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NEW BIN STORAGE AND MILL RENOVATION AT THE BELIZE MARKETING BOARD BIG FALLS RICE COMPLEX

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NEW BIN STORAGE AND MILL RENOVATION AT THE BELIZE MARKETING BOARD-BIG FALLS RICE COMPLEX

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EXECUTIVE SUMMARY

Belize Marketing Board (BMB) Bin Relocation Plan Versus New Bin Installation

Recognizing the urgent need for additional paddy storage at the Big Falls Rice Complex to accommodate increased rice production in the Toledo district, the Government of Belize/Belize Marketing Board (GOB/BMB) undertook a plan to relocate four bins having a total storage capacity of 855,000 lb (428 tons) of paddy from BMB-Belize City to Big Falls. Kansas State University/Food and Feed Grains Institute (KSU/FFGI) was asked to provide technical assistance to BMB in the transfer and installation of the bins.

A thorough inspection of the bins was made and the following analysis and recommendations were given.

A. For reasons such as old age, poor structure, general condition, impossibility or enormity and slowness of the repair job, high cost of repair, and low estimated useful life expectancy of the repaired bins, it was recommended that GOB/BMB cancel the bin relocation plan. Proper renovation using local resources does not seem to be technically feasible. Even if the bins could be renovated, the minimum estimated cost of renovation would be B$200,000 to increase the storage capacity by only 428 tons. This is an exorbitant cost to renovate a very old installation. In addition, the estimated useful life expectancy of the relocated bins would only be 5 years.

B. The suggested alternative would be to undertake off-shore procurement of storage bins of an approximate capacity of 1,600,000 lb (800 tons). The addition of only 428 tons capacity would not reduce the storage shortage to an acceptable level. The bins should also be provided with bin filling, emptying, and aeration equipment. The civil, mechanical, and electrical work needed for the installation of new bins could be done by using local resources only. The estimated installed cost for this alternative would be B$300,000 divided into a foreign exchange component of US$69,000 and a local component of B$162,000. The estimated life expectancy for the new bins would be 20 years.

C. Since the storage capacities of the two alternatives are different (428 tons - relocated bins versus 800 tons - new bins), the cost for the new bins project was prorated to B$160,500 to make capacities of both alternatives equal to 428 tons. Total estimated annual savings because of depreciation of new bins versus relocated bins amounts to B$31,977. In addition, new bins will also result in savings of interest on B$39,500, the difference between the renovated cost of B$200,000 and prorated new bin cost of B$160,500. Another important element to consider is a high salvage value of B$120,476 for the new bins at the end of 5 years as compared to no salvage value for the relocated bins. If the relocation of bins is undertaken GOB/BMB will need to replace the bins after the estimated useful life of 5 years, possibly at a much higher cost than now.

Renovation of Big Falls Rice Mill and Grain Complex

A. Extension of existing mill building - To house a new rice mill and eliminate present storage congestion, GOB/BMB should undertake this work by using local resources. Accurate cost estimate is not possible at this stage because building requirement depends not only on the site soil condition but also on the mill equipment supplier. An approximate 60 ft x 40 ft x 30 ft high building should be adequate. For budget estimate, B$300,000 should be adequate.

B. Selection of proposed mill equipment - Existing mill is not only very old and of low capacity, but also incapable of delivering good quality milled rice. To eliminate these problems, a new compact packaged rice mill having 2 to 2.5 mt per hour of paddy capacity was recommended. The installed costs for such a rice mill are US$221,523 and B$40,000.

C. Existing equipment renovation - This includes essential maintenance work of the existing mill and improvement of the milling quality and processing capacity by adding and deleting equipment. The estimated costs are US$50,000 and B$50,000. Total project budget estimate is shown in the following table.

TOTAL PROJECT BUDGET ESTIMATE

PROJECT COMPONENT	FOREIGN EXCHANGE US $	LOCAL CURRENCY B $
1. New bin installation (1,600,000 lbs of paddy)	69,000	162,000
2. Renovation of Big Falls Rice Mill and Grain Complex		
A. Extension of existing mill building (60 ft x 40 ft x 30 ft high)	0	300,000
B. Selection or proposed mill equipment New compact packaged rice mill (2 to 2.5 mt paddy per hour)	221,523	40,000
C. Existing equipment renovation	50,000	50,000
GRAND TOTAL	340,523	552,000

The total project cost in equivalent local currency is B$1,233,046. At the present paddy milling rate, annual total yield of milled rice should be at least 3,600,000 lbs. By undertaking the project, a better quality milled rice is expected to produce a price premium of B$0.05 per pound of rice. This premium could generate additional B$180,000/yr and at this rate simple payback period for the project would be about 7 years.

Under the United States Agency for International Development/Kansas State University (USAID/KSU) existing contract, only US$156,000 is available for equipment. However, the full amount has not been obligated yet. To allow KSU/BMB to undertake a comprehensive renovation plan rather than adopting a segment by segment approach, the full budgeted amount for the equipment should be obligated as soon as possible.

D. Given the availability of the required funding, the technical assistance for the new bins project could be provided by KSU/FFGI possibly with some amendment of the existing USAID/KSU contract.

E. Estimated minimum execution time of the project is 9 months from project initiation and amendment of the USAID/KSU contract.

Activities related to the renovation of the Big Falls Rice Mill and Grain Complex were initiated as of May 12, 1989. A preliminary on-site inspection was made to assess the needs of the mill to improve efficiency of the mill and the quality of rice. Lists of interventions involving equipment and process modifications, and urgently needed equipment were prepared. Equipment and process modifications that could be undertaken by rice mill crews were identified and the BMB Big Falls facility is in the process of implementing those recommendations. The remaining modifications will be made using KSU supervision. Since these modifications will require the mill equipment to be shut down, a convenient time will be found to commence the renovation without adversely affecting the BMB rice supply to the market.

