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VALUE ENGINEERING STUDY
OF THE
CONSTRUCTION COMPONENT
OF THE
WESTERN SUDAN AGRICULTURAL RESEARCH PROJECT
PREPARED FOR THE
U. S. AGENCY FOR INTERNATIONAL DEVELOPMENT
DECEMBER 12, 1984
SUDAN: PROJECT NO. 650-0020

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CONTRACT
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GLOSSERY OF ACRONYMS AND TERMS

A/E	Architect/Engineer	
ARC	Agricultural Research Corporation	Sudan
CID	Consortium for International Development	U.S.A.
CONTRACTOR or EK/D	The joint venture of El Khidir and Diraije Co. Ltd.	Sudan
FX	Foreign Exchange (US dollars)	
GOS	Government of Sudan	Sudan
G-Z	Grube-Zimmer, Inc	USA/Sudan
KARPLEN	KARPLEN Consultants	Sudan
LC	Letter of Credit	
Ls.	Sudanese Pounds	
Payment Certificate	Progress billing form which is signed by WSARP, A/E, Contractor	
USAID	United States Agency for International Development/Sudan	Sudan
VE	Value Engineering	
WB or IBRD	International Bank for Reconstruction and Development (World Bank)	USA/Sudan
WSARP	Western Sudan Agricultural Research Project (This project is under the Agricultural Research Corporation, GOS Ministry of Agriculture)	Sudan

INTRODUCTION

This report covers the findings and conclusions of Burns & McDonnell Value Engineering (VE) team composed of Rodd D. Staker and Gary Robertson, engineers with Burns and McDonnell Engineering Company. Burns & McDonnell was retained under contract with the United States Agency for International Development (USAID), to perform a value engineering analysis of the construction component of the Western Sudan Agricultural Research Project (WSARP) and make recommendations concerning how this component should proceed from the current status. A detailed scope of the study is included in Appendix E.

The Value Engineering (VE) team arrived in Khartoum, Sudan on November 7, 1984 to conduct this study, and subsequently departed Khartoum on December 14, 1984. An outline of VE team daily activities is included in Appendix A.

In the course of conducting this study, the VE team has reviewed pertinent Project information from files of the USAID Engineering Section, the USAID Agricultural Project Office, and the Grube-Zimmer Resident Architect.

The VE team has interviewed key people currently associated with this Project, where available, and others who could provide pertinent general information concerning construction in Sudan.

All four Project construction sites were toured by the VE team to observe current completion status, activity, and construction management.

OVERVIEW

The Western Sudan Agricultural Research Project (WSARP) is jointly funded by USAID, the Government of Sudan (GOS), and the World Bank, for an initial six year period beginning August 1979. The Project involves establishment of agricultural research programs at four Sudanese locations and construction of three new research facilities and an administrative headquarters.

Development of the program is led by the Consortium for International Development (CID), which is providing technical assistance, architectural and engineering services, and education of Sudanese scientists under contract with USAID. CID has further employed the services of Grube-Zimmer, Inc. of Portland, Oregon for design and resident services during construction of the Project.

In 1981 design was completed and bids were taken for construction of facilities at El Obeid, El Fasher, Ghazala Gawazet and the ARC headquarters at Khartoum North. Appendix F indicates the relationships of the Project organizations.

Prior to award of the construction contract, numerous discussions took place between project principals and El Khidir and Diraige Co. Ltd., a Khartoum joint venture, and the apparent low bidder. In consideration of their split between U.S. dollars and local currency (50/50); construction costs; and their schedule for completion; the Construction Contract was awarded to them in June, 1981. Construction activities began in earnest during August 1981.

Since construction began in August 1981, it has been plagued with a multitude of problems and setbacks, and in fact remains uncompleted sixteen months beyond the original contract completion date of August 1983.

Latest revised construction schedules prepared by C-Z indicate completion of all four sites by mid 1985.

Questions raised regarding the construction schedules and the possibility of cost over-runs have been the basis for USAID authorizing this Value Engineering Study.

CURRENT PROJECT STATUS

I. CONSTRUCTION STATUS

El Obeid - Construction at El Obeid is 69% complete. Brickwork on the houses and administration and research buildings is complete and the roof framing and decking is in place. Some window and door frames are in place, the remainder are on site and being installed. Concrete slabs in the buildings and houses are in place except where sub-floor piping will be installed and in verandah areas. Most conduit is installed and some wiring is done. Plumbing piping is about half complete and plastering of walls is nearing completion. Tile slabs are partially complete. Installation of the verandah screens is in progress. Underground water lines are over half complete and underground sewer lines are substantially installed. The sewerage ponds are nearly complete except for piping.

Remaining major items to complete other than those noted above include site grading, fencing, installation of window glass, water tower and tank erection, electrical and plumbing fixtures, painting, suspended ceilings, lab and kitchen cabinets, air coolers, and the generators. Of these items, parts of the water tower/tank are in transit, door and window frames are on site. Verandah material and electrical fixtures are in Khartoum. Plumbing fixtures, window glass, suspended ceilings, lab and kitchen cabinets, and generators are on order. Fencing, wall tile, paint, AC units and air coolers have not been ordered.

El Fasher - Construction at El Fasher is 42% complete. Brickwork on the houses, buildings and retaining walls is complete. Only a portion of the roof framing and roof deck is in place. None of the window or door frames are in place. Some are at Khartoum North, Ghazala Gawazet and in transit. Most of the conduit and wiring is in place except for the research and administration buildings. Most interior slabs are poured except areas for sub-floor piping. None of the interior plumbing is complete; piping is in transit for this site and Ghazala Gawazet. None of the plastering is done. No cement tile is installed, but the material is on site. Underground water lines and sewer lines are not in place; the material is on order. The septic tanks and soaking wells are complete. Remaining items to complete other than those noted previously include site grading; doors and window glass, which are on order; electrical fixtures, which are in Khartoum; plumbing fixtures, suspended ceilings, lab and kitchen equipment, verandah screening, and generators which are on order; and air coolers, fencing, wall tile and paint which have not been ordered.

Ghazala Gawazet - Construction at Ghazala Gawazet is 51% complete. Except for openings in compound walls, the brickwork for houses and buildings is complete. Nearly all the roof framing and decking is complete. Some of the window and door frames are on site. Nearly all the electrical conduit and most of the wiring is in place. Most interior slabs are poured except areas for sub-floor plumbing. None of the interior plumbing piping is in place; material is in transit. None of the interior plastering is done. Floor tiles have not been placed; but material is on site. None of the underground water and sewer lines are installed. A few soaking wells are constructed and the septic tanks are constructed. The water tank foundation is in place, and the tank is ordered. Remaining items to complete include site grading; electrical fixtures which are in Khartoum; glass, plumbing fixtures, suspended ceilings, lab and kitchen equipment, underground fuel tank, verandah screening and generators all of which are on order; and air coolers, fencing and paint which have not been ordered.

ARC Khartoum North - Construction of Khartoum North is 94% complete. Brick work for the buildings is complete. The built-up roof on the administration building is not complete. Many of the window and door frames are in place; the remainder are on site. Nearly all electrical conduit and some wiring is installed. Interior slabs are poured except for areas of sub-floor plumbing. Plastering is in progress. Floor treatment is pending a decision on terrazo tile versus concrete tile. Most of the underground piping is not installed. Remaining items to complete include site grading and roads; electrical fixtures which are in Khartoum; window glass; suspended ceilings, which are on order; air conditioners or air coolers which are unresolved; and fencing and paint which are not on order.

II. COST STATUS

Original Tender plus Variation Order No. 1 comprises the original contract price, with Variation Order No. 4 being added in August 1983. Variation No. 4 was funded from budget contingencies. The only other approved Variation is No. 2 which produced no change in price.

Figure 1 indicates current status of progress billings (gross), amended contract price and amounts remaining.

Eighteen Payment Certificates have been approved for disbursement, with seventeen being paid previously. Certificate 18 is reported to be held by USAID. Certificate 19 is currently being reviewed.

To date 59.4% of the amended contract has been billed and 6.4% of contingencies have been committed (Var. 4).

Changes have been proposed but not approved in the amount of approximately LS 1,168,000.

Contractor currently has claims submitted for Economic Dislocation reimbursement and time extensions.

FIGURE 1

CURRENT BILLING STATUS

	Orig. Tender (Ls.)	Var.Order #1(Ls.)	Var.Order #4(Ls.)	Current Contract	Gross Billings (Ls.)	Ls. Remaining
E1 Obeid	6,471,360	859,089	153,826	7,484,275	5,162,502	2,321,773
E1 Fasher	3,006,105	404,405	53,711	3,464,221	1,467,221	1,996 13
Ghazalag	2,803,718	389,300	55,355	3,248,373	1,654,377	1,593,996
ARC HQ	426,036	1,405	34	427,475	401,927	25,548
TOTAL	12,707,219	1,654,199	262,926	14,624,344	8,686,715	5,937,629

	<u>REM. GOS (Ls.)</u>	<u>REM WB (\$)</u>	<u>REM USAID (\$)</u>
E1 Obeid	1,160,887	1,088,331	362,777
E1 Fasher	998,157	935,771	311,923
Ghazalag	796,998	747,186	249,062
ARC HQ	12,774	11,975	3,992
TOTAL	2,968,815	2,783,264	927,755

NOTE: 1. Figures are gross amounts (before deduction)
 2. Calculated through Certificate 19 (estimated)

ANALYSIS AND RECOMMENDATIONS

1. CONSTRUCTION

A. CONTRACTOR PERFORMANCE

1. Quality

a. Analysis

Generally the quality of the workmanship has been good and meets or exceeds construction quality evident on other Sudanese projects. Undoubtedly the presence and efforts of the Resident Engineer has had positive impact on the quality. The quality of the work at the El Fasher, Ghazala Gawazet, and Khartoum North sites was better on some items than at the El Obeid site. Then again, it should be pointed out that the first two sites are further behind schedule than El Obeid.

The Contractor is using construction techniques common in the Sudan. During our site visits we observed some practices which could be improved to ensure quality construction is achieved. These may have been spot occurrences but nevertheless need to be addressed. Specifically, concrete floor slabs should be vibrated. Mortar materials (sand and cement) should not be blended on the ground, but rather in some container to avoid foreign materials. Care should be taken to preclude mortar and plaster from getting in the prefinished window frames. Concrete slab finishing of steel troweled floors needs improvement at some sites. Also better formwork and good vibrating techniques for precast items will result in improved quality. The Senior Architect noted these items also and discussed them with the Site Superintendent.

b. Recommendations

Since the quality has generally been good, we have no recommendations or comments other than those noted in the previous paragraph.

2. Schedule

a. Analysis

(1) Planning - There has been a lack of scheduling, planning and management on the part of the Contractor. An initial schedule was submitted by the Contractor early in the construction, however there was not a copy in any of the files. The Senior Architect rejected it for being inadequate. The Contractor, after requests from the Senior Architect and Resident Engineers finally prepared a schedule in May, 1983, 3 months before the project was to have been completed. This schedule indicated completion dates as

follows:

El Obeid	May 1, 1984
El Fasher	March 1, 1984
Ghazala Gawazet	March 1, 1984
Khartoum North	July 1, 1984

Other than the two schedules mentioned, no other schedule either for procurement or construction has been prepared by the Contractor. There was little evidence at the construction sites of construction planning, although at El Obeid an outdated schedule was posted in the Superintendent's office and from the progress of construction it appears at least some planning was done although inadequate. Inadequate staffing levels and sequential rather than simultaneous execution of the work also indicate there was little, if any, construction planning or scheduling on most sites. Procurement planning and scheduling was inadequate also. Materials were not ordered in a timely manner and late materials often held up construction.

The Senior Architect and Resident Engineers from time to time requested revised schedules from the Contractor, which per Clause 14 of the Construction Contract the Contractor is required to provide. In the absence of Contractor-prepared schedules, the Senior Architect with input from the Contractor, prepared revised schedules in November, 1983, July 1984, and October 1984. The latter schedule indicated completion dates of April 1, 1985 for Khartoum North and July 1, 1985 for the remaining three sites.

(2) Execution - Although there were a number of factors beyond the control of the Contractor that had a detrimental effect on the Contractor's progress, many of these would have had much less impact had the Contractor planned the work well and executed it in a timely manner. Many of these constraints occurred after or near the Contractor's required completion date of August, 1983.

Some of the significant external factors were as follows:

- November 1981 - GOS devalued Sudanese pound 12%.
- August 1981 to June 1982 - GOS military used firing range near El Fasher site.
- May to November 1982 - Ban in cutting timber which affected brick making.
- November 1982 - GOS devalued Sudanese pound 44%.
- Mid 1982 to Mid 1983 - Periodic bans on the use of water for construction.

- July 1983 - GOS imposed import bans on certain items (refer to Appendix D).
- October 1983 - 100% deposit was required on Letters of Credit whereas previously it was 25%.
- Continuing shortage of petrol which requires a request to GOS monthly and an approved allocation.
- Continuing Railroad usage restrictions to permit only 'strategic items' to be transported by rail.

The periodic use by the military of the firing range near the El Fasher site did slow construction at that site. The ban on cutting timber might not have been a significant factor at El Obeid and Ghazala Gawazet had the work been planned and executed in a timely manner as much of the brick making could have been completed prior to the ban. As it was, brickwork on these two western sites did not begin until mid May-June, 1982, right after the timber ban began. The GOS ban on imports which began in July, 1983 only affects, on this project, the purchase of furniture (kitchen and lab cabinets), air conditioners, fabricated aluminium, and doors and windows (refer to Appendix D for a complete list). Had items been ordered early in the job as would be expected, the import ban would not have affected the project. The first foreign materials were not ordered until the first quarter 1983 and it wasn't until third quarter 1983 (shortly before required completion in August) that windows and door frames were ordered. Also the 100% deposit requirement on L/C's which went into effect October, 1983 would not have impacted Contractor purchases because by that time purchases should have been completed. Fuel shortages, however, could not have been avoided. The monetary impact of the water shortage is less than at first glance since the Contractor was paid per the Bill of Quantities for hauling water when water shortages occurred.

Construction started with mobilization at all sites in August 1981. The Construction Contract specified a contract completion date of August 7, 1983. Progress at El Fasher in 1981 and the first half of 1982 was slowed by the firing at the nearby military shooting range. The start of concrete work at El Fasher and Ghazala Gawazet was delayed until the concrete mixers arrived at the site in March, 1982. Since 1982 the Contractor has continued to experience on-site shortages of materials such as sand and cement. Also inadequate staffing levels has continued to be a problem. Shortages of local building materials and personnel at the job sites appear to be primarily due to inadequate planning and scheduling by the Contractor and may also be linked to the Contractor's weak cash position which has been reported by the Resident Engineers and Senior Architect from time to time. Shortly after the Contract was signed, Mr. El Khidir

and Mr. Diraige announced their intention to operate as separate entities with Mr. El Khidir's firm constructing El Obeid, and Mr. Diraige's firm constructing the other three sites. This split coupled with Mr. Diraige's departure from Sudan in late 1983, may have had an affect on procurement of materials and expenditures for labor. Another item which added to the complexity of the situation was that Mr. Diraige entered into a labor contract with China Engineering Construction Company for construction of Diraige's three sites.

By October 1982, 14 months into the 24 month construction period, construction was significantly behind schedule as can be seen in Billing Curves, Figures 2,3,4,5 and 6 with little progress being made. (See Appendix 1 for explanation of Billing Curve Plots).

Construction completion as of October 1982 was as follows:

El Obeid	16%
El Fasher	14%
Ghazala Gawazet	15%
Khartoum North	62%
TOTAL PROJECT	17%

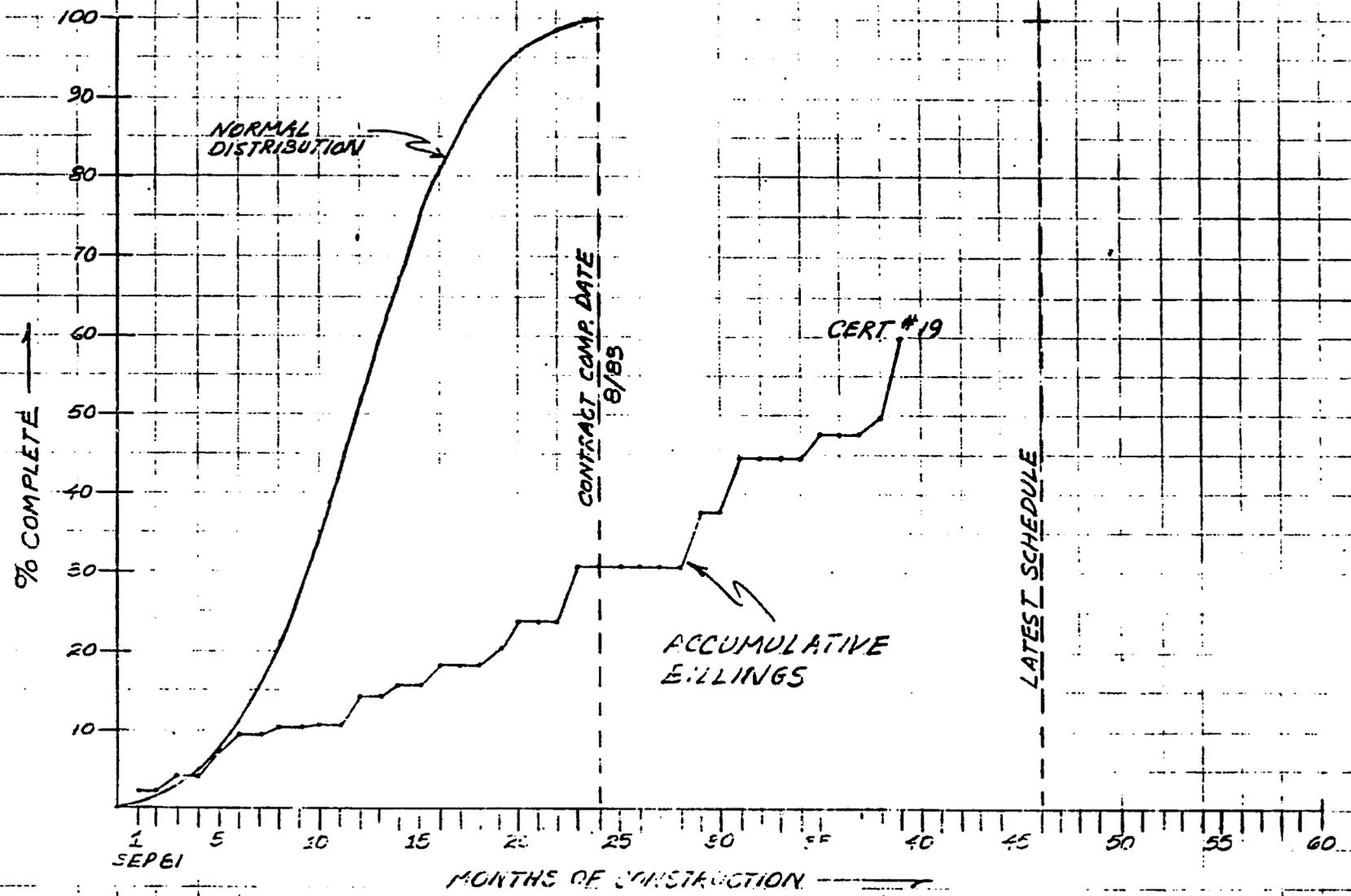
Also in October 1982 Variation Order #2 was signed which extended Contract completion dates for the El Obeid, El Fasher and Ghazala Gawazet sites from August 7, 1983 to January 28, 1984. The Contract completion date for Khartoum North remained August 7, 1983. The Variation Order took into account the impact of fuel shortages and the timber cutting ban.

