East Berbice region of the country (Map IBRD 12978 and 12979). The existing cultivated areas which would directly benefit from the project are the Black Bush Frontlands (29,600 ac) and Block III (19,400 ac). The existing Black Bush Polder area (26,500 ac) would benefit indirectly from an increased water supply, as a result of the provision of full water supply to the Frontlands, and irrigation and drainage improvements on about 4,000 ac within the Polder which are required to correct malfunctions in the systems. The Block III lands would benefit from improvements to the main water supply works and an increased water supply while the Frontlands area would be fully rehabilitated. The new land areas in the Manarabisi Cattle Pasture (31,500 ac) and the Black Bush Backlands (20,000 ac), which were included in the initial proposals and feasibility studies for future development, would not be included in this project due to the amount of financing required, both through loans and Government contributions. Further, the water supply available from the Canje and Berbice rivers would not be sufficient to develop all of these lands at present and increasing this supply would require construction of a dam and storage reservoir on the Canje river to regulate excess flow during the rainy season.

1.02 The proposed project would be part of a comprehensive plan being undertaken by Government to rehabilitate existing irrigation and drainage systems, including roads and on-farm development, and improve agricultural supporting services for about 450,000 ac of lands suitable for rice and sugarcane production in the coastal areas of the country. The main objectives of this program are to provide flood protection, a dependable water supply for double-cropping, adequate drainage, all-weather roads, on-farm development (land leveling) and improved agricultural supporting services, all of which would increase rice production and improve the quality for export markets. The Bank is already providing financial assistance (Loan 1016-GUA) for rehabilitation and improvement of the Tapakuma irrigation project (41,750 ac) in the northwest coastal region, known as the Essequibo Coast, and this project is the first to be undertaken as part of the comprehensive plan. Following initial delays and serious cost overruns, which Government is attempting to cover by loans from external sources, this project is presently making good progress. The programs on fertilizer use for rice and for training extension workers have contributed to improved farm practices and higher yields and have had an impact on national policy for the rice industry. The adoption of block planting by several groups of farmers in the project area is an important innovation which would improve production throughout the country.

The Bank also provided financial assistance with two loans (559-GUA and 765-GUA) for two sea defense projects, which have been completed, and which are also a part of the ongoing plan to protect both urban and agricultural areas throughout the coastal areas of the country, of which a large part are at or below the high tide level. The ongoing Livestock Development project (Credit 221-GUA) has provided further assistance for improving the agricultural sector. In addition to the Bank's assistance, Government is presently negotiating a loan from the Inter-American Development Bank (IDB) for the first phase of the Mahaica-Mahaicony-Abary (MMA) project to develop about 98,000 ac out of a total of about 287,000 ac of arable land in the coastal zone between the Demarara and Berbice rivers. This zone covers most of the central coastal agricultural area and a major part of the area remaining to be developed. During the period from 1969 to 1975, Government also completed a Rice Modernization Program, with financial assistance from USAID, which included the construction of six large drying and storage facilities, improvement of Government-owned mills, a fund to assist privately owned mills to expand and modernize (which did not fully materialize), establishment of a new central research station at the Mahaicony Abary Rice Development Station (MARDS), importation of seed of improved varieties, feasibility studies for the Black Bush and Tapakuma projects, and technical assistance for improving the rice industry.

1.03 Feasibility studies for rehabilitation and development of the Polder, Cattle Pasture and Backland areas were completed by Harza Engineering Co., Chicago, Ill., and Aubrey Barker Associates, Georgetown, in November 1975. A supplemental study for the Frontlands and Block III was completed in February 1977, by the same firms. The first study was financed by USAID and the second by a Bank Project Preparation Facility loan. These two studies are the basis of the appraisal covered by this report.

II. THE PROJECT AREA

Description of the Project Areas

2.01 The project area is located in the southeastern part of Guyana in the East Berbice coastal region between the Berbice and the Corentyne rivers. The area is a low lying coastal plain having little relief, with parts of the area below mean sea level and the general elevation of the low lying lands about 3 to 4 feet and the reef lands about 5 to 8 feet with a slope of about one foot in 10,000 feet toward the sea coast. The region lies between latitudes 2^{o} N and 9^{o} N, in the tropical rainfall zone, and has two wet and two dry seasons as follows:

Major Wet Season	May - July
Major Dry Season	August - November
Minor Wet Season	December - January
Minor Dry Season	February - April

Precipitation in the area occurs mainly as high intensity showers, with an annual average of about 80 inches. Other climatic factors such as temperature, humidity, sunshine and evaporation show little variation throughout the year; the recorded average monthly temperature at New Amsterdam, the largest urban area in the region located near the mouth of the Canje river, is 82^{o} F.

2.02 The region has more than 200,000 ac of land which has been, or could be, developed for agriculture, all lying on the right bank of the Canje river from which a water supply is obtained for those areas presently under irrigation. These include five sugar estates covering 44,000 ac which are supplied by three pumping plants with a total installed capacity of 810 cusec. An additional 80,000 ac are used for rice production, out of which about 46,000 ac are irrigated, the balance being dependent on rainfall, mainly for the autumn crop (May-September) each year. The three areas in the project area are briefly described below:

(a) The Black Bush Polder is a new land settlement scheme (26,500 ac) completed in 1963 and presently farmed by about 1,500 families on state lease land with homestead plots of 2.5 ac and rice plots of 7.5 ac or 15.0 ac. The scheme is located inland from the cultivated areas along the coast and was constructed in an area that was mostly occupied by a swamp. The irrigation supply for this area is obtained by pumping from the Canje river. This scheme was constructed as a model rural development project with four central villages including housing, water supply, electric power, schools, health services, paved roads and four rice mills with drying and storage facilities. The scheme has been successful and is presently producing about 500,000 bags (31,250 tons) of paddy annually. From the standpoint of rehabilitation and improvement of existing developed areas, the Polder is not specifically a part of the project, since this is not a critical problem with the existing systems in the Polder. However, it must necessarily be considered in the planning and implementation of the overall project since the main canal and distributaries would be enlarged to convey water to the Frontlands area, supplied from a new pumping plant which would be constructed adjacent to the existing Black Bush pumping plant. This would make it possible to increase the water supply to all lands in the Polder, which is operating with less than the optimum capacity in the system, however, no benefit would be claimed for this;

(b) The Black Bush Frontlands (29,600 ac) are located between the Polder and the sea, along the public road extending from Bloomfield Estate No. 8, about 13 miles east of New Amsterdam, to Estate No. 51. This is one of the older developed areas along the coast and was formerly farmed partially under

irrigation by water supplied from the Black Bush swamp. However, with construction of the Polder this supply was cut off and presently the area is generally limited to the autumn rice crop under rainfed conditions. The lower lying clay soils (20,200 ac) are suitable for rice growing and a full water supply would permit double-cropping and more than double production. This area has the highest priority for future development and entitlement to water with the increase in supply under the project. The area also has 1,000 ac in sugarcane, 500 ac in food crops, and 3,800 ac in coconuts on the reef lands which are also suitable for vegetables, soybeans, maize and other crops that require light textured and well drained soils. The existing coconut groves consist of trees 30 to 40 years old with low productivity. Investment to irrigate these trees, for the small benefit to be gained, could not be justified and very little could be done to develop these lands for other crops under irrigation until these trees are removed. This probably would not occur as long as there is some production. Due to this situation the project does not include on-farm development of these lands at present; however, the pumping plants and main canal would provide sufficient capacity to irrigate these lands in the future, when it is almost certain they would be utilized for other crops. There are about 4,100 ac in the area which are not suitable for cultivation due to salinity; and

(c) The Block III area (19,400 ac) is contiguous with the Frontlands and extends along the coast from Estate No. 52 to Estate No. 74, which is adjacent to the Skeldon sugar estate and the village of Corriverton. The depth of these frontland areas from the seacoast to the backdams or distributary canals is roughly 4 miles. The Block III area was developed as an irrigation and drainage district during the 1940s, mainly by and for private landowners, and the efficiency of land and water use and the level of production is better than in most irrigated areas in the country, including the Polder. However, after 30 years of operation, the main pumping plant needs to be replaced and the project works require rehabilitation. About 12,000 ac are cropped to rice under irrigation at present, with more than 5,000 ac which cannot be served due to insufficient water supply or low levels in the canals which are below the level of these lands. The initiative of the farmers in this area is reflected in better cultivation practices and higher production than in other areas, the high percentage of ownership of tractors and combines, and the large number of privately owned rice mills.

2.03 The project area would also include the existing Torani canal, which connects the Berbice and Canje rivers, as the transfer of additional water for the project by pumping from the Berbice river would utilize this canal.

Some improvement to the banks of the Canje river to carry the increased flow from the outlet of the canal to the Manarabisi (Block III) pumping station would also be included in the project. Government has expressed an interest in developing an area of about 10,000 ac for irrigation and drainage between the back of the Manarabisi Cattle Pasture and the Canje river where a number of livestock cooperatives have been established. This area would be included in the project for the purpose of carrying out a feasibility study for a later stage of the project.

2.04 The area between the public road and the sea, comprising about 10,500 ac adjacent to the Frontlands and Block III, would not be included in the project area since a large part is subject to inundation by sea water. The lower land areas are heavily salinized and reclamation of the soils would be very costly as it would require construction of a sea defense, an extensive drainage system including pumping plants, and a large supply of fresh water for leaching.

Present Land Use and Production

2.05 At present, the cultivated land in the three project areas comprises a total of 35,900 ac. This includes only 4,000 ac in the Polder which would directly benefit from rehabilitation but does not include the remaining lands (22,500 ac) which would receive marginal benefit from an increased water supply and improvement in supporting services. It includes 12,900 ac in Block III which would receive a marginal benefit from an increased water supply and improved services. In addition, there is a total of 17,100 ac of non-cultivated land, including reef soils (3,900 ac) and arable rice lands (13,200 ac) largely due to lack of irrigation water. Non-agricultural use of lands in the project areas, including public roads, housing, and areas of tidal marsh total 11,033 ac, about 17% of the total project areas. Cropping intensity for the total cultivated lands is 110%, much lower than the potential in the three areas, mainly due to the lack of irrigation water in the Frontlands and Block III. The major crop in the three areas is rice with traditional varieties occupying about 20% of the rice areas and improved varieties such as Starbonnet and "N" about 80%. Rice is grown under flooded conditions (paddy), and rainfed crops, including rice, are grown in areas where irrigation is not available and where autumn rainfall conditions are favorable. A variety of food crops are also grown in some of the low-lying clay soils, including eggplant, cabbage, black-eyed peas, tomatoes, and peppers and legumes. Details on crop production are given in Chapter VI, "Agricultural Production and Farm Budgets." The estimated present net value of production for the three areas is G$ 6.5 million (US$2.5 million) using current prices.

2.06 In the Frontlands, rice constitutes the predominant agricultural land use, occupying 74% of the cultivated lands. Coconuts represent the second most extensive crop (20%) but they occupy the reef soils which are not suitable for rice and not feasible for irrigation. Sugarcane (5%)

occupies an area of 1,000 ac in the area south of Bloomfield, and food crops (1%) are grown mainly in the small lots adjacent to the village centers or in the low-lying areas of clay soils interspersed with the long narrow strips of reef soils. Cropping intensity in this area is the lowest in the total project area (104%), due mainly to the lack of irrigation water which, in most cases, precludes a spring crop of rice and limits the production of food crops. About 2,800 ac in the Frontlands (reef soils) and 7,800 ac of arable rice lands are not cultivated at present. Some of these lands adjacent to the public road are saline.

2.07 Rice is even more predominant in Block III where it occupies 93% of the cultivated lands. The availability of irrigation water from the existing scheme allows for a higher cropping intensity (119%) than in the Frontlands. Coconuts occupy only 6% of the cultivated lands and they are planted on the reef soils. Food crops are also grown on 1% of the cultivated lands. Some 6,500 ac, representing 34% of the total Block III area, are not cultivated. These lands comprise 1,100 ac of reef soils and 5,400 ac of arable rice lands, mainly those occupying the low flats between the reef soils and which are not accessible to the existing irrigation scheme.

2.08 A total of 4,000 ac in the Polder would benefit directly from the proposed project, comprising 2,500 ac which are too high to be irrigated and 1,500 ac adjacent to the Lesbeholden and Mibikuri villages which are at present imperfectly drained, restricting the growth of vegetables and other food crops. Cropping intensity is at present quite low: 90% for rice and 50% for food crops, reflecting the lack of irrigation water in the first case and deficient drainage in the second. With the proposed works, double cropping of rice would be possible and food crops production increased considerably.

Population, Employment and Land Tenure

2.09 The present population of the project areas is estimated at approximately 56,000 people. This figure includes an estimated 29,000 persons in the Frontlands, 18,000 persons in Block III, and 9,000 in the Polder. The average farm family is relatively large with some four to nine persons to a household. The average age of farmers in the Polder has been estimated at 47 years, with 80% of the farm operators having attended school for periods of four years or more. These figures can be assumed to apply also to the Frontlands and Block III.

2.10 Information on employment is not available for the individual project areas, but data on the East Berbice region, where the project is located, indicate that 42% of working age males are employed in non-government positions, mostly hired laborers; 20% have their own business (mostly farms), and 27% are unemployed. Of the female group over the age of 14 and not in school, over 90% are engaged in home duties. These figures indicate a relatively high level of unemployment and underemployment among individuals in the regional agricultural sector.

2.11 The present farm tenure situation in the project areas is a complex system of ownership and conditions under which farm land is held and used, and quantitative information on land tenure is scarce and generalized. In general terms, land tenure can be subdivided into privately owned (freehold) and Government or State-owned lands. Private lands are held under one of four modalities: land received (a) in lieu of transport; (b) through letters of decree; (c) through certificates of registration; and (d) through lease ((a), (b), and (c) are all freehold). State-owned lands are also held under various types of modalities, including: (a) license of occupancy; (b) grants; (c) provision grants for homestead; (d) conditional grants; (e) provisional free grants; (f) lease; and (g) permissions. In recent times, nearly all Government and State lands are given out through leases and permissions, with the exception of freehold titles for residential lots. In the Frontlands and Block III, it is estimated that approximately 60% are freehold lands while the remaining 40% are State-owned. In the Polder, however, all farms are leased from the Government through the Land Development Division of the Ministry of Agriculture (MAG). The above percentages indicate that, of a net total of 46,600 ac of cultivable lands in the project areas, 25,600 ac are privately owned and 21,000 ac are State-owned, most of which are leased to farmers for a long term, usually 25 years.

2.12 Table 1 gives an indication of the land tenure situation in the Frontlands and Block III. The Lands Department has a register of all land titles and leases in the country but these data have not been compiled by regions or projects and specific information on all holdings in the project area is not available. The table was developed from random sampling of cultivated areas and on the frequency of the farm size categories as revealed in the samples. Small farms predominate in these areas, with 83% less than 10 ac and only 2% more than 20 ac. In the Polder, which is not included in the table, farm size has been established at 15 ac of crop land plus a 2.5-ac homestead plot for production of food crops, except for a limited number of smaller (7.5 ac) rice farms. The reef soil lots in the Frontlands vary from 0.5 to 2 ac.

Table 1

Farm Size and Number of Farms in the Frontlands and Block III

Farm Size Category (ac)	Cultivated Area (ac)	Cultivated Area (%)	Number of Farms	Total Farms (%)	Representative Farm Size (ac)
Up to 5	13,412	31	3,773	58	3.5
5 to 10	13,000	31	1,651	25	8.0
10 to 15	9,798	23	754	11	13.0
15 to 20	4,260	10	237	4	18.0
20 to 25	852	2	37	1	23.0
25 and over	1,278	3	46	1	28.0
Total	42,600	100	6,498	100	6.0

2.13 Distribution of ownership in small holdings has created problems, particularly in the efficient use of farm machinery. Efforts have been initiated in Block III to consolidate these holdings into larger blocks and if the system is successful it is expected to extend to the Frontlands. Inadequate land surveys, the absence of public records, and poor land titles with antiquated legal descriptions result in considerable confusion and frequent misunderstanding regarding land ownership in the Frontlands and Block III. Discussions with public officials have indicated a dire need for cadastral and land tenure surveys in the country to establish land ownership and to set up a uniform system of titles and leases. It is estimated such a program would require at least three years; however, this situation would not create a problem for the project.

Agricultural Credit

2.14 In the project area there are a number of institutional as well as informal credit sources. The principal source is the Guyana Rice Board (GRB) which primarily serves the small rice farmers. Others include the Agricultural Cooperative Development Bank (AGBANK), commercial banks, private machinery operators and local merchants. A 1975 survey of credit recipients in the Polder showed that 41% had access to GRB, 32% received cash loans from friends and neighbors, 22% had loans from agricultural and commercial banks and 17% borrowed from merchants and money lenders.

2.15 The Guyana Rice Board. From its branch offices located in the Polder and at Corriverton, the GRB provides fertilizers, chemicals, seeds, bags and machinery services on credit. The supply of these inputs at subsidized rates is limited to farmers with less than 30 ac. Rice millers are also supplied with acetic acid free of charge. Normally, GRB's charges range from 17% to 58% below actual costs which GRB absorbs as part of its annual operating expenses. Table 2 presents some comparative costs for inputs and machinery services.

Table 2

Cost of Inputs and Machinery Services

	GRB's Rate (G$)	GRB's Cost (G$)	Rate of Subsidy (%)
Seeds (per bag of 140 lb)	23.25	23.25	-
Urea (per bag of 112 lb)	15.72	21.80	28
TSP (per bag of 112 lb) /1	17.54	21.25	17
Bags (per bag)	0.70	1.60	46
Insecticides (per lb)	1.54	3.68	58
Land preparation (per ac)	32.00	44.00 /2	27
Combining (per 140 lb bag)	2.00	3.00 /2	33

/1 Triple Superphosphate.
/2 Estimated on the basis of custom hire rates by privately owned machinery.

2.16 The rationing of these inputs is determined by the Board's rice agronomists who fix the minimum requirements per ac and farmers can purchase only the prescribed amount on credit. For the last three years, the interest rate charged on these credits remained constant at 8.5% per annum. Since GRB's machinery pool is limited (30 tractors and 34 combines in the Polder), more than 80% of the land preparation in the project area, particularly in Block III, is accomplished by private owners and custom hired contractors.

2.17 Agricultural Cooperative Development Bank (AGBANK). One of the fast growing agricultural credit institutions is the AGBANK. Since its inception in 1973, the bank has made 214 loans valued at G$ 2.3 million in the East Barbice region; 70% of the total loans were disbursed for rice and 18% for sugarcane at 9% interest rate. The bank conducts a supervised credit program with six supervisors from its office in Whim, located in the project area. In order to encourage the formation of cooperatives, the bank lowers the interest rate by 1/2% for loans channeled through either registered cooperatives or groups of farmers. A recent Government decision requires a minimum holding of 50 ac double-cropped for machinery loans. This holding may be cultivated by farmer groups or cooperatives.

2.18 AGBANK raises its capital requirements from different sources. For the 1977 fiscal year (January 1 to December 31), the Government contributed G$ 6.3 million at no interest, the Caribbean Development Bank (CDB) and Barclay's Bank provided G$ 6.6 million and G$ 1.5 million, respectively, at 7-1/4% and the bank sold bonds in the amount of G$ 0.4 million at 5-1/2% interest for a total of G$ 14.8 million.

2.19 Based on recent repayment data, collection rates on credit programs in the project area have been relatively good. In 1975 repayment to GRB in the project area was 85% while in 1976 the rate dropped to 78%, reflecting the poor harvest. Since farmers are highly dependent on the few credit sources available and have no other alternative source of inputs, they make a strong effort to repay credit loans each year and any defaults result largely from crop failures.

Future Credit Needs for Rice Production

2.20 Future input requirements with the project would require an expansion of GRB operations to supply the additional inputs and machinery services and strengthening the links with private millers to assist in debt collection. Specifically, the required rates for application of seeds, fertilizers, insecticides and herbicides for high yielding varieties would increase the per capita credit needs which GRB would have to meet, together with the AGBANK and other financial institutions. GRB's efforts to initiate block planting could ease the administrative burden in supervising the credit schemes and greatly facilitate the use of machinery. Unless the credit programs are enlarged the incremental income of the project's target group would not be realized since their capacity to borrow from the informal markets is limited. Assurances have been obtained from Government that an

adequate level of production credits (inputs) and machinery services on reasonable terms would be maintained in the project area to meet the requirements with a higher intensity of land cultivation and the introduction of high yielding rice varieties.

Institutional Participation

2.21 Farmers in the project area receive support and assistance from several Government agencies. MAG has the major responsibility for planning, implementation and management of irrigation and drainage projects, for administration of land ownership and settlement and to provide extension and training services. These functions are carried out by the several departments and divisions in the Ministry which have specific competence for different aspects of agricultural and rural development. These include the Drainage and Irrigation Board (D & I Board) for policy formulation and general planning; the Hydraulics Division for engineering, construction and operation and maintenance; the Extension Division for agricultural planning, research on crops other than rice, distribution of seeds other than rice and extension assistance to farmers; the Land Development Division for administration of settlement schemes such as the Polder; and the Lands Department for administration of land ownership and leases.

2.22 The rice industry, including production, processing and marketing, is largely controlled by the Guyana Rice Board (GRB), a statutory body attached to MAG. GRB provides assistance to rice farmers for production in the form of machinery services for land preparation and harvesting, fertilizers and chemicals, seed for improved varieties, bags for transport of both paddy and milled rice and technical assistance, mainly for disease and pest control. GRB also provides drying, storage and milling facilities, and all milled rice, except that retained by the farmers, must by law be sold to GRB which handles both internal and export marketing. In the project area, about 80% of the milling is performed by privately owned mills. GRB also operates the central rice research station at MARDS.