SECTION I

INTRODUCTION

Objectives

The objectives of this study were to :

1. Provide technical assistance in the transfer and installation of the four grain storage bins from the Belize Marketing Board (BMB) in Belize City to Big Falls Rice Mill and Grain Complex,

2. Develop specifications for the equipment and spare/replacement parts to be used in the renovation of the Big Falls complex. Develop a work plan to complete the renovation, and

3. Work with the Chief of Party (COP) of the Toledo Agricultural Marketing Project/Volunteers in Technical Assistance (TAMP/VITA) Private Sector; the General Manager and Adviser of BMB in implementing the private sector component to assure that on-farm postharvest improvements recommended under the private sector component are compatible with and complementary to the renovation of the BMB facilities effort to insure a smooth vertically-integrated system for grain production in Toledo.

Description of Report

This report is divided into two major parts - Section II deals with BMB's technical assistance request to KSU regarding bin relocation and Section III relates to Renovation of Big Falls Rice Mill and Grain Complex as described in the TAMP Public Sector work plan proposed by KSU/FFGI.

SECTION II

BIN RELOCATION

GOB and BMB apparently have given urgent priority to elimination of present storage congestion at the Big Falls facility. To meet this objective, GOB has been actively seeking to relocate four galvanized steel bolted storage tanks and other equipment that have remained unused in BMB-Belize City for many years. The approximate dimensions of each bin are 17 ft. 6 in. diameter, 23 ft. eave height, 30 degree hopper and a nearly flat roof. To accomplish this relocation, bids were invited from local contractors. Contact with two bidders revealed that one of them proposed to disassemble and erect the bins at Big Falls (Appendix I), while the other bidder wanted to relocate the bins without disassembling because of the apprehension that once taken apart, it could be extremely difficult to put the bins together since they are very old. The lower of these two bids amounting to B$111,250 was accepted and the contractor was notified of this acceptance by a letter (Appendix II).

KSU was asked to provide technical assistance in the transfer and relocation of the bins. However, before such a relocation was undertaken, an assessment was made as to the viability of the project. A thorough inspection of the bins and other equipment was made and the following analysis elaborates the critical points.

1. It was not possible to determine the exact age of the bins and other equipment. Sources at BMB estimated the age of the bins at 10 to 20 years. One of the sources indicated that the bins were "used" when bought by BMB. In any case, the bins seem to be very old as is evident by their condition and somewhat outdated design features. Given a proper maintenance schedule, a schedule that is closely followed by bin users in many developed countries of the world, this type of bin and equipment usually lasts more than 30 years. However, in the humid developing countries, their useful life is usually about 20 years. The main reason for the reduction of the longevity is the lack of proper maintenance and care for various reasons including nonavailability of resources, lack of trained maintenance personnel, and high humidity. Galvanized metal is used to make rust formation difficult, however, galvanization cannot eliminate rust formation completely. In the humid tropics, because of high rainfall and consequent high humidity, the zinc that is used to galvanize the ordinary steel oxidizes relatively easily and rust is formed more quickly than in less humid areas. Once rust appears on a metal, further deterioration proceeds very rapidly. Any sign of oxidization of zinc (appearance of loose whitish powdery substance, commonly known as white rust) should be treated quickly. The maintenance work should be thorough and done with utmost care. It should consist of preparation and repainting of the affected area as well as all other areas of the equipment. Surface preparation includes removal of the loose zinc oxide by the use of an appropriate tool such as emery paper, file, grinder, and sand blasting etc.; cleaning of all debris; cleaning of oil and grease by using soapy water; and etching of cleaned bare metal surface by using a weak acid such as vinegar, lime juice, or muriatic acid. Proper surface preparation

allows the paint to stick to the metal. Repainting consists of applying galvanized paint by using brush or spray. This type of elaborate maintenance procedures is usually not undertaken in developing countries. Even repainting of rusty areas is seldom done. There was no sign of repainting of the bins at BMB-Belize City.

2. Each bin is supported by 14 legs made of 3/16 in. formed ordinary sheet metal that is painted on the surface. The legs have been corroded to such an extent that they are irreparable. Because of the standing or collected water around the legs, the bottom part of the legs are rusted to such an extent that in some cases legs are hanging up in the air without providing any support to the bins. In addition, the inside surfaces of the partially open channel shaped legs are severely corroded which has reduced the material thickness to a dangerously thin level. The removal of the rust and zinc oxide down to cleaning the steel of the rusty debris is impossible because of the inability of all cleaning equipment including sand blasting to gain access into the inside surfaces, corners, and crevices of the legs. Also, even if complete rust removal was possible, it would be very difficult to guarantee the distribution of paint at all inside points of the legs unless a paint bath, generally available only in large industrial facilities were used. The legs are some of the most important parts on which the structural integrity of the bins depend. The importance of legs are so much so that many manufacturers in recent times have chosen to make the legs stronger by using thicker structural steel such as H- or I-section instead of formed sheet metal sections. The alternative proposed by one contractor of replacing the most severely corroded part of a leg by a new one is unacceptable because the old portion would still be thinner. Furthermore, during the welding process the two sections would have a tendency to buckle due to intense heat of welding unless very expensive restrictive jigs and fixtures were designed and used. Making a new formed section for this welding job is also very difficult. The sections are formed by roll forming machines. Reputed bin manufacturers have this expensive equipment in their factories. Manual methods of leg making will not meet the required quality, strength, and accuracy.