Foreign materials were not purchased at an early stage in the project and this has continued to slow construction progress. For example, roof framing was not ordered until the first quarter of 1983 and window frames were not ordered until the third quarter of 1983. Work was suspended in Khartoum North in November 1982 due to lack of windows, doors and did not resume until March 1984. No foreign materials were purchased until the first quarter 1983 as indicated by Contractor payment request.

In summary, the major external factors which affected the Contractor's progress and over which he had little control were the fuel shortage, and the ban on cutting timber. To a lesser extent, the firing range problem at El Fasher was a problem, as were periodic water shortages at all western sites. Many of the other external factors would not have affected his progress had he properly planned, scheduled and executed the construction.

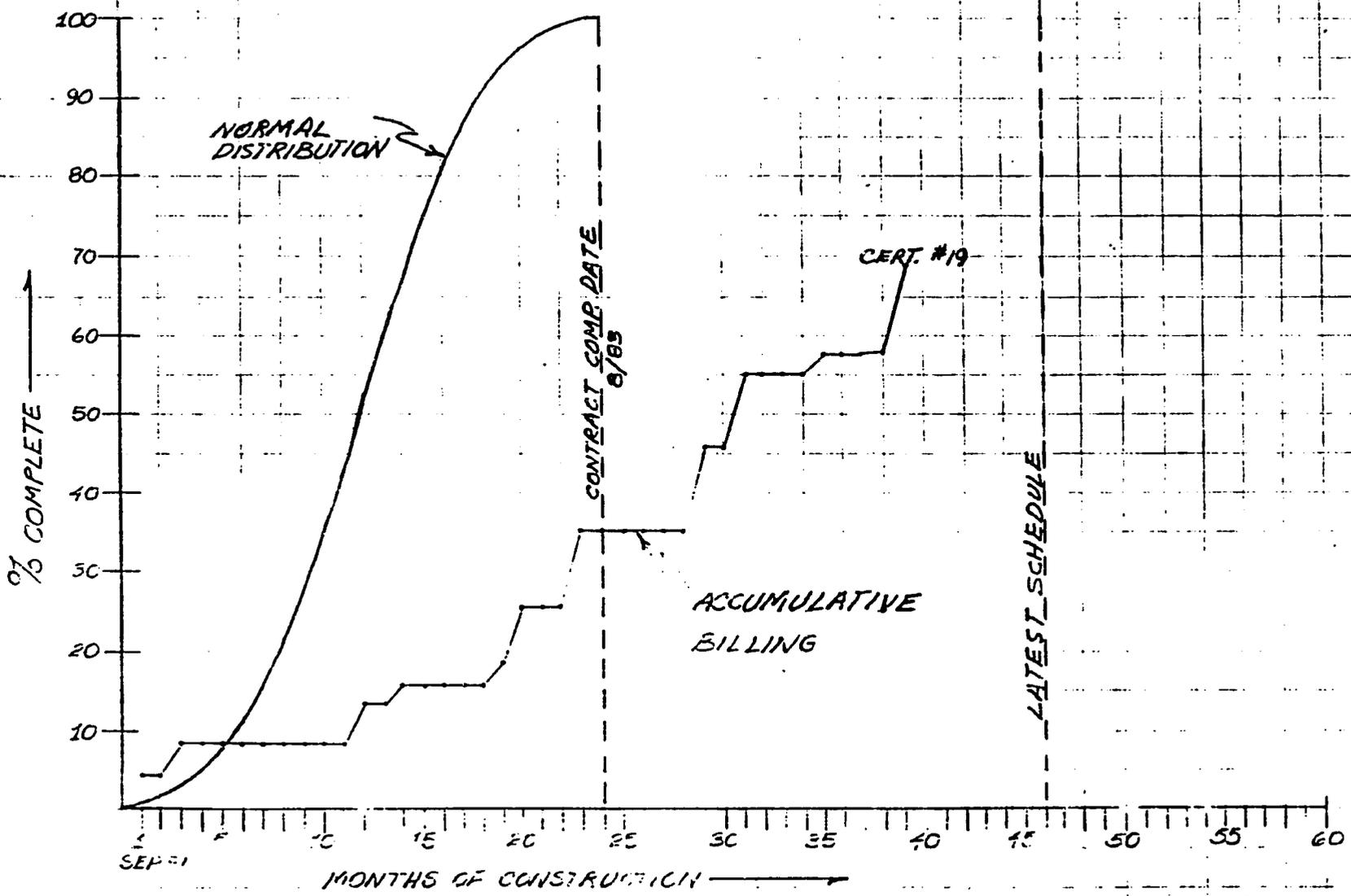
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FIGURE 2



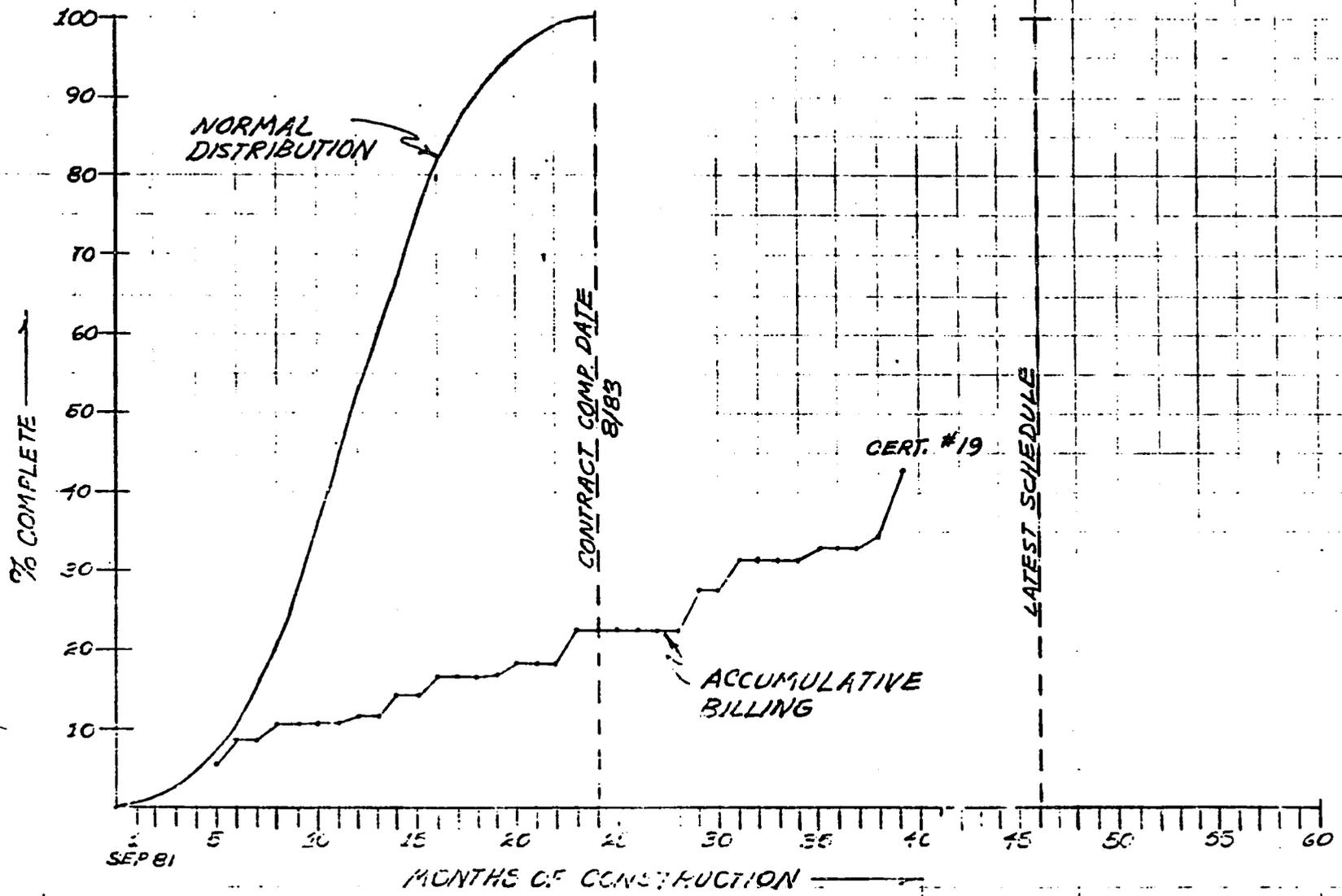
BILLING CURVE - TOTAL PROJECT

FIGURE 3



BILLING CURVE - EL OBEID

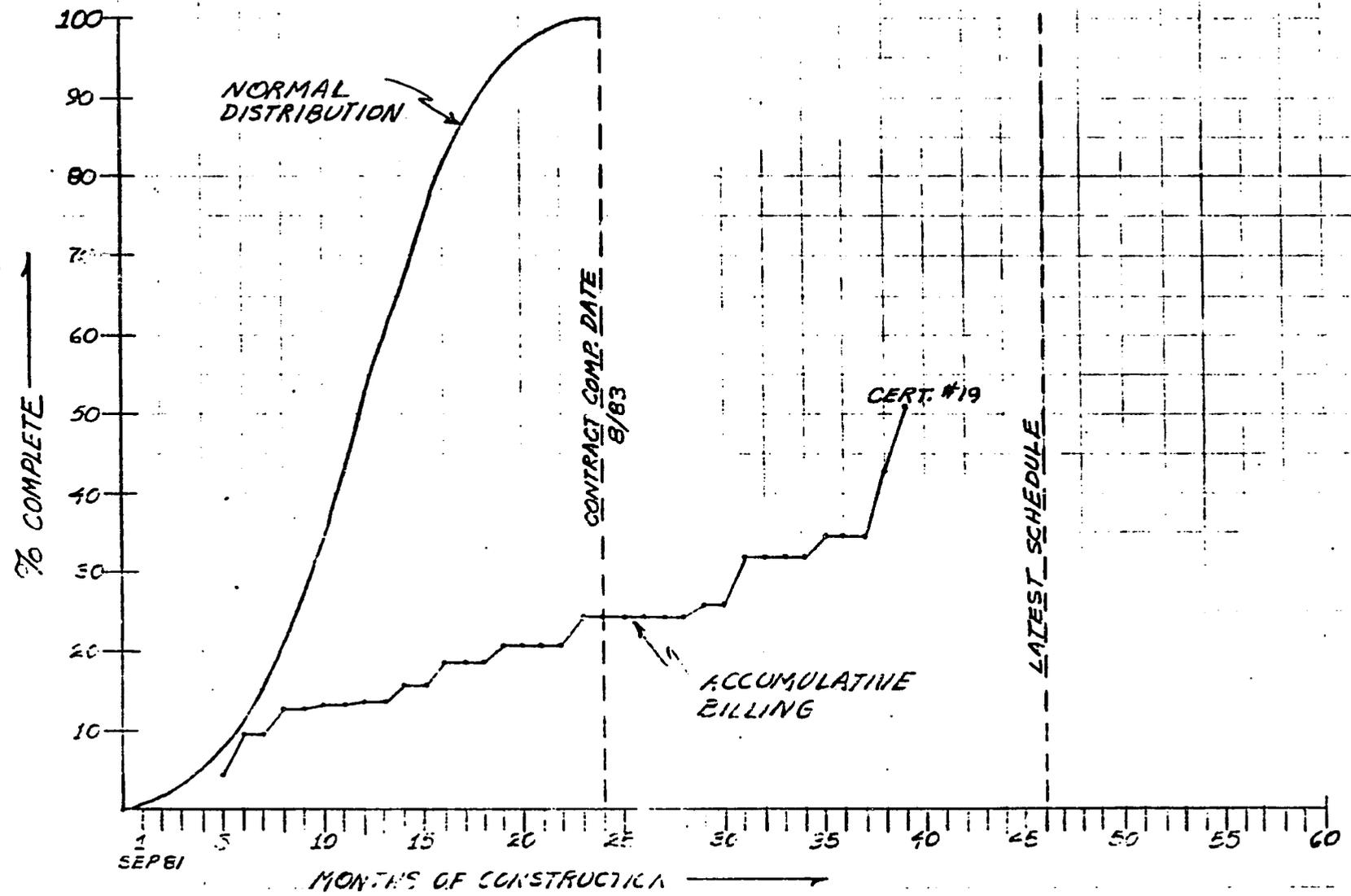
FIGURE 4



BILLING CURVE — FL FASHER

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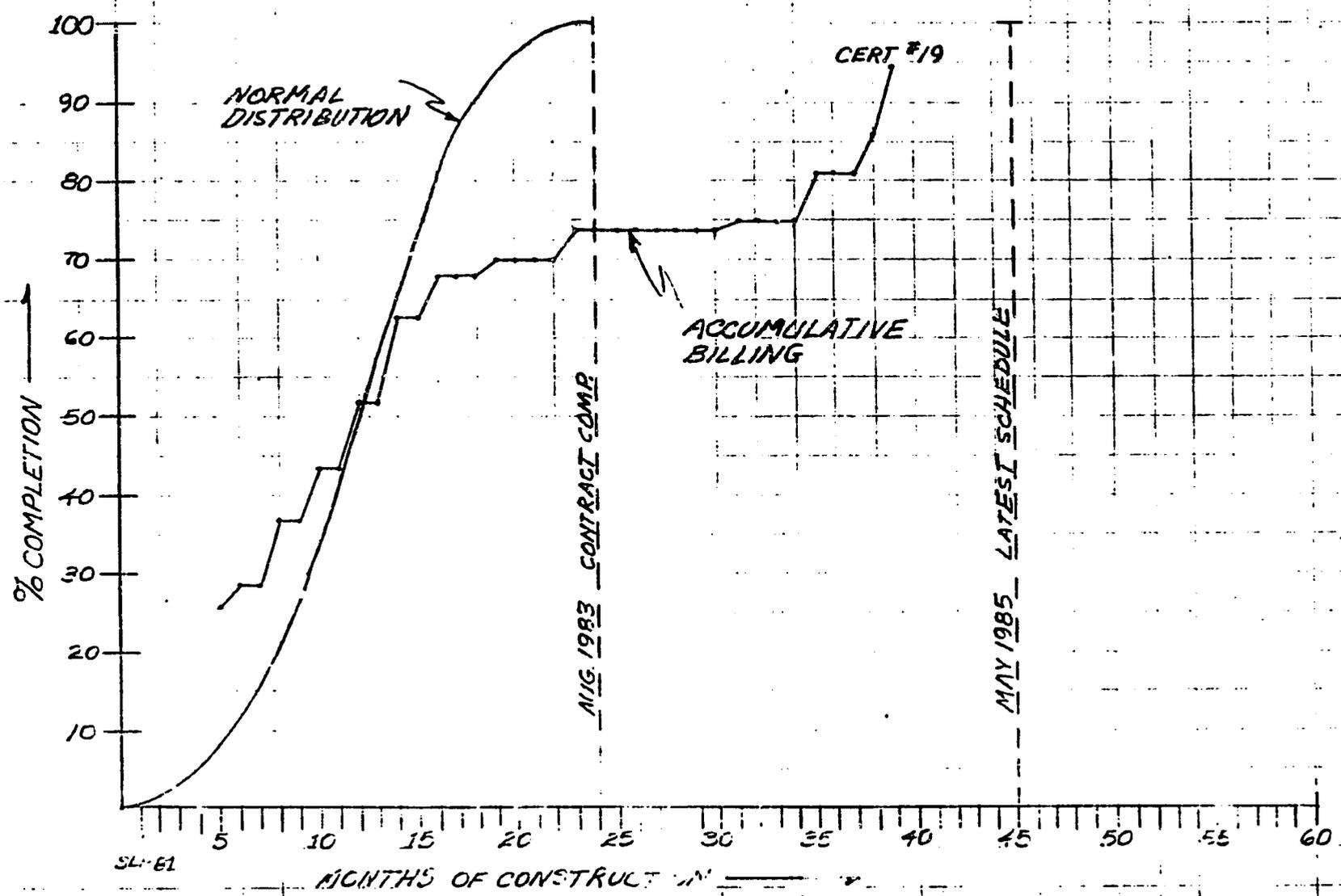
FIGURE 5



BILLING CURVE — GHAZALA GAWAZET

- 14 -

FIGURE 6



BILLING CURVE - ROU... QUARTERS

The Contractor's lack of planning and scheduling of labor and of material procurement has and continues to impact the progress of the work.

b. Recommendations

- (1) The Contractor must prepare and monitor a realistic construction schedule as required in Clause 14 of the Construction Contract. Use a schedule format similar to the one included in this report.
- (2) Weekly on-site meetings must be held and include the Resident Engineer who will conduct the meeting; Clerk of Works and EK/D's Superintendent and Foremen. The purpose of the meeting would be to review the construction and procurement schedules, status of procurement, quality and problem areas. The Resident Engineer should prepare minutes and distribute copies to all those attending, to EK/D offices in Khartoum and to the Senior Architect.
- (3) The Contractor must advise the Senior Architect immediately and in writing of any significant problems affecting the schedule or cost of the project and particularly when it will require the assistance of the Senior Architect, funding agencies, or WSARP.
- (4) Monthly on-site meetings must be held to include the Senior Architect, who will conduct the meeting, EK/D's management - Mr. El Khidir and Mr. El Hag, Resident Engineer, Clerk of Works, and EK/D Superintendent. The purpose of the meeting will be the same as for the weekly meetings. The Senior Architect will prepare minutes of the meeting and distribute to all present and to the funding agencies and WSARP.
- (5) Post a copy of the schedule in each Superintendent's office and keep it updated.