2.23 Agricultural credit for rice is provided by GRB through services in kind as noted above, and credit for both rice and other crops, together with longer term credits up to seven or eight years for on-farm development and machinery, is provided by AGBANK. The AGBANK provides supervision on use of credits and assistance on farm planning and management.

2.24 Other agencies which operate in the project area are the Guyana Sugar Company (GUYSUCO), which controls the recently nationalized sugar industry, and the Guyana Marketing Corporation (GMC), which assists with the marketing of food crops and maintains price controls on certain essential agricultural products.

Soils and Land Classification

2.25 The soils of the project area, which originate from predominantly riverine or marine deposits, are predominantly dark-colored, fine-textured, and slightly to moderately acid in the surface layers and fine-textured,

light-colored but mottled and somewhat alkaline in the subsoil. Owing to their very high clay content, these soils swell and shrink considerably, showing some characteristics of Vertisols, but are not true representatives of this group.

2.26 Near the coast, a group of soils, presenting a sandy surface commonly underlain by sandy material and interstratified with clay materials, occurs in elongated strips generally parallel to the coast and 200 to 4,000 feet in width. These soils, developed on the reefs or old beach lines, apparently originated from more recent marine sediments. These reef soils were classified only as regards their suitability for sprinkler irrigation, which, for various reasons, including high cost, is not likely to be adopted for these soils in the near future. They constitute about 15% of the Frontlands and Block III areas, but do not occur in the Polder area.

2.27 The lands of the Frontlands and Block III areas were classified according to their suitability for production of irrigated crops and rice. While perhaps too high a proportion of these lands have been assigned to Class I for rice production or to Class II for upland crops (Table 3), it was found that 82% of the lands in the Frontlands and 91% in the Block III area are suitable for rice production, and 70% of the lands in the Frontlands and 91% in Block III are suitable for upland crops with appropriate soil management. It is estimated that all the area of the Polder directly benefitting from the project (4,000 ac) is suitable for rice and/or upland crops, with 43% included in Class II lands.

Table 3

Suitability for Upland Crops and Rice
Land Classification of the Frontlands and Block III Areas
(Values in Acres)

Land Class	Frontlands		Block III	
	For Upland Crops	For Rice	For Upland Crops	For Rice
I	-	23,657	-	19,518
II	22,943	3,549	19,518	-
III	4,303	543	-	-
IV /1	1,171	668	845	845
Total	28,417	28,417	20,363	20,363

/1 Includes urban areas and tidal flats.

2.28 Cation exchange capacity of the predominantly clayey soils is moderate, with magnesium being the predominant adsorbed cation; neutral salt exchange acidity values are low but apparently none are sulphate soils. In any case, improvement of irrigation and drainage systems in areas with salt affected soils will enhance desalinization.

2.29 Soil infiltration and permeability values are low to very low, but this is not an unfavorable condition for rice under flood irrigation. For vegetable crops, however, it is required that the soil be formed into beds or cambers to ensure satisfactory drainage conditions. Soil fertility is relatively high as compared with most humid tropical soils but the soils in the project areas respond to additions of nitrogen and phosphorus, and often to calcium.

2.30 In the tidal flats near the coastline, the soils are saline and in some cases alkaline, but a majority of these soils occur east of the public highway, in the areas which would not be included in the project area.

Soil Drainage

2.31 The general slope of the lands in the project areas is very low, averaging about 0.5 feet per mile towards the coast. The extensive low areas inland from the higher reef soil areas and which constitute the main crop areas in the Frontlands and in Block III, as well as in the Polder, are 4 to 5 feet above mean sea level. The Frontlands are drained by a relatively large number of channels, most of which are too small to carry the peak flows, causing excessive flooding of the low-lying crop areas in most years. The Block III area has somewhat better drainage facilities than the Frontlands and, with proper management and control of the irrigation supply, flooding does not constitute a serious constraint to most crops, particularly to rice production.

2.32 The moderate irregularities of the terrain produce low spots in the fields and an accumulation of surplus irrigation or rain water with the corresponding adverse effects on crop production. Extensive leveling is required in these fields but the effective depth of the surface layer of the soil, seldom exceeding 4 to 6 inches, precludes large movements of earth and leveling should be carried out through progressive filling up of the lower areas over a period of several years. This method of land leveling, combined with improved land preparation, should result in optimum conditions of soil and water management.

Rice Production and Processing

2.33 Rice production in Guyana fluctuates dramatically from year to year because of changing weather conditions but recent performance points to a significant trend increase. Production reached a 17-year low in 1972 at 94,000 tons but since then it has increased substantially reaching 160,000 tons in 1975 and 210,000 tons in 1977. The 1976 crop, however, was only 110,000 tons as a result of extraordinarily adverse weather. The principal factors in these increases were favorable weather, high land use intensity for the spring crop, introduction of high yielding varieties and generally higher yields with all improved varieties. Processed rice represented 7 to 9% of export earnings in Guyana in recent years. Of the rice produced in the country, about 50% is exported, mainly white rice, while most of the domestic consumption is parboiled rice. GRB has five rice mills in the East Berbice region and there are 52 privately owned mills (32 single-stage and 20 multi-stage). These facilities include concrete drying floors and, in some cases,

small mechanical drying units. In addition, there is a new and larger drying unit comprising three dryers combined with bulk storage for 7,500 tons at the GRB mill at Joanna in the Polder. The drying capacity is 240 bags (15 tons) per hour. Almost all private mills provide drying floors and a few own small mechanical drying units. The estimated combined mechanical drying capacity in the region is 240,000 bags of paddy (15,000 tons) per month, or 25 tons per hour. At a milling yield of 65%, two bags (140 lb) of paddy yield one bag (180 lb) of milled rice.

2.34 The five GRB milling units have a combined capacity of 250,000 bags (20,000 tons) of milled rice per year. The private sector provides an additional annual capacity of 975,000 bags (78,000 tons) per year. These figures indicate that private operators mill 80% of the rice produced in the region. This capacity would be adequate to handle the increased production with the project; however, many of the private mills are old and inefficient and the milling quality is low. Throughout the country 59 single-stage mills were closed down and only seven new multi-stage mills constructed during the period 1969-75. In the past the owners have lacked incentive and funds for capital improvements due to the low profit margin between the fixed prices paid for paddy and prices paid by GRB for milled rice. Further, the policy of the AGBANK is that private owners may receive investment loans as cooperative enterprises and not as individuals. There is a trend for farmers to use toll milling, i.e., a fixed cost per bag, instead of selling paddy to the mills. This permits farmers to sell milled rice to GRB and retain the by-products. It also permits private millers to earn higher revenues for their services. With the increased production in the last three years GRB has begun contracting a significant amount of milling to the privately owned mills. With toll milling and the contracts with GRB, the private sector has started to recover from the previously depressed conditions but it is important that Government recognize the importance of private mills to the industry and ensure their operation in the future.

2.35 Total storage capacity in the project region is estimated at 1,205,000 bags (75,312 tons) per year, including 315,000 bags (19,687 tons) in the GRB facilities and 890,000 bags (55,625 tons) in the private sector. Although GRB storage capacity is smaller, it stores 65% of all rice milled, leaving storage of paddy largely to the private mills. Of the total storage capacity, only 10% is bulk-type storage (7,500 tons). Projections shown in Table 4, based on estimated production with the project, indicate a maximum drying and storage deficit of about 450,000 to 500,000 bags (28,000 tons) in November. This could lead to serious problems of loss and damage and the project provides for construction of new drying and storage facilities, particularly in the Frontlands area (para 3.06). Guyana is moving toward bulk storage of paddy and milled rice but this would not be fully achieved for several years and additional facilities are needed to process the present and projected production with traditional methods.

Table 4

Monthly Flow of Paddy
Harvested, Dried, Milled and Stored
(140-lb bags)

	February	March	April	May	June	July	August	September	October	November	December	January	February
Harvested	81,431	285,007	325,723	122,146	-	-	-	333,264	555,439	222,176	-	-	-
Dried[1/]	81,431	240,000	240,000	240,000	12,876	-	-	240,000	240,000	240,000	240,000	204,537	-
Not Dried[2/]	-	45,007	130,730	12,876	-	-	-	93,264	315,439	444,537	204,537	-	-
Milled[3/]	81,431	204,166	204,166	204,166	48,710	-	-	204,166	204,166	204,166	204,166	204,166	371
In Storage	-	80,841	166,564	48,710	-	-	-	129,098	480,371	498,371	240,371	371	-

1/ Mechanical drying capacity - 240,000 bags/month - 25 tons/hr (20-hour day).
2/ Maximum monthly volume of paddy not dried - 445,000 bags - 29,000 tons.
3/ Milling capacity - 204,166 bags/month. - 21 tons/hr (20-hour day)

Water Supply and Requirements

2.36 At the present time the water supply for irrigation of 44,000 ac in the five sugar estates, 26,500 ac in the Black Bush Polder, 19,400 ac in Block III and a partial supply for the Frontlands is obtained by pumping from the Canje river. A part of this supply is presently secured by gravity flow from the Berbice river to the Canje river through the Torani canal. The additional supply required under the project to supplement the existing supply to Block III and the Polder and to provide a full supply to the Frontlands would be achieved by installation of a 1,000-cusec pumping plant on the Berbice river for delivery of additional water through the Torani canal. An analysis of project water requirements and supply, based on long-term records of rainfall and river flow, is presented in Annex 2. This analysis indicates that an adequate supply would be available for the project with a probability of 80% (four years out of five) during the critical dry months of February, March, September, October and November each year, these being the months when high plant water use coincides with climatic extremes of high temperature, wind and low humidity. The analysis also indicates that normal flow in the Berbice river, with 80% probable excedence, is more than adequate to supply the added project requirements and that this additional extraction would not increase the incidence of salt water intrusion during periods of low flow.

Water Rights

2.37 Water resources in Guyana are owned by the State and vested in the Guyana Water Authority, which was created by law in 1972 to control and regulate all activities related to water development and use. The Authority may delegate its power to other agencies or boards but all new projects for development and use of water resources must be reviewed and approved by the Authority. For existing irrigation and drainage projects, the Authority has delegated its powers to the D & I Board.

2.38 Legislation for the granting of water rights to individual farmers for irrigation does not exist in Guyana. Within declared drainage and irrigation areas, the D & I Board grants the right to use by establishing "time run" schedules at the beginning of each irrigation season for all land owners or lease holders within an area, which assigns a given number of hours of use during each return period of seven to 15 days. There is no measurement or limit on quantity used and this unregulated use, together with unauthorized use, as when farmers open the gates outside the period assigned, is a serious problem on all irrigation schemes. This leads to wastage and conflicts of interest whereby some farmers are left with insufficient supplies or do not receive water at proper intervals to maintain satisfactory crop growth. The Water Authority and the D & I Board recognize the problem and are making an effort to control water use at the farm level and penalize unauthorized use. The best means available at present to achieve better control of water use is to improve management and supervision within the irrigation areas and to work with farmers' associations and cooperatives for better cooperation and sharing of responsibility between the project staff and the farmers.

Water Quality

2.39 The quality of streamflow in both the Berbice and Canje rivers is excellent for irrigation use. During low rainfall and low flow periods, the dissolved solids content rarely exceeds 200 ppm and the pH factor ranges from neutral to slightly acid. The only real quality problem has to do with salt water intrusion upstream from the river mouth, particularly in the Canje river, and this occasionally makes it necessary to temporarily cease operation of the sugar estate pumping plants which are downstream from those which would supply the project area. The transfer of additional water from the Berbice river would eliminate this problem. Otherwise the water contains no toxic or harmful elements and there is no evidence of waterborne disease.

III. THE PROJECT COMPONENTS

General Scope and Purpose of the Project

3.01 The project would include works to improve and increase the water supply, rehabilitation and improvement of irrigation and drainage systems, on-farm development and improvement of agricultural supporting services and other facilities for the main purpose of increasing rice production in the Frontlands (29,600 ac), Block III (19,400 ac) and the Polder (26,500 ac). The rehabilitation of irrigation and drainage systems would be carried out on the Frontlands area and on about 4,000 ac in the Polder as the general systems serving the remaining 22,500 ac in the Polder are in relatively good condition and do not require extensive rehabilitation. Existing systems in Block III would not be rehabilitated under the project as Government plans to include this work in a later phase. This increase in production would be partially achieved by providing a full water supply to the three areas sufficient for double-cropping of rice on about 59,500 ac and for about 5,000 ac in sugarcane and food crops. The 4,600 ac in coconuts in the Frontlands and Block III would not be provided with on-farm development or irrigation until use of this land is converted to food crops or oilseeds, or replanted to higher yielding coconut varieties. About 6,400 ac of reef lands which are too high in elevation or salt affected would remain idle and not be irrigated. The increased water supply would be obtained by pumping from the Berbice river to supplement the present gravity diversions through the Torani canal to the Canje river, from which the supply to the three areas would be obtained by pumping. The entire cultivated area in the Polder would benefit from the increased water supply, since the new pumping plant to be constructed for the Frontlands would discharge into the existing main canal serving the Polder and the capacity of the plant would provide an increased supply of the Polder.

3.02 In addition to the project works and on-farm development, the project would include an agricultural development program to improve supporting services and other facilities to improve the processing of rice. A description of the main components is presented below.

Project Works

3.03 The project works would consist of the following:

(a) a new 1,000-cusec pumping plant on the Berbice river at the intake of the existing Torani canal for transfer of water to the Canje river;

(b) rehabilitation of the Torani canal to restore it to the original capacity of 1,000 cusec and bank improvements on the Canje river between the outlet of the Torani canal to the Manarabisi pumping plant to contain a maximum discharge of about 1,800 cusec;

(c) a new 300-cusec pumping plant on the Canje river to replace the existing 30-year old plant which supplies Block III;

(d) rehabilitation of the main supply canal (10 mi) to Block III and the Seaford distributary (8 mi), including construction of approximately 15 new main regulators, to increase the water delivery rate into the water courses;

(e) a new pumping plant adjacent to the Black Bush Polder pumping plant on the Canje river with a capacity of 500 cusec to serve the Frontlands and supply additional water to the Polder;

(f) upgrading the capacity of the Black Bush main canal (7 mi), the north and south branch canals (7 mi), and the distributaries (22 mi) to convey the additional supply to the Polder and the Frontlands;

(g) improvement of existing facilities in the Polder to provide water to 2,500 ac which cannot be irrigated at present and to correct certain localized problems on drainage in the Lesbeholden and Mibikuri homestead areas;

(h) rehabilitation and improvement of irrigation and drainage systems and roads and on-farm development in the Frontlands area; and

(i) provision of five sluice structures on the new main drains to be constructed in the Frontlands area together with about 1,000 cusec of drainage pumping to supplement discharge through the sluices.

3.04 The feasibility report includes a proposal to install return flow pumping plants on the main drains from the Polder as a means to provide additional water for the Frontlands and Block III. This proposal was made on the basis that the Manarabisi Cattle Pasture and the Backlands would be included in the project and the additional water supply would be required. However, since these two areas would not be part of the project (para 1.01), these five additional pumps would not be required until a second phase of the project is undertaken or until more of the reef lands are converted to crops other than coconuts and irrigation becomes necessary.

Project Headquarters and Operation and Maintenance

3.05 The facilities available at present for management in the project areas include operation and maintenance stations at Whim and Benab, both of which need to be rehabilitated, and a headquarters office at Mibikuri where the local head of the Land Development Division serves as project manager for the Polder. The operation and maintenance station at Whim has responsibility for the Polder and the Frontlands, even though it is actually located in the extreme northwestern part of the Frontlands. The project would include construction of a new project headquarters for all three areas of the project, possibly at Leeds (Estate No. 50), and either improving the station at Whim or moving it to the same location as the project headquarters. The Benab station (Estate No. 66) would also be rebuilt in a more suitable location. The project would also provide for improvement of operations in all areas by increasing the staff, particularly for control of water use, and additional equipment to facilitate maintenance.

Drying and Storage Facilities

3.06 The project would include construction of drying and storage facilities in the Frontlands and Block III areas for paddy rice with a capacity of about 400,000 bags (140 lb) per month. This would include additional yard drying space as well as mechanical dryers and flat storage in covered structures (para 2.35). This would be an important factor in reducing losses and in producing higher quality rice for the export market.

Applied Research Program

3.07 The project would include a program of applied research for variety trials on rice and fertilizer response in different soil types and for improvement of water management, leading to implementation of control measures to improve field use efficiency and reduce wastage. These programs would be similar to those being carried out on the Tapakuma irrigation project, which have been successful in demonstrating the benefits of using improved rice varieties together with proper and timely applications of fertilizers. These programs would be implemented under the direction of a consultant with field and laboratory staff provided by both MAG and GRB.

Extension Service and Training Program

3.08 Extension assistance for rice production in the project area is inadequate as the GRB has only one rice specialist and two assistants stationed in the region. The Extension Division of the Ministry of Agriculture has four agents working on crops other than rice, mainly vegetables and ground provisions, but these agents spend most of their time in the Polder. There is, therefore, an urgent need to strengthen extension work in the project area. The situation is similar to that encountered on the Tapakuma project and it was partially through the efforts of project staff and some success in establishing an extension training program for this project that Government is now undertaking an agricultural education and extension training program. The

Bank-financed Second Education Project (Loan 1106-GUA and Credit 544-GUA) includes a rural training center to be established in the Polder and a national extension training center. One of the objectives of this program is to establish a countrywide extension service but it is not expected that it would provide a sufficient number of qualified extension workers for the project area in time to meet the needs of projected agricultural development. In order to meet the immediate needs, the project would include a program to train extension agents and assistants and to conduct training sessions and demonstrations for farmers. The program would involve the participation of both the MAG and GRB and be under the guidance of a consultant. The program would also be carried out in close cooperation and coordination with the work on extension training in the Education project.

Seed Production and Testing Program

3.09 The state farm in the Polder is presently producing rice seed for the project area. This farm is an extension of the central seed producing station at MARDS. There is a need, however, to upgrade the quality of seed produced and to establish a seed testing laboratory. A rice seed improvement program would be carried out under the project which would be similar to the program now being carried out on the Tapakuma project, which is showing good results.

3.10 Assurances have been obtained from Government that: (a) a plan of operations satisfactory to IDA for strengthening extension services in the project area and for implementing programs for training extension workers and farmers, fertilizer and variety trials, soil testing, and research on water management would be prepared with the assistance of consultants (para 3.11) and submitted no later than June 30, 1979; and (b) minimum acceptable standards for control of the quality of seed paddy would be introduced and applied to both private and public seed producers (Section 3.07 of Joint Project Agreement).

Consultant Services

3.11 The project would include 560 man-months of consultant services for carrying out surveys, investigations and final designs for project works; preparation of specifications, bills of quantities, cost estimates and tender documents; evaluation of tenders and negotiation of construction contracts; and for supervising construction of project works, including on-farm development. The consultants would also assist the MAG and GRB with the extension training program, the applied research program and the program for seed production and testing. It is expected that the consultants would be employed from both foreign and local firms and the terms of reference would be similar to those being used on the Tapakuma project. The employment of a consultant firm(s), acceptable to IDA and under terms and conditions approved by IDA, to provide the required professional services for implementation of the project works and for carrying out the agricultural development programs would be a condition of credit effectiveness (Section 3.02 of Joint Project Agreement and Section 5.01 of IDA Credit Agreement).

3.12 The services of a consultant firm would be obtained to carry out surveys and studies and prepare a feasibility report for development of the area presently occupied by about seven livestock cooperatives and several private holdings between the Manarabisi Cattle Pasture and the Canje river. Government assigns a high priority to developing this area for irrigation and would take the necessary action to redistribute the land into 15-ac to 20-ac tracts. With the proposed pumping from the Berbice river and some return flow pumping in the Frontlands (para 3.04), an adequate water supply from the Canje river, about 200 cusec, would be available for this area of about 10,000 ac.

Farm Machinery

3.13 At the present time about 60% of the land preparation (plowing, discing and puddling) and harvesting in the project area is carried out with privately owned equipment. The incidence of machinery ownership is very high in Block III and while more than 300 farmers own tractors and plows in the Polder, only a few own combines. GRB attempts to provide the balance of the equipment needed for the Polder and the Frontlands from its main machinery pool and maintenance station at Joanna in the Polder; however, this would not be adequate to meet the needs during critical periods and with the higher land use intensity with the project. This creates the well known problems of delays in preparing the land, poor land preparation and untimely harvesting. Land preparation (plowing) is usually poor since the small tractors (35 hp) and disc plows are able to turn only about four inches or less of topsoil. There is a need to use heavy moldboard plows and larger tractors (65 hp) so that the topsoil could be turned to a depth of 12 inches at least once every three years. The project would include the purchase of additional machinery, primarily to service the Frontlands area. In addition a stock of spare parts would be provided for the maintenance station at Joanna in an effort to salvage about 50% of GRB's equipment which is currently inoperable. Additional tools and shop equipment would also be provided to upgrade the maintenance station. Assurances have been obtained from Government that: (a) priority would be given to the Frontlands for use of the new equipment; and (b) GRB would give consideration to purchase of suitable tractors and moldboard plows as a means to improve land preparation (Section 3.08 of Joint Project Agreement). In giving prior consideration to the need for machinery services by farmers in the Frontlands, the GRB will provide services to the smaller farmers in preference to the larger farmers. The larger farmers will be expected to obtain machinery services from sources other than the GRB.

Project Preparation Facility Advance

3.14 The Bank advance of US$280,000 to finance the supplemental feasibility study for the Frontlands and Block III would be refinanced as part of the IDA Credit for the overall project.

Environmental Evaluation

3.15 All lands in the project area are under cultivation at the present time and since the main objectives of the project are to increase the water supply to these lands and rehabilitate existing irrigation and drainage

systems, there would be no significant change in the environment. There is no evidence of waterborne diseases or bilharzia; nevertheless, the Government would be watching the situation to ensure that the project area is kept free of such diseases.