3. The compression ring, the part which connects the hopper sheets and side wall sheets, is also severely corroded. This is also one of the most vital structural components of the bin. For similar reasons as those mentioned above, repair of this part in Belize is virtually impossible.

4. The hopper sheets are also corroded to an irreparable point. Portions of the hoppers have fallen apart. All hopper sheets need to be replaced. Manufacturers make these parts by an assembly line process that cuts, sizes, and punch holes using various presses, dies, jigs, and fixtures to an extremely low and accurate tolerance that ensures good fit and prevents leakage. Adopting a manual method to perform these jobs will not only be painfully slow, and exorbitantly expensive, but will also be unable to maintain the required accuracy, quality, and tolerance level.

5. The outside of the side wall sheets are in fair condition. However, there are visible signs of corrosion, particularly at joints including the holes on the side wall sheets.

6. The roof sheets are also rusting at many points, though the rust is not as heavy as the legs and hopper. However, they need proper repainting.

7. Inside wall sheets of the bins, including the wall stiffening pillars, are likely to be corroded because it seemed that bad rusting of the hopper was caused by moisture entry into the bins.

8. In the headhouse, where the elevator and cleaner are housed, the rusting problem is evident but to a lesser extent.

9. All the conveying equipment, such as overhead loading and ground level unloading screw conveyors, have also corroded to an irreparable extent.

10. Thousands of bolts need to be replaced. These bolts are special galvanized grade 8 type with integral steel washers neoprene rubber impregnated on top and need to be imported.

11. Thousands of holes on the fastened parts need cleaning to remove rust before repainting.

12. Local engineering (structural design) and fabrication of new parts such as legs, hopper sheets, compression rings, etc. may not be possible. An estimated 25 percent of bin parts need replacement. Use of such a high proportion of spares to renovate a very old and poor facility does not seem to be justified.

13. Names and addresses of the equipment manufacturer(s) could not be found. It was not possible to determine whether same models of equipment are still being fabricated. Bin manufacturers frequently change their models and assembly lines and discontinue the older models to upgrade their products and remain competitive in the market. It is highly unlikely that such an old design still exists. Moreover, costs of spare parts are generally many times higher than prorated costs of parts at initial purchase. Buying spares from the manufacturers to renovate the bins does not seem to be an expedient, practical, and economical alternative either. It could even be impossible for reasons given here.

14. Even if the bins could be repaired, the estimated life expectancy of the relocated bins would only be about 5 years.

For reasons such as old age, poor structure, general condition, impossibility or enormity and slowness of the repair job, high cost of repair, and low estimated useful life expectancy of the repaired bins, it is recommended that GOB/BMB cancel the bin relocation plan and consider a viable alternative given in this report.

Storage Capacity Constraint at Big Falls

Existing storage capacity of 4,000,000 lb (2,000 tons) at the Big Falls Complex consists mainly of galvanized corrugated bins and warehouse space. Eight flat-bottomed bins of equal size (24 ft. diameter x 25 ft. eave height) have a total

storage capacity of 3,000,000 lb (1,500 tons) of rough rice. Two hopper-bottomed holding bins add 300,000 lb (150 ton) to the capacity. An assortment of smaller bins in the rice mill area and the warehouse provide the remaining 700,000 lb (350 tons) of storage space.

Total annual purchase of paddy at Big Falls increased from 3,500,000 lb (1,750 tons) in 1984-85 to 7,200,000 lb (3,600 tons) in 1988-89 as of April 1989. Most of the purchasing is done from September to December (Appendix III) with the peak period between October 15 to November 15. Peak period intake is also trending upward ranging from 1,800,000 lb (900 tons) in 1984-85 to 3,300,000 lb (1,650 tons) in 1988-89 crop year.

The drastic increase in annual total, and peak period paddy purchase has apparently created a severe bottleneck in the grain storage ability of the rice complex in recent years and specifically last year (1988-89). Given stable prices and favorable pre- and post-planting conditions in rice growing areas in Belize, this upward trend is expected to continue in the years ahead. To remove this constraint, GOB/BMB undertook the bin relocation plan. Recognition of urgency of need for additional storage at Big Falls is very well justified.

Alternative Strategies to Bin Relocation

Instead of relocating the existing bins at Belize City, the following two alternative strategies are given.

Bagged Storage. Capacity addition through building of a new bagged storage warehouse at Big Falls is a tempting alternative. Such an alternative is appealing because of the simplicity and flexibility of a warehouse in terms of day-to-day operation without any electro-mechanical equipment and maintenance. It is also appealing since the construction of the warehouse could be undertaken with local resources. However, this alternative has serious limitations related to the management of quality of inventory of bags both by BMB and rice producers; the high labor requirement of warehousing, and many other socio-political considerations. As an example of how serious the limitations are, labor shortages in Big Falls during harvest season could create a severe bottleneck in the rice complex operation. Any such bottleneck could disturb the timely supplying of milled rice by BMB. Additionally, given these limitations and the fact that the complex has been operating as a bulk facility for the last 10 years, proved its usefulness, and has since served a very vital national role, it would not be prudent to steer the complex away from its bulk storage mode towards more bag storage, especially when bulk storage inherently results in speedy and efficient operations which are likely to be the key factors in inducing private sector interests in eventual acquiring of the rice mill complex.