3. Procurement

a. Analysis

Procurement, particularly of foreign materials, has had a significant effect on progress as construction slowed at various times while awaiting materials. The Contractor's procurement procedures are as follows:

- The EK/D Joint Venture offices sends copies of the specifications, plans and other requirements to a purchasing agent (Lidcell) they have retained in London. El Khidir prepares separate purchase orders for materials at their site at El Obeid. The EK/D joint venture office prepares separate purchase orders for the other three sites
- The purchasing agent contacts prospective suppliers and from a supplier obtains a pro-forma invoice which states the price along with technical data. The suppliers will not generally prepare detailed shop drawings or begin fabrication or shipment until a Letter of Credit (LC) is opened by the Contractor.

- The pro-forma invoice, which states the price and shipping costs, along with technical information is sent via the EK/D joint venture office and El Khidir in Khartoum to C-Z's Senior Architect for review and approval.
- After approval, an application for an import license is made by EK/D to the Ministry of Commerce for approval. An import license application is required for each item. This request may take 2-3 months for approval.
- The import license is in effect for 45 days (prior to November 1984 it was 15 days). If an LC is not opened within this time period, a new application for license must be made.
- If the import items are on the banned list (which has been in effect since July 1983) (refer to Appendix D) then the Bank of Sudan must approve the import license application. This can take several weeks.
- After approval of the import license by the Ministry of Commerce and the Bank of Sudan, the Contractor's Sudanese bank opens a LC which requires 100% deposit (prior to October 1983 the required deposit was only 25%).
- The Contractor's Sudanese bank then notifies the supplier's bank the LC is opened. At this point the Contractor has paid 100% for the goods.
- The materials are fabricated and shipped to Port Sudan. If, however, the materials are not in Sudan within 3 months after the import license was issued, the Contractor must apply to the Ministry of Commerce for an extension of the license.
- Once at Port Sudan, there are various GOS charges which the Contractor must pay. These include customs taxes, development taxes, defense taxes and other taxes.
- The Contractor receives payment for 80% of materials, transportation and GOS charges once he receives the Bill of Lading, submits it for payment to the Senior Architect, and it is approved.

These GOS import bans and the requirement for 100% deposit on LC's went into effect in July and October 1983 respectively. These requirements would not have been a factor had the Contractor ordered his foreign materials early in the project. Even as the job progressed, knowing that there are these constraints, the Contractor should have incorporated these into his procurement planning and scheduling.

There is no evidence of a procurement schedule or any procurement planning. Fabricated items, for example door and window frames, and roof framing and decking, were not ordered until late in the project and as a result delayed construction progress. It appears many times items were ordered when it became time to install the item and as a result of the time required to order, process the GOS approvals, fabricate and ship, the items reached the site long

after they were initially needed. Separate procurement by each of the two companies in the EK/D joint venture has slowed procurement also. Compliance submittals also had an impact on procurement. Based on a review of the files and discussions with the Senior Architect, the Contractor has been slow in submitting them to the Senior Architect for review and many times the submittals were rejected because they did not meet the technical specifications in the Construction Contract. When rejected, the Contractor frequently did not re-submit them for review in a timely manner. This, of course, caused further delay in the final approval and purchase of materials.

Suppliers were reluctant to go to the expense of preparing detailed shop drawings until the LC was opened and thus the supplier was assured of payment. For critical items the Contractor could have paid an amount in advance to cover the supplier's cost for making the shop drawings and thus the Contractor could be obtaining the Senior Architect's review and approval while the import licenses and LC's were being processed.

As procurement now stands, all foreign materials are on order, and are in fabrication or shipment. Prior to October 1984 a majority of the foreign purchase items were not on order but in October EK/D's El Hag went to the UK and ordered all the remaining foreign items. The off-site items remaining can all be purchased locally. These include items such as fencing, evaporative coolers, air registers and grills, kitchen exhaust fans and air conditioning units (refer to Appendix C). Delays in construction will result if remaining items and equipment are not purchased within the next few months.

b. Recommendations

The Contractor must:

- (1) Prepare a procurement schedule and indicate the procurement schedule for each remaining item to be purchased. Indicate scheduled and actual dates for the following: pro-forma invoice, shop drawing review period, order date, fabrication period and transportation period. Monitor and update. Provide copies to Senior Architect, WSARP, USAID on a monthly basis.
- (2) Advise the Senior Architect in writing of any significant procurement problems that will require the assistance of the Senior Architect, WSARP, or the funding agencies. Provide copies of these letters to these parties as well.
- (3) To ease cash flow problems, submit request for payment promptly after the Bill of Lading has been received.

(4) Immediately submit all remaining compliance submittals for approval. Pay supplier in advance if necessary an amount for shop drawing preparation.

(5) Order all remaining fabricated items or purchase items immediately.

(6) Address any internal cash flow problems affecting any of the sites.

(7) Provide the Senior Architect with evidence of each LC or purchase order, for the purpose of verifying the order has been placed.

4. Logistics

a. Analysis

Some difficulties in logistics were unavoidable considering the remoteness of the sites, shortage of petrol and GOS limitations on the use of the railroad to strategic goods only. With proper planning and scheduling, the Contractor could have been much less affected by these factors than he was. There is no evidence that there were planned shipments to the sites, periodic and scheduled shuttles between the sites to transport needed materials or personnel, or any other logistic plans. Materials were late in arriving on site not only due to late procurement, but also due to inadequately planned transportation.

The EK/D joint venture appears to have insufficient numbers of staff in their Khartoum offices to handle the logistics and procurement responsibilities for materials and other project related matters. At El Khidir's Khartoum office there is an assistant and a secretary in addition to Mr. El Khidir himself. Mr. El Khidir said for his El Obeid site he does all the procurement himself.

At EK/D offices the staff currently includes Adam El Hag, Managing Director, who is also performing many of the procurement activities, Mr. Gu, Deputy Manager, China Engineering and Construction Company, Mr. Chang, Accountant, a Sudanese Accountant and a secretary.

As recently purchased imported materials arrive in the next several months, good logistics planning will be important. The Contractor has indicated that rail cars will be needed for transportation of the diesel generators when they arrive. The feasibility of truck transit should be investigated. Support of WSARP and the funding agencies may be needed to acquire the necessary rail car space from GOS.

The Contractor will need to estimate his fuel requirements for transportation of the large quantity of foreign as well as local materials that will be arriving and will need immediate transport to the sites.

Several of the sites have fabricated materials that must be transported to the other sites immediately to avoid construction delays.

b. Recommendations

The Contractor must:

(1) Develop a plan for transporting materials to the sites. The plan should include items such as the number and types of vehicles, scheduled transit dates and fuel requirements. Monitor weekly. Provide copies monthly to WSARP, Senior Architect and USAID.

(2) Consider weekly or bi-weekly shuttles between sites to transport needed materials particularly when spot shortages occur.

(3) Project monthly fuel requirements for the remainder of the project. Submit to WSARP with copies to the Senior Architect and funding agencies. Investigate to determine if GOS will approve the entire allocation. If not, establish administrative procedures and assign responsibility to an individual in EK/D to submit the necessary monthly allocation requests to GOS in a timely manner and follow up. Advise the Senior Architect WSARP and the funding agencies in writing of any problems in obtaining the necessary allocations.

(4) Assign one individual responsibility for procurement, logistics, scheduling and expediting for the entire project. Advise the Senior Architect who this person will be.

5. Personnel

a. Analysis

Without a sufficient number of construction workers particularly skilled personnel, construction will not progress at the desired rate and work cannot progress in a number of areas simultaneously. This has been the case on this project and it remains a problem.

Figure 7 shows the present staffing levels at each of the sites. At El Fasher only 19% of the labor force are skilled, at Ghazala Gawazet the figure is 20% and at El Obeid 33%. These should be higher at this stage in the construction since unskilled labor intensive tasks such as excavation, concrete placement and brickwork are nearly complete. Installation of items such as doors, windows and hardware and electrical and mechanical equipment require skilled workers. Given the extensive ordering of foreign

FIGURE 7

CURRENT ON-SITE CONSTRUCTION WORK FORCE*

EL OBEID	1 Superintendent
	6 Foremen
	14 Plumbers
	7 Carpenters
	13 Bricklayers
	7 Electricians
	8 Plasterers
	2 Tile Setters
	94 Laborers
	<u>22 Drivers</u>
	174 TOTAL
EL FASHER	1 Chinese Superintendent
	1 Chinese Interpreter
	3 Chinese Bricklayers/Plasterers
	6 Chinese Carpenters
	6 Sudanese helpers
	<u>35 Laborers</u>
	52 TOTAL
GHAZALA GAWAZET	1 Sudanese Superintendent
	2 Chinese Superintendent and Interpreter
	1 Chinese Cook
	2 Chinese Engineers
	3 Carpenters (2 Chinese)
	5 Chinese Technicians
	1 Chinese Electrician
	1 Chinese Plumber
	5 Support and Admin. Personnel
	<u>50 Laborers</u>
	71 TOTAL
KHARTOUM NORTH	15 TOTAL

Note: *Information provided by EK/D

materials that has taken place in the past several months and imminent arrival on site, well over 50% of the site labor forces should be skilled workers and certainly these would need to be concentrated in crafts such as electricians, plumbers and carpenters. This will require planning in advance by the Contractor to obtain the necessary skilled workers which likely will need to come from other locations since local skilled labor is limited in the two western sites particularly.

At the El Fasher site, both the total number of workers and the number of skilled workers has continued to be low, resulting in very slow progress. Work that lies immediately ahead includes plumbing, installation of doors and window frames, plaster and some wiring which will require a skilled labor intensive work force. Ten skilled workers and 52 total people is not enough to ensure reasonable progress.

At Ghazala Gawazet, a similar situation exists and has existed in the past. Only 14 skilled workers are on site and total work force is 71. At Ghazala Gawazet, work that lies immediately ahead includes installing doors and window frames, plaster, plumbing and tile. Again, a larger work force and higher number of skilled workers will be needed. Also it was observed on our site visit that workers were working a shortened work day, often stopping at 1pm or sooner. Discussions with on-site personnel indicated that this had been the practice for some time. Full work hours are a must.

At the El Obeid site, the scope of the project and construction site is larger than at the other two sites and thus a much larger staff would be expected. The proportion of skilled labor to total labor should be much higher as progress on this site is further along than that at the two aforementioned sites. Immediate tasks which will require a high concentration of skilled labor include installation of some remaining door and window frames and hardware, interior plumbing, some wiring and floor tile installation. Over the next several months when ordered equipment arrives an even higher number of skilled workers such as carpenters, electricians and plumbers will be needed.

The Khartoum North site will require a similar large proportion of skilled workers to complete the interior plumbing and begin installation of electrical and plumbing fixtures, ceilings and other equipment.

Throughout the project, there have been times when work virtually came to a standstill. For example at El Fasher and Ghazala Gawazet work came to a virtual stop in July 1983 as the Chinese left for home leave. The Chinese comprised nearly the entire skilled work force at the sites. They returned 3 months later in March 1984. At Khartoum North which also

employed Chinese workers, work stopped in November 1982 due to material shortages, but did not resume until March 1984 when the Chinese workers returned. These gaps in staffing, which can also be observed as the flat areas of the curves in Figures 3,4,5 and 6, were very detrimental to job progress.

Another point meriting comment regards the current staffing levels as shown in Figure 7. We obtained these from the job site superintendents during our site visits several weeks ago. We observed far fewer numbers of people on the site than the figures indicate.

Exchange of skilled personnel between sites to meet manpower needs would have been beneficial and would have improved progress. However, there is no indication this has been done.

Reviewing supervisory personnel, the Superintendent at El Obeid appears to have strong leadership capabilities which were not observed in the Superintendents at the other sites. Strong leadership and management skills are needed to manage this type of project with its attendant complexities.

Communications between the two joint venture companies project sites appears to be minimal. Resolution of mutual problems encountered would improve the progress of the project.

b. Recommendations

The Contractor must:

- (1) Increase work force at the sites.
- (2) Increase the proportion of skilled labor at all sites to at least 50% of the total work force. This will require advanced planning by the Contractor since skilled labor is likely not available at most site locations.
- (3) Exchange skilled labor and materials between sites as required to fill needs.
- (4) Improve communication between sites and resolve mutual problems of material and personnel shortage.
- (5) Provide a weekly manpower report to the Senior Architect, WSARP and USAID.

B. REDUCTION IN SCOPE OF THE CONSTRUCTION

1. Analysis

Decisions regarding termination of any elements of construction involve consideration of the current status of the construction progress and items remaining to be installed, constructed or purchased; consideration of the intended use of the facilities; and a review of any elements not essential to the basic functions of the facilities.

At this advanced stage of the construction, the basic building shells are in place. The floors, walls and roofs of buildings are completed and a substantial amount of conduit, wiring, window frames and door frames are in place. All the major fabricated materials are now either on site, in transit, or on order and costs for many of these items have been incurred by the Contractor. Items not on order include fencing, wall tile, evaporative coolers, air registers and grills, kitchen exhaust fans, and air conditioning units, but these are not significant cost items. (Refer to Appendix C for a detailed list) Thus remaining work and costs include primarily labor intensive items such as plastering, installation of electrical and plumbing fixtures and equipment, installation of cabinets and window glass, installation of door hardware, fencing and painting.

Based on the status of construction and the material purchased, a limited amount of cost savings would result from terminating any elements of the facilities remaining to be constructed.

The intended future use of the facilities relate to the direction and magnitude of the agricultural research program which these facilities are intended to serve. Any decisions regarding future intended use of the facilities must be made by WSARP and the funding organizations. Any cost savings would depend on the magnitude of any increase or decrease in the use of the facilities with the major factor being the size of the staff, since this would dictate the number of housing units required. Some cost savings would result if construction would be terminated on some houses but any savings would not be significant due to the advanced stage of construction and material procurement and would be partially offset by the cost of mothballing the buildings.

In the event the decision is made to immediately discontinue construction at the individual sites, the cost savings would result primarily from the remaining labor costs to complete the work and from the few procurement items that have not been shipped or paid for by the Contractor. The Contractor would have to be compensated for his costs to demobilize which would reduce the amount saved. Refer to Figure 8 for shut down cost savings.

FIGURE 8

PROJECT SHUT-DOWN COST

	<u>Current Remaining Contract (LS)</u>	<u>Committed Additions</u>	<u>Ordered Material</u>	<u>Contractor Demob. 1.5%</u>	<u>Projected Savings</u>
EL OBEID	2,321,773	48,250	462,270	112,264	1,698,089
EL FASHER	1,996,313	1,950	213,925	51,963	1,728,475
GHAZALA GAWAZET	1,593,996	1,300	200,645	48,726	1,343,325
ARC H.Q.	25,548	-	26,379	6,412	

DISTRIBUTION OF SAVINGS

	<u>GOS(LS)</u>	<u>WB(\$)</u>	<u>USAID(\$)</u>
EL OBEID	849,495	796,401	265,467
EL FASHER	864,238	810,223	270,074
GHAZALA GAWAZET	671,663	629,684	209,895
ARC H.Q.	-	-	-
TOTAL	2,385,396	2,236,308	745,436

- NOTE: 1) The above is an estimated savings realized if each of the project sites is shut down and no work is continued. Should funding be carried by others, and construction continued, the demobilization costs would not apply.
- 2) Ordered materials refer to imported items for which 100% irrevocable letters of credit have been opened and orders placed. Any refund for cancellation would be at Vendor's discretion.
- 3) Current Remaining Contract figure represents the amended contract price less gross billings through Certificate 19.

Based on information provided by WSARP, it is our understanding that the current planned staffing levels for each site are substantially the same as originally planned for the project. The projected staffing levels provided by WSARP, and available housing as designed are shown below. It is assumed that not all staff will require on-site housing. Assuming the planned staffing levels remain in effect, no reduction can be made in any of the essential elements of the construction.

WSARP Current Staffing Plan and Housing Available

	<u>El Obeid</u>		<u>El Fasher</u>		<u>Ghazala</u>		<u>Khartoum</u>	
	<u>Staff/Houses</u>		<u>Staff/Houses</u>		<u>Gawazet</u>		<u>North</u>	
	<u>Staff/Houses</u>		<u>Staff/Houses</u>		<u>Staff/Houses</u>		<u>Staff/Houses</u>	
Senior Staff	20	21	5	5	8	6	3	0
Middle Staff	47	22	21	8	24	8	5	0
Junior Staff	150	18	47	6	83	8	20	0
TOTAL	217	61	73	19	115	22	28	0

The design of the facilities is very simple, basic and there are few non-essential items that could be eliminated to reduce maintenance and operating costs. One of the items we have identified is the fountains. These are in part ornamental but are also linked with the lawn irrigation system. Elimination of the fountains would also result in slight long term maintenance cost savings. Another item being considered for a future variation order is landscaping. Also being considered for a future variation order is paving of site roads to reduce dust. Chip and sealing would cost less and still serve the basic function.

It should be noted that in addition to these last two items, several further pending additions to the project scope are being proposed by G-Z. These are shown in Figure 9.

2. Recommendations and Options

- For cost savings, we recommend elimination of the following non-essential items:

	<u>Estimated Cost Savings</u>
a. fountain	LS 3,000
b. landscaping	125,000
c. chip and seal access roads in lieu of paving - cost difference of	127,000

FIGURE 9

PROPOSED ADDITIONS

	<u>GOS</u> (Ls.)	<u>WB</u> (\$)	<u>USAID</u> (\$)
<u>El Obeid</u>			
2 Generators @ Ls.150,000	150,000	140,625	46,875
Stone at ponds	22,500	21,094	7,031
Asphalt paving	105,900	99,281	33,094
Drain inspection chambers	9,125	8,555	2,852
Extra road gravel	61,850	57,984	19,328
Extra cement tile	1,625	1,523	508
Landscaping	<u>25,000</u>	<u>23,438</u>	<u>7,813</u>
	376,000	352,500	117,501
<u>El Fasher</u>			
Drain inspection Chamber	4,563	4,277	1,426
Extra road gravel	37,110	34,791	11,597
Extra cement tile	975	914	304
Landscaping	<u>25,000</u>	<u>23,438</u>	<u>7,813</u>
	67,648	63,420	21,140
<u>Ghazala Gawazet</u>			
1 Generator @ Ls.150,000	75,000	70,313	23,438
Drain inspection chambers	4,563	4,277	1,426
Extra road gravel	30,875	28,945	9,648
Extra cement tile	650	609	203
Landscaping	<u>10,000</u>	<u>9,375</u>	<u>3,125</u>
	121,088	113,519	37,840
<u>ARC Headquarters</u>			
Cement brick	4,323	4,053	1,351
Terrazo tile	3,750	3,516	1,172
Revised electrical	9,039	8,474	2,825
Landscaping	<u>2,500</u>	<u>2,344</u>	<u>781</u>
	19,612	18,837	6,129
 GRAND TOTAL	 584,348	 548,276	 182,610

Notes: All landscaping is estimated (no design currently)
 Drain inspection chambers are required (not an option)

C. CONSTRUCTION CONTRACT MODIFICATIONS OR TERMINATION

1. Analysis

At this stage in the project, modifications to the Contract that would force the Contractor to meet a specific completion schedule or expedite his work are not likely to be accepted by the Contractor unless a substantial financial incentive were provided. The funding agencies and WSARP will need to consider the relative importance to the research project of completing the construction before the dates now expected. Then negotiations would need to be conducted with the Contractor with an incentive amount fixed for each day or month each site is finished before a prescribed date. This could be negotiated as an offset to the liquidated damages clause (Clause 47) included in the Construction Contract. WSARP and the funding agencies could agree to forego assessing the liquidated damages if the Contractor finishes on the prescribed date. Another option is to agree that for each day he finishes before that date, the Contractor would receive an incentive bonus which would partially offset the liquidated damages. The amount of the assessment per day should be calculated so that if he finishes significantly ahead of time, say 9 months, his accrued incentive amount would slightly exceed his accrued liquidated damages. In the event he is late, a higher liquidated damages amount than currently in the Contract should be used.