IV. PROJECT COSTS AND FINANCING

Cost Estimates

4.01 Cost estimates for the project civil works are based on estimates in the feasibility report prepared by Harza Engineering Co., dated February 1977 and revised in line with unit prices in the tenders for Contract I of the Tapakuma irrigation project (April 1977). They represent costs as of mid-1977 when construction under Tapakuma Contract I started. Costs of imported equipment at 1977 prices are estimated CIF Guyana, free of duty and taxes as the purchaser would be a Government agency. Costs of materials and equipment which would be purchased locally are based on prices of local suppliers during 1977 and those for local services for administration, engineering and supervision reflect salary levels during the first half of 1977, to which has been added the estimated cost of an official increase in minimum wage rates of 53% for 1977, 100% for 1978 and 155% for 1979, over the minimum wage of December 1976. The estimates for foreign consultants are based on costs in recent contracts for these services in Guyana and other Caribbean countries. Physical contingencies are estimated at 15% of the project base cost. Expected price increases during the six-year implementation period of the project, from 1978 through 1983, are calculated on the basis of projected inflation rates for civil works of 9% during 1977-79 and 8% thereafter. For equipment the rates are 7.5% during 1977-79 and 7% thereafter. A rate of 10% increase per year was used for consultants and local staff to be employed on the project. The estimated cost of the civil works and of the overall project are summarized in Table 5. Detailed cost estimates, an estimated expenditure schedule and the estimated requirements for local staff and cost are presented in Annex 3. The total cost of the project is estimated at US$42.8 million, with a foreign exchange component of US$27.0 million, or 63% of the total cost. Most of the foreign exchange is required for the project's civil works (50%), irrigation equipment (20%) and consultancy services (15%). The estimated total project costs include US$4.1 million for physical contingencies and US$11.2 million to cover expected price increases.

Financing

4.02 Apart from the proposed IDA credit of US$10.0 million, loans of US$10.0 million from IFAD, US$7.5 million from USAID, and US$6.0 million from IDB are expected to be approved shortly. In addition, it is expected that CIDA will contribute US$2.5 million equivalent in local currency generated from a commodity import credit now being negotiated. The terms of financing of the IFAD loan are yet to be determined, but it is expected that they would be concessional. The USAID loan would be for 20 years, with 10 years of grace, with interest at 2% for the first 10 years, and 3% thereafter. The terms and

Table 5

Summary of Costs and Financing Plan
(US$ million)

	Costs			Financing		
	Local	Foreign	Total	IDA/ IFAD	USAID	Govt. & Other Cofinancing
Civil Works	6.785	8.815	15.600	10.320		5.280
Buildings	0.559	0.241	0.800		0.800	
Equipment, including pumps	0.361	6.000	6.361	3.840	2.160	0.361
Engineering and supervision	0.667	-	0.667			0.667
Consultant services	0.297	2.715	3.012		2.720	0.292
Extension, research and seed production	0.382	-	0.382			0.382
Project preparation facility advance	-	0.280	0.280	0.280		
Feasibility study for cooperative lands	0.100	0.300	0.400		0.300	0.100
Subtotal	9.151	18.351	27.502	14.440	5.980	7.082
Physical Contingencies	1.374	2.754	4.128	2.120	-	2.008
Price Contingencies	5.234	5.970	11.204	3.440	1.520	6.244
Total	15.759	27.075	42.834	20.000	7.500	15.334
Percentage	37	63	100	46	17	37

conditions of the loan from IDB and the credit from CIDA are yet to be determined, but it is expected that they would be on concessional terms. The credit would become effective when the loan agreements with IFAD, USAID and IDB have been executed (Section 5.01 of Credit Agreement). The IFAD loan and IDA credit, totaling US$20.0 million, would be used as a joint fund to finance civil works (US$10.32 million), equipment (US$3.84 million), and project preparation advance (US$0.28 million), while the remaining amount of US$5.56 million would be unallocated. The loan from USAID would be used on a parallel financing basis to finance construction of project headquarters, operation and maintenance stations, laboratory and drying yards and paddy storage buildings (US$0.80 million); equipment and spare parts for rice production and processing, on-farm development, extension, research and seed production and administration, engineering and supervision (US$2.20 million); and consultant services for the project, including preparation of a feasibility study for development of livestock cooperative lands (US$3.00 million); the remaining amount of US$1.50 million would be unallocated. The components to be financed out of the proposed IDB loan would be finalized at loan negotiations between Guyana and IDB. In the light of this, it might be necessary to revise the list of goods covered by the IFAD loan and IDA credit. External loans and credits to the project would provide US$9 million equivalent for local currency expenditures. Of this, the IDA credit would provide US$1.5 million. A proposed allocation of the proceeds of the credit and the loans is presented in Table 6. The Government's contribution would finance US$6.83 million of local costs to cover the balance of estimated project costs. This contribution would finance US$1.6 million of local costs for staff and services for engineering and supervision; extension research, research and seed production, and the feasibility study for a Stage II project; and support the consultants and internal operational costs. An amount of US$5.2 million would be used to finance civil works local cost. The Government would be the borrower and carry the foreign exchange risk.

Procurement

4.03 Contracts for the main project works (US$15.6 million) and imported equipment (US$5.2 million) to be financed from the IDA credit and IFAD loan would be procured through international competitive bidding in accordance with the "Guidelines for Procurement under World Bank Loans and IDA Credits." Contracts for construction of a new project headquarters, service centers and other buildings and local procurement of minor items of equipment and supplies would be let on the basis of local procurement procedures acceptable to the Association. Equipment to be imported (Annex 3) would include equipment for administration and engineering, irrigation pumps, operation and maintenance, extension service, applied research, improved seed production, rice production and processing, shop equipment and spare parts. The USAID loan would finance the procurement of the administration and engineering, extension research and seed production, and on-farm development equipment and spare parts in the

Table 6

Proposed Withdrawal of the Proceeds of the Loans and Credit

	Category	Amount of Loans and Credit Allocated (Expressed in Dollar Equivalent) USAID	IFAD	IDA	% of Expenditure to be Financed
			(US$ '000)		
I.	Civil Works		5,160	5,160	66%
II.	Buildings	800			100%
III.	Equipment[1/]	2,200	1,920	1,920	
	a. directly imported				100% of foreign expenditures.
	b. imported and purchased locally				85% (the foreign exchange component).
	c. manufactured locally				90% of ex-factory cost.
IV.	Consultant Services	3,000			100% of foreign expenditures or 100% or local costs (professional salary only).
V.	Project Preparation Facility			280	100% of total expenditures.
VI.	Unallocated	1,500	2,920	2,640	
	Total:	7,500	10,000	10,000	

1/ Annex 3, pages 6 and 7, details the parts of equipment proposed to be financed by USAID, IFAD and IDA.

amount of US$2.16 million and construction of buildings (US$0.8 million). Consultant services (US$3.0 million) to be financed from the USAID loan would be under terms of reference satisfactory to the Association (Annex 3). Domestic manufacturers in Guyana would be accorded preferential treatment in bid evaluations, limited to 15% of the CIF price of imported goods or the actual tariff application, whichever is lower, and regional preferences for other members of the Caribbean Common Market (CARICOM) 1/ would be limited to 15% of the CIF price of non-regional goods or the difference in tariffs, whichever is lower.

Disbursement

4.04 The IFAD loan and the IDA credit would be disbursed against 66% of the total expenditures for project works and against 100 % of the foreign cost (CIF) of directly imported equipment, 85% of the total cost for imported equipment purchased locally and 90% of the ex-factory cost for equipment, materials and supplies manufactured locally. The IDA credit would refinance the Project Preparation Facility loan of US$280,000 made to Government in June 1976 and an amount of US$5.56 million would be unallocated in the joint fund. Disbursements would follow estimated expenditures with a six-month lag. The estimated schedule of disbursements, which is presented in Annex 3, indicates that they would be completed over about six years. The loan from USAID (US$7.5 million) for procurement of equipment, construction of buildings, and hiring of consultants would be disbursed against expenditures.

Accounts and Audits

4.05 MAG would maintain separate accounts for operations financed under the project, from both the IDA credit and the other loans. Assurances have been obtained that: (a) the Ministry of Agriculture and its dependent departments, divisions and boards would maintain separate accounts for the project and for each of the main components; (b) these project accounts would be audited annually by an independent auditor satisfactory to the IDA and IFAD; and (c) the audited accounts, together with the auditor's report, would be submitted to the IDA and IFAD within six months of the close of each fiscal year (Section 4.02 of Joint Project Agreement).

4.06 In addition to the conventional financial audit, the auditor's report should cover matters such as whether:

(a) the goods and services have been procured in accordance with the conditions set out in the loans and credit agreements;

(b) the goods have been received or work performed;

1/ Caribbean Common Market is composed of Antigua, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Montserrat, St. Kitts-Nevis-Anguilla, St. Lucia, St. Vincent, and Trinidad and Tobago.

(c) Payment has been made; and

(d) the goods or services are eligible for financing under the loans and credit agreements and have been used in the project.

V. ORGANIZATION AND MANAGEMENT

Project Organization

5.01 MAG would be the executing agency for the project and have responsibility for all the principal activities to be undertaken on the project. This responsibility would be administered through the several departments, divisions or boards within the Ministry which have specific competence for irrigation and drainage and agricultural development throughout the country as well as in the project area. The project components for which these divisions or boards would be responsible are as follows:

(a) Drainage and Irrigation Board (D & I Board) - The D & I Board was designated as the legal entity under the Drainage and Irrigation Ordinance of 1953 for policy formulation, administration and management of irrigation and drainage development. The ordinance empowered the D & I Board to have sole control for planning, implementation and management of irrigation and drainage works, but in reality the Board functions under the direction of the Minister of Agriculture as a policy advisory group and fulfills certain legal requirements, as established in the ordinance, such as declaring developed areas to be declared irrigation and drainage areas. In these areas the D & I Board has authority to operate and maintain the works, schedule and control water deliveries and collect project charges. The Polder, Block III and a part of the Frontlands are declared areas at present and the balance of the Frontlands would become so with implementation of the project. The ownership of all works and lands occupied by works is vested in the Board.

(b) Hydraulics Division - The Hydraulics Division would have direct responsibility for engineering planning, construction of project works, and operation and maintenance of works, tasks which this division is presently fulfilling on other projects in the country as well as on existing works in the project area. The Hydraulics Division would be assisted in implementation of the project by a team of consultants in the same manner the Tapakuma project is presently being executed. The division would appoint a Project Engineer as its official representative on the project and provide the necessary support staff to work with the consultants on investigations and surveys, planning and design, and supervision of construction (Annex 3). The Chief Hydraulic Officer would represent the Ministry for management of the engineering and construction phases of the project and serve as "Contract Engineer" for the administration of construction contracts.

(c) Extension Division - This division of the Agricultural Department in the Ministry would have responsibilty for the extension and training programs on the project and for the agricultural research program for crops other than rice. At present this division has a senior Agricultural Officer serving the East Berbice region and an Agricultural Office with three assistants working in the Polder. The extension and research programs on the project would be patterned after similar programs now underway on the Tapakuma project which are proving to be effective. Since Guyana does not have a national extension service at present, the main task of the Extension Division would be to train extension workers and create a permanent extension unit to serve the area. This unit would become a part of the national service when it is established but there is a need to provide this assistance to farmers during the course of the project (1978-83) if the objectives and goals are to be met. This training program would be coordinated with the rural training center to be established in the Polder under the Bank-financed Second Education Project (para 3.08) and the national Agricultural Extension In-service Training and Communications Center to be established under MAG.

(d) Land Development Division (LDD) - The Land Development Division would continue to be responsible for administration of settlement schemes in the project area, of which the Polder is the main one. These schemes comprise groups of settlers farming land leased from the Government, and the LDD assists with selection and settlement of the farmers, provides technical assistance on crop production and farm management, performs on-farm development, helps farmers to obtain credit and inputs and cooperates with the Hydraulics Division on water management and collection of project charges. The chief of the LDD in the Polder is presently serving as Project Manager for the Polder. This arrangement would be continued with the project.

(e) Lands Department - The Lands Department administers registration of titles on freehold land, the leasing of Government land and the collection of rents and land taxes.

(f) The Guyana Rice Board (GRB) - GRB is a semi-autonomous organization which exercises considerable independence in its budgetary and physical operations, but which is part of MAG and comes under the supervision of the Minister of Agriculture. The activities of GRB under the project would include: an agricultural credit program to supply fertilizers, chemicals, and other inputs to rice farmers; machinery services for land preparation and harvesting from their machinery pool; drying, storage and milling of rice;

a research program for varietal improvement; production of foundation seed and multiplication for supply of pureline seed to farmers; technical assistance for pest and disease control, introduction of improved varieties and production practices; the cleaning, grading, blending and packaging of rice for both export and local consumption; and the marketing of all milled rice, except that retained by the farmers for their own use. Assurances have been obtained that Government would cause GRB to carry out these functions as required to achieve the objectives of the project (Sections 3.06, 3.07 and 3.08 of Joint Project Agreement).

5.02 MAG would appoint a Project Manager who would have authority to supervise and manage field activities and operations and, specifically, to coordinate the participation of the departments, divisions and boards in the project. The Project Manager would be under the authority of the Minister of Agriculture and his appointment would provide administrative authority for operation and management of the project at the project level. His authority would extend to the three project units (Frontlands, Polder, Block III) and the present Project Manager in the Polder would continue in that post, but under the supervision of the new Project Manager. This would include all activities carried out by MAG with the exception of those which are the direct responsibility of GRB and under the supervision of the GRB Regional Manager, whose office is in Corriverton. The Project Manager would, however, have authority to consult with the GRB Regional Manager in order to obtain better coordination of land preparation and harvesting with irrigation schedules; to increase the use of improved varieties; to facilitate the availability of credit, seed and inputs for the farmers; and to generally improve the standards of GRB's operations. The Project Manager would work closely with the consultants during the project implementation period but the position would be permanent. Local staff requirements to be provided by Government for administration, engineering and supervision of the project and for agricultural development are presented in Annex 3. A proposed organization for the project is presented in Chart 17522 in Annex 4.

5.03 The Minister of Agriculture, through the Hydraulics Division, would appoint a Project Engineer who would work with the consultants and represent the division on technical matters during the implementation period and, following completion of construction, would supervise operation and maintenance (O & M) for the three project units, particularly for scheduling the operation of pumping plants and delivery of water as required to the project areas. The Project Engineer, who would be under the administrative supervision of the Project Manager, would also supervise overall maintenance activities and the two District Engineers now located at Whim and Benab who are responsible for O & M in the Polder and Block III, respectively. The station at Whim also performs a limited amount of work in the Frontlands. These two engineers with their staffs and equipment would continue to operate as at present; however, the O & M facilities would be expanded and improved under the project (para 3.05). Assurances were obtained that suitably qualified persons would be appointed to serve as a Project Manager and Project

Engineer on terms and conditions satisfactory to IDA and IFAD. Appointment of a Project Manager and Project Engineer would be a condition of credit effectiveness (Section 5.01 of IDA Credit Agreement).

Project Implementation

5.04 A team of consultants, from both local and foreign firms, would be contracted to perform the engineering work required to implement the project, including surveys, site investigations, technical studies, planning and final designs, construction drawings, specifications and tender documents, and to supervise contruction. This team would be supported by local staff supplied by the Hydraulics Division (Annex 4). The construction of major project works would be by contract, most likely by a foreign contractor with small local firms as sub-contractors. On-farm works would be executed directly as a force account operation by the Hydraulics Division, with equipment provided under the project, or under contract to local firms who would basically supply skilled and ordinary labor and use Government equipment. The Hydraulics Division would administer and provide general supervision of all engineering work and construction through the Project Manager and Project Engineer. The agricultural development programs, specifically for extension and applied research, would be implemented by MAG assisted by consultants. GRB would cooperate in these programs and would supervise the use of the additional farm machinery provided under the project, the seed production program, and construction of the additional drying and storage facilities.

5.05 It is estimated that implementation of the project would require about six years, i.e., from mid-1978 to June 1984 (Chart 17521 - Annex 4). With approval of the credit by mid-1978, it should be possible to have the consultants on the project by the second half of 1978. Allowing 12 to 18 months for surveys, site investigations and design, the first contracts for construction of the Berbice and Manarabisi pumping plants could be let near the end of 1979. This would allow a full four-year period to complete construction of the project works, and activities on the agricultural development program would be carried out concurrently. It is estimated that the construction phase would be completed by the end of 1983 and full development of agricultural production would be reached in 1985.

Participation of Other Agencies

5.06 The AGBANK would provide medium-term farm development loans to farmers in the project area. The loans would be mainly for crops other than rice and could include funds for purchase of farm machinery. The AGBANK provides supervision of credit and some assistance to farmers on management planning, mainly to private owners, since farmers on State leased land usually are given this assistance by MAG through the Land Development Division. The Guyana Marketing Corporation (GMC) would provide assistance in the distribution and marketing of food crops, as part of its national responsibility to improve the supply of food to local consumers.

Project Monitoring

5.07 Monitoring of the project would form an integral part of the project. To set up a monitoring system for the project, the Government of Guyana, after proper study, would submit a request to IFAD for technical assistance. Assurances were obtained that the Government would send to IFAD and IDA proposals as early as practicable, but, in any event, not later than December 31, 1978, for establishing a satisfactory monitoring system for the project (Section 3.09 of Joint Project Agreement).

VI. AGRICULTURAL PRODUCTION AND FARM BUDGETS

Areas Cultivated and Cropping Patterns

6.01 Present land use and proposed cropping patterns for 29,600 ac of arable land in the Frontlands, 19,400 ac in Block III, and 4,000 ac in the Polder which would benefit directly from the project are shown in Annex 5. Of the latter, improvements in canals and distribution ditches would allow 2,500 ac of the higher areas to be fully irrigated, and improvement of drainage in 1,500 ac adjacent to the villages would increase the productivity of the food crop holdings as well as the cropping intensity for fruits, vegetables, ground provisions and pulses. The 12,900 ha presently cultivated in Block III would benefit from an increased water supply which would increase production through more double-cropping.

6.02 The project would provide full irrigation to the Frontlands, including 6,500 ac of lands lying between the areas of reef soils which at present are not cultivated. The total rice lands would increase by 6,200 ac and food crop lands by 300 ac, mainly on reef soils. Coconuts are grown only on the reef soils which are too high to receive water from the irrigation systems unless expensive sprinkler systems are used. This would not be justified in the foreseeable future and these areas would remain largely unchanged during the life of the project. Sugarcane is grown mostly by small farmers on 1,000 ac in the western portion of the Frontlands and delivered to the Albion mill. This area would not change significantly as a result of the project, but more irrigation water would be made available during the dry months.

6.03 The cropping intensity for all cultivated lands in the project would increase, as a result of improved irrigation and agricultural practices, from the present level of 106% to 146%. There would be no significant change in coconuts and sugarcane production but cropping intensity in rice would be expected to increase from 110% to 154% as a result of a full water supply for irrigation during both the autumn and spring cropping seasons. Food crops at present reach an intensity of 180% on the lighter soils of Block III and 140% in the Frontlands, but it is only 50% on the heavier soils in the Polder, where poor drainage conditions prevail. On these soils the intensity would be expected to increase to 104% with the project. However, with the 1,500 ac of food crops in the Polder, representing 65% of the total food crops area in the project (2,300 ac), the cropping intensity for the combined food crops area would increase with the project to 116%.

Crop Yields

6.04 The projections for yields without the project represent small increases except for rice (para 6.05). Potential improvement of crops other than rice would be inhibited by the uncertainties of water supply, drainage problems and adverse weather conditions. Projected crop yields with the project are conservative and would therefore be expected to be achieved. Benefits from assured water supplies with irrigation, improved drainage, and land leveling have been taken into account. However, to maintain a conservative estimate, these yields do not reflect the use of optimum fertilizer rates, together with introduction of high yielding varieties and improved farm management. With increased fertilizer availability from GRB, a successful program to promote block planting in rice production, better supporting services, adequate credit, and better land preparation, yields higher than those used in the projections would be attainable. With the favorable spring seasons in 1977, higher rice yields have already been achieved by some growers with the new rice varieties.

6.05 Rice. Rice yields in Guyana are expressed in terms of 140-lb bags of paddy (16 bags per long ton) per ac. For various reasons, among which the price paid to the farmers is considered to be the most critical, average rice yields per crop gradually declined from 13.6 bags/ac in 1965 to 10.5 bags/ac in 1973. Government increased the fixed price of paddy in 1973 because of higher world prices and yields increased to an average of 13.0 bags in 1974/75, not only due to better prices, but also because of the introduction of the variety "Starbonnet" from the United States in the early 1970s. This was done partly to increase production but also to improve rice quality for the export market. Starbonnet at present occupies about 80% of the rice lands in the project areas, with traditional varieties being grown on the rest, except for limited areas of the new variety "N" which was developed from an IRRI cross at the MARDS research station. Compared to world standards, rice yields in Guyana are low but with the introduction of variety "N" and others to follow, it can be expected that yields would increase by about 27% even without the project. With the project and additional nitrogen fertilizer, yields are estimated at 20 bags/ac, (1.3 tons/ac or 3.2 tons/ha), an increase of 54% over present conditions and of 27% over the projections for the future without the project. In the past 13 years, the spring crop has yielded 26% less than the autumn crop due to a greater use of traditional varieties in the face of the uncertain availability of water, the expectation of adverse weather, the application of low fertilizer rates because of these hazards, and the inclusion of drop-seed crops in the yield results. With the project supplying full irrigation for the spring crop and the greater potential due to more sunshine hours, the projected yields indicate that the spring crop would produce 14% more than the autumn crop.