New Bin Storage. The only remaining alternative is to consider off-shore procurement and erection of off-the-shelf standard corrugated bulk bins that would not only fit and blend well into the existing system, but would also have a level of mechanization appropriate for Belize and Big Falls. Bin prices internationally remain very attractive and have been lagging behind many other manufactured goods for various reasons including recent worldwide grain glut, droughts, and general overall downturn of agricultural economy. However, the situation has been changing somewhat in recent months.

Bin Relocation Versus New Bin Storage

The estimated total storage capacity of the planned relocation is 855,000 lb (428 tons). The accepted bid of B$111,250 (Appendix II) appears to be too low in the light of the extensive repair and fabrication work needed to properly renovate, transfer, and relocate the bins. A more realistic estimate could be B$200,000. On this basis, the renovated storage would cost B$467.29 per ton. Using an estimated useful life of the renovated bins of 5 years, the straight-line depreciation per year per ton is B$93.46. After 5 years, the salvage value is assumed to be zero.

Last crop year's storage space shortage was 3,200,000 lbs of paddy. It will be prudent to increase the capacity by at least 50 percent of the last year's storage shortage i.e. by 1,600,000 lbs rather than by only 855,000 lbs which could be added by relocated bins. Installing more capacity is not only needed, it will reduce the unit cost and improve the economics of the project.

It is therefore recommended that four storage bins each 24 ft in diameter, 26 ft in nominal height, with a total capacity of 1,660,000 lbs of rough rice be installed.

Cost Estimation of New Bin Storage

Cost estimate for the bins, filling and emptying equipment, and erection of equipment and service is given in Table 1.

The cost estimate is expected to remain valid until June 1990 and should be increased by an annualized rate of 15 percent after this time.

It is not possible to estimate the cost of civil work accurately at this time. Earth work and foundation requirement is very site specific and should be undertaken by a local qualified civil engineer. However, an estimate was made based on consultation with people knowledgeable in site soil conditions at Big Falls.

Estimated inland transport, earth work, civil, mechanical, and electrical erection (undertaken locally in Belize)	B$ 162,000
Total Project Cost	B$ 300,000

Since the storage capacities of the two alternatives are different (428 tons - relocated bins versus 800 tons - new bins), the following comparative analysis is made by prorating the new bin total project cost to B$160,500 to reflect equal storage capacity of 428 tons. Given the relatively poor soil condition of the site, the cost of site improvement, site preparation, and foundation will be disproportionately high and that is reflected in the cost estimation. Minimum life expectancy of the new bins and equipment is 20 years. Straight-line depreciation per year per ton for this intervention is B$18.75, thus resulting in a savings of B$74.71 per annum per ton over the bin relocation alternative,

or a total annual savings of B$31,977. In addition, bin relocation will need an additional interest expense (B$200,000 - relocation versus B$160,500 - new bins) on the difference of principals amounting to B$39,500. Another important element to consider in this analysis is a high salvage value of B$120,375 for the new bins that will be left at the end of 5 years as compared to no salvage value for the relocated bins. If relocation of bins is undertaken, GOB/BMB will need to replace the bins after the estimated useful life of 5 years, possibly at a much higher cost than now.

Recommendations

GOB/BMB should actively consider off-shore procurement of 1,600,000 lb (800 tons) of rough rice storage along with associated bin filling and emptying equipment at an estimated project cost of B$300,000 divided into US$69,000 and local currency of B$162,000. Under the current USAID/KSU contract, no funds are available to undertake this job.

Availability of adequate and reliable power to operate the new equipment is a vital consideration. The power at the mill complex is provided by three generators. Two of the essential generators, Caterpillar 3306 and Brown Boveri, have a power capacity of 155 KW and 150 KW respectively at 227/480 V, three phase, and 60 HZ. The new bin storage project should not be undertaken without ensuring that at least one of these two generators remains operational at any time.

Planning and Execution of the New Bin Storage Project

The task will consist of the following essential elements. The technical assistance for the elements that need overseas help could be provided by KSU/FFGI possibly with some amendment of the existing USAID/KSU contract.

1. Equipment specification and site plan development

   KSU/FFGI will prepare a set of specifications for storage bins and handling equipment required to fill and empty the bins and a site plan to locate the bins at Big Falls facility.

2. Invitation and acceptance of international bid

   According to specifications and other guidelines given by KSU/FFGI, GOB/BMB will invite an international tender to procure equipment. It is vital that a qualified bidder is selected. KSU/FFGI will assist in evaluating the bids and in accepting a bid.

3. Appointment of a local civil-electrical-mechanical contractor

   It appears that qualified local expertise exists to undertake this job under the guidance and supervision of KSU/FFGI. During the international bid selection process, a qualified contractor will be selected on recommendation of KSU/FFGI to develop the site, perform the earthwork including removal of soft layers of vegetation and top soil, consolidation, compaction, and determination of soil bearing capacity. After determina-

tion of soil strength, an appropriate foundation will be designed by this contractor according to KSU guidelines and specifications.

4. Overseas equipment shipment

The successful international bidder will procure the off-shore equipment according to specifications and ship the equipment CIF Belize City or Big Falls.

5. Civil work

The local contractor will perform the civil work as per GOB/BMB instructions according to definitions and procedures described in item 3 above. All civil work including the foundation will be finished during the period.

6. Electro-mechanical erection

The local contractor will perform this work under the guidance and supervision of KSU/FFGI and GOB/BMB.

It is estimated that the project will require a minimum execution time of 9 months. Time schedule for the new bin storage project is shown in Table 2.