It is also important to note that the disincentive, the liquidated damages clause, included in the present Construction Contract for being late, has not been effective and the Contractor has not expressed concern relative to this matter. If enforced, the Contractor can claim he was delayed by mitigating circumstances such as wood bans, import bans, late payments, etc. Enforcement of the liquidated damages clause would also negatively impact the Contractor's reported cash flow problem.

Forced termination of the Construction Contract, as described in Clause 63, is not desirable in our opinion for several reasons. First, the Contractor is continuing the work and making some effort to improve his progress. Second, the Contractor might file suit against COS. According to Dr. El Sir of the Ministry of Construction and Public Works, when a suit is filed, the court in Sudan immediately seals the jobsite until the matter is resolved. In other words, no work whatsoever could be performed on the construction sites until the suit is dismissed or resolved, which would likely take years.

The Contractor could, if termination was proposed, take the position that since he has received payment for most of his material costs and has only labor remaining, that it may be in his best interest to accept termination as prescribed in Clause 63 of the Construction Contract.

In either case, to complete the project, GOS would need to hire another Contractor. This would be costly since mobilization, job familiarization and demobilization costs would be included in the new Contractor's price. A new Contractor would have to inventory all materials to determine what was still needed to complete the work and this would add to his price, also. Depending on when the EK/D Contract would be terminated these costs could be offset against liquidated damages assessed EK/D.

Other factors to consider are construction delays of one to two months which would occur as the new Contractor moves onto the sites. In addition, there is no assurance that another Contractor would execute the work in a more timely manner than EK/D.

El Khidir's construction company which was started by his father, is reportedly an established medium sized construction firm that has constructed housing projects of similar size as this project. In addition, he is a member of a well-known Sudanese family. These factors plus the concern and interest he has shown in this VE study give some indication that he may cooperate and pursue expeditious completion of this project. He is continuing the work and there are indications he has made efforts in the last several months to increase staff and speed up procurement.

Dr. El Sir said that in the many Sudanese contracts he had dealt with, contractors are frequently behind schedule and he advised that the best approach is to work with the contractor to complete the work and avoid termination unless the contractor is willing to do so.

2. Recommendations and Options

1. Do not terminate the Construction Contract with EK/D.
2. Make no modifications to the Construction Contract other than possibly adding an incentive to complete the project by a specific date if the completion time is critical to the research project.
3. If progress does not improve on the two western sites, an option to consider is terminating EK/D's work on these two sites only (El Fasher and Ghazala Gawazet) and retaining a contractor or two individual contractors for those sites.

D. FINANCIAL ASPECTS

1. Disbursements to Contractor

a. Analysis

(1) Procedures

Procedures for construction progress payments are consistent with standard practice. Quantities are verified by A/E personnel on the job site in cooperation with Contractor personnel and an application for payment is submitted by EK/D to G-Z's Senior Architect in Khartoum. G-Z's Senior Architect reviews the submittal and after approval produces a formal Payment Certificate which must be signed by EK/D, G-Z and the WSARP Director, Dr. Dafalla. Copies are then sent to all funding agencies initiating payment.

(2) Disbursement

Timely payment of progress billings is essential to Contractor cash flows, especially since reported financial problems have plagued this Contractor. Although the Contractor should be expected to support necessary mobilization funding, his expectation for timely payment on construction progress is upheld by the Construction Contract.

Payments to EK/D have been unusually slow and irregular after Certificates are approved by all parties. Complexity of this funding arrangement has predictable delays which considerably exceed the 30 days required by Construction Contract. Figure 10 lists payment receipt dates supplied by EK/D.

Approved Certificates are funded as follows:

GOS (General Funds)	:	50% of LS component
GOS (PL 480)	:	50% of LS component
WB	:	75% of FX component
USAID	:	25% of FX component

Payments provided under PL 480 have been disbursed promptly due to WSARP Director having control of these funds. Payments from GOS General Budget have been slow and irregular. Full payment is seldom made at one time. No firm reason for this could be determined, other than governmental complexities involved.

Payments from WB have been chronically late, apparently averaging over 60 days from Certification. Firm data to indicate a reason for delays was not obtained, however we speculate that necessary authorizations between the US accounting center and disbursing banks has been slow. Payments from USAID also have been late. Again the apparent reason is processing lags during review by the separate handling centers.

FIGURE 10

RECEIPT OF PAYMENTS BY CONTRACTOR

Certificate No.	Date Approved	GOS Payment Ls.	WB Payment \$	USAID Payment \$
11	3/6/83	5/15/83	5/5/83	8/5/83
12	4/15/83	5/15/83	8/4/83	8/5/83
13	7/10/83	11/22/83	10/12/83	11/21/83
14	2/21/84	2/7/84	7/17/84	2/27/84
15	1/11/84	2/7/84	3/8/84	3/15/84
16	3/15/84	6/18/84	8/9/84	6/30/84
17	7/30/84	8/30/84	10/11/84	10/2/84
18	10/3/84	Unpaid	Unpaid	Unpaid

Delays in payment range from 2 to 5 months for these Certificates.

- Note:
1. Information is supplied by El Khidir/Diraige:JV
 2. GOS payments are made in partials; latest date shown

We have been made aware that this situation has been under investigation by AID personnel and that they are working to relieve the problem.

The sizeable payment delays alleged by EK/D cannot be directly translated into project delays, however, this situation may leave WSARP open to delay claims by EK/D. We have been informed that such a claim has been formally submitted to G-Z and is now under review. If successful in this claim, the implication is that time extensions would be granted thus nullifying all or a portion of liquidated damages due WSARP under Construction Contract. EK/D may also attempt to gain reimbursement for the time value of money not promptly paid and construction inefficiencies caused.

(3) Contractor's Timely Billing Submittals

The Construction Contract allows EK/D to submit billings monthly assuming progress can be verified for the period. This has not occurred and in fact submittals by EK/D have been very erratic as illustrated graphically by Figure 2.

There have been long periods without submittals (flat areas of curve), however it is significant to note that at the end of these periods a large billing has been submitted (steep portion). Since review of detailed billings indicates that large submittals were not due totally to material invoicing, we would summarize that construction progress was being made during these periods. However slight this progress may have been, the Contractor's late billings may also be a factor in his reported cash flow problems.

(4) Advance FX Disbursement

We are advised that it is common practice in Sudanese construction contracting to disburse to the Contractor a percentage (10-25%) of the contract amount as soon after signing as practically possible. The advance is written off over the term of the Contract against the contract price. The Construction Contract with EK/D provides for 10% of the contract price to be advanced and secured by bond against non-performance. It was agreed that FX funds would be advanced for expected early purchase of foreign materials, and that these funds would be provided by WB (75%) and USAID (25%). Actual payment of the USAID portion was made in November 1981, four months after the Construction Contract was executed and the WB portion was paid in January, 1982, six months after the Construction Contract was executed. Since the purpose of the advance was for early procurement, its effect was somewhat diluted due to its lateness. Write off against the contract price began immediately after receipt of the advance payment and at an accelerated rate which further went contrary to its purpose. It is evident from Payment Certificates that at least a portion of the USAID advance was written off in the same month that it was received by EK/D, thus completely nullifying its desired effect.

The impact of early write off may even be more significant in FX cash flow than lateness of the advance under normal conditions.

It is not practical to expect Contractor to use the advanced FX funds immediately after receipt because of time required to get approvals, and initiate and confirm orders on imported goods

We do not excuse the Contractor's excessive tardiness in placing foreign orders, however we believe a more realistic approach to this matter could have been developed. We assume that the 10% bond provided as security for the advance funds would be valid until funds have been reclaimed.

Early write off insured that EK/D would not have the advanced FX available later in the project when a majority of imported materials were being purchased.

b. Recommendations

- (1) USAID, GOS and WB should take immediate action to expedite future payments to EK/D. We suggest that the WSARP assign an expediter, suitable to all parties, with responsibility for tracking the status of each Payment Certificate and making expediting contacts within payment channels. EK/D cash flow will be improved and future claims could be minimized.
- (2) The Senior Architect should continue to solicit monthly payment applications from EK/D in strongest terms.
- (3) The Senior Architect should request EK/D to keep him informed on the status of payment receipts.
- (4) For impact on future projects, contracts should be prepared with more realistic payment deadlines based on accounting procedures being used.

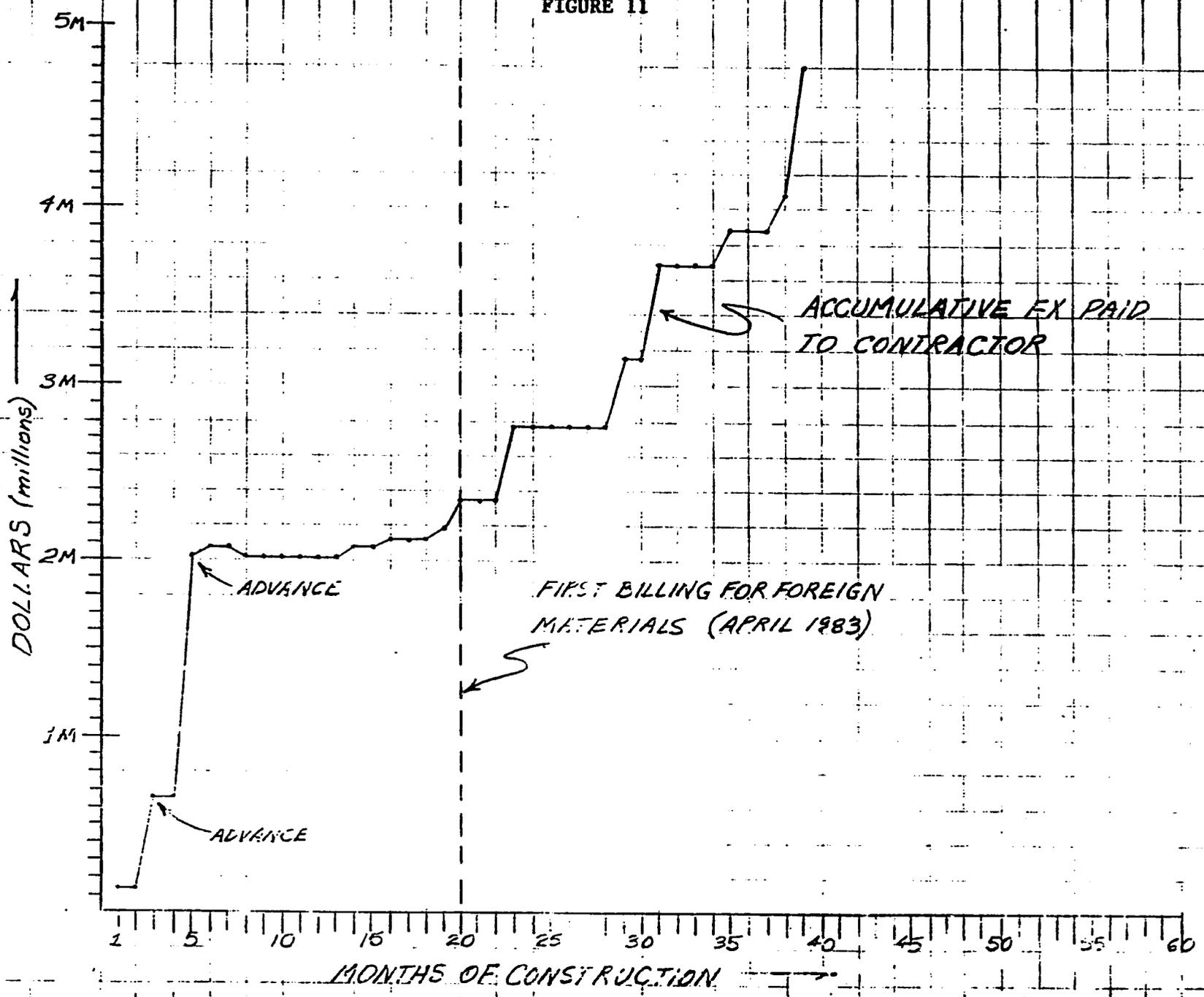
2. Foreign Exchange Funding

a. Analysis

(1) Contract

The FX component of the Construction Contract has been set by the original tender and is a 50/50 split between local currency and F... The conversion rate of \$1.25 = 1LS has been used in calculations for each Payment Certificate. Figure 11 indicates how the entire FX component has been disbursed to EK/D. The plot indicates total accumulative FX including 10% advance funds and FX write off. Figure 12 is a tabulation of the FX component. It would be expected that much of Contractor's anticipated profits be derived from FX funds because of its stability and a favorable exchange rate. The FX component of each progress payment is calculated as follows:

FIGURE 11



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FIGURE 12

AVAILABLE FX COMPONENT BY MONTH (TOTAL BILLING)

DATE	CERT. NO.	MONTH NO.	TOTAL BILLING	GOS AMOUNT	FX COMPONENT	FX ADVANCE	USAID DEDUCTION	WB DEDUCTION	ACCUM. AVAILABLE FX
9/81	1	1	328193.60	147687.12	184608.90	0.00	38000.00	0.00	146608.90
		2	0.00	0.00	0.00	0.00	0.00	0.00	146608.90
11/81	2	3	296448.35	133401.76	166752.20	380000.00	38099.26	0.00	655281.84
		4	0.00	0.00	0.00	0.00	0.00	0.00	655281.84
1/82	3	5	449940.00	202473.00	253091.25	1191301.00	63273.00	0.00	2036381.09
2/82	4	6	288954.00	130029.30	162536.63	0.00	40634.25	66183.00	2092100.46
		7	0.00	0.00	0.00	0.00	0.00	0.00	2092100.46
4/82	5	8	192423.00	86590.35	108237.94	0.00	27059.53	98929.94	2074348.93
		9	0.00	0.00	0.00	0.00	0.00	0.00	2074348.93
6/82	6	10	32596.00	14668.20	18335.25	0.00	4593.90	13751.71	2074348.57
		11	0.00	0.00	0.00	0.00	0.00	0.00	2074348.57
8/82	7	12	478082.00	215136.90	268921.13	0.00	67230.25	201690.00	2074349.74
		13	0.00	0.00	0.00	0.00	0.00	0.00	2074349.74
10/82	8 & 9	14	377303.00	169786.35	212232.94	0.00	53058.24	148909.35	2084614.74
		15	0.00	0.00	0.00	0.00	0.00	0.00	2084614.74
12/82	10	16	207395.00	93327.75	116659.69	0.00	27104.92	66183.00	2105926.58
		17	0.00	0.00	0.00	0.00	0.00	0.00	2105926.58
		18	0.00	0.00	0.00	0.00	0.00	0.00	2105926.58
3/83	11	19	304150.00	136867.50	171084.38	0.00	18896.65	66183.00	2171431.26
4/83	12	20	540565.00	243254.25	304067.81	0.00	0.00	132365.00	2363233.10
		21	0.00	0.00	0.00	0.00	0.00	0.00	2363233.10
		22	0.00	0.00	0.00	0.00	0.00	0.00	2363233.10
7/83	13	23	794153.00	447382.35	559227.94	0.00	0.00	105065.00	2790495.03
		24	0.00	0.00	0.00	0.00	0.00	0.00	2790495.03
		25	0.00	0.00	0.00	0.00	0.00	0.00	2790495.03
		26	0.00	0.00	0.00	0.00	0.00	0.00	2790495.03
		27	0.00	0.00	0.00	0.00	0.00	0.00	2790495.03
		28	0.00	0.00	0.00	0.00	0.00	0.00	2790495.03
1/84	14 & 15	29	1021017.00	459457.65	574322.06	0.00	0.00	198549.00	3166268.10
		30	0.00	0.00	0.00	0.00	0.00	0.00	3166268.10
3/84	16	31	1039694.00	467862.30	584827.88	0.00	0.00	65191.00	3685904.97
		32	0.00	0.00	0.00	0.00	0.00	0.00	3685904.97
		33	0.00	0.00	0.00	0.00	0.00	0.00	3685904.97
		34	0.00	0.00	0.00	0.00	0.00	0.00	3685904.97
7/84	17	35	360120.00	162054.00	202567.50	0.00	0.00	0.00	3888472.47
		36	0.00	0.00	0.00	0.00	0.00	0.00	3888472.47
		37	0.00	0.00	0.00	0.00	0.00	0.00	3888472.47
10/84	18	38	352363.00	158563.35	198204.19	0.00	0.00	0.00	4086676.66
	19	39	1423288.00	640479.60	800599.50	0.00	0.00	0.00	4887276.16
TOT. =			8686714.95	3909021.73	4886277.16	1571301.00	380000.00	1190302.00	

* PAYMENT CERTIFICATE 19 ESTIMATED

FIGURE 13

FX COMPONENT STATUS

	<u>FX Portion of Current Contract</u>	<u>FX Billed (Gross)</u>	<u>FX Remaining to Bill</u>
El Obeid	4,677,672	3,226,564	1,451,108
El Fasher	2,265,138	917,443	1,247,695
Ghazala Gawazet	2,030,233	1,033,986	996,247
ARC HQ	267,172	251,204	15,968
	<u>9,140,215</u>	<u>5,429,197</u>	<u>3,711,018</u>

FX Remaining = \$ 3,711,018
 Estimated Remaining FX Purchases = \$ 803,000
 Estimated Excess FX = \$ 2,908,018

b. Recommendations

- (1) Constant pressure should be applied to EK/D to ensure timely delivery of remaining FX purchases.

3. Project Cost

a. Analysis and Recommendations

- (1) The Current Billing Status sheet, Figure 1, was developed from latest approved budget and information from Payment Certificates. Figure 1 is a tabulation of gross billings.