6.06 Food Crops. The diversity of food crops grown in the project areas required the use of the weighted average method for yield and price determinations. The food crop groups and the corresponding percentage of the project area they occupy are shown below.

Food Crop Group	Percentage of Area in Food Crop
Fruits	34
Vegetables	43
Ground Provisions	8
Legumes (Blackeyed peas)	15
Total	100

Food crop yields without the project are expected to increase by about 4% but with the improved drainage provided by the project in the Polder, yields would increase by about 18% over those at present. The overall proportion of the different food crops is not expected to change as it has already adjusted to market demand.

6.07 Sugarcane. Yields of sugarcane have declined somewhat in the two major cane growing areas in Guyana during the past 10 years, particularly in small farm holdings (5 ac or less). The overall area in sugarcane would not change with the project but it is assumed that yields would increase from 3.2 tons of sugar per ac to 3.6 tons. At 11 tons of sugarcane per ton of sugar, this would represent an increase of 4.4 tons of sugarcane per ac as a result of more reliable supplies of irrigation water in the drier months when moisture stress can reduce yields. Yields of sugarcane of more than 40 tons per ac have already been attained by larger growers in the area and it is reasonable to assume that the expected benefits from the project to smaller growers would easily be realized.

6.08 Coconuts. Coconut yields have declined during recent years in the project area for a variety of reasons. The plantations are often under-planted with competitive fruit trees, ground provisions and other crops and cattle are allowed to graze in parts of the areas; the trees are 30 to 40 years old and dead trees are seldom replaced; weed control is negligible; fertilizers are rarely used; and insects are not controlled. Irrigation of these groves would not be justified and there is no assurance that these lands would be converted to new coconut groves or other crops within the foreseeable future. Local demand for coconut production is still good, however, and for the purposes of the project it has been assumed that growers would maintain present yield levels.

Production Costs

6.09 Agriculture in the project area, particularly in rice production, is characterized by extensive mechanization for land preparation and harvesting. Fertilizers are obtained from GRB at subsidized prices for rice and food crop production and pesticides are applied, although not as frequently or consistently as would be desirable. Hand labor is used mainly at planting and harvesting time and 85% of the labor required is supplied by family labor.

Both hired labor and family labor have been priced at G$ 8.00 per day, an average price for the project area. Total cost of production per ac of rice under present conditions is estimated at G$ 160.15, including land preparation, seeds, fertilizers, pesticides, harvesting, bags, transport, drying, family labor and interest. The same cost with the project is expected to increase to G$ 238.85. For food crops the present total cost per ac is G$ 765.20, the higher cost due mainly to additional costs of fertilizers and higher transport and packaging costs for the Georgetown market. With the project, total costs of production are expected to rise to G$ 931.53 per ac. Sugarcane production costs are intermediate between those of rice and food crops, although costs of fertilizers and pesticides, as well as land preparation, are somewhat higher; transport and labor costs are considerably less than in the case of food crops. Total production costs per ac of sugarcane are estimated at present at G$ 421.90 and with the project are expected to increase to G$ 467.10, the increase representing the additional harvesting and loading costs resulting from increased yields.

Production Features in the Project

6.10 Almost all of the project efforts in variety improvement would be devoted to rice. The horticultural station in the Polder is at present supplying virus-free seed and improved varieties of vegetable crops but would need more support and help from the Government in the future. Traditional rice varieties are expected to be replaced by new varieties that have good quality along with other desired features. Variety "N," which is a short, stiff strawed, nitrogen-responsive type is expected to be grown on at least 80% of the project areas as soon as irrigation water is available, with Starbonnet occupying the remaining 20%. This new variety has good blast resistance, its quality is reputed to be almost as good as Starbonnet, and it is a non-photosensitive, early maturing rice. Two new lines (77916 and 75698) are being increased in 1977 for release in 1978. These lines have better blast resistance than variety "N" and better yielding ability. All new releases would meet or improve the quality standards of Starbonnet and improved blast resistance would help to allay fears that more nitrogen fertilizer would cause heavier blast infections.

6.11 Seed Quality and Supply. There are no laws controlling seed purity in Guyana and almost all of the rice seed in the country is produced by GRB through contracts with a few private growers. Foundation seed is produced at MARDS and this is supplied to contracted growers for multiplication into what is considered pureline seed, but it normally is of low quality. There are plans to produce from 600 to 1,000 ac of rice seed on the Rice Improvement Farm in the Polder, enough to supply 50% of the acreage in the Polder, the Frontlands and Block III, allowing growers to obtain new seed every other crop, or once a year, which is more frequent than in other rice areas in the world. The quality of seed produced in the Polder farm has been good in recent years, but efforts would be made to provide, besides varietal purity, a seed which is free of red rice and weed seeds. Other aspects of seed growing which would be taken into consideration in operating the farm are the fallowing of

fields to eliminate weeds in preparation for planting a variety, a suitable scheme of rotations to produce several varieties and planting in head rows for better rogueing for red rice. Enough equipment for proper seed bed preparation is already available so that weeds and red rice could be controlled with proper management. The proposed support of the seed program under the project is outlined in paragraph 3.09.

6.12 Fertilizers. Nitrogen is one of the most important factors in attaining high rice yields, especially with the IRRI varieties or crosses such as "N." In the project areas not all farmers have been using fertilizers, particularly with traditional varieties, but the majority do use them, at least at low rates. Farmers growing improved varieties use as much fertilizer as they are able to procure from GRB, usually one 112-lb bag of urea or 50 lb of nitrogen per ac. A few of the farmers obtain a little more but from experience in other countries nitrogen-responsive varieties should have twice this amount. The growers' usual practice is to use one-half bag (56 lb) of Triple Superphosphate (TSP) with one bag of urea, a practice that should be continued because soils in the project area are low in phosphate. One aspect which would be studied under the project's component of applied research and fertilizer response studies (para 3.07) is the effect of sunshine hours, both during the spring and autumn crops, upon the optimum rate of nitrogen use by the new varieties. These determinations of the most efficient use of nitrogen are important in Guyana where all urea has to be imported. Methods would also be sought to incorporate the urea into the soil at depths of 3 to 4 inches before planting since the present practice of applying all the urea in the water on top of the soil results in serious losses of nitrogen through denitrification. Vegetable crops also require fairly high rates of nitrogen but at present the use of fertilizer in these crops is limited to about the same level as for rice, since larger amounts are not made available to vegetable growers. In view of their contribution to the incremental income under the project, this problem would receive special attention from project management.

6.13 Pest Control (insects, diseases and weeds). The staff of GRB and of MAG responsible for providing farmers with assistance in pest control is at present inadequate. The extension component of the project (para 3.08) would alleviate this problem until a nation-wide extension service already under study could be successfully established. At present farmers apply two or three insecticide treatments but if all pests occur, a four to five treatment program would be required for full control. The main problem is for farmers to recognize the danger early enough to treat for insects before the economic damage level is reached. Vegetable growers are at a disadvantage because Government procurement is geared to pest control in rice and they cannot always obtain the required chemicals or in the quantities needed and, consequently, they suffer significant crop losses. The present level of fungicide use on rice to control blast is low and applications are late. Under the project, the increased use of higher blast-resistant new varieties and efforts to apply fungicides on a preventive basis would help solve these problems. Another aspect of pest control which would receive special attention is the control of red rice, muraina grass, and other weeds through better leveled fields, proper

water management, and good seed-bed preparation. The ability of the new varieties to grow through four inches of water, allowing continuous flooding after seeding, would be an important contribution to effective weed and red rice control. Propanil is highly subsidized in Guyana for weed control and 2-4-D is an economic chemical even without subsidy, but at present both of these chemicals are seldom used by rice farmers. Propanil is an effective control of muriana grass which offers strong competition to rice, once it is established, but timing of application is extremely critical. Effective use of these pesticides would receive increased attention under the project.

6.14 Mechanization and Land Preparation. Rice production is highly mechanized in the project area where only an average of 3.5 man-days of labor per ac per crop is used, mainly at seeding time and at harvest, with very little weeding and rogueing done by hand. Although family labor is available during the growing season, much less is done in the way of crop management and care than would be desirable. Many of the farms are too small to justify ownership of tractors and these smaller farms must rely on custom work for land preparation and harvest. The project would provide assistance to improve tractor service in the project area since inadequate land preparation constitutes a basic cause for low yields. The extension component of the project (para 3.08) would assist in implementing a system of planting by blocks of farms, thus facilitating water control, better land preparation, uniform variety use and better utilization of equipment. However, due to the small size of some of the farms, farmers would continue to depend on the use of custom hire operators or on the GRB equipment pool, and the efficiency of these services would have a definite effect on the yields that could be attained.

6.15 Farm Labor. Although most rice operations are mechanized, a small amount of hired labor is required at planting and harvesting times. Family labor is underutilized on the rice crop but has a good potential and is utilized more on the food crops. Some of the labor in the project areas, particularly in the Frontlands, is used in the fishing industry, at least part of the year, but there is sufficient unused manpower available to supply the additional labor that would be required with the project.

Production and Value

6.16 Total annual agricultural production in the project areas under without project conditions has been estimated at 34,568 long tons of rice, 3,200 tons of sugarcane, 4,087 tons of food crops and 5.75 million coconuts with a total net value of G$ 6.5 million (US$2.5 million). These figures, with the project, would be expected to reach 67,541 tons of rice, 3,600 tons of sugarcane and 9,248 tons of food crops, with coconuts remaining at the same level and the total net value of production reaching G$ 12.1 million (US$4.7 million). This increase would result from higher intensity of land use, bringing non-cultivated lands under cultivation, higher yields, improved water supply and drainage, improved seed, and better farm management, and would represent an incremental net value of production of G$ 5.6 million (US$2.2 million) as presented in Annex 5.

6.17 Increases in rice production are based on present average yields of 13 bags per ac per crop which would be raised to 20 bags per ac per crop. Sale price of paddy rice has been assumed to be constant since it has been fixed by GRB and is not expected to change in the near future. Net value of rice production per ac per crop can be expected to increase from G$ 80.35 under present conditions to G$ 135.90 with the project. Since the use of new varieties would increase the net value of production per ac per crop to an estimated G$ 105.90, the actual incremental value per ac due to the project would be G$ 30.00, or 28% over the future value without the project.

6.18 A determination of weighted yields (para 6.06) of food crops in the project area shows present production to be 3.22 tons per ac per crop. With the project and through improved irrigation and particularly drainage in the homestead lots in the Polder, these yields would be expected to increase to 3.79 tons per ac per crop. While this increase appears to be small in terms of volume, net value of production would increase from G$ 1,526 under without project conditions to G$ 1,698 per ac per crop with the project, an increase of 11%. Although food crops occupy only 5% of the cultivated land in the project area, they would contribute 34% of the incremental value of production with the project.

6.19 Production of sugarcane would increase only slightly with the project as a result of increased availability of irrigation water during dry periods (para 6.07). Incremental value of production per ac would be G$ 65.50, or 14% over the value without the project.

Farm Budgets

6.20 The size of farms in the Polder is uniform since the land was parceled out as a land settlement scheme. In the Frontlands and in Block III it is more difficult to determine representative farm sizes because holdings are quite varied in size and modality (para 2.12 and Table 1). In these two areas, 83% are 10 ac or less and 58% are in the group of up to 5 ac, corresponding to the small or subsistence type farms from which the 3.5-ac farm budget presented in Annex 5 has been selected as representative. An 8-ac farm budget (Annex 5) has been chosen as representative of the large group of medium-sized farms. In the Polder, the typical 15-ac farms also include 2.5-ac homestead plots for food crops near the villages. Since 65% of the food crops produced in the area would be grown on these farms, the largest proportion of food crops are included in the corresponding farm budget (Annex 5). In the smaller 3.5- and 8-ac farm budgets, food crops were included to better utilize family labor while, on the other hand, no food crops were included in the larger 28-ac farm budget (Annex 5) where family labor would be more fully utilized in rice production. This farm budget represents the large farms in the project area or it may also represent a typical family holding where the father owns a larger acreage but it is actually farmed by several sons as individual operations using the same equipment and labor.

6.21 Some yield and input differences can be observed in the four farm budgets, viz., smaller farms have slightly lower yields of rice due to dependency upon custom or GRB equipment for land preparation and harvesting, and the timeliness and quality of this work would affect the yields. For these reasons, they would tend to use less fertilizer, but, on the other hand, would give the crop better care in pest control, weeding and application of fertilizers and would not need hired labor. It has been assumed that all farms would use improved varieties of rice irrespective of size. In food crop production, the same principles would apply, resulting in higher yields for smaller farms than for the larger farms. Land preparation has been assumed to cost less per unit for the 28-ac farm or even for the 15-ac farm than for the smaller farms because these larger farms would either own their own tractor or have access to family-owned or a neighbor's tractor. The 28-ac farm would tend to use more fertilizer and have less problems of procurement. Pest control programs would be less intensive in these larger farms because of the problems of coverage with the hand equipment; however, this would not be a problem on the smaller farms.

VII. MARKETS, MARKETING AND PRICES

Market Situation

7.01 Rice. Guyana's membership in CARICOM has insured substantial market outlets, accounting for 95% of rice exports, an average of about 70,000 tons during 1975 and 1976. The Agricultural Marketing Protocol, a mechanism created by CARICOM, facilitates trade flows among member countries. Export prices are negotiated annually and have remained almost constant since 1975 despite world market prices falling substantially. At present the negotiated price is some 30% above the prevailing world market price.

7.02 The volume of rice exports has largely been determined by the availability of a marketable surplus. The slow export growth is attributed to internal factors affecting the rice industry rather than market limitations. First, paddy output fluctuated significantly in response to pricing policies, particularly in the mid-1960s when both acreage and productivity declined substantially. In addition, recurrent droughts and floods affected the level of output thus depressing the marketable surplus. Second, the quality of rice has been below international standards, containing a high proportion of foreign material and red rice. With increasing per capita income of the principal trading partners, Jamaica and Trinidad and Tobago, demands for better quality rice were met by suppliers from the United States. A breakdown of rice purchases, exports and domestic sales is presented in Annex 6.

7.03 Despite recent improvements in the quality of rice exports it is not expected that CARICOM will continue to absorb the bulk of Guyana's rice exports at the present level of prices. The recent economic difficulties of many CARICOM members and the resulting imposition of trade restrictions within the major CARICOM markets appear to indicate that preferential price treatment for Guyanese rice is unlikely to be given to the same extent as in earlier

years. Nevertheless, the current annual import requirement of CARICOM is 150,000 tons, with Canada, Cuba and other Central and South American countries importing a further 250,000 tons. The project is estimated to increase production and exports of milled rice by 21,000 tons by 1985, bringing total rice exports for Guyana to approximately 200,000 tons. Projected demand increases both within the Western Hemisphere and the rest of the world of 2.4% per annum should ensure Guyana suitable markets provided an aggressive marketing strategy is adopted.

7.04 In order to guarantee an expanded steady supply of rice exports at a high quality, the marketing infrastructure will have to be strengthened. With only one domestic and export marketing channel, the country's annual production of rice is purchased and sold solely by GRB. Farmers have the option of delivering paddy or milled rice at prices fixed by the Board. The predominance of private millers has given them an indispensible role in the marketing mechanism. The deteriorating state of these private mills coupled with low profit margins has led to poor quality milling. Often GRB must remill, clean and blend the rice delivered to its warehouses. In order to maintain acceptable quality requirements for the export markets, GRB incurs considerable marketing and processing costs. Unless a program is launched to offer some support either through improvement of the profit margins or opening of credit facilities to rehabilitate and modernize the private mills, GRB would have to absorb the current high cost of processing which affects its future competitiveness in the open world markets. Other measures required to improve efficiency in rice marketing would involve immediate expansion of storage and drying facilities as discussed in paragraph 3.06. Existing storage and drying facilities in the project area lend themselves to crop losses and quality deterioration. Since improvement in quality is essential in future rice export performance, these additional facilities would augment other complementary measures. Finally, GRB should initiate export shipments directly from rice producing areas as they are currently doing from Corriverton. This practice would not only eliminate double handling when the rice is shipped to Georgetown but also reduce transport costs. Furthermore, introduction of bulk storage and transport could cut the cost of handling the rice in bags. Assurances have been obtained during negotiations that Government would assist in the improvement and expansion of rice mills in the project area and shall, for this purpose, take measures adequate to enable the provision of credit facilities, on reasonable terms, to owners of these mills and take all action necessary to maintain reasonable returns for rice milling that will permit improvement in the quantity and quality of rice milled in the project area.

7.05 Food Crops. Fruits and vegetables produced in the project area are either consumed domestically or add marginally to export supplies. The markets for these crops are largely Georgetown and the coastal towns. The GMC (para 2.24), the agency responsible for food crops distribution, is strengthening its services to cater primarily to domestic markets. 1/ However,

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1/ The marketing capacity of GMC is limited to major food crop growing areas and absorbs only 40% of total production.

increasing internal demand for food has not stimulated production significantly and the incremental output of 5,200 tons of food crops from the project would be easily absorbed and would contribute to Guyana's becoming more self-sufficient in food supply.

7.06 The GMC has a weekly collection schedule for the project area when farmers can dispose of their produce at guaranteed fixed prices. Other marketing channels include the small traders whose presence is felt strongly during times of excess demand and, by bidding higher prices, they monopolize the market. Additional marketing facilities to accommodate the incremental output from the project area would be warranted at full development and the GMC has plans to open a central warehouse for farmers to dispose of their products regularly.

7.07 Sugar. With nationalization of the two major sugar companies, the newly created GUYSUCO (para 2.24) has taken over production and distribution. GUYSUCO has retained the services of Bookers' Associates to assist in management of the sugar estates and export marketing. The additional output from the project would easily be absorbed in the existing markets and the established channels are adequate.

Prices

7.08 The market mechanism in Guyana has a secondary role in determining prices. Essential consumer products like rice, wheat, edible oils, sugar and other food crops are subject to Government price control. While the Government's intervention to stabilize food prices has eased the domestic inflation rate, it has resulted in a heavy burden on public revenues. It is estimated that over 12% of annual current revenue is allocated to subsidize both consumers and producers. The depletion of foreign exchange reserves in recent years has forced Government to introduce austerity measures by eliminating or reducing subsidies for transport, rice, wheat flour, electricity and stock feed. However, sugar and edible oils are still highly subsidized. A summary of economic and financial prices for all commodities produced in the project area is presented in Annex 6.

7.09 Rice. The process of fixing domestic prices of both paddy and milled rice is complex and involves primarily the GRB, the Rice Action Committees and the Rice Producers Association. Upon the recommendations of these organizations, the Cabinet Ministers establish prices for different grades of both paddy and milled rice, as well as the retailer's margin for the internal market. Since 1974, rice and paddy prices paid by GRB remained unchanged except for a few selected grades. 1/ In the meantime, however, export prices rose between 1974 and 1976. A comparison of producers and export prices would indicate that the latter have been growing at a faster rate than the former. As a result, GRB's profit margin, after allowing for

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1/ Incentive prices of G$ 1.00 per bag of paddy and G$ 2.00 for milled rice have been in force since 1976.

the costs of processing and marketing, is estimated at an average of G$ 12.30 per bag of paddy in 1977 prices. Although this price differential accrues to GRB, it is used to support the subsidy programs for production inputs, domestic sales and research and to cover operation and management costs. Domestic consumers used to receive a price subsidy of 40% which GRB absorbed as part of its operating costs; this subsidy was eliminated with effect from February 1, 1978.

7.10 To derive the farmgate price for the economic evaluation of the project, it is assumed that the incremental production of rice would be exported at a price equivalent to the prevailing world price of rice, which, in 1977 prices, FOB Georgetown, is estimated to be G$ 1,171 per ton (US$390) by 1985. A farmgate economic price of G$ 852 per ton (US$284) is estimated after deducting marketing and processing costs.

7.11 Food Crops. Since it is assumed that the incremental production of food crops would be marketed domestically and not considered as import substitutes, no attempt was made to estimate export prices. Comparisons of vegetable prices in urban centers of Guyana and other Caribbean countries show no significant price differences, with the exception of cabbages and blackeyed peas, which are in strong demand in Jamaica and Trinidad and Tobago. However, the absence of regular shipping services in the CARICOM area, particularly facilities for perishables, Guyana's current deficit in most foods and self-sufficiency in other CARICOM countries would make it unlikely that Guyana could enter these markets. For the purpose of the economic and financial analysis, a weighted average price for fruits and vegetables of G$ 694 per ton has been derived, based on domestic market conditions. It is further assumed that in real terms the price will remain constant.

7.12 Sugar. The Bank's commodity price projection for sugar shows an upward trend from the 1976 price level. In 1976 Guyana' export earnings from sugar were at their lowest in several years due to a combination of falling prices and bad weather; however, Guyana's contractual arrangements under the Lome Convention maintained prices above world market quotations. Only 19% of the total export volume was shipped to North American markets and sold at lower world prices. Following the Bank's commodity price forecast, the economic price equivalent at the farmgate for sugar sold on the world market would increase, from G$ 695 per ton in 1977 to G$ 868 per ton in 1980.

7.13 Farm Inputs. All fertilizers must be imported and the cost is an important factor in the overall production cost. According to the Bank's commodity price forecasts, the economic prices of both urea and Triple Superphosphate (TSP) would gradually increase at an average annual rate of 5% between 1977 and 1980. A projection of prices based on CIF Georgetown quotations is shown in Annex 6.