TABLE 1

COST ESTIMATE FOR BINS, HANDLING EQUIPMENT, AND ERECTION OF FACILITIES

ITEM	QUANTITY	DESCRIPTION	TOTAL WEIGHT LBS	TOTAL PRICE US $
1	4	Galvanized corrogated grain bins, 24 ft dia. x 26 ft, eave height 13 in, plenum each to include 1 - inside ladder, 1 outside ladder, and safety cage, necessary foundation seal, 1 - roof safety ring, 1 - roof hand rail, and manhole rail package	30,080	$19,650
2	4	Full perforated drying floors for each of the above bins including 1 - High speed centrifugal fan, 1 - Fan transition, 3 - Elbow roof vents	12,560	$20,000
3	4	8 in dia. unloading system for each bin, with 1 center and 1 intermediate well, 3 HP drive and motor, Sweep auger with 1 HP drive and motor	2,296	$ 5,900
4	4	Temperature cable systems (3 cable)		
	1	Portable temperature reading instrument	97	$ 1,550
5	1	Transport auger with 10 HP drive, motor, wheels, and tires	775	$ 1,170
7	1	Set of miscellaneous hand tools including electric impact wrench	100	$ 575
Estimated total weight - 48,139 lbs				
Requiring the use of one 40 ft and one 20 ft steamship container				
Container loading and documentation				$ 1,075
Inland and Ocean Freight				$ 7,980
Marine Insurance				$ 300
TOTAL CIF Belize City price			US	$62,100
8	1	Technical erection supervision @ $1,725 per week for 4 weeks, 6 work days per week, and 10 work hours per day		$ 6,900
			US $69,000	(B$138,000)

TABLE 2

TIME SCHEDULE FOR NEW BIN STORAGE PROJECT

	TASK ELEMENT	MONTHS									
		0	1	2	3	4	5	6	7	8	9
1.	Equipment spec. and site plan develop	----									
2.	International bidding			--------							
3.	Appoint local contractor			------							
4.	Overseas equipment shipment					--------					
5.	Civil and foundation work						----------				
6.	Electro-mechanical erection									-----	

SECTION III

RENOVATION OF BIG FALLS RICE MILL AND GRAIN COMPLEX

Renovation of Big Falls Rice Mill and Grain Complex involves the following major tasks:

1. Extension of existing mill building

2. Selection of proposed mill equipment

3. Existing equipment renovation

3. Construction and installation supervision

4. Training of BMB personnel, and

5. Preparing BMB for divestiture

Extension of Existing Mill Building

The initial intent of this component was to extend the existing mill building primarily to house a proposed new rice mill, eliminate present congestion, and avoid sharing of common warehouse space by different products. This extension work is to be undertaken by BMB by using its own resources, including funding. Since this activity is well within the technical capability of Belize, the only anticipated technical assistance is the preparation of building specifications related to physical dimensions and some essential construction features. The approximate dimensions for the extension building is 60 ft x 40 ft x 30 ft height above the floor. Since the existing mill building is made of steel, the extension building should also have the same construction material. However, depending on the cost, expertise, and ease of construction considerations, BMB may also choose masonry as the construction material. Cost estimate for this work should be locally undertaken by GOB/BMB. An accurate cost estimate cannot be done at this time because the structural requirement of the building is dictated by the brand and model of the rice mill selected. For budgeting purposes B$300,000 should be adequate.

Selection of Proposed Mill Equipment

This component should not be undertaken unless the existing mill building is extended. To increase the milling capacity and milled rice quality, a new compact rice mill having an hourly capacity of 2 to 2.5 mt of paddy was originally planned. However, because of a severe cost escalation in the rice milling machinery, the estimated minimum installed cost of this rice mill is B$483,046 divided into a foreign exchange component of US$221,523 and a local component of B$40,000. The details of the estimate is shown in Table 3.
This cost estimate is expected to remain valid until June 1990 and should possibly be increased at a minimum annualized rate of 15 percent after that date.

Existing equipment renovation

Renovating existing equipment is a major thrust of the USAID/KSU contract. To improve the operational efficiency and milled rice quality, deletions and modifications of and additions to the existing equipment, facilities, and structures will be required. This task will be supported by assisting BMB management (1) in identifying critical repair works of the mill, (2) in preparing a list of equipment, spare parts, and services, (3) in procuring equipment, spare parts, and services, (4) in planning and scheduling a renovation program, and (5) in executing the program.

As a part of this activity, an assessment of the existing condition of the mill equipment was made. Here are the critical issues that need addressing:

Existing mill efficiency and rice quality problem. The existing processing capacity of the mill is low. In a 9-hr shift, approximately 112 bags of 100 lb weight is processed through the mill yielding 0.6 ton an hour of milled rice. It appears that this capacity could significantly be increased by certain modifications, improvements, additions, and deletions.

The reasons for efficiency and quality problems are identified as follows:

1. Low handling capacity - The spout that delivers the paddy to the rice mill paddy elevator from the overhead 12,500 lb surge bin has a greatly reduced flow rate not because the spout size is inadequate but because the bin that feeds the spout has collected residual small fines, sticks, and other trashes that accompany paddy to the mill. The rice complex has two paddy cleaning machines, the larger one located in the headhouse and the other in the rice mill. If both could be used in combination, there would be much cleaner paddy used in the milling process. But at present, only the smaller cleaner which is located in the mill is being used because the surge bin delivering paddy to the mill is not connected to the larger cleaner. Because of this operational constraint, uncleaned paddy is being passed through the surge bin in which heavy amount of fines, trashes, and cleanings accumulate over a period of time thereby causing a phenomenon called bridging which drastically reduces the grain flow out of the bin. Cleaning of the bin is extremely difficult because the bins do not have any convenient manhole for the clean up. The center cover on the bin top is located very close to the headhouse ceiling making maintenance crew entry into the bin impossible. Availability of only one small surge bin whose storage capacity has been greatly reduced by trash accumulation causes other operational problems such as the need to continuously operate a few high capacity conveyors and an elevator at a very low capacity that matches the rice processing rate.