We are also providing Figure 14 which estimates a total projected expenditure shown by each funder's portion.

The Economic Dislocation settlement will be paid from GOS PL 480 funds (LS) and is reported to be a separate budgeted item apart from contingencies.

Settlement of liquidated damages assessed against EK/D would, of course, reduce final construction costs to funders, however pursuit of this matter could open the project to a myriad of additional problems (i.e. legal action, project shutdown, more claims).

Using information from Contract, G-2 and the schedule we have prepared for this report, Figure 15 provides an accounting of liquidated damages.

The current cost of performing research without permanent facilities at El Obeid as indicated by WSARP input, does not affect the construction budget, however, the detriment to the research program without constructive use of facilities, bears closer analysis by program participants.

4. Cost Overruns

a. Contingency

A summary of contingency expenditures is covered by Figure 16. It appears, at this time, that contingency amounts will be adequate to cover proposed and foreseeable changes to the Construction Contract.

b. Overruns

The original contract has to date been increased by 1.8%. If cost projections discussed previously hold firm, they will result in a 12.9% total increase at completion, Economic Dislocation excluded.

We envision no construction cost overruns based on currently budgeted contingencies for Construction. However, there will be extended A/E and resident site services costs.

FIGURE 14

PROJECTED CONTRACT COST

GOS Ls.)	Current Contract	Proposed Additions	BOQ Discrepancy 2%	Economic Dislocation	Undeter. Changes 1%	Projected Contract
Obeid	3,742,138	376,000	73,305	1,746,821	36,652	5,974,916
Fasher	1,732,111	67,648	34,105	808,378	17,053	2,659,295
azala; G.	1,624,187	121,088	31,930	758,196	15,965	2,551,366
C HQ	213,738	19,612	4,274	99,682	2,137	339,443
TAL	7,312,174	584,348	143,614	3,413,077	71,807	11,525,020
3 \$)						
Obeid	3,508,254	352,500	68,723	-	34,361	3,963,838
Fasher	1,623,854	63,420	31,974	-	15,987	1,735,255
azala; G.	1,522,675	113,519	29,935	-	14,967	1,681,096
C HQ	200,379	18,837	4,007	-	2,004	225,227
TAL	6,855,161	548,276	134,639	-	67,319	7,605,396
SAID \$)						
Obeid	1,169,418	117,501	22,908	-	11,454	1,321,281
Fasher	541,285	21,140	10,658	-	5,329	578,412
azala; G.	507,558	37,840	9,978	-	4,989	560,365
C HQ	66,793	6,129	1,336	-	668	74,926
TAL	2,285,054	182,610	44,880	-	22,440	2,534,984

NOTE: 1) Projected final Contract cost assumes that construction at all sites will be completed.

FIGURE 15

LIQUIDATED DAMAGES

Status at 12/1/84

	<u>Apprx. Comp. Date</u>	<u>Days Late</u>	<u>Damage LS/Day</u>	<u>Damages Accrued (LS)</u>
El Obeid	1/28/84	307	750	230,250
El Fasher	1/28/84	307	300	92,100
Ghazalag	1/22/84	307	300	92,100
ARC HQ	8/7/83	480	150	<u>72,000</u>
				LS. 486,450

Status at 6/1/85 (consider pending time extension)

El Obeid	6/9/84	488	750	366,000
El Fasher	6/9/84	488	300	146,400
Ghazalag	6/9/84	488	300	146,400
ARC HQ	8/7/83	661	150	<u>99,150</u>
				LS. 757,950

Status at Completion on Revised Schedule

	<u>Sched. W/Ext.</u>	<u>Rev. Comp.</u>	<u>Days Late</u>	<u>Damage LS/Day</u>	<u>Total Damages</u>
El Obeid	6/9/84	10/1/85	6/8	750	463,500
El Fasher	6/9/84	4/1/86	792	300	237,600
Ghazalag	6/9/84	4/1/86	792	300	237,600
ARC HQ	8/7/83	5/1/85	630	150	<u>94,500</u>
					LS. 1,033,200

FIGURE 16

PROJECTED CONTINGENCY EXPENDITURE.

	<u>Proposed Additions</u>	<u>BOQ Discrepancy</u>	<u>Undeterm. Changes</u>	<u>Var.#4</u>	<u>Total Cost Covered by Conting.</u>
GOS (Ls.)	584,348	143,614	71,807	131,462	Ls. 931,231
WB(\$)	548,276	134,639	67,319	128,246	\$ 878,480
USAID(\$)	182,610	44,880	22,440	41,082	\$ 291,012

	<u>GOS(Ls.)</u>	<u>WB(\$)</u>	<u>USAID(\$)</u>
Contingency Amount	2,048,777	1,920,728	640,243
Less Additions	<u>931,231</u>	<u>878,480</u>	<u>291,012</u>
Projected Contingency Remaining	= 1,117,546	1,042,248	349,231

NOTE: If Contract is completed, all expected additional costs will come from contingencies. Probable remaining contingency amounts are shown.

5. Economic Dislocation

a. Analysis

The Construction Contract provides for Contractor reimbursement of any increased costs caused by Governmental currency devaluation. Official devaluations have occurred in November, 1981 and November 1982. No further official devaluations have occurred.

EK/D has submitted a claim for recovery, however no settlement has been reached and the matter has been under review for more than a year. Since a settlement will involve only local currency (LS) it is being reviewed by GOS.

The Ministry of Finance position is to weigh the LS devaluation against FX increased value to discover the net effect to the Contractor. The Contractor refuses to supply documentation in regard to FX expenditures required by Ministry of Finance and the matter is currently at a stalemate.

EK/D legal reported advice supports their position while GOS has asked for comment of Attorney General.

G-Z has sustained close involvement with all parties from the beginning and have committed to continuing until a settlement is reached.

If EK/D has a cash flow problem, as reported, then settlement of Economic Dislocation may be crucial to alleviate this problem. Maximum liability of GOS has been estimated by G-Z to be 3,413,760LS and this amount is confirmed to be budgeted separately from contingency funds.

We speculate that a substantial benefit has been gained by EK/D due to increased FX valuation but we cannot comment as to the intent of the Contract or its legal ramifications.

Delaying settlement of this issue could aggravate any cash flow problems, however it may be an incentive for Contractor to pursue this work more diligently.

b. Recommendations

- (1) All parties should attempt to reach a settlement on the cost involved.
- (2) As an incentive, make arrangements to pay dislocation amount to Contractor based on a percentage which coincides with actual construction progress.

6. Liquidated Damages

a. Analysis

(1) Current Status

The Construction Contract provides that WSARP is entitled to collect liquidated damages for Contractor's non-adherence to project schedule at the following rates:

El Obeid	Ls. 750/day
El Fasher	300/day
Ghazala Gawazet	300/day
ARC Headquarters	150/day

These amounts may be collected at any time after the schedule has been breached, through withholding monies otherwise due the Contractor.

Liquidated damages have been accruing on El Obeid, El Fasher and the Ghazala Gawazet sites since January 28, 1984 and on ARC Headquarters at Khartoum North since August 7, 1984. Monies have been withheld on Payment Certificate #16, March 1984 only against damages for the ARC HQ site in the amount of LS 30,900.

Figure 15 shows the accounting for liquidated damages as of December 1, 1984. It also shows probable amounts which will have accrued by the expected completion schedule. Note that Figure 15 takes into account schedule extensions which seem likely to be approved and have already been recommended by C-2.

(2) Assessment

The liquidated damage clause provided in construction contracts may serve three purposes. First, to encourage the Contractor to meet schedules for which he has contracted. Second, to help the Owner defray costs incurred due to lack of constructive use of project. Third, if the project gets involved in litigation, the Owner may not be required to substantiate actual damages, which are often very difficult to substantiate and are open to conjecture. In the U.S., damage clauses are a reasonably effective tool to serve the first purpose. However, our findings on this project have been contrary.

Discussions with EK/D seem to indicate no serious regard for possible assessment of damage amounts. This attitude deserves close scrutiny. It may indicate that Contractor feels he has little to lose by walking away from the project or, more likely in our opinion, he feels comfortable in his position if project should go to litigation.

We are advised that in Sudan, liquidated damages are very difficult, if not impossible, to collect through litigation. Contractors can present courts with some very convincing arguments in their defense. We believe that assessment of damages at this time would not facilitate completion of the project and may in fact aggravate an already reported cash flow problem.

b. Recommendations

- (1) Liquidated damages should not be assessed at this point in project completion.
- (2) Construction progress, accounting and accrued damages should be monitored closely by G-Z until damage amounts approach remaining contract amounts. The feasibility of assessment should be reviewed at that time. If the project is substantially complete, damage assessment may be viable, considering monies retained.
- (3) G-Z with cooperation with WSARP's Accountant should produce a monthly detailed accounting for WSARP and USAID review.
- (4) Pressure should be kept on the Contractor by G-Z regarding schedule attainment, preferably through written correspondence. Liquidated damages should be a common subject in this correspondence.

7. Withholding Payments

a. Analysis

- (1) Construction Contract allows withholding progress payments only in the case of liquidated damages. Withholding as a punitive measure to encourage construction progress is not addressed.

Normally we would expect this action to provide a potent incentive to the Contractor, however we do not believe this would be as effective under the current circumstances. If an actual cash flow problem exists, then withholding payment may not be prudent.

b. Recommendation

- (1) We recommend that payments due Contractor be made promptly and not held in an attempt to encourage progress.
- (2) As liquidated damages approach the level of retained monies, a further review of this matter is warranted based on completion status and trend at that time.

II. ARCHITECT/ENGINEER SERVICES

A. Grube-Zimmer, Inc.

1. Analysis

The firm of Grube-Zimmer Inc., a professional architectural firm with home offices in Portland Oregon, was retained by CID to perform preliminary design, final design and to provide a Senior (resident) Architect and a Senior (resident) Engineer during construction with the Senior Architect to be stationed in Khartoum and Senior Resident Engineer to be stationed initially at El Fasher. The design and supervision services were provided under several succeeding contracts between CID and G-Z, the latest one made as of August 8, 1983. (CID is under contract with USAID to provide the engineering services). This Contract indicates the duties of the Senior Architect and Engineer. The Senior (resident) Architect, Mr. Henry Bergman, an experienced architect, has held that position since construction began in August 1981. Also Mr. Joachim Grube, a Principal of Grube-Zimmer, Inc. has been involved in the project, and made numerous trips to Sudan and to the project sites.

A review of the design documents prepared by G-Z indicates that the design was consistent with good engineering practice. The designs have incorporated materials and construction requirements consistent with those typically used in the Sudan. The design included a new roof framing concept designed for ease of erection by hand labor. This design utilizes light gauge galvanized framing members which were screwed together and which facilitated fabrication and erection.

G-Z's specifications for the Construction Contract are based on the Bill of Quantities type contracting method which is one of several types used by the Government of Sudan. British technical standards were used. For electrical and mechanical design and compliance submittal review, G-Z subcontracted with Interface Engineering of Milwaukie, Oregon.

From a functional standpoint, the facilities appear to be adequate, as confirmed in discussions with Dr. LaMoyne Hogan, Deputy Director of WSARP and head of the research program.

The Engineering Services Agreement between CID and G-Z lists the duties of the Senior Architect and establishes his overall responsibility for construction contract administration. The CID/G-Z Contract makes no mention of the Senior Architect's responsibilities regarding schedules. The Construction Contract

between EK/D and GOS further defines the Resident Architect's authority and grants considerable authority to the Resident Architect to act on GOS's behalf in matters such as quality of work, schedule, and additional work. The Resident Architect also is the arbitrator in disputes.

The Senior Architect has performed the duties prescribed in both contracts previously mentioned. He has been involved in scheduling since the Contractor was not performing this function. He prepared a schedule for the Project in May 1983, although the Senior Architect and the Resident Engineer from time to time requested schedules from the Contractor. The requests were usually reflected in monthly progress reports of the Senior Resident Architect or in the Resident Engineer's report, rather than in letters to the Contractor. There are a few letters directed to EK/D regarding schedule or any other project matters or problems. Letters to the Contractor and to the funding organizations and WSARP regarding schedules and other problems would have drawn more attention and possibly resulted in greater impact.

The Senior Architect reportedly has made frequent visits to job sites, usually once every two weeks and often weekly, but there is little documentation of the trips. Trips were limited particularly in the first year of construction by the availability of air transportation which currently does not appear to be a problem. There are some indications on-site that meetings were held periodically, but few were documented with meeting minutes.

Mr. Bergman and also Mr. Grube have been involved in attempting to resolve constraints impacting the Contractor, such as GOS import license approval delays, water and fuel allocation problems, and the economic dislocation matter. When these and other problems arose, the Senior Architect mentioned them in his monthly progress reports, but more attention could have been brought to the problems by direct requests for assistance in verbal and written form to funding agencies and WSARP. There was no evidence of a formal compliance submittal review procedure, however there are some indications compliance submittals are reviewed generally in a timely manner, as are Contractor payment requests.

2: Recommendations

- a. The Senior Architect should be retained through to completion of construction of the last site. For the one year oversight period following this, the services of the Senior Architect would not be required. KARPLEN's Senior Resident Engineer can handle the problems during the oversight period.
- b. The Senior Architect should conduct regular monthly meetings at the job site with the Superintendent, Resident Engineer, Clerk of the Works, and preferably the Senior EK/D joint venture representatives, Mr. Khidir and Mr. El Hag, to review progress, schedule and procurement status, and problems. The Senior Architect shall prepare minutes of the meeting and distribute to attendees, as well as to both joint venture Contractors, all funding organizations and WSARP, and attach copies of updated schedules which show actual completion status.
- c. When major problems occur, notify and send a letter to the Contractor, all funding organizations, WSARP, and CID to draw attention to the problem. If assistance is required so state.
- d. If Contractor will not prepare construction and procurement schedules as required, prepare schedules similar to the one included in this study to show scheduled and actual progress. Update monthly and review during monthly meeting with the Contractor.
- e. Request in writing that the Contractor submit weekly staffing reports to the Resident Engineers (refer to Clause 35 of the Construction Contract).
- f. Request in writing from Contractor an increase in staffing at sites.
- g. For documentation as well as possible impact on the Contractor, send monthly letters to the Contractor advising him of the fact he is past the required completion date and request he expedite his work. Mention Liquidated Damages Clause. Provide copies to WSARP and funding agencies.
- h. Provide fully conform copies of the Construction Contract, including Bill of Quantities to USAID which they presently do not have.

- i. Work to resolve remaining Variation Orders. Seek assistance of funding organizations (3, 5, 6 are still pending). Also provide all funding organizations with copies of all Variation Orders that have been executed to date.
- j. Provide USAID and WSARP with a copy of the latest record drawings and when drawings are revised in the future, provide copies.
- k. Provide WSARP and USAID, if requested, copies of all compliance submittals with notations to indicate Senior Architect's approval.
- l. Consult WSARP, USAID on all Variation Order items and submit Variation Orders to them for review and approval, if requested.
- m. Send copies to WSARP, WB, and USAID of correspondence to or from the Contractor regarding significant problems affecting project schedule or cost.
- n. Request Contractor in writing to perform functions addressed in Part IA (Contractor Performance) of this report.
- o. Advise Contractor's bonding agent that the Contractor is behind schedule and provide brief history. Periodically provide updated report.
- p. Document in letters to the Contractor significant items discussed verbally.

B. KARPLEN

1. Analysis

KARPLEN is an established Khartoum architectural firm of 18 technical people. Eleven are architects, five are civil structural engineers and two are drafters. The CID/G-Z Engineering Services Agreement indicates a Senior Resident Engineer would be provided by G-Z through a sub-contract with KARPLEN. As initially planned, this individual would oversee the El Fasher and Ghazala Gawazet sites and the Senior Architect would oversee the remaining sites.

WSARP was to provide a Resident Engineer and a Clerk of the Works at each site, but the positions could not be filled, which we understand was due to the low GOS wage scale. Thus, some of the positions remained unfilled for periods of time and Resident Engineer positions were held temporarily by Clerks of the Works.

An Engineering Services Agreement between WSARP and KARPLEN to provide these individuals was then executed. Currently, the Senior Resident Engineer is at El Obeid and there is a Resident Engineer at El Obeid, El Fasher and Ghazala Gawazet. There is currently a Clerk of the Works at El Obeid, El Fasher and ARC headquarters in Khartoum North, but not at Ghazala Gawazet. The duties of the Senior Resident Engineer are defined in the G-Z/CID Engineering Services Agreement and are similar to the Senior Resident Architect, but includes monitoring the construction schedule. The Senior Resident Engineer is also a representative of the Architect (G-Z). Based on the project records and correspondence, it appears this individual, Mr. Hussein, has performed his required duties. He appears to be capable of handling most of the problems that may arise during the one year oversight period following completion of the project.

The Resident Engineers at the sites appear to be primarily engaged in inspection, quality control and Contractor Payment Requests, and appear to be performing these duties as required. They appear to be only minimally involved in schedule related matters, although in their monthly reports from time to time state they had requested schedules from EK/D.

2. Recommendations

- a. Continue Resident Engineer services until completion of construction. Beyond that point the Senior Resident Engineer should be able to handle any problems or unresolved quantities.
- b. Continue Clerk of the Works services until completion of construction.
- c. Resident Engineers need to take a more active and assertive role in monitoring procurement and construction schedules.
- d. Resident engineers conduct weekly on-site meetings with Superintendent, key foremen and Clerk of the Works to review schedule progress, procurement, quality and problem areas. Prepare minutes of the meeting with copies to Superintendent, Senior Architect, EK/D offices in Khartoum, WSARP and USAID.
- e. Correspondence sent to the Contractor's Superintendent should be copied to the Senior Architect and EK/D offices in Khartoum. Any correspondence concerning major schedule or cost matters or problems should also be copied to funding organizations and WSARP.
- f. Retain the Senior Resident Engineer for the 12 month oversight period after completion of construction of the last site.

C. Schedule and Cost Projections

Figure 17 indicates the cost projections for A/E and resident services in consideration of the schedule included in this report.