VIII. FINANCIAL ANALYSIS

Financial Management of GRB

8.01 GRB is the principal institution through which Government deals with the rice subsector and it has been entrusted with key functions in the areas of production, marketing and price policy. It is difficult to assess its present financial position as its audited accounts are available only up to 1974. This information, together with unaudited figures for 1975 and 1976, is presented in Annex 7. These data indicate that GRB's financial position has recently been under strain, with its annual surplus declining from G$ 9.35 million in 1975 to G$ 3.37 million in 1976 and turning into a deficit of about G$ 2.4 million in 1977. Operating and development expenses as a percentage of sales increased from 21% in 1975 to 28% in 1976. The volume of borrowing has been rising, both in the form of overdrafts to finance the rising level of stocks and of long-term loans from the USAID and Government to finance capital expenditures for expansion and renovation of rice mills, silos and agricultural machinery. The Cabinet, upon the recommendation of the GRB, the Rice Action Committees and the Rice Producers Association, establishes the buying and selling prices and the levels of subsidies to farmers and consumers on the two public policy considerations of providing reasonable incentives for rice production and keeping in check increases in cost of living. The fiscal implications of GRB's operations have not always been clearly perceived in the absence of up-to-date detailed and audited accounts, but it was becoming increasingly doubtful whether GRB could meet, as envisaged under Government policy, all its operational and developmental expenses, including subsidies, from its own income. An important step was taken, from this point of view, with the recent elimination of the consumer subsidy which had amounted to G$ 7.5 million in 1977 and had been a major cause of GRB's financial weakness. Another key factor in this context is the existing marketing arrangement with CARICOM, as Guyana obtains at present a preferential price for its rice from these countries. It is this higher price which has helped GRB meet the cost of its support to the rice industry, including the subsidies and the provision of research, extension and other services, and cover operating losses in its rice mills. Given, (a) the uncertainty about the continuation of the premium prices on the CARICOM market; (b) the growing capital requirements, estimated at about US$16.6 million for the four-year period ending 1981, for maintaining and expanding the infrastructure sufficiently to handle the substantially increased production expected to result from the various irrigation projects; and (c) the existing fiscal and foreign exchange constraints in the country, it is of the utmost importance that GRB should be so managed, based on appropriate price and marketing policies and adequate operational efficiency, that it can assist and develop the rice industry from its own resources, as indeed is contemplated under Government policy.

8.02 Assurances were obtained under the Tapakuma Irrigation Project Loan Agreement (Loan 1016-GUA) that GRB would establish a separate reserve out of profits on export sales for stabilizing the price paid to rice farmers and

covering costs of replacement and repairs of its farm machinery and rice processing equipment. GRB has not yet created this special fund which was intended as a means to reduce the impact of fluctuations in the international rice price on farmers' income and production incentives as well as on GRB's financial viability. GRB's assumption has been that its general reserves would suffice for the purposes in view but this is increasingly open to question in the light of the recent weakening of GRB's financial position. In view of the crucial role played by GRB in the rice industry, which, in turn, is of strategic importance to the country, and the fiscal implications for the Government of GRB's operations and financial position, assurances have been obtained that GRB would prepare and implement a plan for the improvement of its accounting system and financial management, so as to provide detailed and up-to-date data to its management and to Government for assessing the financial results and implications of its policies and determining, from time to time, the steps necessary for ensuring its financial viability and operational efficiency. Assurances have also been obtained that its audited financial accounts for the years 1974/75, 1975/76 and 1976/77 would be furnished to IDA not later than the end of 1978, and the audited accounts for 1977/78 not later than June 30, 1979 and that its financial accounts for every subsequent financial year would be furnished to IDA within six months of the close of the year and that effective measures, including the provision of qualified staff and other personnel in the form of technical assistance, would be taken for improving GRB's accounting system and financial management and updating its accounts for audit. It is expected that, on the basis of better and more up-to-date financial data, it would be possible to develop appropriate pricing and marketing policies and monitor their impact, so that GRB can maintain its capital assets, undertake the expanded investment program which is needed and build up a reasonable reserve. Under the technical assistance arrangements, which GRB is trying to organize with external finances, the consultant would be expected to review GRB's accounting system and other related aspects of GRB's operations and help establish an accounting and management system, including arrangements for collecting and processing information on operational results so as to enable GRB management to monitor developments closely and determine and implement appropriate operational policies (Section 4.05 of Joint Project Agreement).

Producer Benefits

8.03 It is estimated that more than 6,000 families would benefit directly from the project. The distribution of these benefits is a function of the existing land distribution and future access to credit facilities and other supporting services. A recent estimate of the relative annual per capita poverty level income in Guyana is US$138. Hence, the target group in the project area has been identified as those families with an average holding of less than 10 ac. This group constitutes 83% of the farm population and cultivates 62% of the project farm lands. The target group is represented by two subcategories with average farm sizes of 3.5 ac and 8 ac. This breakdown was necessary in the farm budget analysis to show the income differential within the target group. For the 3.5-ac farms, the annual per capita family net income without the project would be G$ 592, which represents a per capita income of about G$ 100, or US$40 per annum. To supplement their farm incomes,

farmers in the project area are employed part-time as hired laborers and engage in fishing. With the project, the annual net farm income of the 3.5-ac target group would increase to G$ 1,063 per family after allowing for family labor and project charges consisting only of operation and maintenance costs. Notwithstanding the additional labor requirements with the project, the small farm holders would continue to augment their annual income by off-farm activities. Furthermore, farmers in this category would be exempted from project charges for recovery of investment, which represents a form of subsidy. For the largest farm size, annual per family net income would reach G$ 4,635 net of project charges and allowance for family labor. A summary of the farm budgets for representative size farms and net income is presented in Annex 7.

Cost Recovery

8.04 The Drainage and Irrigation Ordinance of 1953 empowers the D & I Board to collect actual operation and maintenance costs and recover the full amount of capital investments from the beneficiaries. Government, however, has made no effort to recover capital investments and the collection of operation and maintenance costs has averaged about 15% for the past several years. In the Black Bush Polder, farmers were assessed G$ 17.50 per ac for all charges in 1976 and, even though this is less than half the operation and maintenance costs, the collection record has been far less than the capacity of the farmers to pay. As a result, Government subsidizes O&M costs for all projects at a rate of about G$ 1.0 million per annum.

8.05 Assessments for O&M costs are based on detailed estimates prepared by the Hydraulics Division. However, no rates are levied towards the recovery of capital costs. The situation regarding recovery of investment is complicated by the unique nature of the rice industry in Guyana. Almost 50% of the rice lands are farmed under Government leases and farmers object to repaying development costs on land they do not own but from which they receive benefits. Producer prices are fixed and there is no free market since GRB has sole control of the market for milled rice, leaving farmers with no access to negotiated markets or prices. GRB earns profits in export markets which are used to subsidize the industry and provide inputs, some of which must be imported; such as fertilizers, chemicals, farm machinery and drying, storage and milling facilities.

8.06 Project costs and benefits are presented in Chapter IX. The capital cost of the project net of price contingencies amounts to G$ 2,050 per ac and the annual operation and maintenance cost at full development is estimated at G$ 44.00 per ac. The annual operation and maintenance of project facilities would amount to G$ 1.47 million for serving 42,000 ac, or a rate of about G$ 35.00 per ac. An annual charge of G$ 10.00 per ac has been considered for replacement of the irrigation and drainage pumps at year 25 of project life. Operation and maintenance costs are based on detailed estimates prepared by the Hydraulics Division and 70% of the operation and maintenance costs is due to the operation of the irrigation and drainage pumps. It was assumed that the total annual cost of operation and maintenance would be charged to all the beneficiaries in the project area. The analysis of cost recovery takes into

account the income surplus which would be available to pay project charges. Moreover, other factors like the need for the project executing agency to mobilize additional revenue, the attainment of allocative efficiency and equity were considered. In the absence of strict water management and regulation, the charges levied may not reflect the real economic cost of the scarce resource. However, the equity and generation of additional revenue criteria could be fulfilled. Two alternative plans were examined to recover costs of capital and operation and maintenance in 43 years, allowing a grace period of seven years. The first alternative is to recover 100% of total costs which would amount to G$ 60 million when discounted at 10%. However, a progressive distribution of cost recovery in this amount among the different farm sizes results in an excessively high proportion of total net farm income. Hence, another alternative cost recovery scheme was analyzed under the assumption that the maximum direct project charge should not exceed 35% of total net farm income for the larger farms and progresively less for smaller farms as shown in the table below. The schedule presents proposed charges per ac on a progressive scale, the relation between charges and farm size, and the percent of farm income allocated to project charges as farm size and income increases. This indicates that these charges would be within the capacity of the farmers to pay, ranging from 10% of net income for farms less than 5 ac to 35% for larger farms of 20 ac to 50 ac, and would cover the O&M costs and recover a portion of the capital investment.

Proposed Annual Project Charges at Full Development

Representative Farm Size (ac)	Total Area (ac)	O&M Charges (G$/ac)	Total O&M Charges (G$'000)	Recovery of Investment (G$/ac)	Total Recovery of Investment (G$'000)	Total O&M and Capital Recovery (G$'000)	% of Total Net Farm Income
3.5	11,718	44	516	-	-	516	10
8	11,718	44	516	15	176	692	18
15	12,474	44	549	35	436	985	19
28	1,890	44	83	50	94	177	35
Total	37,800		1,664		706	2,370	16

8.07 To derive the rent and cost recovery indices, the total incremental project costs, rents and charges have been discounted at 10%, the assumed opportunity cost of capital in Guyana. On this basis the present value of the total project charges would be US$10.0 million. The results are shown in Annex 6 where the total rent recovery index is 36% and the respective cost recovery index is 16%. The cost recovery index under this assumption is low, while the average charges appear relatively high, due in part to the relatively high charge for reserve and replacement of irrigation and drainage pumps. Higher rates may affect the farmers' incentives and willingness to pay such charges.

8.08 The analysis presented above indicates that farms in all categories from small to large would have a net income with the project sufficient to pay project charges to cover O & M costs and a proportion of the capital costs. Assurances have been obtained that Government would carry out a study, not later than six months before the estimated date for the completion of each irrigation or drainage system included in the project for determining the extent to which the investment cost of such a system could be recovered over a period of 40 years, taking into account, inter alia, users' ability to pay and the need to maintain economic incentives for them, and the appropriate interest rate to be used for this computation and that the Government would review with IDA and IFAD the conclusions and recommendations of the study soon after it is completed. Assurances were also obtained that Government would establish and maintain a progressive system of project charges, as project facilities are completed and lands come into full production, sufficient to cover the annual operation and maintenance costs and recover as much of the capital investment in project works as can be recovered on the basis of the proposed study. The adequacy of the system of charges would be reviewed by Government with IDA and IFAD at least once every two years, taking into account the users' incomes and the effect of the changes in prices on the value of the investment, and adjustments would be made as required in these charges (Section 4.06 of Joint Project Agreement).

IX. ECONOMIC ANALYSIS

Project Benefits

9.01 The benefits from the project would accrue directly to over 6,000 families. The project would also satisfy efficiency criteria in terms of allocation of scarce resources and equity considerations since the benefits would largely accrue to small farm holders of less than 10 ac. In addition, secondary benefits in terms of employment creation and expansion of commercial services related to processing of agricultural produce in the East Berbice region would be forthcoming. The incremental economic benefits and cost and benefit streams for the project are given in Annex 8. These incremental benefits are attributed to higher yields, cropping intensity rising from the current level of 110% without the project to 154% with the project and the development of 6,500 ac of unutilized land. The principal crop, rice, would occupy 92% of the total irrigable land, excluding the coconut groves, followed by food crops, 5%, and sugarcane, 3%. Although the water supply would suffice to irrigate the 4,600 ac of coconuts, this area would not be irrigated and no incremental output is expected. Total incremental benefits would gradually increase starting in year 3 (1980) and full development is anticipated to peak in year 8 (1985). The incremental foreign exchange earnings from rice exports would amount to US$8.2 million annually at full development. Food crop production from the project area would be destined for the domestic markets and would contribute to the attainment of food self-sufficiency.

Project Costs

9.02 The estimated cost of the project, not including price contingencies, farm machinery and feasibility study stage II, is US$30.4 million in mid-1977 prices. The annual operation and maintenance cost at full development would be US$643,000, or US$17 per ac. Farmers' contribution toward project costs during project implementation for on-farm development is not anticipated. Government's share of the total project financing is 17% to be financed by annual budgetary appropriations spread over six years. In addition, Government would take full responsibility for the operation and maintenance of the project.

Economic Rate of Return

9.03 For the purpose of the economic evaluation, the following assumptions were made and some cost items were excluded to reflect the real resource cost to the economy at large:

(a) Price contingencies which amount to 26% of the total project cost are deducted since the analysis is in constant 1977 prices. It is further assumed that relative prices would not change;

(b) The cost of farm machinery has not been included since this is part of annual production costs. The cost of the studies for a Stage II project is not included;

(c) The total project cost is also net of taxes since they represent financial costs rather than real resource consumption;

(d) In an attempt to estimate shadow wage rate for unskilled labor, both the national and project area unemployment situations were examined. The recent unemployment figure for Guyana indicates a 15% overall unemployment rate and 27% for the East Berbice region. In the absence of any regional parameters for a shadow wage rate for labor, it is assumed that the opportunity cost of labor is 75% of the going wage rate;

(e) The life of the project will be 50 years and construction is scheduled for completion in year 6 (1983). Accordingly, project benefits would gradually reach their peak in year 8 (1985);

(f) Commodity prices used in the economic analysis are based on world market projections provided by the Bank's Commodities and Export Projection Division (Annex 5); and

(g) A shadow exchange rate of G$ 3.00 to US$1.00 was adopted, against the official rate of G$ 2.55.

9.04 Based on the above assumptions and values, the economic rate of return is 13.3%, which is higher than the opportunity cost of capital for Guyana. Hence, the project as proposed is viable in both economic and financial terms. In order to gauge the response of the rate of return to possible changes in costs and benefits, sensitivity analysis was carried out for selected variables and the results are set out below. The stream of cost and benefits used in the computation of these rates of return are given in Annex 7.

Sensitivity Analysis

	Rate of Return	Percentage Change from Basic Rate
(a) Basic rate	13.3	
(b) Benefits reduced by 10%	11.9	-11
(c) Costs increased by 10%	12.0	-10
(d) Combination of b and c	10.8	-19

9.05 Even for the most severe combination with benefits reduced by 10% and project costs increased by 10%, the project remains viable with a rate of return of about 11%. Given the Government's commitment to the modernization of the rice industry and increasing production, the most serious risk in implementing the project would be the Government's limitation in providing counterpart funds in the amounts and as required for construction and other project activities. With construction expected to start shortly on the Tapakuma project and in 1978 on the MMA project, financed by an IDB loan, the three projects would all be underway concurrently which could burden the Government's financial resources, especially from 1980 onward. A second risk arises from the limitations to the ability of the Guyana Rice Board to properly manage the rice industry and to keep and expand existing markets and at the same time provide adequate incentives and supporting services to the farmers so as to maintain rice production and quality at satisfactory levels. The shortage of trained and experienced professional and technical staff for implementation and management of the project could create difficulties but this would be partly overcome by in-service training with the consultant team.

X. SUMMARY OF AGREEMENTS REACHED AND RECOMMENDATION

10.01 During negotiations, assurances have been obtained from Government that:

(a) an adequate level of production credits and machinery services for rice production would be maintained in the project area to meet the requirements with a higher intensity of land cultivation and the introduction of high yielding rice varieties (para 2.20);

(b) the Ministry of Agriculture, with the assistance of the consultants, would prepare a plan, to be submitted to IDA no later than June 30, 1979, for strengthening extension services in the project area and for implementing programs for training extension workers and farmers, research on fertilizer use and variety trials for rice, soil testing and water management studies; and minimum acceptable standards for control of the quality of rice seed would be introduced for both private and public seed producers (para 3.10);

(c) priority would be given to the Frontlands for use of the farm machinery to be provided under the project; and the GRB would give consideration to purchase of suitable tractors and moldboard plows as a means to improve land preparation (para 3.13);

(d) the Ministry of Agriculture and its dependent departments, divisions and boards would maintain separate accounts for the project and for each of the main components; these accounts would be audited annually by an independent auditor satisfactory to IDA and IFAD; and the audited accounts, together with the auditor's report, would be submitted to the IDA and IFAD within six months of the close of each fiscal year (para 4.05);

(e) it would cause GRB to carry out its obligations under the project as required to achieve the objectives of the project (para 5.01);

(f) the Ministry of Agriculture shall as soon as practicable, but, in any event, not later than December 31, 1978, send to IDA and IFAD proposals for establishing a system satisfactory to IDA and IFAD for monitoring the project (para 5.07);

(g) it would assist in the improvement and expansion of rice mills in the project area by taking measures for enabling the provision of credit facilities to them and maintaining reasonable returns for such mills (para 7.04);

(h) GRB would review and improve its accounting system and financial management, so as to provide detailed and up-to-date data to its management and to Government for assessing the financial results and implications of its policies and determining, from time to time, the steps necessary for ensuring its financial viability and operational efficiency; its audited financial accounts for the years 1974/75, 1975/76 and 1976/77 would be furnished to the IDA not later than the end of 1978 and the audited accounts for 1977/78 not later than June 30, 1979; and its financial accounts for every subsequent financial year would be furnished to IDA within six months of the close of the year (para 8.02); and

(i) based on a study to be carried out by Government, a progressive system of project charges would be established and maintained, as project facilities are completed and lands come into full production, sufficient to cover actual annual operation and maintenance costs and to recover, over a period of 40 years, as much of the capital investment in project works as can be recovered, taking into account users' ability to pay and the need to maintain economic incentives for them. The system of charges would be reviewed with IDA and IFAD at least once every two years to evaluate the users' incomes and the effect of the changes in prices on the value of the investment and to make adjustments as required in these charges (para 8.08).

10.02 The employment of a consultant firm(s), acceptable to IDA and under terms and conditions approved by IDA, to provide the required professional services for implementation of the project works and for carrying out the agricultural development programs, as well as the appointment of suitably qualified persons to serve as Project Manager and Project Engineer on terms and conditions satisfactory to IDA and IFAD, are conditions of credit effectiveness (paras 3.11 and 5.03). The effectiveness of the proposed credit will be conditional upon the execution of the loans by IFAD, USAID and IDB (para 4.02).

10.03 With the assurances indicated, the proposed project would be suitable for an IDA credit of US$10.0 million and co-financing in the amount of US$23.5 million to be provided by loans from IFAD, USAID and IDB.

May 22, 1978

ANNEX 1

GUYANA

BLACK BUSH IRRIGATION PROJECT

Related Documents and Data Available in the Project File

A. Black Bush Project Feasibility Report; Harza Engineering Co.; Chicago, Ill., and Aubrey Barker Associates, Georgetown, Guyana. November 1975.

Volume I - General Report
Volume II - Technical Appendices
Volume III - Organization, Agriculture and Economic Appendices

This report covers the Black Bush Polder, the Manarabisi Cattle Pasture and the Backlands areas.

B. Draft Feasibility Report for Black Bush Frontlands and Block III; Harza Engineering Col., Ill., and Aubrey Barker Associates. March 1977.

Volume I - General Report

Volume II - Technical, Agronomic and Economic Appendices (13)

C. Drainage and Irrigation Board Estimates of Operation and Maintenance Costs - 1975, 1976, 1977.

January 18, 1978

ANNEX 2

GUYANA

BLACK BUSH IRRIGATION PROJECT

Water Requirements and Water Supply

Water Requirements

1. Crop water requirements for rice in the project area were estimated by the Blaney-Criddle method, as modified by the USDA Soil Conservation Service, which has given good results in similar conditions. Measurements of consumptive use were not available; however, reliable climatological data for extended periods of record (a minimum of 36 years at one of three stations in the area) made it possible to use this method with confidence. These calculations provided the estimated monthly consumptive use which was adjusted for effective rainfall, based on the 80% probable precipitation, i.e., that which would be equalled or exceeded in four out of five years. Monthly values for the 80% probable rainfall were obtained from the ratio of the 80% annual probable precipitation to the average annual precipitation. The field requirements were estimated on an efficiency of 70% for rice and 80% for sugarcane, which reflects the very low percolation loss in the heavy clay soils, and a conveyance loss of 15% was assumed to arrive at the diversion demands for irrigation. These demands also took into account the necessary non-beneficial uses of water in rice production such as draining the fields to apply fertilizers; however, it was assumed that the local practices of draining the fields just to change the water and letting water run through rice fields continually would be better controlled by operations staff in the future.

2. The estimated consumptive use of sugarcane, of which there is only 1,000 ac in the project area, was based on pan evaporation data which was available from one station in the area with 12 years of record. Ratios of evapotranspiration/pan evaporation, as determined by research in other sugarcane growing areas in the world, were used to estimate the crop requirements. The consumptive use values of food crops (vegetables and ground provisions) was also estimated by this method. The irrigation requirements of the areas in coconuts were estimated with possible use of these lands for vegetables and ground provisions or soybeans; however, these lands will not be irrigated as long as they are occupied by the present coconut groves.

3. The values for consumptive use, field requirements and diversion demands for each crop, in acft/month, taking into account double-cropping, were then applied to the cropping pattern adopted for the project area at full development (Chapter VI) to determine the total project irrigation demands for each month of the one year in five with 80% probable precipitation. On the basis of these calculations, it is estimated that the Polder area would require diversion of about 115,000 acft of water annually; the Frontlands, 128,000 acft; and Block III, 84,000 acft, or an average of 4.3 acft/ac. In an area predominantly cropped to rice and the need to maintain ponding, the requirements appear reasonable. Since the diversions for irrigation would be by pumping from unregulated flow of the Canje and Berbice rivers, the monthly diversion demands in acft have been expressed directly in average monthly discharge in

cusec, as presented in Table 1. This facilitates comparison of the demand with average monthly flows in the Canje and Berbice rivers and permits evaluation of the pumping requirements and source of supply, as also presented in Table 1.