   This is not only a very inefficient operation but also makes rice processing dependent on other equipment in the flow line and any breakdown in the feeding conveyors stops the mills. This constraint has significantly cut down the milling capacity in recent times.

2. Low mill bucket elevator capacity - The capacity of this bucket elevator has been significantly reduced because many buckets are damaged (there are

no spare buckets), and because of possible drive belt slippage caused by a v-drive pulley connected to a flat driven pulley by a single v-belt.

3. Low mill paddy cleaner capacity - The paddy cleaner and husk separator each have an aspirating fan. The two fans are connected together in parallel and used to convey husk and cleanings of the paddy to an outside location. This parallel connection of the two fans was not engineered properly in respect to balancing the pressures at the two ducts. As a result, the fan delivering air at a higher pressure was creating a back pressure on the delivery of the other fan resulting not only in an operational problem but also a reduction of paddy cleaning capacity.

4. Inadequacy of maintenance - Maintenance is an essential function that needs to be routinely performed on machines and buildings. The Big Falls facility which has fairly complex electro-mechanical equipment needs more maintenance than ever before because it is 10 years old and maintenance in previous years was less than satisfactory. Lack of proper maintenance is attributed to under (or no) staffing for maintenance, paucity of resources including funds to buy and maintain required inventory of spare parts and tools, and general unawareness or lack of recognition of the importance of maintenance. The facility did not have any maintenance staff until a few months ago when a person was hired as a "know-all" mechanic. The skill requirements for electrical and mechanical maintenance are different with both skills seldom found in one person. Sundry procurement of spares is routine. Spare part needs are determined after the breakdown of equipment and repairs sometimes await arrival of spares from Belize City or elsewhere. Given the fact that the rice mill is very old and located in a remote area of a developing country, the importance of employing adequate and qualified maintenance staff, inventory maintenance of required tools and spares at all times, and adoption of proper maintenance program cannot be over emphasized.

5. Need for personnel training - Training needs for operational and maintenance staff has already been established and the USAID/KSU contract provides for technical assistance in this area.

6. Poor milled rice quality - The quality problem is caused by various factors including production and post-production practices, paddy inventory management at rice complex, and mill machine limitations. Many different varieties such as Blue Bonnet, Belle Patna, Century Patna, Texas Patna, Star Bonnet, C-22, and Blue Bell, etc. are produced in Toledo district. Long-grain paddy constitutes most of the intake of the mill, medium and short grain rice are also received in smaller amounts. Mill machine adjustments for each of the three classes of rice are different and affect the final milled rice quality. Incoming paddy moisture varies widely because of different on-farm harvesting and drying practices and because of "weather related constraints". Paddy moisture ranges predominantly between 15 to 17 percent. Various efforts at high temperature artificial drying at Big Falls failed due to high fuel cost, sophisticated control requirements, and inadequacy of drying capacity. Presently, ambient in-bin air drying is practiced with less than desirable results. Drying by ambient air cannot be accomplished when the air relative humidity is high.

Segregation of paddy according to classification and moisture is not practiced because of storage space limitation, insufficient labor, and poor inventory control. Old and inadequately maintained machines can at best produce a poor quality rice. The screen type milled rice grading machine has limitations as to its capability of producing a high quality rice demanded by the present market.

Mill efficiency and rice quality improvement. Interventions related to improvement of rice mill efficiency, and rice quality are divided into two categories, namely, equipment and process modifications and new equipment installation.

Equipment and Process Modifications

The problem of a low milling capacity caused by factors such as the lack of a convenient process of surge bin cleaning, and low capacities of surge bin, mill paddy cleaner, and mill paddy bucket elevator can be partially solved by the following tasks:

1. A cleaning hole covered by a blind flange will be made at the surge bin hopper by using local resources.

2. A regular monthly cleaning procedure for the surge bin will be developed.

3. A procedural modifications to segregate long, medium, and short grain rice will be made.

4. Three additional overhead surge bins in the rice mill area with a total capacity of 37,500 lb (18.75 tons) of rough rice will be brought in line to connect to the rice mill paddy elevator. This will (a) allow paddy to be cleaned before going to the mill paddy cleaner which will reduce the load and increase the capacity of the paddy cleaner, and reduce the cleaning requirement of the surge bins, (b) add 18.75 ton to the present surge capacity of 6.25 ton thereby making it possible to keep at stock all the paddy the mill needs for at least one 18-hour day operation which will not only make the use of the high capacity surge bin filling conveyors more efficient but also the mill less dependent on the conveyors.

5. Modifications of the aspirating fan connections of both paddy cleaner and husk separator will be made to make the fans independent of each other which will increase the paddy cleaner capacity because of elimination of back pressure created by the husk aspirator fan on the paddy cleaner aspirating fan.

6. Modifications to feed the paddy along the entire width of the cleaner rather than at only one location will also contribute to the increase of the paddy cleaning capacity.

7. Paddy bucket elevator capacity will be increased by replacing the damaged buckets and preventing belt slippage by modifying the drive.