FIGURE 1 /

PROJECTED A/E AND RESIDENT SERVICES COST

	<u>Dates</u>	<u>Months</u>	<u>Fixed Fee</u>	<u>Expenses</u>	<u>Total</u>
Senior Architect	9/85-7/86	11	\$299,750	\$77,000	376,750
Senior Engineer	7/86-5/87	10	57,500	-	57,500
El Obeid			(LS)	(LS)	(LS)
Resident Engineer	1/85-10/85	9	40,500	2,250	42,750
Clerk of Works	1/85-10/85	9	24,300	2,250	26,550
El Fasher					
Resident Engineer	1/85-4/86	15	67,500	3,000	70,500
Clerk of Works	1/85-4/86	15	40,500	3,000	43,500
Ghazala Gawazet					
Res. Architect	1/85-4/86	15	67,500	3,000	70,500
Clerk of Works	1/85-4/86	15	40,500	3,000	43,500
ARC HQ					
Clerk of Works	1/85-5/85	4	7,600	-	7,600

TOTAL \$ = \$434,250 (USAID)

TOTAL LS. = LS.304,900

- Note: 1) Cost for Senior Architect is borne by USAID through CID.
 2) Site resident costs covered by WSARP
 3) Senior Engineer is carried under A/E (Senior Architect) cost until last year of maintenance.

D. CID

1. Analysis

CID is under contract with USAID and is 'responsible for managing, supervising and completing the construction of all major physical facilities funded under this project'.

The AE Consultant to CID(G-Z) is responsible for design, for supervising the construction, and for management of all procurement functions to be funded by AID. These latter responsibilities are not defined. The Contract states a CID 'Project Architect/Planner' is required to supervise the AE consultants and liase closely with the research staff in building design. Further clarification of his functions is not provided in the Contract between CID and USAID. There is no indication that CID has an Engineer acting in this capacity. Some early correspondence indicated that Dr. David Higgins was in a project related engineering position, but there is no clear indication of duties, and at present he apparently is not involved in the construction aspect of the project.

CID's involvement in the construction component of the project appears to be minimal based on a review of USAID and G-Z files.

2. Recommendations

CID's specific responsibility and required involvement in the construction component should be clarified and agreed upon by USAID and CID.

III. FUNDING AGENCIES

A. GOVERNMENT OF SUDAN

Analysis and Recommendations

Throughout the project there have been a number of constraints which have affected the Contractor and his progress. Some of these were discussed previously in this report.

Constraints no longer affecting the Contractor include the following:

- The 1982 timber cutting ban affected brick production.
- The import license requirements and import restrictions instituted in 1983 are still in effect, but import licenses have now been granted for all import items, and thus this constraint no longer affects the project. Previously, delays of two to three months were incurred from the time the application was made to when approval was received. In addition, the Contractor, as recently as 6 months ago, had submitted the import license requests to the wrong Government officials which resulted in delays.
- Water restrictions by local government should no longer be a significant problem since project water requirements are decreased with substantial completion of brickwork and with concrete floors and plastering nearing completion.

Current constraints and their effects are as follows:

1. Fuel Allocation

a. Analysis

The Contractor has been faced with fuel shortages and GOS fuel allocation requirements. On a periodic basis, the Contractor must submit his petrol requirements to GOS for approval. The full amount of the request is not always granted. This will become an even more crucial factor in the next several months as a large amount of recently purchased material must be transported to the sites.

b. Recommendations

- Contractor prepare an estimate of fuel requirements for the remainder of the project and provide this to the funding agencies, GOS, WSARP, and Senior Architect.
- Funding agencies, WSARP, and Senior Architect meet with GOS to assist Contractor in obtaining his fuel requirements.
- If monthly allocation requests are required by GOS, Contractor should assign one individual on his staff the responsibility for submitting the requests and expediting

them. If requests are delayed or amount provided is less than requested, Contractor should first attempt to resolve with GOS and if it cannot be resolved, request assistance from WSARP then as a last resort the funding agencies.

- WSARP assign an individual on their staff responsibility for assisting the Contractor with fuel allocations.

- A possible option to explore is to determine if WSARP could obtain several months allocation of fuel and then sell it to the Contractor.

2. Rail Shipments

a. Analysis

The use of rail cars is restricted to 'strategic goods'. Authorization to use rail cars for shipment is granted by the Ministry of Transportation. The Contractor has and continues to experience difficulty in acquiring railroad cars for larger shipments of materials to the vicinity of the project sites. Authorization is rarely granted for 'non strategic goods'. The Contractor has requested nine rail cars for shipment of the diesel generators and associated equipment which will be arriving in the next few months. Shipment of generators by truck may be possible.

b. Recommendations

- Contractor first determine if shipment by truck is feasible.

- Contractor submit a request to the Ministry of Transportation immediately if not done so.

- If permission is not granted, initially seek the assistance of WSARP and advise the Senior Architect as well.

If it is then unresolved, funding agencies provide assistance and become actively involved through discussions with all parties.

3. Late Payment

a. Analysis

As discussed previously under Part II D, the payment process of GOS has been responsible for many disbursements to Contractor exceeding the 30 day limit required by Contract. PL 480 funds under control of WSARP Director have not been a problem. However, these funds represent only 50% of the LS portion of payments.

Disbursements from GOS General Budget funds are consistently late and are often made in portions. We speculate that processes internal to GOS are at least part of the problem, as well as possible lack of funds.

Discussions with project principals indicates that a resolution to the problem has been sought without notable relief to date.

b. Recommendations

WSARP should continue efforts with GOS Ministries to minimize delays and explore expediting procedures.

4. Economic Dislocation

a. Analysis

The Economic Dislocation settlement allowed by construction Contract continues to be a problem area involving GOS and EK/D .

Discussions on this matter have been taking place for more than a year and it appears a resolution is not imminent. GOS Minister of Finance must approve disbursement of Economic Dislocation funds and he has requested spending documentation from EK/D which Contractor has refused to provide. G-Z has been involved in facilitating discussions and if the matter cannot otherwise be resolved, WSARP will request a formal decision by G-Z to be reviewed by GOS and EK/D.

If G-Z's decision is not accepted by both parties, then the next recourse is submittal to arbitration process.

Current discussions are centering around trying to find a compromise position which could be accepted by all parties.

b. Recommendations

Refer to recommendations under Financial Aspects.

5. Customs and Clearing

a. Analysis

Once imported materials reach Port Sudan they must be cleared through customs and certain fees and taxes must be paid at that time. The time lag to get the materials cleared through Port Sudan has been one to two months. It is not known whether this is entirely due to GOS delays. Delays could occur if the timely or proper application for clearing was not made or fees and taxes paid in a timely manner.

With the large shipment of import materials expected within the next several months it is critical to the project schedule that the items are cleared quickly through customs.

b. Recommendations

- Contractor meet with appropriate GOS officials to resolve the clearing delays.
- If Contractor is unsuccessful in these efforts, notify WSARP and the Senior Architect of the problem and request their assistance.
- If the above efforts fail, funding agencies should become involved and meet together with GOS to resolve the delays.

B. USAID

1. Late Payments

a. Analysis

Figure 10 indicates payment receipt dates supplied by EK/D for Certificates 11 through 18. Payments consistently breach the 30 day limit and a review of USAID payment procedures points to possible causes.

Certificates must be approved by USAID Project Officer prior to transmittal of payment vouchers. Vouchers are then transmitted to Nairobi Office, then to USAID/Washington and finally to a disbursing bank in Paris, before disbursement is made. Time accumulated in processing and transmittal is probably not abnormal for an operation of this size, however, there is no indication that these time constraints were considered before being included in the construction Contract.

Continued late disbursement can only serve to strengthen the Contractor's legal position and weaken his cash flow situation. EK/D has now submitted claims for time extension based on late payment, which are under review by G-2.

b. Recommendations

- USAID should continue to expedite payment process assuming that an alternate procedure at this point is not feasible.
- Time constraints must be considered more closely in future constraints.

2. Project Involvement

a. Analysis

In the past USAID/Sudan did not have staff available to closely monitor the construction component of the project. With the hiring of Mr. Aulakh, a civil engineer about six months ago, USAID Engineering has assigned him to monitor the construction of this project. This is important to ensure that progress is proceeding at an adequate pace and to monitor any problems that may arise.

b. Recommendations

- Active involvement by USAID as well as the World Bank and WSARP is crucial to the progress of the construction project. Involvement by USAID in day to day construction matters are not necessary. However, when problems arise that affect schedule or costs and which cannot be resolved by the Contractor, Senior Architect and WSARP, then USAID must become actively involved and provide assistance in resolving the problem.
- Formally charge the engineer in the USAID Engineering office with responsibility for monitoring the construction progress and appraising the Ag project director of the status of the project and significant problems. The Engineer should receive and review copies of the Senior Architect's monthly progress reports and the Resident Engineer's reports and correspondence relating to the construction matters and problems; all of which we have recommended the Contractor and Senior Architect provide to USAID.
- USAID give immediate attention and active support in resolving the following problem areas affecting construction progress which were discussed in prior segments of this report: GOS fuel allocations, GOS customs and clearing at Port Sudan, GOS railcar allocations, resolving economic dislocation adjustment and other remaining Variation Orders.
- USAID discuss and develop with WSARP, World Bank and the Senior Architect procedures for review and approval of changes in the scope of the construction Contract which are to be included in Variation Orders. Determine which organizations and individuals must approve changes.
- USAID Engineer monitor schedules and update and monitor the progress curves in Figures 2 thru 6.

3. USAID Records

a. Analysis

USAID files related to the construction of this project are located in two areas - the Agricultural Project office and the Engineering office. Each set contains some of the items missing in the other, thus melding the files together in one

place would provide more complete information. Both sets of files are incomplete in certain key areas. For example, a complete set of the Senior Architect's monthly progress reports are needed. Copies of some, but not all, prior project schedules are in the files. Neither office has a complete conformed copy of the Construction Contract including the Bill of Materials and latest revised drawings.

b. Recommendations

- Set up a USAID file in a single area, preferably the Engineering office.
- Request missing information as noted under 'analysis' from the Senior Architect.
- Review files to ensure that USAID has original conformed copies with amendments of CID/USAID Contract, CID/G-2, CID/KARPLEN, GOS/USAID and other related contract documents. Also check to see if copies of all signed amendments or Variation Orders are in the files.
- Meld the Project office and Engineering office files together. We recommend keeping all correspondence pertaining to construction in one place, preferably the USAID Engineering office, with files established for schedules, monthly progress reports, resident engineers reports, Variation Orders, general correspondence and other required files.

C. WORLD BANK

1. Late Payments

a. Analysis

Disbursement of funds from World Bank is experiencing delaying factors similar to USAID. Payments are chronically late due to apparent processing delays at the various processing centers. Processing of the certified pay requests are not handled by the local WB office. According to a Project Implementation Letter dated July 6, 1981 from the USAID Director, the payment process for WB is as follows:

The certified payment request from the Senior Architect is reviewed and approved by USAID/Sudan. USAID cables its approval to WB (IBRD) and USAID offices in Nairobi, Kenya. IBRD/Nairobi gets approval from IBRD Washington DC office. IBRD/Nairobi then makes the payment to the Contractor. Based on other verbal information received, it is unclear whether this is the current process. This information indicates payments are made thru WB's bank in New York, then through another bank and then to the Contractor's bank.

b. Recommendations

- Assign responsibility for expediting to local office personnel associated with this project. It should not take an inordinate amount of time to make periodic inquiries during the remaining construction period.
- Determine current WB internal payment handling process and explore ways of expediting payments to the Contractor.

2. Involvement

The World Bank should take a more active role with USAID in assisting to resolve major schedule and cost related problems that impede progress and that cannot be resolved by the Contractor, WSARP and the Senior Architect.

D. WESTERN SUDAN AGRICULTURAL RESEARCH PROJECT

1. Analysis

WSARP is under the Agricultural Research Corporation (ARC) in the Ministry of Agriculture. Actual involvement of WSARP in the construction component of the project is crucial to the ultimate success of the project. WSARP can provide valuable assistance in resolving GOS constraints which impair construction progress. To be aware of areas requiring their assistance, WSARP must be kept informed of major construction problems related to cost, schedule, or scope changes. Recommendations in this report specify procedures to be followed by the Senior Architect and the Contractor related to this matter.

In the months ahead a substantial amount of materials will be in transit to the sites. WSARP's assistance in helping to resolve some of the GOS constraints referred to earlier in this report is crucial to the construction progress.

2. Recommendations

- WSARP should assign an individual specific responsibility for day to day assistance in resolving GOS problems related to the construction such as fuel allocations, customs and clearance delays, availability of rail cars, and late payments.

- Assist in resolving GOS related constraints that impact the cost or progress of construction, such as fuel allocation, rail car assignments, customs and clearing at Port Sudan, and late payments to the Contractor.

PLAN, SCHEDULE AND COSTS

I. ACTION PLAN

For the action plan recommended in this study to be effective, it will be necessary for all parties - EK/D, G-Z and KARPLEN, WSARP, COS, WB, USAID and CID, to work together to resolve problems impeding the construction progress of this project.

At this late stage in the construction, the options available for improving construction progress are limited. Close monitoring of progress schedule, costs and problem areas by all parties and co-operative action to resolve problem areas are the central aspects of this plan.

A brief statement of the action plan items follows. Specific details of the plan are contained in the ANALYSIS AND RECOMMENDATIONS section of this report. The following actions should be taken:

A. CID

- Determine and define with USAID, CID's specific responsibilities and required involvement in the construction component.

B. CONTRACTOR - EK/D

- Improve rate of construction progress.
- Prepare and update a construction schedule and monitor progress.
- Prepare and update procurement schedule and plan for materials not currently on site and monitor progress.
- Prepare and monitor a logistics plan for transport of remaining materials.
- Immediately submit compliance submittals for all items not approved.
- Immediately order all remaining purchase items.
- Provide Senior Architect with copies of all LC's or purchase orders for items for which a Bill of Lading has not been received.
- Assign an individual with specific responsibility for day to day procurement, logistics, schedule and expediting activities.
- Address any internal cash flow problems affecting the construction.
- Improve communications between sites to resolve mutual problems and consider exchange of personnel and materials between sites to fill short term needs.
- Increase size of staff at sites. Increase the number of skilled workers and the proportion of skilled workers to at least 50% of the work force.

- Provide a weekly staffing report to the Senior Architect, WSARP and USAID.
- Advise the Senior Architect in writing with copies to all parties of problems affecting schedule, progress or cost.
- Attend weekly and monthly On-site meetings. The presence of EK/D senior management at monthly meetings is required.
- Project monthly fuel requirements and work with GOS and WSARP to resolve the fuel allocation problem.
- Submit pay requests monthly.
- Keep G-Z Senior Architect informed on status of payment receipts.

C. GOVERNMENT OF SUDAN AND WSARP

- Assist Contractor in resolving fuel allocation restraint. WSARP explore the possibility of purchasing fuel for Contractor.
- Assist Contractor in obtaining rail car assignments for generator shipment.
- Expedite payments to Contractor.
- Assist in resolving Economic Dislocation Settlement, but delay payment until end of contract.
- Assist Contractor in resolving customs and clearing delays at Port Sudan.
- WSARP assign an expediter with responsibility for tracking and expediting Payment Certificates through payment channels.
- WSARP assign an individual with the specific responsibility for day to day assistance in resolving GOS restraints which affect construction progress.
- Reductions in scope of project: for cost savings, eliminate fountains and landscaping and chip/seal roads in lieu of asphalt paving.
- Construction Contract modifications or terminations: do not terminate at this time. Explore incentive option to expedite construction if timely completion is critical to research program. If construction progress does not improve at western sites, consider retaining a contractor or contractors to complete.
- Liquidated damages: do not assess at this time. When total accrued liquidated damages approach retainage, review feasibility of assessing

D. G-Z SENIOR ARCHITECT

- In writing, request the Contractor to take actions stated in this plan.
- Conduct regular monthly on-site meetings to review progress, schedule, procurement status, quality and problems. Prepare minutes and copy all parties.

- When major problems occur, notify funding agencies, CID and WSARP, in writing, and request assistance if needed.
- If construction schedules, procurement schedules, and logistics plans are not prepared, updated and monitored by the Contractor, then Senior Architect prepare and monitor.
- Request Contractor in writing to submit weekly staffing reports.
- Request Contractor to increase the total work force and increase the number and proportion of skilled workers.
- Send monthly letters to Contractor advising him he is behind schedule. Mention liquidated damages. Request he take action to improve progress.
- Provide USAID with fully conformed copies of Construction Contract including Bill of Quantities and drawings.
- Provide USAID with latest revised drawings and in future continue to do so.
- Send copies to all parties of correspondence to or from the Contractor, concerning problems affecting project schedule, progress or costs.
- Report monthly to WSARP and USAID the current accrued liquidated damages amount.
- Advise Contractor's bonding agent of the status of the construction and progress.
- Provide WSARP and USAID, if requested, copies of all compliance submittals with notations to indicate Senior Architect's approval.
- Consult WSARP and USAID, regarding all Variation Order items and submit them for review and approval.
- Continue efforts to resolve remaining Variation Orders.
- Document in letters any significant items discussed with the Contractor verbally.
- Continue to apply pressure to Contractor to submit payment requests monthly.

E. KARPLEN RESIDENT ENGINEERS

- Conduct weekly on-site meetings to review progress, schedule, procurement status, quality and problems. Prepare minutes and distribute copies.
- Take an active and assertive role in monitoring procurement and construction schedules.
- Correspondence to Contractor's Superintendent should be copied to Contractor's Khartoum offices, the Senior Architect, WSARP and USAID also.

F. USAID

- Actively assist in resolving problems or constraints affecting construction progress of costs.
- Meet with GOS, WSARP and WB to resolve the following GOS related items and constraints currently impacting construction: fuel allocations, customs and clearing, rail car allocations, economic dislocation allowance, pending Variation orders and late payments. Actively encourage resolution.
- Assign USAID Engineer responsibility for monitoring construction progress and apprizing Ag project officer of status and problems.
- USAID Engineer receive, review and retain construction related reports and documents as specifically outlined in this study. Monitor schedules and progress.
- Establish one set of files for the construction component of this project. Meld current files together. Obtain original conformed copies of project related contracts and documents including amendments.
- Retain Senior Architect (G-Z) until completion of construction of the last site.
- Retain Senior Resident Engineer (KARPLEN) until the end of the one year oversight period.
- Retain other Resident Engineers and Clerks of Works until the completion of construction at their sites.

G. WORLD BANK

- Expedite payments to Contractor.
- Assign responsibility for expediting payments to local office personnel.
- Take an active role in assisting in the resolution of major problems affecting project construction progress and costs.

II. SCHEDULE

We have made a review of previous schedules, acquired information on productivity and obtained information on time requirements for procurement of imported materials. Using this and other information we have reviewed each item in the schedule and developed a conservative schedule for each site which is shown on the 'original schedule' line on the enclosed schedule forms (Appendix H). We estimate the completion dates for each site are as follows:

El Obeid	October 1, 1985
El Fasher	April 1, 1986
Ghazala Gawazet	April 1, 1986
Khartoum North	May 1, 1985

Note that we have provided estimates of on-site work force levels. The figures do not include drivers and others required for logistics support. The work force levels are higher than the Contractor's current levels, thus an increase in the work force will be required in order to complete the construction within a reasonable time frame. In addition to the increases in the total size of the work force at each site, the proportion of skilled labor will need to increase to over 50% and probably close to 60% of the work force in order to have sufficient skilled workers to perform the skilled labor intensive activities that will be required in the coming months.