4. As noted above the values presented in Table 1 include effective rainfall based on 80% probable precipitation. The values are presented for only the critical months when a coincidence of low streamflow and high diversion demand occurs. It may be noted that in the project area these months are February, March, September, October and November, with September being the most critical. These are the months when high plant use coincides with climatic extremes of high temperature, wind, low humidity, or a combination of these factors and the peak demand occurs during periods ranging from 10 to 30 days when no precipitation occurs in any of these months. Table 2 presents the results of an analysis of peak demand and maximum design capacity for the irrigation systems to meet the maximum monthly consumptive use, without precipitation, with an irrigation interval for rice not exceeding 10 days. This takes the form of the number of acres that could be served under these conditions by 1 cusec, i.e., rice (60 ac/cusec), sugarcane (65 ac/cusec), vegetables and ground provisions (53 ac/cusec), and reef lands, when converted to crops other than coconuts or new coconut groves (53 ac/cusec). These values take into account the relatively high moisture-holding capacity of soils in the area and the capacity of rice paddies to store water and permit a longer irrigation interval during drought periods. The table indicates that the peak demand occurs in September for each of the major areas that would divert water from the Canje river, including the project area and the five sugar estates. Fortunately, the peak demand for sugarcane is in October which would reduce the peak demand in September. This analysis indicates that the peak diversion demand would be about 1,650 cusec, of which about 650 cusec would be available from the Canje river, and about 1,000 cusec would need to be diverted from the Berbice river, either by gravity via the Torani canal or by pumping.

Water Supply

5. At the present time, the water supply for irrigation of 44,000 ac in the five sugar estates, 26,500 ac in the Black Bush Polder, 19,400 ac in Block III, and a partial supply for the Frontlands is obtained by pumping from the Canje river. It is estimated that about 25% of the Frontlands area, that part adjacent to the Polder, receives water for irrigation on a regular basis and with some assurance of availability. Three pumping stations at Providence (Calabash), Brotherson, and Skeldon, with a combined capacity of 810 cusec, supply the Providence, Rose Hall, Albion, Port Mourant and Skeldon Sugar estates. The Manarabisi (220 cusec) and Black Bush (420 cusec) stations supply Block III and the Polder, with some return flow available for the Frontlands. A small station at Creeklands supplies water to the municipality of New Amsterdam. Total operational pumping capacity on the river is 1,560 cusec and the maximum monthly recorded pumpage was 1,324 cusec in February 1975. The monthly average in the critical months of low flow and high demand during the period 1966-76 varied from 365 cusec in April to 734 in September,

with all the months recording an average monthly pumpage rate in one or more years of more than 600 cusec. The records also indicate that, in one or more months of every year, the demand exceeded 1,000 cusec during short drought periods.

6. A part of the available supply in the Canje river is obtained by gravity flow through the Torani canal which connects the Berbice river with the Canje river. This canal, completed in 1958, operates on the difference of the tidal water level in the two rivers with the flow controlled by gates at each end of the canal. The gates are operated in accordance with the two daily tide cycles and are normally open about 14 hours and closed for 10 hours each day to prevent reverse flow from the Canje river into the Berbice river. The average monthly discharges through this canal are presented in Table 1, together with the average monthly (80% probable exceedence) flow of the Canje river. The combined flow during the critical low flow/high demand months ranges from 810 cusec in December to 994 cusec in September. This would be the flow available at present, without allowance for salinity control, for irrigation pumping for lands in the East Berbice area. Experience in the past with salt water intrusion during one or two of the critical months almost every year as far up the Canje river as Calabash, 14 miles from the mouth, provides evidence that present utilization by all users exceeds the drought period streamflow, including transfers through the Torani canal. The analysis of demand versus available flow in one year out of five presented in Table 1 indicates the deficits that would occur in five out of the eight critical months and the additional pumping required to provide a full water supply to the project area. With the project these deficits during the critical months of February, March, September, October and November would be met by additional pumping from the Berbice into the Torani canal and Table 1 also indicates that normal flow in the Berbice river (80% probable exceedence) is more than adequate to supply the added project requirements. During some months, i.e., January, April, December, the smaller deficits would be met by gravity flow through the Torani canal, but during the five critical months the canal could not operate by gravity when the pumps were in operation as pumping would raise the water level in the canal above the Berbice river level. For this reason, the pumping plant must have sufficient capacity to transfer the full monthly requirements from the Berbice river. During the most critical month of September this capacity, as indicated on Table 1, would be about 800 cusec. Table 2 presents an analysis (para 4) of the peak demand under drought conditions with no precipitation during which the full crop requirement would need to be supplied by irrigation. These conditions occur for periods of 10 to 30 days on an average of one year out of two. During these periods about 1,000 cusec would be required from the Berbice river by pumping and this would be the design capacity of the Berbice pumping plant. Table 2 also indicates the peak demand for each area that would receive water from the system. The sugar estates pumping plants presently have a maximum capacity of about 810 cusec and the Polder plant can deliver 420 cusec. The Manarabisi plant (Block III) would be rebuilt for 300 cusec and the new plant for the Frontlands would be designed for about 450 cusec in order to provide some additional capacity for the Polder.

May 16, 1978

ANNEX 2
Table 1

GUYANA

BLACK BUSH IRRIGATION PROJECT

Water Diversion Requirements[1/]

and Supply Available from Canje and Berbice Rivers

Component	Jan.	Feb.	March	April	Sept.	Oct.	Nov.	Dec.
	(Cubic Feet per Second)							
Diversion Demands[2/]								
Sugar Estates	105	310	315	250	480	640	560	130
Block III	114	186	150	45	300	88	94	95
Black Bush Polder	150	227	206	67	317	142	140	124
Frontlands	161	254	257	103	323	179	165	131
Total:	530	977	928	465	1,420	1,049	959	480
Canje River								
Normal Flow[3/]	640	540	470	530	700	520	460	510
Salinity Control	50	50	50	50	50	50	50	50
Available for Diversion	590	490	420	480	650	470	410	460
Surplus or Deficit (transfer required from Berbice river)	60	(487)	(508)	15	(770)	(579)	(549)	20
Historical average transfer from Berbice via Torani canal by gravity	293	303	363	394	294	372	390	300
Deficit to be supplied by pumping from Berbice	-	487	508	-	770	579	549	-
Berbice River								
Normal Flow[3/]	1,710	1,410	1,290	1,410	1,950	1,440	1,260	1,410
Salinity Control	400	400	400	400	400	400	400	400
Available for Diversion	1,310	1,010	890	1,010	1,550	1,040	860	1,010

1/ Average monthly demand during months of low river flow and high crop water requirement.
2/ Exclusive of 80% probable effective rainfall.
3/ Average monthly flow during period 1963-75, at 80% probable exceedence level.

May 11, 1977

ANNEX 2
Table 2

GUYANA

BLACK BUSH IRRIGATION PROJECT

Peak Demand and Design Capacity

Crop and Design Capacity in Acres/Cusec	Black Bush Polder		Block III		Frontlands		Sugar Estates	
	Area Cropped (acres)	Peak Demand (cusec)	Area Cropped (acres)	Peak Demand (cusec)	Area Cropped (acres)	Peak Demand (cusec)	Area Cropped (acres)	Peak Demand (cusec)
Rice (60 acres/cusec)	23,300	388	17,400	290	21,800	363	-	-
Sugarcane (65 acres/cusec)	-	-	-	-	1,000	15	44,000	680
Vegetables and Ground Provisions (53 acres/cusec)	3,200	60	300	6	500	9	-	-
Reef Lands (allowance for future cropping for vegetables, soybeans, maize, new coconut plantations, other) (53 acres/cusec)	-	-	1,700	32[1/]	6,300	118[1/]	-	-
	26,500	448	19,400	328	29,600	505	44,000	680[2/]
Peak Demand (September)	-	450	-	300	-	400	-	500

1/ To be supplied in future by return flow pumping from main drainage canals in Polder.
2/ Peak demand for sugarcane occurs in October.

Summary (peak month--September)

Peak Diversion Demand:	1,650 cusec
Available from Canje river:	650 cusec
To be supplied by pumping from Berbice river:	1,000 cusec

May 11, 1977

GUYANA

BLACK BUSH IRRIGATION PROJECT

Civil Works Cost Estimates

Item	Local	Foreign	Total	Local	Foreign	Total
		(G$ '000)			(US$ '000)	
1. Berbice Pumping Station	1,017	1,352	2,369	399	530	929
2. Torani Canal	264	360	624	104	141	245
3. Canje River Bank Improvement	315	435	750	123	171	294
4. Manarabisi Pumping Station	296	428	724	116	168	284
5. Manarabisi and Seaford Canal Improvements	393	831	1,224	154	326	480
6. Black Bush Pumping Station	625	823	1,448	245	323	568
7. Black Bush Polder Scheme						
(a) Main Irrigation System	1,015	2,253	3,268	398	884	1,282
(b) Main Drainage System	410	860	1,270	161	337	498
Sub-total:	1,425	3,113	4,538	559	1,221	1,780
8. Frontlands Scheme						
(a) Irrigation System	4,770	5,530	10,300	1,870	2,169	4,039
(b) Drainage System	5,612	6,497	12,109	2,201	2,548	4,749
(c) Land Development	1,470	1,125	2,595	576	441	1,017
(d) All-weather Roads	1,117	1,984	3,101	438	778	1,216
Sub-total:	12,969	15,136	28,105	5,085	5,936	11,021
Total:	17,304	22,478	39,782	6,785	8,816	15,601

Rate of Exchange: G$ 2.55 = US$1.00.

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GUYANA

BLACK BUSH IRRIGATION PROJECT

Project Cost Estimate

Item	Local	Foreign	Total	Local	Foreign	Total
	G$ '000			US$ '000		
Civil Works (from Table 7, Page 2)	17,304	22,478	39,781	6,785	8,816	15,601
Buildings:						
Seed testing laboratory	70	30	100	27	12	39
Project headquarters at Leeds	300	130	430	118	51	169
Improvement of operation and maintenance stations for Block III and Frontlands	355	155	510	140	60	200
Drying yards and paddy storage	700	300	1,000	274	118	392
Sub-total:	1,425	615	2,040	559	241	800
Equipment:						
Administration, engineering and supervision	51	255	306	20	100	120
Irrigation and drainage pumps	357	6,885	7,242	140	2,700	2,840
Operation and maintenance	153	2,907	3,060	60	1,140	1,200
Extension, applied research and seed production	54	408	462	21	160	181
On-farm development	153	2,040	2,193	60	800	860
Rice production and processing	153	2,295	2,448	60	900	960
Spare parts	-	510	510	-	200	200
Sub-total:	921	15,300	16,221	361	6,000	6,361
Management and Technical Services:						
Administration, engineering and supervision	1,702	-	1,702	667	-	667
Consultants services	757	6,923	7,680	297	2,715	3,012
Extension, research and seed production						
(a) Ministry of Agriculture	594	-	549	223	-	223
(b) Guyana Rice Board	405	-	405	159	-	159
Project preparation facility	-	714	714	-	280	280
Feasibility study - Stage II	255	765	1,020	100	300	400
Sub-total:	3,713	8,402	12,115	1,446	3,295	4,741
Base Cost Estimate:	23,361	46,797	70,158	9,151	18,352	27,503
Physical Contingencies	3,504	7,020	10,524	1,374	2,753	4,127
Expected Price Increases	13,347	15,223	28,570	5,234	5,970	11,204
Total Expected Cost of the Project:	40,212	69,040	109,252	15,759	27,075	42,834

October 25, 1977

GUYANA

BLACK BUSH IRRIGATION PROJECT

Estimated Schedule of Expenditures

Calendar Years

	1978			1979			1980			1981			1982			1983			Total		
	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total
											(US$ '000)										
Civil Works																					
Berbice Pumping Station	-	-	-	-	-	-	239	318	557	160	212	372	-	-	-	-	-	-	399	530	929
Torani Canal Improvement	-	-	-	-	-	-	-	-	-	104	141	245	-	-	-	-	-	-	104	141	245
Canje River Improvement	-	-	-	-	-	-	-	-	-	123	171	294	-	-	-	-	-	-	123	171	294
Manarabisi Pumping Station	-	-	-	-	-	-	70	101	171	46	67	113	-	-	-	-	-	-	116	168	284
Manarabisi and Seaford Canals Improvement	-	-	-	-	-	-	62	130	192	92	196	288	-	-	-	-	-	-	154	326	480
Black Bush Polder Pumping Station	-	-	-	-	-	-	147	194	341	98	129	227	-	-	-	-	-	-	245	323	568
Black Bush Polder Main Canals and Drains	-	-	-	-	-	-	145	300	445	248	553	801	166	368	534	-	-	-	559	1,221	1,780
Frontlands Scheme:																					
(a) Irrigation System	-	-	-	-	-	-	-	-	-	743	872	1,615	561	651	1,212	566	646	1,212	1,870	2,169	4,039
(b) Drainage System	-	-	-	-	-	-	-	-	-	880	1,020	1,900	665	759	1,424	656	769	1,425	2,201	2,548	4,749
(c) Land Development	-	-	-	-	-	-	-	-	-	232	175	407	172	133	305	172	133	305	576	441	1,017
(d) All-weather Road	-	-	-	-	-	-	-	-	-	175	311	486	131	233	364	132	234	366	438	778	1,216
Sub-total:	-	-	-	-	-	-	663	1,043	1,706	2,901	3,847	6,748	1,695	2,144	3,839	1,562	1,782	3,308	6,785	8,816	15,601
Buildings																					
Seed Drying and Testing Laboratory	7	3	10	20	9	29	-	-	-	-	-	-	-	-	-	-	-	-	27	12	39
Project Headquarters at Leeds	27	12	39	70	30	100	21	9	30	-	-	-	-	-	-	-	-	-	118	51	169
Improvement of Operation and Maintenance Stations for Block III and Frontlands	28	12	40	84	36	120	28	12	40	-	-	-	-	-	-	-	-	-	140	60	200
Drying Yards and Paddy Storage	64	28	92	140	60	200	70	30	100	-	-	-	-	-	-	-	-	-	274	118	392
Sub-total:	126	55	181	314	135	449	119	51	170	-	-	-	-	-	-	-	-	-	559	241	800
Equipment																					
Administration, Engineering, Supervision	5	25	30	10	50	60	5	25	30	-	-	-	-	-	-	-	-	-	20	100	120
Irrigation and Drainage Pumps	-	-	-	-	-	-	90	1,950	2,040	50	750	800	-	-	-	-	-	-	140	2,700	2,840
Operation and Maintenance	-	-	-	-	-	-	30	500	530	30	640	670	-	-	-	-	-	-	60	1,140	1,200
Extension, Applied Research, Seed Production	-	-	-	17	128	145	4	32	36	-	-	-	-	-	-	-	-	-	21	160	181
On-farm Development	-	-	-	14	186	200	28	372	400	18	242	260	-	-	-	-	-	-	60	800	860
Rice Production and Processing	-	-	-	10	150	160	35	525	560	15	225	240	-	-	-	-	-	-	60	900	960
Spare Parts	-	50	50	-	150	150	-	-	-	-	-	-	-	-	-	-	-	-	-	200	200
Sub-total:	5	75	80	51	664	715	192	3,404	3,596	113	1,857	1,970	-	-	-	-	-	-	361	6,000	6,361
Management and Technical Services																					
Administration, Engineering and Supervision	57	-	57	128	-	128	148	-	148	131	-	131	108	-	108	95	-	95	667	-	667
Consultant Services	-	195	195	45	450	495	54	900	954	72	555	627	72	420	492	54	195	249	297	2,715	3,012
Extension, Research and Seed Production:																					
(a) Ministry of Agriculture	-	-	-	5	-	5	60	-	60	67	-	67	67	-	67	34	-	34	233	-	233
(b) Guyana Rice Board	-	-	-	6	-	6	32	-	32	43	-	43	43	-	43	35	-	35	159	-	159
Project Preparation Facility	-	280	280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	280	280
Feasibility Study Stage II	-	-	-	50	150	200	50	150	200	-	-	-	-	-	-	-	-	-	100	300	400
Sub-total:	57	475	532	234	600	834	344	1,050	1,394	313	555	868	290	420	710	218	195	413	1,456	3,295	4,751
Base Cost Estimate	188	605	793	599	1,399	1,998	1,318	5,548	6,866	3,327	6,259	9,586	1,985	2,564	4,549	1,744	1,977	3,721	9,161	18,352	27,513
Physical Contingency	28	91	119	90	210	300	193	757	950	499	939	1,438	303	459	762	261	297	558	1,374	2,753	4,127
Total Base Cost	216	696	912	689	1,609	2,298	1,511	6,305	7,816	3,826	7,198	11,024	2,288	3,023	5,311	2,005	2,274	4,279	10,535	21,105	31,640
Expected Price Increase	22	58	80	174	250	424	532	1,267	1,799	1,775	2,087	3,862	1,345	1,300	2,645	1,386	1,008	2,394	5,234	5,970	11,204
Total Expected Cost of Project	238	754	992	863	1,859	2,722	2,043	7,572	9,615	5,601	9,285	14,886	3,633	4,323	7,956	3,391	3,282	6,673	15,769	27,075	42,844

May 10, 1978

GUYANA

BLACK BUSH IRRIGATION PROJECT

Local Staff Requirements and Estimated Cost

During Construction Period

	Calendar Years						
	1978	1979	1980	1981	1982	1983	Total
	(man-months)						(G$ '000)
1. Administration, Engineering and Supervision:							
Project Manager	6	12	12	12	12	12	112
Project Engineer	-	12	12	12	12	12	82
Administrative Officer	6	12	12	12	12	12	66
Surveyors and Crews (4)	2	4	4	3	3	2	288
Drilling and Site Testing Crews (2)	2	2	2	1	-	-	112
Senior Surveyor	6	12	12	12	-	-	32
Senior Inspectors (2)	-	6	24	24	24	12	45
Inspectors (6)	-	24	48	72	72	72	115
Technicians (6)	12	48	72	72	48	48	100
Draftsmen (4)	12	48	48	24	-	-	44
Secretaries (2)	12	24	24	24	24	24	44
Clerks (4)	6	24	48	48	48	36	42
Drivers, boatmen, laborers, others (10)	2	8	10	10	10	10	120
Sub-total:							1,202
Miscellaneous operational costs for vehicles, internal travel, public services, materials and supplies, and local support costs.							500
Sub-total:							1,702
2. Agricultural Extension, Applied Research and Seed Production:							
Ministry of Agriculture							
Extension Division							
Senior Agricultural Officer	-	6	12	12	12	12	67
Agricultural Officers (3)	-	-	36	36	36	36	96
Field Assistants (6)	-	-	36	72	72	72	82
Sub-total:							245
Applied Research							
Senior Field Assistants (2)	-	-	24	24	24	-	25
Field Assistants (4)	-	-	48	48	48	-	40
Technicians (2)	-	-	24	24	24	-	24
Equipment Operators (2)	-	-	24	24	24	-	18
Laborers (10)	-	-	10	10	10	-	72
Sub-total:							179

January 18, 1978

GUYANA

BLACK BUSH IRRIGATION PROJECT

Local Staff Requirements and Estimated Cost

During Construction Period

	Calendar Years						
	1978	1979	1980	1981	1982	1983	Total
	(man-months)						(G$ '000)
Miscellaneous operational cost for vehicles, internal travel, public services, materials and supplies							170
Sub-total:							594
Guyana Rice Board							
Technical Assistance							
Rice Specialists (6)	-	12	48	72	72	72	138
Rice Agronomist (1)	-	6	12	12	12	12	36
Field Assistants (4)	-	-	24	48	48	48	54
Sub-total:							228
Seed Production and Testing1/							
Seed Production Specialist	-	-	12	12	12	-	18
Laboratory Technician	-	-	12	12	12	12	16
Technicians (2)	-	-	24	24	24	-	23
Sub-total:							57
Miscellaneous operational cost for vehicles, internal travel, public services, materials and supplies							120
Sub-total:							405
Total:							2,701

1/ Does not include staff presently employed on seed farm.

January 18, 1978

GUYANA

BLACK BUSH IRRIGATION PROJECT

List of Equipment

	Number	Estimated Cost CIF - US$ '000	Financing
1. Administration, Engineering and Supervision:			
Office equipment and supplies	lot	20	
Engineering equipment	lot	20	
Vehicles, standard or 4-wheel drive	10	50	
Concrete and soils laboratory equipment	lot	10	
Drilling and site investigation equipment	lot	20	
Sub-total:		120	USAID
2. Pumps, Motors and Auxiliary Equipment:			
Irrigation pumps (1,800 cfs)		2,700	
Drainage electric pumps[1/] (1,000 cfs)		1,000	
Sub-total:		3,700	IFAD/IDA
3. Operation and Maintenance:			
Draglines, 1/2 cuyd and 3/4 cuyd, 40 ft. boom	3	270	
Excavators, back-hoe type, 1/2 cuyd	1	80	
Tractors, truck type, 170 hp, with angle dozer	1	80	
Tractors, farm, 85 hp	2	40	
Graders, self-propelled, 100 hp, 12 ft. blade	2	120	
Loaders, wheel type, 1.0 cuyd	1	50	
Rollers, drum type, tractor pulled	3	50	
Trucks, dump, 4 cuyd	4	70	
Trucks, tank, water sprinkling	2	15	
Trucks, stake body, 4-ton	2	25	
Trucks, pickup, 1 ton	3	20	
Trailers, farm, 4-wheel, 1/2 ton	3	10	
Vehicles, 4-wheel drive	6	40	
Boats and outboard motors	3	10	
Compressor, air, wheel mounted	1	15	
Concrete mixers, wheel mounted, 1/2 cuyd	2	5	
Motorcycles	10	10	
Barge, fuel hauling, self-propelled, 2,000 gal.	1	30	
Shop and servicing equipment	lot	150	
Spare parts	lot	50	
Sub-total:		1,140	IFAD/IDA

1/ To be provided by Government from pumps on hand.