New Equipment Installation

To accomplish the renovation, some new equipment, tools, spares, and supplies need to be purchased. The following includes a list of some urgently needed equipment. Present obligated fund for equipment is not sufficient to cover expenses related to many other new equipment that could be installed to increase the milled rice processing capacity and improve rice quality. Adjustment in the following new equipment list involving addition and deletion will be required once the full funding situation is more clearly known. Detail specifications of the items listed below will be prepared at KSU and sent to USAID/BMB for final approval before the invitation for bid.

New Equipment

All the equipment listed below will include the required electrical system comprising motors, controls, and wiring.

	DESCRIPTION	JUSTIFICATION	NO. REQUIRED
1.	Heavy-duty portable industrial vacuum cleaner	Surge bin and other cleaning work	1
2.	Screw conveyor	Feed paddy from 3 surge bins to mill	1
3.	Bucket elevator	Elevate paddy to cleaner and shelled products to husk separator	2
4.	Rubber roll sheller	Increase shelling capacity	1
5.	Cylinder grader	Better quality rice	1
6.	Scale	Weigh paddy milled, better inventory control	1

Tools

For various renovation works, and routine maintenance such as lifting, repairing, assembling, disassembling, measuring, laying out, fabricating, and trouble shooting, tools purchase will include but not be limited to the following: chain hoists and steel cables, turn buckles, gas cutter, welder, power drill, power grinder, clamp-on electric multimeter, electric quick tester, hammers, chisels, hacksaws, electric solders, vises, wrenches, protractors, steel rulers with angle measures, tape measures, tachometer, manometer, pulleys, safety devices (such as belts, teethers, glasses, gloves, masks, portable fire extinguishers), and brushes, etc.

Spares

Immediate spare needs will include buckets, belts, pulleys, etc. A more elaborate spare parts list will be prepared in conjunction with BMB rice complex management.

Supplies

Many tools and equipment listed above need consumable supplies that will be purchased for the renovation.

Renovation Plan

A time schedule for renovation is given in Table 4. Even though the plan is somewhat ambitious, the plan could be carried out depending on the priority attributed to it by various concerned agencies. The procurement process involves certain minimum time requirement according to various agency regulations including KSU.

International shipment of equipment, tools, spares, supplies, and the required coordination and mobilization of resources will need additional time. Also, the BMB Big Falls complex is a functioning facility that needs to operate to supply rice to the Belize national market. Keeping this facility shutdown for any protracted period of time to complete renovation in one continuous time slot is virtually impossible. Therefore, the renovation effort must continue intermittently to meet the two contrasting objectives, namely keep the mill running uninterrupted and complete the renovation expediently.

Construction and installation supervision. The task of construction and installation supervision consists of providing technical assistance to BMB management (1) in selecting and employing a construction crew/agency for extension work of the existing mill building, and in supervising this work. For the installation of the mill equipment, technical assistance will be provided to plan and schedule the erection work and to execute the erection in respect to civil, mechanical, and electrical works. This supportive task will also consist of test running the new mill so as to determine if the equipment performs to the specifications.

However, as discussed earlier, the source for funding of the extension of the existing mill building to house the proposed new rice mill is not known. Also, available funding to cover the cost of a new mill is not adequate.

Preparing BMB for Divestiture

One of the most important objectives of the contract is to make the BMB rice complex an efficient operation producing good quality rice at reasonable cost so as to be able to attract private enterprise interest in acquiring the facility. The interventions discussed in sections A through E are geared to accomplish this objective. A COP and KSU engineer will assist GOB/BMB in determining a fair market value of the BMB facilities and preparing specifications for documents needed for the invitation of bids. This activity will be undertaken near the completion of the renovation of the complex.

Total project budget. The total project budget is given in Table 5.

Coordination with TAMP/VITA Private Sector Project

The means of coordinating on-farm and off-farm postharvest improvements implemented under the TAMP Private Sector Component with the renovation of the BMB facilities proposed under the TAMP Public Sector Component were discussed and developed. Coordination will occur in the areas of training, product differentiation and promotion, and divestiture of the Multipurpose Service Centers (MCS's).

Training. Since the Big Falls - Toledo facility will be upgraded to produce better quality milled rice in a more efficient manner, rice producers and MSC staff must be trained in various areas of postharvest drying and storage in order to improve the quality of the rice delivered to the mill. To assist the producers with drying their paddy, it is advised that on-farm dryers should be installed on a trial basis. TAMP/VITA would be directly involved in promotion of this postharvest technique.

MSC staff will be trained in all aspects of rice collection, grading, storage, and transport. The staff will need to be able to address those problems (e.g., moisture laden paddy, paddy with excess foreign matter) that the MSC's assume when the paddy is procured.

Product differentiation and promotion. The milling of rice is done much more efficiently when the type of rice milled is uniform. It is urgent that producers understand that they must produce (given, of course, sufficient market incentives) the type of rice the rice mill is most efficiently able to both mill and market. Up until now, BMB has accepted all varieties and types of paddy.

Divestiture of multipurpose service centers. A major thrust of the TAMP project is to assist the BMB and the GOB in the divestiture of the MSC's after the MSC staff have been sufficiently trained and the MSC's have become an integral and efficient part of the marketing system. With the training of MSC staff in, especially, rice grading and storage techniques and once the type of rice most suitable for the mill and the market has been accepted by producers as part of their standard production practice, divestiture of the MSC's will become a much easier task for BMB and the GOB.