The previous schedule, which was prepared in October 1984 by the Senior Architect, indicates completion dates as follows:

El Obeid	July 1, 1985
El Fasher	July 1, 1985
Ghazala Gawazet	July 1, 1985
Khartoum North	April 1, 1985

If the Contractor's current work force levels and low number of skilled labor is maintained and not increased, then expected completion dates for most of the sites will increase significantly. Using the curves in Figures 3, 4, 5, and 6, and the historical rate of progress, the expected late completion dates assuming this situation would be as follows:

	<u>Completion Date</u>	<u>Average Progress Percent per month</u>
El Obeid	April, 1986	1.77
El Fasher	April, 1989	1.09
Ghazala Gawazet	Dec. 1987	1.31
Khartoum North	March 1985	2.41

Current Contract completion dates are August 8, 1983 for ARC Khartoum North, and January 28, 1984 for the other sites. The schedule in this report assumes some delays in procurement and is based on past experience on this project. However, unexpected GOS constraints or delays could seriously impact progress and will need to be identified and resolved quickly.

III. COST

A. Current Contract Status

The current amended Contract is comprised of the original tender, Variation Order No. 1, and Variation Order No. 4. Figure 1 shows the breakdown of costs between funders.

Figure 1 also indicates funders' remaining liability if the Contract is completed without further additions, however there are factors which in reality will increase these figures and further consume contingencies. They are:

1. Proposed additions (Fig. 9)
2. Undetermined Changes
3. Bill of Quantity Discrepancies
4. Economic Dislocation (GOS only - not contingency)

1. Proposed Additions

Figure 9 indicates additional cost items which are not yet justified by Variation Orders. Some of these items will be essential if construction is completed, while others are non-essential and may be eliminated at a cost saving. Landscaping is the only item on which design is not completed, thus our amount is a rough allowance at all sites. It must be noted that cost for two of the items has already been committed. They are:

1. Generators - ordered and considered essential.
2. Stone at sewage ponds - this work nearly complete.

This cost will be absorbed by contingency amounts.

2. Undetermined Changes

Should this Project be carried to completion, we will expect minor additional changes to continue through the prescribed year of maintenance. Extras such as minor site changes, changes to electrical/mechanical systems, finish work variations, we would estimate at 1% of the original Contract (LS.143,614). This cost will be absorbed by contingency amounts.

3. Bill of Quantity Discrepancies

The Bills of Quantities (BOQ) were prepared by a certified Quantity Surveyor prior to tender. We expect these quantities to be much more accurate than 'order of magnitude', however the Contractor is not bound to his tender total if these quantities are in actuality exceeded. Contractor will be paid for the actual work in place, at his unit price, whether it be greater or lesser than BOW indicates.

We expect a tendency for BOQ to be conservative and in course of construction verifiable quantities would be greater. For this reason we estimate an additional 2% of original Contract to be included in final cost (LS.287,228).

This cost would be absorbed by contingencies.

4. Economic Dislocation

Additional cost for Economic Dislocation as prescribed by Contract will be borne by GOS and has been included in latest budget as a cost separate from contingencies. Nevertheless, cost to complete for GOS must include this item which has been budgeted at a maximum of LS.3,413,760.

B. Projected Costs

1. Construction

We believe that extended schedules must be considered regarding their impact on construction costs. Although we have not assumed an amount, which could be highly speculative, there is possible increase in Economic Dislocation settlement, a tendency toward relaxation of Liquidated Damages, and the possibility that more justifiable additions could be discovered.

2. WSARP

The extended schedule will create additional costs toward the WSARP operating budget, some of which can only be determined through subjective analysis of the research program itself.

Loss of constructive use of facilities will impair the research program by thwarting its intended purpose. Assignment of dollars to this problem bares close review by WSARP/CID.

Tangible costs due to delay include temporary scientist lodging, temporary WSARP office costs, transportation costs, personnel involvement costs, and temporary research facilities.

We are advised by WSARP that temporary facilities at El Obeid have amounted to approximately LS.26,000 over the past year. While this amount may not be significant in itself, if delays continue with the arrival of more researchers, the costs could be substantial when balanced against completed facilities operating costs.

3. A/E

Based on projected monthly cost figures supplied by C-2, Fig. 17 illustrates cost of extended A/E and resident services, all sites, from December 1984 to completion of all sites based on our anticipated schedule, and our proposed A/E staffing arrangement. Retention of a Senior Architect and site Resident Representatives are essential to an orderly completion of construction.

RECOMMENDATIONS FOR FUTURE USAID PROJECTS

- Require a project schedule to be submitted with the Contractor's bid, with breakdown pre-established.
- List key milestone items in the bid form for fill-in by the bidder with specific completion dates.
- Indicate desired interim completion dates for milestone items as well as final desired dates (in terms of days from Contract date).
- Consider reasonableness of schedule supplied by Contractor.
- Specify in detail in the Contract documents how advance payment for materials is to be paid and amortized and the items for which it is to be used. Specify type of back-up documents to be provided by Contractor on purchases.
- Provide specific details in the Contract documents concerning methodology for calculating and making payments for Economic Dislocation.
- Assign USAID Engineer to monitor construction progress and oversee AE services. Early action is the key to avoiding compound problems.
- Set reasonable payment deadlines considering actual processes.
- Include a formal compliance submittal review procedure in the Construction Contract.
- Require the Contractor provide a breakdown of labor and material portions of all Contract component items satisfactory to the Engineer.
- Clearly define the A/E's limit of authority to make changes which involve cost. Also define approval procedure that must be followed beyond this limit.

APPENDIX A

VE TEAM ACTIVITIES

Major meetings and activities are listed below. Other short internal meetings held with staff members of USAID, G-Z, and others, are not listed.

Nov. 4	Sunday	Depart U.S.
Nov. 6	Tuesday p.m.	Arrive Khartoum
Nov. 7	Wednesday	Briefing meeting with Mr. McAleer and Mr. Aulakh of USAID at USAID offices and later with Mr. W... Meeting with Dr. Dafalla, WSARP; Mr. McAleer and Mr. Aulakh of USAID; Mr. Bergman, G-Z; and Mr. Rahman, KARPLEN; at WSARP offices
Nov. 8	Thursday	Begin review of project plans and specs. and USAID Engineering Office files at USAID. Meeting with Mr. Cornell, Mr. McAleer, and Mr. Aulakh of USAID at USAID.
Nov. 9	Friday	Holiday - Review USAID Engineering Office files.
Nov. 10	Saturday	Meeting with Mr. El Khidir of EK/D; Mr. Bergman, G-Z; Mr. Rahman, KARPLEN; Mr. Aulakh, USAID at KARPLEN offices.
Nov. 11	Sunday	Review G-Z files at KARPLEN. Meeting with Mr. Bergman, G-Z at KARPLEN office. Meeting with Mr. Rahman, KARPLEN at KARPLEN
Nov. 12	Monday	Site visit to ARC Khartoum North construction site. Meeting with Ms. Martella, Mr. McAleer, and Mr. Aulakh of USAID at USAID.
Nov. 13	Tuesday	Site visit to El Obeid construction site. Meeting at site with Mr. Bergman, G-Z; Mr. Aulakh, USAID; Mr. El Khidir, Mr. El Hag, and Mr. Homeida of EK/D; Mr. Ahmed Hussein, Mr. Salah Said, and Mr. Yusif Sulieman of KARPLEN.
Nov. 14	Wednesday	Site visit to El Fasher construction site. Meeting at site with Mr. Bergman, G-Z; Mr. Aulakh, USAID; Mr. El Hag, Mr. Tao of EK/D, Mr. Hassan Abbas, KARPLEN. Talked with Dr. Higgins of CID.

Nov. 15 Thursday Site visit to Ghazala Gawuzet construction site. Meeting at site with Mr. Bergman, G-Z; Mr. Aulakh, USAID; Mr. El Hag, Mr. Ishaq Adam Saleim, and Mr. Lu Zhen Fei of EK/D; Mr. Casim Omer Fadlelseed, Mr. El Jack Murat of KARPLEN.

Nov. 16 Friday Holiday.

Nov. 17 Saturday Review of G-Z project files at G-Z offices.

Nov. 18 Sunday Review of USAID Agriculture Development Office files at USAID office. Meeting with Ms. Martella, Mr. McAleer, Mr. Aulakh of USAID at USAID.

Nov. 19 Monday Review of USAID Agriculture Development Office files at USAID. Meeting with USAID/Sudan Director Mr. Brown, Ms. Martella, Mr. McAleer, Mr. Cornell, Mr. Pascual, Mr. Aulakh of USAID at USAID.

Nov. 20 Tuesday Review of USAID files and preparation of report at USAID. Meeting with Mr. Grube and Mr. Bergman of G-Z and Mr. Aulakh of USAID at KARPLEN office.

Nov. 21 Wednesday Preparation of report at USAID office. Meeting with Mr. McAleer and Mr. Aulakh at USAID. Meeting with Mr. Brazil of USAID at USAID.

Nov. 22 Thursday Thanksgiving.

Nov. 23 Friday Holiday

Nov. 24 Saturday Meeting with Mr. Grube and Mr. Bergman of G-Z and Mr. Aulakh of USAID at KARPLEN offices. Reviewed G-Z project files.

Nov. 25 Sunday Meeting with Dr. El Sir of Ministry of Construction and Public Works and Mr. Aulakh of USAID at Ministry offices. Meeting with Dr. Hogan of WSARP at WSARP. Meeting with Mr. El Khidir of EK/D at KARPLEN office. Meeting with Mr. Grube of G-Z at KARPLEN office. Review of G-Z project files at KARPLEN offices.

Nov. 26 Monday Meeting with Ms. Foik of World Bank and Mr. Aulakh of USAID at World Bank offices. Review G-Z files at KARPLEN offices.

Nov. 27	Tuesday	Prepare report at USAID offices
Nov. 28 - Dec. 4		Obtain additional information from G-Z and prepare report.
Dec. 5	Wednesday	Holiday - Gave oral presentation of report to Ms. Martella, Mr. Pascual, Mr. Moody and Mr. Aulakh of USAID and Mr. Gephart at USAID offices.
Dec. 6 - 8		Prepare Report.
Dec. 9	Sunday	Gave oral presentation to Mr. McAleer, Ms. Martella, Mr. Moody and Mr. Aulakh of USAID and Mr. Gephart at USAID offices.
Dec. 10-11		Prepare Report
Dec. 12	Wednesday	Submitted final typed report and gave oral presentation to Mission Director Mr. W. R. Brown, Ms. Martella, Mr. McAleer, Mr. Aulakh, Mr. Witt and Mr. Cornell of USAID at USAID offices.
		Gave oral presentation to USAID and representatives of WSARP and World Bank.
Dec. 14	Friday	Depart Sudan in a.m.
Dec. 15	Saturday	Arrive U.S. p.m.

APPENDIX B

LIST OF PROJECT RELATED
ORGANIZATIONS AND PERSONNEL

Abdalla El Khidir and Son Mohammad, General Contractors

P.O. Box 784,
Khartoum.
Tel: 324455/33880

Mr. M.A. El Khidir, Owner.

Consortium for International Development (CID)

5151 E. Broadway, Suite 1500,
Tucson, AZ 85711-3766,
Tel: 602-745-0455

Ms. Jean R. Kearns, Phd, Deputy Director.
Dr. David Higgins, Engineer.

El Khidir and Diraige Co. Ltd.

P.O. Box 784,
Khartoum, Sudan.
Tel: 223469

Mr. M.A. El Khidir, Owner Abdalla El Khidir and Son,
General Contractors and Joint Venture partner
Mr. Diraige, Joint Venture partner

at Joint Venture Office:

Mr. Adam El Hag, Managing Director

Mr. Gu, Deputy Manager, China Engineering Construction Company

Mr. Cheng, Accountant, China Engineering Construction Company

At El Obeid Site:

Mr. M.H. Humeida, Superintendent

At El Fasher Site:

Mr. Tao, Superintendent, China Engineering Construction Company

At Ghazala Gawazet Site:

Mr. Ishag Adam Saleim, Joint Venture Superintendent

Mr. Lu Zhen Fei, China Engineering Construction Company Joint Venture

Government of Sudan - Ministry of Construction and Public Works

P.O. Box 2665,
Khartoum, Sudan.
Tel: 70878/79879/80808(h)

Dr. El Sir Mohamed El Hassan, Chief Engineer for Development
Projects, Ministry of Construction and Public Works

Grube-Zimmer, Inc.

2040 S.W. Jefferson St.,
Portland, Oregon 97201
Tel: 503-221-0150

P.O. Box 2531,
Khartoum, Sudan.
Tel: 221798/221799/223359

Mr. Joachim C. Grube, Principal
Mr. Henry P. Bergman, Senior Architect

KARPLEN Consultants

P.O. Box 2531,
Khartoum, Sudan.
Tel: 221798/221799/223359

Mr. Abdel Wahab Abdel Rahman, Principal
Mr. Mohamed Makki Ahmed Makki, Principal

At El Obeid Site:

Mr. Ahmed Hussein, KARPLEN Senior Engineer (Architect)
Mr. Salah Said, Resident Engineer
Mr. Yusif Sulieman, Clerk of Works

At El Fasher Site:

Mr. Hassan Hamad Abbas, Resident Engineer

At Ghazala Gawazet Site:

Mr. Gasim Omer Fadlesead, Resident Engineer
Mr. El Jack Murat, Clerk of Works

United States Agency for International Development/Sudan

APO New York 09668,
Tel: 43095/41030/44993

Mr. William R. Brown, Director
Mr. Eric Witt, Chief Agriculture Development Officer, Agriculture Office
Ms. Elizabeth Martella, Project Officer, Agriculture Office
Mr. Tom Cornell, Associate Director, Projects Office
Mr. Carlos Pascual, Project Office
Mr. Walter H. McAleer, Chief Engineer, Engineering Office
Mr. Dean Moody, Electrical Engineer, Engineering Office
Mr. Amar Aulakh, Civil Engineer, Engineering Office
Mr. Donato Brazil, Controller Office
Mr. Dave Gephart, Contract Engineer

Western Sudan Agricultural Research Project

P.O. Box 5141,
Khartoum South, Sudan.
Tel: 74661

Dr. D.A. Dafalla, Phd, Director
Dr. LaMoyne Hogan, Deputy Director

World Bank (IBRD)

P.O. Box 2211,
Khartoum, Sudan
Tel: 78043/78047

Mr. Stuart Marples, Project Officer (Washington, DC)
Mr. Mahfouz E. Tadros, Resident Representative in Sudan
Ms. Ingrid Foik

APPENDIX C

STATUS OF PROCUREMENT

	<u>Approved</u>	<u>Ordered.</u>	<u>In-Transit</u>	<u>On Site</u>	<u>Comments</u>
Div. 2 - Site Work					Local
Fencing	x				Purchase
Div. 4 - Masonry					
Bricks	x	x	x	x	
Div. 7 - Roofing					
Steel roof framing	x	x	x	x	
Metal roofing	x	x	x	x	
Ceiling panel system	x	x			
Thermal insulation	x	x			
Div. 8 - Doors, windows, glass					
Metal windows	x	x	x	x	
Metal doors and frames	x	x	x	x	
Ironmongery(hardware)	x	x	x		
Verandah screen and doors	x	x	part	part	
Div. 9 - Finishes					Local
Wall tiles	x				Purchase
Paving tiles	x	x	x	x	
Paint					Local
					Purchase
Div.10 - Specialities					
Toilet room accessories	x	x			
Flagstaffs	x	x			
Div.11 - Equipment					
Lab cabinets	x	x			
Kitchen & tea cabinets	x	x			
Lab equipment	x	x			
Div.15 - Mechanical					
Plumbing:					
Piping	x	x	part	part	Note 1
Fittings	x	x			
Sewage lift pump	x	x	x	x	
Fixtures	x	x			
Water:					
Water tank	x	x	part	part	Note 1
Booster pumps	x	x			
Automatic valves	x	x			
Gas:					
Gas cocks	x	x			
Gas generator	x	x			

STATUS OF PROCUREMENT (continued)

	<u>Approved</u>	<u>Ordered</u>	<u>In-Transit</u>	<u>On-Site</u>	<u>Comments</u>
Fuel:					
Fuel storage tanks	x	x	part	part	Note 1.
Fuel pumps	x	x			
Air Supply:					
Evaporative coolers	x				Local Purchase
Air registers & grilles	x				
Ceiling & wall exhaust fans	x	x	x	x	Local Purchase
Div.16 - Electrical					
General:					
Main switchgear panels	x	x			
Distribution panels	x	x	x	x	
Cable trunking	x	x	x	x	
Socket outlets,plugs	x	x			Note 2
Kitchen exhaust fans					Loc. Pu.
Air conditioning units	x				Loc. Pu.
Light fittings	x	x	x	x	
Ceiling air fans	x	x	x	x	
Photoelectric cell	x	x	x	x	
Generating Plant:					
Diesel generator	x	x			Note 3
Engine local control brand	x	x			Note 3
Alternators	x	x			Note 3
Automatic transfer switch	x	x			Note 3
Paralleling switchgear and totalizing switch-board	x	x			Note 3

Notes

1. On site at El Obeid only.
2. In electrical sub-contractor's warehouse or on site.
3. Order placed, manufacturer preparing technical data.

APPENDIX D

IMPORT BAN ITEMS

Imports Prohibited July 4, 1983

1. Saloon cars and Box-cars
2. Womens clothes and textiles
- *3. Home and office furniture
4. Fresh fruits
5. All sweets
6. Macaroni and noodles
7. Perfumes
8. Milk
9. Canned Fruits and Vegetables
10. Soft drinks
11. Soap
12. Cosmetics
13. Medicated Cotton
14. Carpets and Mokket
15. Blankets
16. Bed sheets
17. Ready made clothes
18. Leather goods
- *19. Air conditioners
20. Refrigerators and Deep-Freezers
21. T.V. and Records and Video
22. Heaters
23. Washing Machines
24. Cameras and accessories
25. Watches and clocks
26. Stationery
27. Plastic flowers and other plastic goods
- *28. Aluminium goods
29. Matches
- *30. Paints
31. Grinding stones
- *32. Doors and windows
33. Tiles
34. Car Batteries
35. Tyres and inner tubes
36. Small batteries
37. Bleach
38. Playing cards

* Items included in the construction of this project which are affected by the import ban.