May 12, 1978

	Number	Estimated Cost CIF - US$ '000	Financing
4. Extension, Applied Research and Seed Production:			
(a) Extension			
Vehicles, 4-wheel drive	6	35	
Motorcycles	6	6	
Miscellaneous teaching and testing materials and supplies	lot	5	
Sub-total:		46	USAID
(b) Applied research and seed production			
Seed drying, cleaning and sizing equipment	lot	30	
Farm machinery for seed farm and field trial program	lot	30	
Equipment for seed testing laboratory and field testing	lot	10	
Materials for applied research program	lot	10	
Trucks, pick-up, and stake body	4	30	
Vehicles, 4-wheel drive	4	25	
Sub-total:		135	USAID
5. On-Farm Development:			
Tractors, track type, 75 hp or farm type with flotation wheels, 100 hp	9	540	
Land levelers, tractor drawn, 35 ft. with 12-14 foot blade	9	90	
Tractors, farm type, 85 hp with 2 or 3 blade mold board plow attachments	3	60	
Ditchers, tractor drawn, 36 inches	2	20	
Trucks, stake body, 4 tons	2	25	
Vehicles, 4-wheel drive	3	20	
Trucks, pick-up, 1 ton	3	20	
Mobile service unit, truck mounted	2	25	
Sub-total:		800	USAID
6. Rice Production and Processing:			
Tractors, farm type, 65 hp, with disc or mold board plow attachments	40	560	
Dryers, mechanical, oil burning	4	160	
Combines, rice, self-propelled 14 ft header	10	240	
Sub-total:		960	USAID
7. Spare Parts		200	USAID
Total:		7,055	

May 12, 1978

GUYANA

BLACK BUSH IRRIGATION PROJECT

Consultant Services

Type of Consultant	Calendar Year 1978	1979	1980	1981	1982	1983	Total
	(man-months)						
(a) Foreign							
Headquarters Supervision	2	2	2	2	2	2	12
Team Leader (Guyana)	6	12	12	12	12	-	54
Planning Engineer	6	12	12	-	-	-	30
Engineer, Field Surveys	6	12	12	-	-	-	30
Engineer, Design	6	12	12	-	-	-	30
Engineer, Design	-	6	12	-	-	-	18
Engineer, Mechanical	-	4	4	-	-	-	8
Engineers, Construction (2)	-	-	18	24	24	24	90
Engineer, Agricultural	-	-	12	12	6	-	30
Agronomist, Applied Research and Seed Production	-	-	12	12	6	-	30
Extension Training Officer	-	-	12	12	6	-	30
Sub-total:	26	60	120	74	56	26	362
(b) Local							
Engineers, Assist. (2-3)	-	24	24	36	36	36	156
Engineer, Materials	-	6	12	12	12	-	42
Sub-total:	-	30	36	48	48	36	198
Total:	26	90	156	122	104	62	560

May 11, 1977

GUYANA

BLACK BUSH IRRIGATION PROJECT

Estimated Schedule of Disbursements

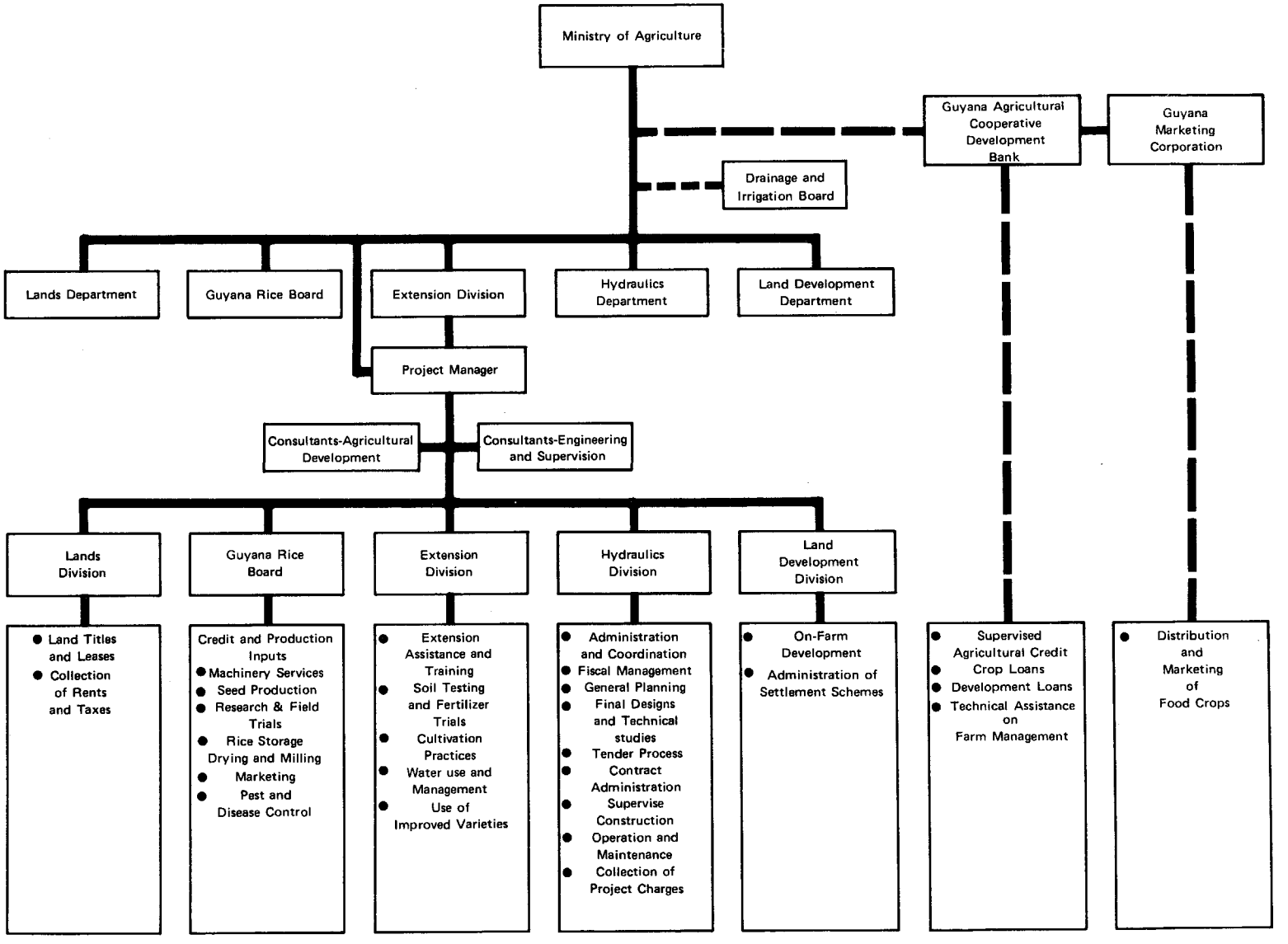
IBRD Fiscal Year and Semester	Cumulative Disbursements at the End of Semester			
	IDA/IFAD	USAID	Government and Other Financing	Total
	(US$ Million)			
1978				
June 30, 1978	-	-	-	-
1979				
December 31, 1978	0.3	-	-	0.3
June 30, 1979	0.4	0.3	-	0.7
1980				
December 31, 1979	1.3	-	-	1.3
Jund 30, 1980	2.2	1.3	0.2	3.7
1981				
December 31, 1980	3.9	-	-	3.9
June 30, 1981	5.7	4.7	3.0	13.4
1982				
December 31, 1981	9.6	-	-	9.6
June 30, 1982	13.5	6.0	8.7	28.2
1983				
December 31, 1982	15.6	-	-	15.6
June 30, 1983	17.8	7.5	10.9	36.2
1984				
December 31, 1983 1/	18.9	-	-	18.9
June 30, 1984 2/	20.0	7.5	15.3	42.8

1/ Estimated completion date.

2/ Estimated closing date.

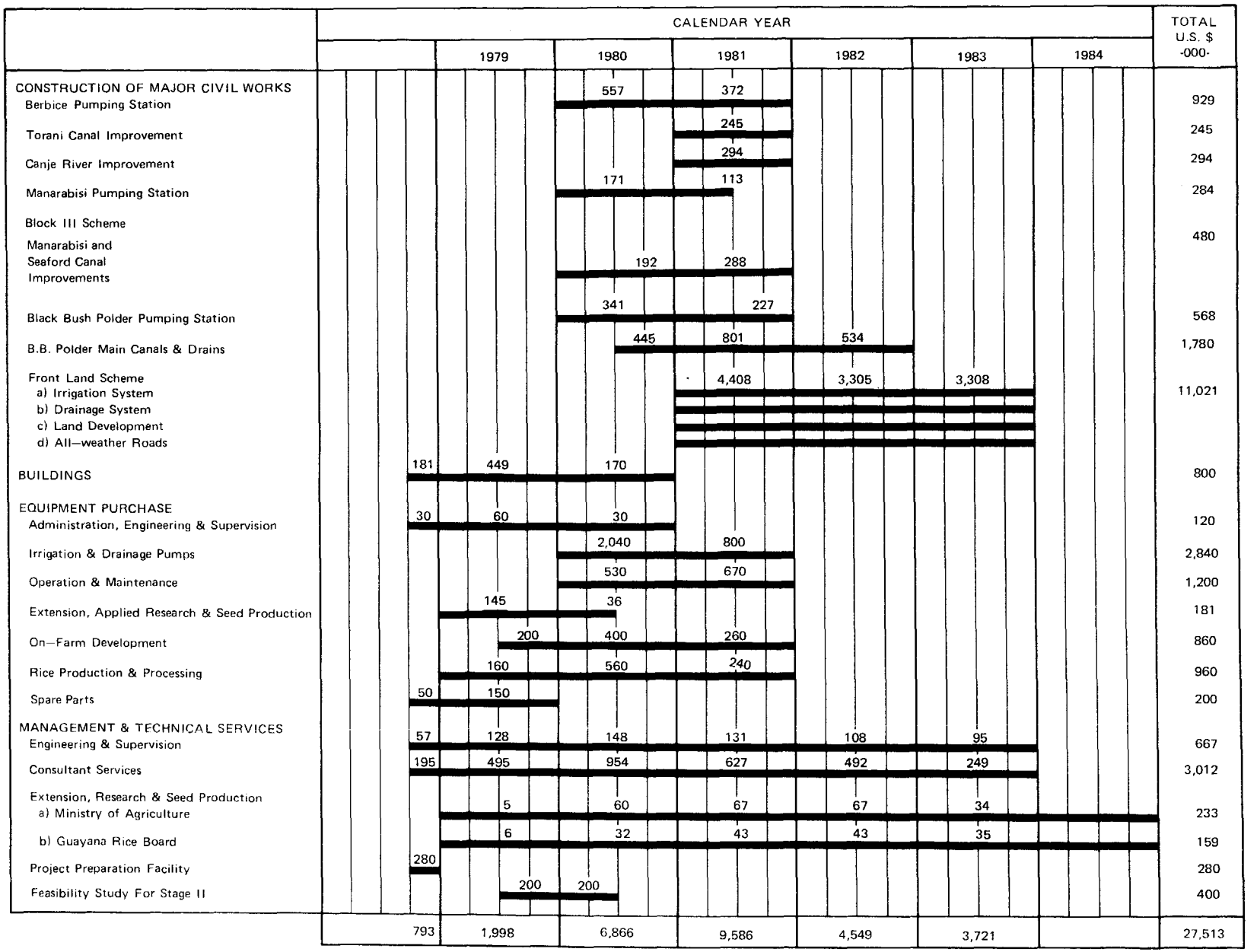
May 19, 1978

GUYANA
BLACK BUSH IRRIGATION PROJECT
PROPOSED PROJECT ORGANIZATION



World Bank -- 17522

GUAYANA
BLACK BUSH IRRIGATION PROJECT
PROPOSED CONSTRUCTION & DEVELOPMENT SCHEDULE



World Bank—17521

GUYANA

BLACK BUSH IRRIGATION PROJECT

Present Land Use and Proposed Cropping Pattern

	A. Present Conditions						B. Future Land Use & Cropping Pattern Without Project						C. Proposed Cropping Pattern at Project Full Development					
	Land Area (Acres)	Land Area[1] (%)	Crop Area (Acres) Spring	Crop Area (Acres) Autumn	Total Crop Area (Acres)	Cropping Intensity (%)	Land Area (Acres)	Land Area (%)	Crop Area (Acres) Spring	Crop Area (Acres) Autumn	Total Crop Area (Acres)	Cropping Intensity (%)	Land Area (Acres)	Land Area (%)	Crop Area (Acres) Spring	Crop Area (Acres) Autumn	Total Crop Area (Acres)	Cropping Intensity (%)
Black Bush Frontlands	29,600	(56)	-	-	-	-	29,600	(56)	-	-	-	-	29,600	(56)	-	-	-	-
Cultivated Lands	19,000	100	2,280	17,500	19,780	104	19,000	100	2,980	17,510	20,490	108	25,500	100	14,540	23,280	37,820	128
Rice	14,000	74	2,100	12,600	14,700	105	14,000	74	2,800	12,600	15,400	110	20,200	79	14,140	18,180	32,320	160
Sugarcane[2]	1,000	5	(1,000)	1,000	1,000	100	1,000	5	(1,000)	1,000	1,000	100	1,000	4	1,000	1,000	1,000	100
Food Crops	200	1	180	100	280	140	200	1	180	110	290	145	500	2	400	300	700	171
Coconuts[2]	3,800	20	(3,800)	3,800	3,800	100	3,800	20	(3,800)	3,800	3,800	100	3,800	15	(3,800)	3,800	3,800	100
Non-Cultivated Lands	10,600						10,600						4,100					
Reef Soils	2,800						2,800						2,500					
Arable Rice Lands	7,800						7,800						1,600					
Block III Frontlands	19,400	(37)	-	-	-	-	19,400	(37)	-	-	-	-	19,400	(37)	-	-	-	-
Cultivated Lands	12,900	100	3,690	11,690	15,380	119	12,900	100	4,890	11,690	16,580	129	12,900	100	8,250	9,530	17,780	138
Rice	12,000	93	3,600	10,800	14,400	120	12,000	93	4,800	10,800	15,600	130	12,000	93	8,160	8,640	16,800	140
Food Crops	100	1	90	90	180	180	100	1	90	90	180	180	100	1	90	90	180	180
Coconuts[2]	800	6	(800)	800	800	100	800	6	(800)	800	800	100	800	6	(800)	800	800	100
Non-Cultivated Lands	6,500						6,500						6,500					
Reef Soils	1,100						1,100						1,100					
Arable Rice Lands	5,400						5,400						5,400					
Black Bush Polder[3]	4,000	(7)	-	-	-	-	4,000	(7)	-	-	-	-	4,000	(7)	-	-	-	-
Cultivated Lands	4,000	100	375	2,625	3,000	75	4,000	100	675	2,675	3,350	84	4,000	100	2,480	3,330	5,810	145
Rice	2,500	63	-	2,250	2,250	90	2,500	63	300	2,300	2,600	104	2,500	63	2,000	2,250	4,250	170
Food Crops	1,500	37	375	375	750	50	1,500	37	375	375	750	50	1,500	37	480	1,080	1,560	104
Total Project:	53,000	100	-	-	-	-	53,000	100	-	-	-	-	48,800	100	-	-	-	-
Cultivated Lands	35,900	(68)	6,345	31,815	38,160	106	35,900	(68)	8,545	31,875	40,420	113	42,400	87	25,270	36,140	61,410	145
Rice	28,500	79	5,700	25,650	31,350	110	28,500	79	7,900	25,700	33,600	118	34,700	82	24,300	29,070	53,370	154
Sugarcane[2]	1,000	3	(1,000)	1,000	1,000	100	1,000	3	(1,000)	1,000	1,000	100	1,000	2	(1,000)	1,000	1,000	100
Food Crops	1,800	5	645	565	1,210	67	1,800	5	645	575	1,220	68	2,100	5	970	1,470	2,440	116
Coconuts	4,600	13	(4,600)	4,600	4,600	100	4,600	13	(4,600)	4,600	4,600	100	4,600	11	(4,600)	4,600	4,600	100
Non-cultivated Lands	17,100	32	-	-	-	-	17,100	32	-	-	-	-	6,400	13	-	-	-	-

1/ Figures in ( ) show the three areas of Frontlands, Block III and Black Bush Polder as percentage of the total project area. Those given for individual crops are the percentage of the cultivated land in that area.
2/ Crops occupying land all year.
3/ Includes only the area of the polder benefitting from project works.

October 18, 1977

GUYANA

BLACK BUSH IRRIGATION PROJECT

Cropping Pattern, Production, Farmgate Prices,

Production Costs, and Incremental Value of Production

		Rice						Food Crops		
	Land	Autumn Crop	Spring Crop	Total Crop	Cropping Intensity (%)	Sugarcane	Coconuts[1]	Crop	Cropping Intensity (%)	Total
WITHOUT PROJECT										
Land Area (acres)	28,500					1,000	4,600	1,800		35,900
Cropped Land Area (acres)		25,700	7,900	33,600	118	1,000	4,600	1,220	68	40,420
Yields (tons (bags) acre)[2]		1.01(16.1)	1.09(17.5)	1.03(16.5)		3.2[3]	1,250	3.35		
Production (tons)[4]		25,957	8,611	34,568		3,200	5.75	4,087		41,855
Prices (G$/ton)[5]		296	296	296		277	0.10	694		
Gross Value of Production (G$ '000)		7,683	2,549	10,232		886	575	2,838		14,531
Cost of Production (G$/acre)				185.40		422	78.60	800		
Cost of Production (G$ '000)				6,229		422	362	976		7,989
Net Value of Production (G$ '000)				4,003		464	213.4	1,862		6,542
WITH PROJECT										
Land Area (acres)	34,700					1,000	4,600	2,100		42,400
Cropped Land Area (acres)		29,070	24,300	53,370	154	1,000	4,600	2,440	116	69,810
Yields (tons (bags) acre)[2]		1.22(19.8)	1.32(21.1)	1.26(20.3)		3.6[3]	1,250	3.79		
Production (tons)[4]		35,465	32,076	67,541		3,600	5.75	9,248		
Prices (G$/ton)[5]		296	296	296		277	0.10	694		
Gross Value of Production (G$ '000)		10,500	9,500	20,000		997	575	6,418		27,990
Cost of Production (G$/acre)				238.85		467	78.60	932		
Cost of Production (G$ '000)				12,747		467	362	2,274		15,850
Net Value of Production (G$ '000)				7,253		530	213.4	4,144		12,140
Incremental Production (tons)		9,508	23,465	32,973		800		5,161		
Incremental Net Value of Production (G$ '000)				3,250		66		2,282		5,598

1/ Yield in nuts/acre/year. Production in million nuts. Price per nut.
2/ In long tons (2,240 lb) = 16 bags of paddy (140 lb).
3/ Yields are given in sugar. Assumes 11 tons cane/1 ton sugar.
4/ In long tons (2,240 lb).
5/ Based on price of G$ 18.50 per 140-lb bag of paddy = G$ 0.132/lb = G$ 296/long ton.
6/ US$2.2 million equivalent.

October 31, 1977

GUYANA

BLACK BUSH IRRIGATION PROJECT

3.5 Acre Farm Budget
(in G$)

Crop	Land Area (Ac.)	Cropped Area (Ac.)	Yield (T/Ac.)	Price ($/T)	GVP 1/ (Per ac. per crop)	Inputs 2/ (Per ac. per crop)	Gross Benefits (Per ac.)	Gross Benefits (Total)
Rice	3.3	5.0	1.25 3/	296	370	190.40	179.60	898
Food Crops	.2	.3	4.0	694	2776	469.26	2308.70	693
Total	3.5	5.3						1,591

Cropping Intensity: 151%

Gross Farm Benefits		
Less: Hired labor	-	
Family labor	276	
Interest 4/	98	374
Net Farm Benefits		1,217
Project Charges		
Operation and maintenance		154
Investment recovery		-
Net Farm Income		1,063
Estimated Net Income Without Project		592
Incremental Net Income		471

1/ Gross value of production.
2/ Production costs less labor.
3/ 20 140 lb. bags.
4/ 9% per annum.

June 28, 1977

GUYANA

BLACK BUSH IRRIGATION PROJECT

8.0 Acre Farm Budget
(in G$)

Crop	Land Area (Ac.)	Cropped Area (Ac.)	Yield (T/Ac.)	Price ($/Ton)	GVP 1/ (Per ac. per crop)	Inputs 2/ (Per ac. per crop)	Gross Benefits (Per ac.)	Gross Benefits (Total)
Rice	7.8	12.5	1.3 3/	296	389.80	196.91	187.89	2,349
Food Crops	.2	.75	3.9	694	2706.6	460.00	2246.60	562
Total	8.0	12.75						2,911
	Cropping Intensity: 160%							
	Gross Farm Benefit							
	Less: Hired labor					49.00		
	Family labor					414.40		
	Interest 4/					236.34		699
	Net Farm Benefits							2,212
	Project Charges							
	Operation and maintenance							352
	Investment recovery							120
	Net Farm Income							1,740
	Estimated Net Income Without Project							1,152
	Incremental Net Income							588

1/ Gross value of production.
2/ Production costs less labor.
3/ 21 140 lb. bags.
4/ 9% on working capital.