TABLE 3

EQUIPMENT ESTIMATE

ITEM	QUANTITY	DESCRIPTION	TOTAL WEIGHT LBS	TOTAL PRICE US $
1	1	Magnetic separator	9	$ 570
2	1	Sifter separator with 1/2 HP motor	946	$ 4,798
3	1	Rice sheller with airlock & 10HP motor	2,574	$17,387
4	1	Paddy separator with 3 HP motor	6,270	$24,571
5	1	Rice whitener with 30 HP motor	1,089	$11,751
6	1	Pneumatic lift with airlock 5 HP & 1/2 HP motors	1,958	$ 6,492
7	1	Sifter grader 1/2 HP motor	506	$ 4,798
8	1	Indented grader, 2 HP motor	1,584	$ 6,740
9	1	Cascade aspirator	649	$ 1,461
10	1	Dust collector with airlock 5 HP & 1/2 HP motors	1,804	$ 5,671
11	1	Hulls blower fan, 2 HP motor	396	$ 2,985
12	3	Bucket elevators with 3/4 HP motors	3,498	$12,515
13	1	Screw conveyer with 3/4 HP motor	1,078	$ 3,651
14	2	1/2 and 3/4 grain grader, 1 1/2 HP motor	1,518	$ 9,051
15	1	Bagging machine	172	$ 1,180
16	1	Bag weigher	638	$ 3,326
17	1 set	Spouts & ducts	1,837	$ 6,958
18	1 set	Hoppers	6,600	$20,873
19	1 set	Structural steel frame	16,500	$41,745
TOTAL			49,626 lbs[1]	$186,523
20	1 set	Tools & erection supplies		$10,000
21		Contingencies		$10,000
Freight Cost				$ 2,100
Insurance				$ 900
TOTAL CIF Belize City Price				$209,523
22		2 erectors @ $2500 per week for 4 weeks, 6 work days per week, and 10ork hours per day		$ 10,000
23		1 Start-up technician @ $2000 per week for 1 week		$ 2,000
TOTAL			US	$221,523
			B	$443,046
Estimated inland transport, mechanical, and electrical erection			B	$ 40,000
TOTAL PROJECT COST			B	$483,046

[1] Total approximate shipping weight and volume are 22.5 mt and 2,650 ft^3 respectively. Additional motor HP for the new mill is 63.5.

TABLE 4

TIME SCHEDULE FOR RENOVATION PLAN

TASK ELEMENT	MONTHS OF 1989 AND 1990													
	6	7	8	9	10	11	12	1	2	3	4	5	6	7
1. Equipment and process modification, locally performed with KSU T/A		----	----	----	----	----	----	----	----	----	----	----	----	----
2. KSU engineer prepares specifications and drawings					----	----								
3. USAID/BMB approve specifications and procurement of equipment, etc.							----	----						
4. Invitation for bid and bid acceptance								----	----	----				
5. Shipment of equipment, tools, and supplies										----	----	----	----	
6. Preparation, installation of new equipment.														

TABLE 5

TOTAL PROJECT BUDGET ESTIMATE

PROJECT COMPONENT	FOREIGN EXCHANGE US $	LOCAL CURRENCY B $
1. New bin installation (1,600,000 lbs of paddy)	69,000	162,000
2. Renovation of Big Falls rice mill and grain complex		
A. Extension of existing mill building (60 ft x 40 ft x 30 ft high)	0	300,000
B. Selection or proposed mill equipment New compact packaged rice mill (2 to 2.5 mt paddy per hour)	221,523	40,000
C. Existing equipment renovation	50,000	50,000
GRAND TOTAL	340,523	552,000

APPENDIX I

CONTRACTOR'S ESTIMATE FOR MOVING BINS

From: Levi Reimer
P.O. Box 427
Spanish Lookout
Cayo District

To: General Manager
Belize Marketing Board
117 North Front Street
Belize City

TENDER

I hereby submit tender regarding dismantling, transporting, and setting up in Punta Gorda four grain tanks from Belize City.

Dismantle 4 grain tanks, Bze. City & transport and set-up in Punta Gorda	---------	$ 34,000
Tanks - Footers for 4 tanks	---------	$ 11,500
Bolts & sealer (10,000 bolts per tank) 40,000 x $ 0.75	---------	$ 30,000
Dryer footer for dryer	---------	$ 3,950
Dismantle dryer & set-up PG	---------	$ 14,000
Side metal molding	---------	$ 5,000
Flooring for dryer	---------	$ 800
Bolts	---------	$ 2,000
Iron & welding	---------	$ 3,000

Augers (replacement)*

Electrician *

* No estimate on replacement of augers and electrician presently available

Respectfully Submitted,

Signed: Levi Reimer

APPENDIX II

AWARD FOR MOVING BINS

Ministry of Agriculture, Forestry, and Fisheries
Belmopan, Belize, CA

14th March, 1989

Mr. Levi Reimer
P.O. Box 427
Spanish Lookout
Cayo District

Dear Sir,

We are pleased to inform you that the Rt. Honorable Minister of Finance has approved to you the award of the tender for the transportation of bins, etc. in the sum of $111,250 as per your bid submission. You should now contact the Chief Agricultural Officer for further instructions.

Faithfully, Signed:

(C.Russell) (MRS)
for Permanent Secretary
Ministry of Agriculture

APPENDIX III

DATA

ANNUAL PADDY PURCHASE AT BMB BIG FALLS

YEAR	AMOUNT IN POUNDS
1984-85	3,500,000
1985-86	5,200,000
1986-87	4,300,000
1987-88	5,800,000
1988-89 (as of April)	7,200,000

ANNUAL PEAK PERIOD PADDY PURCHASE AT BMB BIG FALLS
(From Oct. 15 to Nov. 15)

YEAR	AMOUNT IN POUNDS
1984-85	1,800,000
1985-86	1,600,000
1986-87	1,700,000
1987-88	2,500,000
1988-89	3,300,000