APPENDIX E

VE TEAM SCOPE OF WORK

(From the USAID Work Order, OTR-1406-1-00-2255-00, Work Order 01)

SCHEDULE

ARTICLE I - TITLE

Western Sudan Agricultural Research Project (650-0020)

ARTICLE II - OBJECTIVE

The team will review all project documents, reports, and related items at the office of A) USAID B) WSARP C) G-Z, Consultant, and field sites.

ARTICLE III - STATEMENT OF WORK

I. General

1. The consultant team will be briefed by USAID/WSARP upon arrival in Khartoum.
2. The team will visit the four sites in priority of:
 - (1) El Obeid
 - (2) El Fasher
 - (3) Khartoum North
 - (4) Ghazia Gawazat
3. The team will complete their assignment in the Sudan and submit a final report, prior to their departure, addressing the following items:
 - (a) Analysis and recommendation as to how the construction should proceed. Should elements of uncompleted construction be terminated from project funding? Should the present construction contract be modified, terminated or continued as is? Are there suggestions for accelerating the work? Other factors the Mission should consider.
 - (b) A plan to complete the essential construction, including estimated schedule (implementation plan) and costs.
 - (c) Analysis of and recommendation for the continuation of A&E Services. Is a full time U.S. resident architect required on site? Would short term visits by the A&E suffice? If not could the local firm of Karplen (G-Z's sub-contractor) assume site inspection responsibility? Other recommendations.

- (d) A time and cost projection to provide A&E services through the completion of construction. Should the provision for oversight during the first year of operation be continued?
- (e) Analysis of the contractor's performance at construction sites, and in the management of procurement, logistics and construction. Recommendations for plan to improve this operation, with consideration of items (a) through (d) above.
- (f) Analysis of GOS bottlenecks and constraints Re: approvals, payments, procurement requirements, etc., which are affecting the construction component of the project. Action plan to relieve constraints identified within the GOS context.
- (g) Any other analysis and action plans, determined by the team to be relevant to assisting the Mission in deciding how to best proceed with specific elements of the construction component.

II. Specific

1. Engineer

- (a) Review all construction inspection reports, plans, specifications, contract documents, project correspondence, evaluations, progress reports, claims, claim approvals, etc., for overall understanding of the construction history of the project.
- (b) Make field site inspections related to the report requirements contained in Part I, above. Specific emphasis to be placed on construction management, or lack thereof, at construction sites.
- (c) Assist the financial expert in report completion per requirements.
- (d) Review the role of the A&E firm and recommend changes, if applicable, in time, cost, scope of work of the A&E Services contract which would allow the project to still meet its objectives in the construction component while minimizing costs.
- (e) Review procurement procedures of contractor. Apply findings as noted above.

2. Financial Analyst

- (a) Review with USAID/Controller, WSARP, A&E the disbursement to the contractor of all funds for construction.
- (b) Track advance payment of Foreign Exchange (FX) to contractor, how it was liquidated and determine if FX exists to complete procurement of off-shore materials needed for project completion.
- (c) Review contract documents related to financial aspects, payment flow and recommend appropriate modifications of procedures, checks and balances.
- (d) In conjunction with Engineer on team, determine expected cost overruns, FX, Local Currency (LC) to complete construction components, as determined essential to project scope. (Some construction may be considered non-essential for the achievement of project purpose, goal, etc and therefore may be recommended for cancellation).
- (e) Determine with Engineer if local cost funding can be more effectively used to meet construction completion.

ARTICLE IV - REPORTS

The team will submit a final report to the USAID Agriculture Office, to cover the objectives in Section 3 of the General part of the Scope of Work.

ARTICLE V - RELATIONSHIPS AND RESPONSIBILITIES

The Contractor team members will work with the USAID/Sudan Agriculture Office. USAID liaison officials are Eric Witt (ADO), Terry Hardt (Project Manager), and Dean Moody (Engineer).

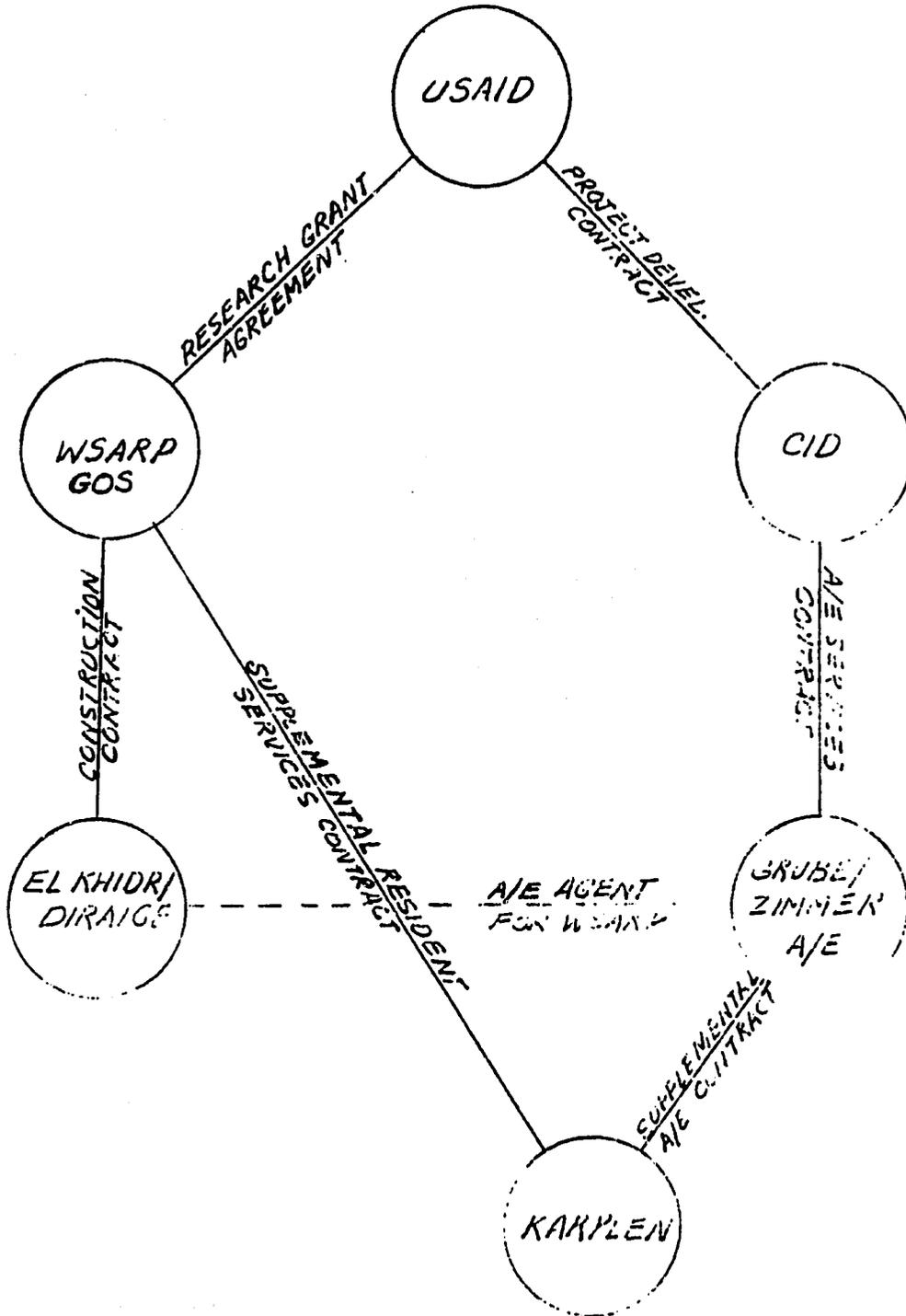
Cooperating Country Official is Dr. Dafalla A. Dafalla (Project Director).

Mr. Hank Bergman is the A&E representative.

ARTICLE VI - TERM OF PERFORMANCE

The effective date of this work order is November 3, 1984, with work to begin in Sudan on November 7, 1984.

Contractor performance under this work order will be completed on December 13, 1984. The estimated completion date of the work order is December 15, 1984.



APPENDIX G

TABULATION OF CONTRACTOR PAYMENT REQUESTS

REQ. DATE	NO.	MONTH NO.	TOTAL PROJECT		EL OBEID SITE		EL FASHER SITE		GHAZALA SITE		ARL HD SITE	
				%		%		%		%		%
9/81	1	1	328193.60	2.24	328193.60	4.35	0.00	0.00	0.00	0.00	0.00	0.00
		2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/81	2	3	296448.35	2.03	296448.35	3.96	0.00	0.00	0.00	0.00	0.00	0.00
		4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/82	3	5	449940.00	3.08	0.00	0.00	189520.00	5.47	151078.00	4.65	109342.00	25.58
2/82	4	6	288954.00	1.98	0.00	0.00	104691.00	3.02	172311.00	5.30	11952.00	2.80
		7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/82	5	8	192423.00	1.32	0.00	0.00	59229.00	1.71	97918.00	3.01	35276.00	8.25
		9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/82	6	10	32596.00	0.22	0.00	0.00	3728.00	0.11	1002.00	0.03	27866.00	6.52
		11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/82	7	12	478082.00	3.27	374502.00	5.00	52289.00	1.51	16239.00	0.50	35052.00	8.20
		13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/82	8 & 9	14	377303.00	2.58	192462.00	2.57	79301.00	2.29	58855.00	1.81	46685.00	10.92
		15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/82	10	16	207395.00	1.42	0.00	0.00	79262.00	2.29	104826.00	3.23	23307.00	5.45
		17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/83	11	19	304150.00	2.08	205972.00	2.75	17955.00	0.52	70881.00	2.18	9342.00	2.19
4/83	12	20	540565.00	3.70	501478.00	6.70	39087.00	1.13	0.00	0.00	0.00	0.00
		21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/83	13	23	994183.00	6.80	725121.00	9.69	144344.00	4.17	107466.00	3.37	15260.00	3.57
		24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/84	14 & 15	29	1021017.00	6.98	817392.00	10.92	166631.00	4.81	36994.00	1.14	0.00	0.00
		30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/84	16	31	1039694.00	7.11	676809.00	9.04	147548.00	4.26	209616.00	6.45	5721.00	1.31
		32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/84	17	35	360120.00	2.46	196568.00	2.63	53318.00	1.54	85030.00	2.62	25204.00	5.90
		36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/84	18	38	352363.00	2.41	15254.00	0.20	44410.00	1.28	271365.00	8.35	21334.00	4.99
	19	39	1423288.00	9.73	832303.00	11.12	286595.00	8.27	268804.00	8.28	35586.00	8.32
TOTAL BILLED=			8686714.95	59.40	5162502.95	68.98	1467908.00	42.37	1654377.00	50.93	401927.00	94.02
TO BE BILLED=			5937629.05	40.60	2321772.05	31.02	1996313.00	57.63	1593996.00	49.07	25548.00	6.98
CONT. TO DATE=			14624344.00		7484275.00		3464221.00		3248373.00		427475.00	

* BILLING AMOUNTS TAKEN FROM CERTIFIED REQUESTS
 * REQUESTS DO NOT MATCH ACTUAL PAYMENTS
 * CERTIFICATE NO.19 ESTIMATED

APPENDIX H

CONSTRUCTION SCHEDULES

ESTIMATED MANPOWER LOADING

MONTH	EL OBEID	EL FASHER	GHAZALA G.	ARC HQ	PROJECT MONTHLY TOTAL
DEC 84	138	28	48	32	246
JAN 85	126	48	50	42	266
FEB 85	137	48	50	58	293
MAR 85	143	68	52	48	311
APR 85	158	76	76	24	334
MAY 85	118	80	80		278
JUN 85	89	83	86		258
JUL 85	69	72	72		213
AUG 85	30	60	60		150
SEP 85	24	64	24		112
OCT 85		52	36		88
NOV 85		36	36		72
DEC 85		26	26		52
JAN 86		22	22		44
FEB 86		14	14		28
MAR 86		8	8		16

The figures above are based on the schedule included in this report and are provided to USAID to indicate the general manpower levels that can be expected. They are not intended to be used by the Contractor in planning or executing his work.

CONSTRUCTION SCHEDULE

1985

1986

		DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
SITE WATER/SEWER	Original				→														
	Actual				→														
ROADS	Original								→	→	→								
	Actual								→	→	→								
BRICK WORK	Original	→																	
	Actual	→																	
WATER TOWER	Original		→	→	→	→													
	Actual		→	→	→	→													
ROOF FRAMING	Original		→																
	Actual		→																
ROOF SHEETS	Original			→															
	Actual			→															
DOORS & FRAMES	Original								→										
	Actual								→										
WINDOW FRAMES	Original			→															
	Actual			→															
GLASS	Original	→	→	→	→	→	→												
	Actual	→	→	→	→	→	→												
VERANDAH SCREENS	Original					→													
	Actual					→													
ELECTRICAL	Original					→	→	→	→	→									
	Actual					→	→	→	→	→									
INTERIOR PLUMBING	Original			→															
	Actual			→															
PLUMBING FIXTURES	Original	→	→	→	→	→	→	→											
	Actual	→	→	→	→	→	→	→											
PLASTER	Original					→													
	Actual					→													
PAINTING	Original							→	→	→	→								
	Actual							→	→	→	→								
SLABS FLOOR TILES	Original							→											
	Actual							→											
CHILING SYSTEM	Original	→	→	→	→	→	→	→											
	Actual	→	→	→	→	→	→	→											
LAB CABINETS	Original	→	→	→	→	→	→	→											
	Actual	→	→	→	→	→	→	→											
KITCHEN CABINETS	Original	→	→	→	→	→	→	→											
	Actual	→	→	→	→	→	→	→											
GENERATORS	Original	→	→	→	→	→	→	→											
	Actual	→	→	→	→	→	→	→											
EVAP. COOLERS	Original		→	→	→	→													
	Actual		→	→	→	→													

PS = DELIVER TO PORT SUDAN
 SITE = DELIVER TO SITE
 INST = INSTALL

CONSTRUCTION SCHEDULE		1985												1986					
		DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
SITE WATER/SEWER	Original Actual	PS	SITE																
ROADS	Original Actual																		
BRICK WORK	Original Actual																		
WATER TOWER	Original Actual	PS	SITE																
ROOF FRAMING	Original Actual																		
ROOF SHEETS	Original Actual																		
DOORS & FRAMES	Original Actual		FRAMES		DOORS														
WINDOW FRAMES	Original Actual																		
GLASS	Original Actual	FAB		PS	SITE														
VERANDAH SCREENS	Original Actual		SITE																
ELECTRICAL	Original Actual																		
INTERIOR PLUMBING	Original Actual	PS	SITE		INST														
PLUMBING FIXTURES	Original Actual	PS	SITE																
PLASTER	Original Actual																		
PAINTING	Original Actual																		
SLABS/FLOOR TILES	Original Actual		COMP. SLABS																
CEILING SYSTEM	Original Actual	PS	SITE																
LAB CABINETS	Original Actual		FAB	PS	SITE														
KITCHEN CABINETS	Original Actual		FAB	PS	SITE														
GENERATORS	Original Actual			PS	SITE		SET	HOOK-UP											
EVAP. COOLERS	Original Actual		FAB	DEL.	INST.														

GHAZALA GAWAZET

16

CONSTRUCTION SCHEDULE		1985												1986					
		DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
SITE WATER/SEWER	Original Actual	PS	SITE			INST													
ROADS	Original Actual																		
BRICK WORK	Original Actual			COMP. WALLS															
WATER TOWER	Original Actual	PS	SITE		ERECT														
ROOF FRAMING	Original Actual	INST																	
ROOF SHEETS	Original Actual	INST.																	
DOORS & FRAMES	Original Actual	DEL.	INST.																
WINDOW FRAMES	Original Actual	DEL.	INST																
GLASS	Original Actual	FAB	PS.	SITE		INST													
VERANDAH SCREENS	Original Actual	FAB	PS	SITE		INST													
ELECTRICAL	Original Actual	SITE		DIST.			FIXT.												
INTERIOR PLUMBING	Original Actual	SITE		INST															
PLUMBING FIXTURES	Original Actual	PS	SITE							INST									
PLASTER	Original Actual																		
PAINTING	Original Actual											COAT 1		COAT 2					
SLABS/FLOOR TILES	Original Actual	SLABS			TILE														
CEILING SYSTEM	Original Actual	PS	SITE							INST									
LAB CABINETS	Original Actual		PS		SITE							INST							
KITCHEN CABINETS	Original Actual		PS		SITE							INST							
GENERATORS	Original Actual	PS	SITE		INST														
EVAP. COOLERS	Original Actual		FAB	DEL	INST														

ARC HEADQUARTERS - KHARJUM NORTH

CONSTRUCTION SCHEDULE		1985												1986					
		DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
SITE WATER/SEWER	Original																		
	Actual		INST																
ROADS	Original																		
	Actual																		
BRICK WORK	Original																		
	Actual																		
WATER TOWER	Original																		
	Actual																		
ROOF SYSTEM	Original																		
	Actual			INST															
ROOF SHEETS	Original																		
	Actual																		
DOORS & FRAMES	Original																		
	Actual		INST																
WINDOW FRAMES	Original																		
	Actual		INST																
GLASS	Original																		
	Actual		FAB	INST															
AIR CON. & DUCT WORK	Original																		
	Actual		FAB	DUCTS		INST													
ELECTRICAL	Original																		
	Actual		WIRING	FIXTURES															
INTERIOR PLUMBING	Original																		
	Actual		INST																
PLUMBING FIXTURES	Original																		
	Actual		PS	SITE	INST														
PLASTER	Original																		
	Actual			TOUCH-UP															
PAINTING	Original																		
	Actual			COAT 1	COAT 2														
SLABS/FLOOR TILES	Original																		
	Actual			TILES															
CEILING SYSTEM	Original																		
	Actual																		
LAB CABINETS	Original																		
	Actual																		
KITCHEN CABINETS	Original																		
	Actual																		
GENERATORS	Original																		
	Actual																		
EVAP. COOLERS	Original																		
	Actual																		

APPENDIX I

EXPLANATION OF BILLING CURVE PLOTS

Figures 2 through 6 show accumulated % billing vs months of construction. They are convenient tools for monitoring progress when used judiciously, considering the labor/material ratio, and physical observations. These plots will seldom be perfectly reflective of actual physical progress, however this does not minimize their value when used properly. The smooth curve shown on graphs is a plot of a Normal distribution over the period of original Contract schedule. Progress throughout project should reasonably resemble this curve thus it is used for a gauge in monitoring. Deviation to the right side of the Normal curve for any extended period may not immediately be cause for alarm, but would definitely warrant further investigation. The slope of the actual billings line is important in determining a logical trend for subsequent periods up to project completion.