June 28, 1977

GUYANA

BLACK BUSH IRRIGATION PROJECT

15.0 Acre Farm Budget
(in G$)

Crop	Land Area (Ac.)	Cropped Area (Ac.)	Yield (T/Ac.)	Price ($/Ton)	GVP 1/ (Per ac. per crop)	Inputs 2/ (Per ac. per corp)	Gross Benefits (Per ac.)	Gross Benefits (Total)
Rice	13.3	23.5	1.3 3/	296	384.80	201.12	183.68	4,316
Food Crops	1.2	1.5	3.9	694	2,706.60	483.00	2,224	3,336
Total	15.0	25.0						7,652

Cropping Intensity: 167%

Gross Farm Benefits		
Less: Hired labor	818.40	
Family labor	768.00	
Interest 4/	525.74	2,112
Net Farm Benefits		2,540
Project Charges		
Operation and maintenance		660
Investment recovery		525
Net Farm Income		4,355
Estimated Net Income Without Project		2,884
Incremental Net Income		1,471

1/ Gross value of production.
2/ Production costs less labor.
3/ 22 140 lb. bags.
4/ 9% on working capital.

June 28, 1977

GUYANA

BLACK BUSH IRRIGATION PROJECT

28.0 Acre Farm Budget
(in G$)

Crop	Land Area (Ac)	Cropped Area (Ac)	Yield (T/Ac)	Price ($/Ton)	GVP 1/ (per ac. per crop)	Inputs 2/ (per ac. per crop)	Gross Benefits (per ac.)	Gross Benefits (Total)
Rice	28	50.4	1.3 3/	296	384.80	187.85	196.95	9,926
Food Crops	-	-						
Total	28	50.4						
	Cropping Intensity: 180							
	Gross Farm Benefits							
	Less: Hired labor					1,412.20		
	Family labor					296.00		
	Interest 4/					952.46		2,660
	Net Farm Benefits							7,266
	Project Charges							
	Operation and maintenance							1,232
	Investment recovery							1,400
	Net Farm Income							4,634
	Estimated Net Income Without Project							3,857
	Incremental Net Income							777

1/ Gross value of production.
2/ Production costs less labor.
3/ 22 140 lb. bags.
4/ 9% on working capital.

June 28, 1977

GUYANA

BLACK BUSH IRRIGATION PROJECT

Rice Purchases, Exports and Local Sales by Guyana Rice Board

		Calendar Year							
	Unit 1/	1969	1970	1971	1972	1973	1974	1975	1976
Deliveries to GRB	Thousand tons	69.8	80.3	78.5	81.2	75.1	77.1	106.3	115.4
Average Value	G$/ton	216	208	215	215	259	354	439	n.a.
Value of Deliveries	G$/million	15.1	16.7	16.9	17.5	19.4	27.3	46.7	n.a.
Export Quantity	Thousand tons 1/	62.3	59.3	67.5	69.7	47.8	50.8	81.9	76.3
Earnings	G$ million	19.2	81.1	21.5	25.3	25.0	49.0	84.8	78.1
Average Value	G$/ton	308	305	316	362	523	965	1035	1023
Local Sales Quantity	Thousand tons 1/	11.0	13.1	12.4	12.8	19.7	24.9	31.8	33.6
Earnings	G$ million	2.8	3.2	3.0	3.1	5.1	7.0	8.8	n.a.
Average Value 2/	G$/ton	249	236	242	245	259	279	277	n.a.

1/ Long tons (2,240 pounds)
2/ Since February 1, 1978, the price of rice locally sold is G$ 500.00 per ton.
Source: Ministry of Economic Development, Government of Guyana.

March 30, 1978

GUYANA

BLACK BUSH IRRIGATION PROJECT

Projection of Economic Prices 1/

	Unit	Economic Prices (1987-2027)	Financial Prices (1977-2027)
Rice (milled)	Ton	852	460
Food crops	Ton	694	694
Sugar	Ton	868	277
Coconuts	Nut	.10	.10

1/ In constant 1977 prices in G$ at farmgate.

January 12, 1978

GUYANA

BLACK BUSH IRRIGATION PROJECT

Rice Price Structure
(G$)

	1977	1978	1979	1980-2027
Milled Rice:				
f.o.b. Georgetown[1/] (per ton)	804	917	1,034	1,171
Less: Marketing costs (per ton)	77	77	77	77
Processing costs (per ton)	250	250	250	250
Total cost (per ton)	327	327	327	327
f.o.b. Price Less Costs (per ton)	477	590	707	844
Value of By-products (from 1 ton of rice)	7	7	7	7
Economic Farmgate Price (per ton milled rice)	484	597	714	852
Economic Farmgate Price (per 140 lb bag paddy)	19.40	24.00	28.70	34.20
Financial Farmgate Price (per 140 lb bag paddy)	18.50	18.50	18.50	18.50

1/ Prices are in constant 1977 G$.

February 7, 1978

GUYANA

BLACK BUSH IRRIGATION PROJECT

Fertilizer Price Structure 1/

	1977	1978	1979	1980	1985
UREA - C.I.F. Georgetown (G$/ton)	385.50	404.78	420.00	443.32	549.72
Add: handling (per ton)	16.50	170.00	17.30	18.20	18.20
transport and distribution (per ton)	34.00	36.00	35.65	37.76	37.76
Farmgate price (per ton)	436.00	457.78	472.95	499.28	605.68
Economic price (per 112 lb. bag)	21.80	22.89	23.65	24.96	30.28
Financial price (per 112 lb. bag)	15.72	-	-	-	-
TSP - C.I.F. Georgetown (G$/ton)	374.62	393.25	419.54	445.80	579.54
Add: handling (per ton)	16.50	17.00	17.30	18.20	18.20
transport and distribution (per ton)	34.00	35.00	35.65	37.76	37.76
Farmgate price (per ton)	425.12	445.25	472.49	501.76	635.50
Economic price (per 112 lb. bag)	21.25	22.26	23.62	25.09	31.78
Financial price (per 112 lb. bag)	17.54	-	-	-	-

1/ Prices given in constant 1977 G$.

June 8, 1977

GUYANA

BLACK BUSH IRRIGATION PROJECT

Guyana Rice Board

Income and Expenditure Account
(G$ Million)

	1973	1974	1975	1976	1977
INCOME					
Local Rice Sales[1/]	5.05	9.78	8.70	9.10	N.A.
Export Rice Sales	23.86	37.37	75.19	78.13	
Total Rice Sales:	28.91	47.15	83.89	87.23	82.42
EXPENDITURE					
Cost of Rice Sales	23.36	28.19	56.69	59.69	64.75
Gross Profit on Rice Sales	5.55	18.96	27.20	27.54	17.67
Total:	28.91	47.15	83.89	87.23	82.42
Gross Profit	5.55	18.96	27.20	27.54	17.67
Profit or (Loss) on:					
Rice Factories	(0.18)	(0.10)	(4.03)	(8.38)	(6.50)
State Farms	0.44	0.26	1.36	0.56	1.54
Stock Feed Mill	(0.04)	0.09	0.23	(0.37)	-
Rice Wa	-	(0.01)	-	-	-
Rice Flour Mill	-	-	-	-	-
Other Income	0.11	0.08	0.16	0.24	0.16
Total:	5.88	19.28	24.92	19.59	12.86
Less					
Administration and Other Expenses	2.07	2.95	5.96	6.61	7.25
Net Income:	3.81	16.33	18.96	12.98	5.61
Less Grants and Aids to Rice Industry[2/]	3.33	9.46	9.58	9.61	8.00
Surplus/(Deficit):	0.48	6.87	9.38	3.37	(2.39)

1/ Implicit subsidy on local sales (G$ Million):

1975	5.90
1976	5.35
1977	7.47

2/ Includes producer subsidies, crop incentives, bonus, etc.

N.B. Only the 1973 and 1974 figures are audited; the other data are "interim."

January 12, 1978

GUYANA

BLACK BUSH IRRIGATION PROJECT

Guyana Rice Board

Balance Sheet
(G$ Million)

	September 30				
ASSETS	1973	1974	1975	1976	1977
Current Assets:					
Stocks and Stores	6.84	13.70	35.37	38.18	42.28
Debtors	4.72	3.60	9.10	8.75	13.47
Pre-paid Expenses	0.38	0.62			
Cash in Hand and at Banks	0.78	0.85	0.67	-	1.31
Total Current Assets:	12.72	18.77	45.13	46.93	67.06
Fixed Assets	10.11	12.80	14.28	14.41	13.37
Works in Progress	25.58	30.80	35.29	49.68	62.39
Deferred Receivable (Loans) Net of Provision for Bad Debts	3.91	5.36	-	-	-
Total Assets:	52.32	67.73	94.70	111.02	132.82

	September 30				
LIABILITIES	1973	1974	1975	1976	1977
Current Liabilities:					
Sundry Creditors	4.64	8.74	6.05	2.00	4.47
Bank Overdrafts	9.10	9.38	24.94	34.34	49.48
Total Current Liabilities:	13.74	18.12	30.99	36.34	53.95
Long-term Loans	-	-	2.89	3.92	3.63
Government of Guyana Debentures	24.89	28.75	30.59	37.15	44.02
General Reserves	13.21	13.99	20.85	30.24	33.61
Net Surplus	0.48	6.87	9.38	3.37	(2.39)
Total Liabilities:	52.32	67.73	94.70	111.02	132.82

N.B. Only the 1973 and 1974 figures are audited; the other data are "interim."

January 12, 1978

GUYANA

BLACK BUSH IRRIGATION PROJECT

Summary of Annual Cash Incomes for Representative Farm Sizes

Range of farm sizes (ac)	0-5	5-10	10-20	20-50
Number of farms	3348	1465	832	68
Average farm size (ac)	3.5	8	15	28
Area in each size (ac)	11718	11718	12474	1890
Percent of total area	31	31	33	5
Estimated net farm income after family labour allowance and project charges (G$)	1063	1740	4335	4634
Estimated net farm income without project (G$)	592	1152	2884	3857
Incremental net income (G$)	471	588	1471	777
US$ equivalent (US$)	185	231	577	305

June 29, 1977

GUYANA

BLACK BUSH IRRIGATION PROJECT

Cost and Rent Recovery Indices[a/]
(G$)

Representative size farms	3.5ac.	8ac.	15ac.	28ac.	Total Project (G$'000)
1. Gross value of production	1158	2313	6149	9138	
2. Less: Production (cash) Costs	473	1252	3668	6274	
3. Equals: Net cash income (1-2)	685	1061	2481	2864	
4. Less: Depreciation	-	-	-	-	
5. Imputed value of family labor	141	182	170	98	
6. Imputed value of management services	35	53	124	143	
7. Imputed return on own capital	-	-	-	-	
8. Allowance for risk/uncertainty	68	106	248	286	
9. General taxes	-	-	-	-	
10. Equals rent/surplus	441	717	1939	2331	27060
11. Rent as a percentage of net cash income	64	67	78	82	
12. O & M charges	73	168	315	588	
13. Capital charges	-	120	525	1400	
14. Total direct charges	73	288	840	1988	9754
15. Rent recovery index (14 ÷ 10)	16	40	43	85	36%
16. Public sector outlays (capital + O&M)					59726
17. Cost recovery index (14 ÷ 16)					16%
18. Farmers income PC, in project year 8 at full development	249	438	1051	1261	
19. Estimated critical consumption level (CCL same project year)	N.A.				
20. Estimated National PCI - 1985	N.A.				

a/All items are incremental. Total project charges rents and outlays have been discounted at 10%

October 31, 1977

GUYANA

BLACK BUSH IRRIGATION PROJECT

Incremental Economic Benefits

	1978	1979	1980	1981	1982	1983	1984	1985-2027
	(US$ '000)							
I. Frontlands								
A. Without Project								
Rice	543	815	1,167	1,212	1,291	1,368	1,468	1,501
Food Crops	120	120	120	121	122	123	124	124
Sugarcane	736	816	902	902	902	902	902	902
Coconuts	69	69	69	69	69	69	69	69
Total:	1,468	1,820	2,258	2,304	2,384	2,462	2,563	2,596
B. With Project								
Rice	543	815	1,315	1,601	2,147	2,774	3,790	4,162
Food Crops	120	120	201	233	288	346	422	449
Sugarcane	736	816	949	1,061	1,061	1,061	1,061	1,061
Coconuts	69	69	69	69	69	69	69	69
Total:	1,468	1,820	2,534	2,964	3,565	4,250	5,342	5,741
Incremental Benefits (B-A)	0	0	276	660	1,181	1,788	2,779	3,145
II. Block III								
A. Without Project								
Rice	542	863	1,280	1,354	1,474	1,597	1,772	1,819
Food Crops	84	84	84	84	84	84	84	84
Coconuts	16	16	16	16	16	16	16	16
Total:	642	963	1,380	1,454	1,574	1,697	1,872	1,919
B. With Project								
Rice	542	863	1,348	1,418	1,574	1,792	2,086	2,181
Food Crops	84	84	86	88	94	100	107	111
Coconuts	16	16	16	16	16	16	16	16
Total:	642	963	1,450	1,522	1,684	1,908	2,209	2,308
Incremental Benefits (B-A)	0	0	70	68	110	211	337	389
III. Polder								
A. Without Project								
Rice	92	138	197	205	216	231	250	255
Food Crops	383	383	383	383	383	383	383	383
Total:	475	521	580	588	599	614	633	638
B. With Project								
Rice	92	138	216	257	332	427	563	610
Food Crops	383	383	492	550	648	755	892	941
Total:	475	521	708	807	980	1,182	1,455	1,551
Incremental Benefits (B-A)	0	0	128	219	381	568	822	913
Total Incremental Benefits	0	0	474	947	1,672	2,567	3,938	4,447

February 8, 1978

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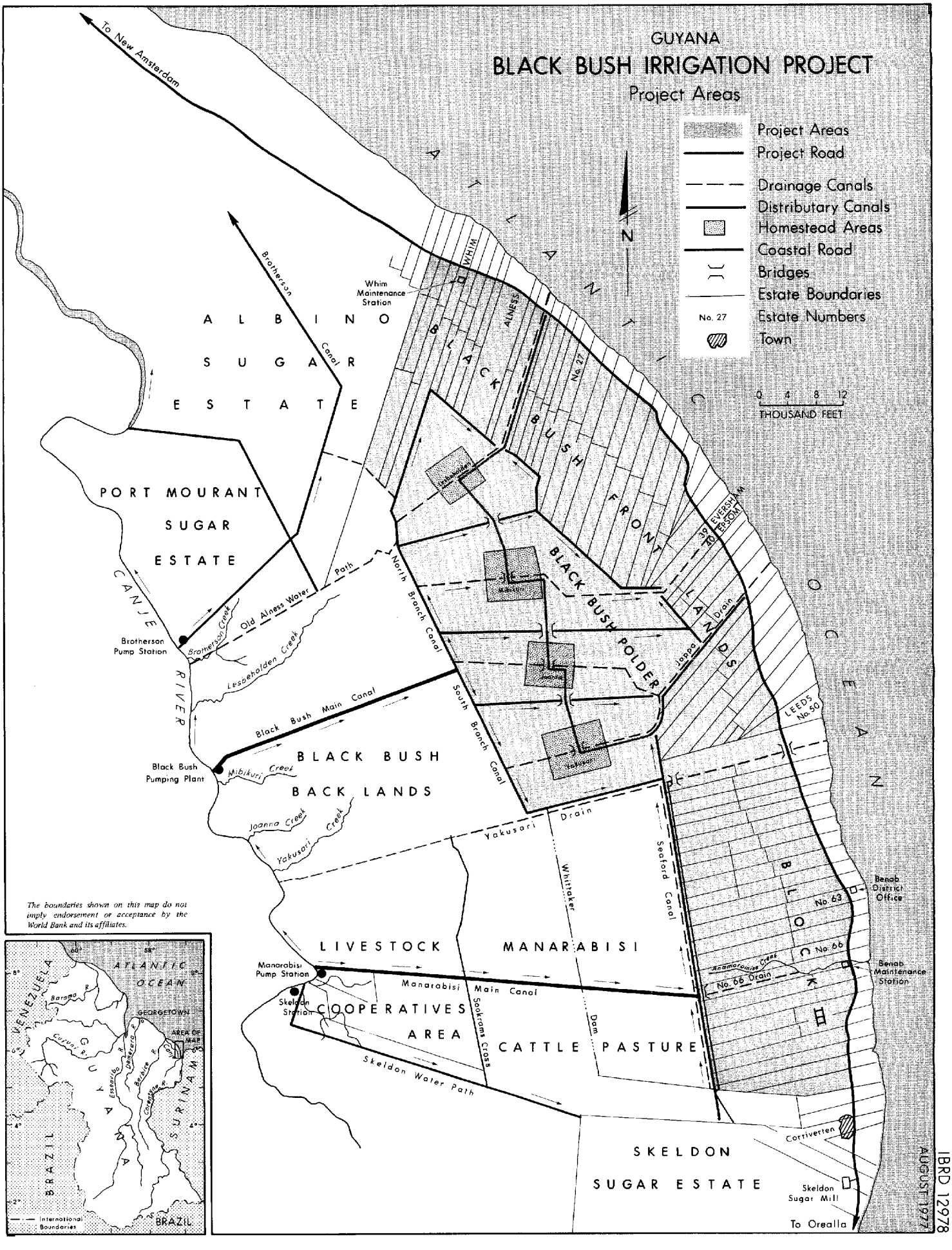
BLACK BUSH IRRIGATION PROJECT

Economic Costs and Benefits[1/]

Year	Project Cost			Incremental Benefits
	Capital	Operation and Maintenance	Total (US$ '000)	
1. (1978)	537	-	537	-
2. (1979)	1,653	-	1,653	-
3. (1980)	6,228	50	6,278	474
4. (1981)	10,985	129	11,114	947
5. (1982)	5,356	67	5,423	1,672
6. (1983)	3,859	121	3,980	2,567
7. (1984)	-	185	185	3,938
8-28. (1985-2005)	-	225	225	4,447
29. (2006)	3,700	225	3,925	4,447
30-50. (2007-2027)	-	225	225	4,447

1/ In constant 1977 prices.

February 7, 1978



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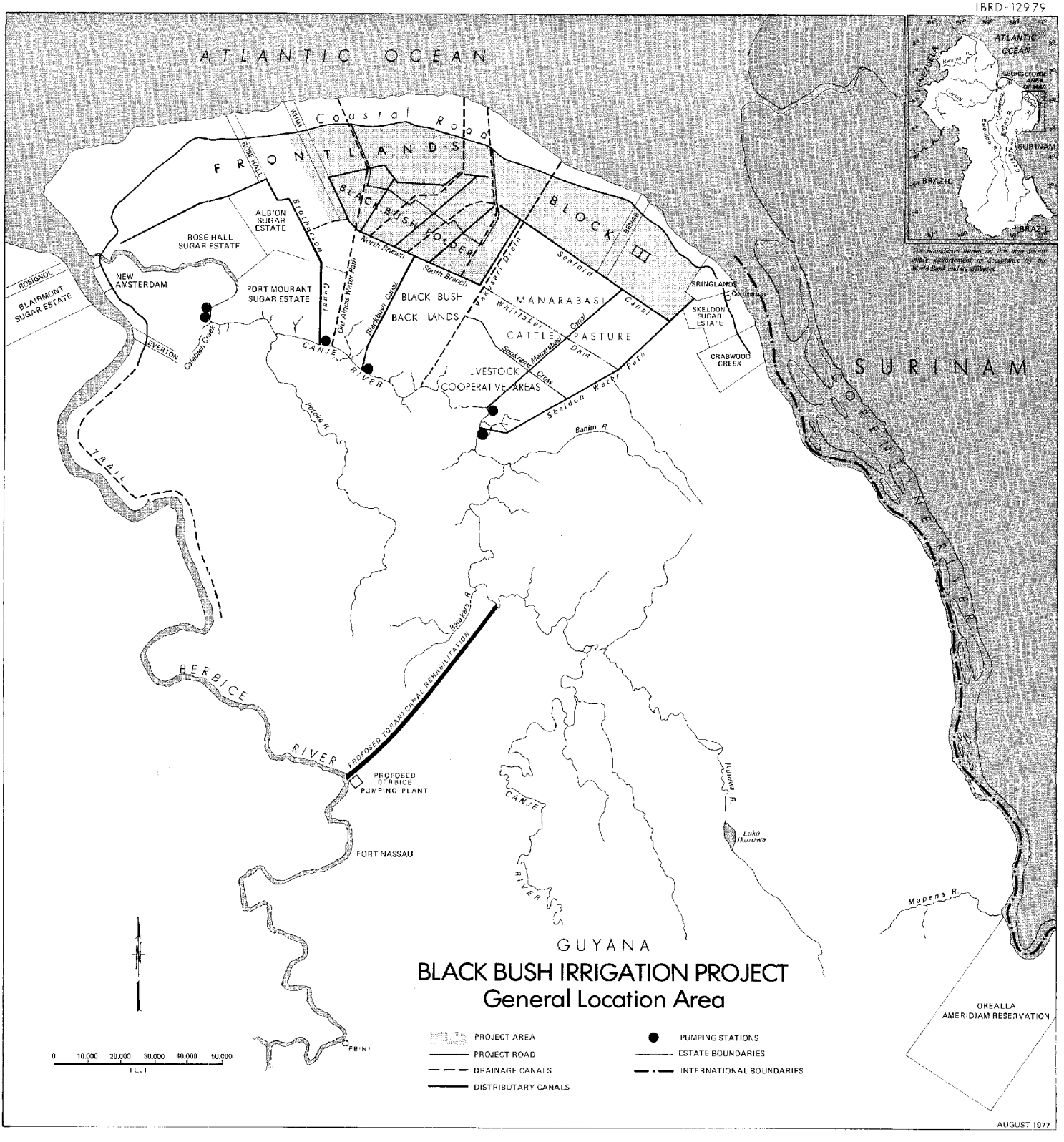
AUGUST 1977

IBRD - 12979



BLACK BUSH IRRIGATION PROJECT
General Location Area

AUGUST 1977