EVALUATION
GAMBIA SOIL AND WATER MANAGEMENT
PROJECT NO. 635-0202

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ACRONYMS

AA	Agricultural Assistant - Extension Service
BS	Bachelor Of Science Degree
DEC	District Extension Center
DO	Direct Overhead
DRCDC	District Resource Conservation And Development Committee
EATU	Extension Aids and Training Unit
ERP	Economic Recovery Plan
FAO	Food And Agricultural Organization Of The United Nations
FFHC	Freedom From Hunger Campaign
FJCD	Foni Jarrol Conservation District
GARD	Gambia Agricultural Research And Diversification Project
GDP	Gross Development Product
GOTG	Government Of The Gambia
GTZ	German Agency for Technical Cooperation
Ha	Hectare
IRR	Internal Rate of Return
ITC	International Trypanotolerance Center
MFC	Mixed Farming Center
MOA	Ministry of Agriculture
MS	Master of Science Degree
MW	Man-Week
OMVG	Gambia River Basin Development Organization
OJT	On-the-Job Training
PACD	Project Assistance Completion Date
PASA	Participating Agency Service Agreement
PIP	Public Investment Program

PP	oject Paper
PPMU	rogram Planning and Monitoring Unit of MOA
PVO	Private Voluntary Organizatior
REDSO/WCA	Regional AID Office/West and Central Africa
SAP	Structural Adjustment Program
SCS	Soil Conservation Service
SWM	Soil and Water Management
SWMP	Soil and Water Management Project
SWMU	Soil and Water Management Unit
TA	Technical Assistance
Tons/ha	Tons per hectare
TPC	Total Project Costs
U.S.	United States of America
USDA	U.S. Department of Agriculture
VRCDC	Village Resource Conservation and Development Committee
WRCDC	Watershed Resource Conservation And Development Committee

Evaluation
Gambia Soil And Water Management Project
(635-02[illegible])

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Gambia Soil And Water Management
Project 635-0002 Evaluation
January 1988

1.0 Executive Summary

1.1 Background

The Soil and Water Management Project was authorized in 1978. Its specific purposes were to: (1) establish a Soil and Water Management Unit within the Ministry of Agriculture and Natural Resources (MANR); (2) to develop technology for improved agricultural methods consistent with Gambian abilities and resources; and (3) to train Gambian soil and water management specialists and agricultural assistants. An AID grant of $2,970,000 provided commodities, training and technical assistance through a U.S. Soil Conservation Service PASA to the MANR. Its main objectives were to: halt and reverse environmental deterioration due to the inadequacy of traditional cultural practices; increase food, forage wood and other cash crops; reduce susceptibility to drought; and to develop the institutional and material capability to deliver educational, technical and material services to rural populations.

The project was conceived in three phases. In Phase I (three years), AID was to provide SCS technical assistance, commodities and training to establish the SWMU as a functioning, effective and integrated part of the MANR. At the completion of Phase II (two years), trained Gambian staff were to have been integrated into the SWMU. Phase III (a possible five years) was designated for the honing and perfecting of the SWMU as a nationally established unit.

1.2 Progress Achieved

Despite the slow start experienced by this project during Phase I, the project purposes have, for the most part, been successfully accomplished. The SWMU has been established within the MANR. Also, Gambian Soil and Water Management specialists and agricultural assistants have been trained and integrated into the SWMU. However, due to initial confusion about the role and functions of the SWMU, and the delay experienced in accomplishment of the project's training component, these two purposes came to full realization only in the last year; thus the process of institutionalization has only just begun. With regard to improved agricultural methods, some Gambian farmers are now familiar with soil and water conservation techniques but routine monitoring, data collection and analysis remain to be done as a precursor to development of technology for improved agricultural methods and practices consistent with Gambian abilities and resources.

Several soil and water conservation structures and measures have been constructed and implemented since SWMU started involving farmers in practical field-oriented activities in 1984. A total of about 1,100 hectares of land have been improved by such measures, a little more than one third of which is in saline affected ricelands, the remainder being on the uplands.

The SWMU has undertaken soil surveys on 24,000 hectares of which 12,400 have been done since the 1985 evaluation.

A soil and water conservation program has been developed for the Gambia College, with regular lectures being provided by SWMU professional staff. There is also a well developed farming training program in which conservation techniques are being disseminated to farmers through the formation of resource conservation committees and conservation districts.

Numerous publications including brochures, videos and posters have been prepared since the last evaluation to publicize the educational technical and material services of the SWMU in soil and water management to rural populations. Two additional working manuals have also been published.

1.3 Major Conclusions and Recommendations

Conclusions

The Soil and Water Management Project is a successful project with a great potential for increasing production of food and other cash crops and in general contributing to the economic development and environmental enhancement of The Gambia. The project has grown in popularity over the last two years and is deluged with requests for assistance from Gambian farmers. Although the process of institutionalization has begun, the project lacks the institutional and material capability to deliver services to a level sufficient to maintain credibility with farmers.

Only by decentralized expansion of its operations will the SWMU be able to respond successfully to the large number of requests for assistance it has received from all over The Gambia. Thus, the SWMU plans to establish five additional substations at strategically selected locations throughout the country (see map, page 27) in order to permit more efficient and effective services.

While the GOTG is committed to hiring the personnel necessary to staff these substations, the new staff will need to be trained in proper soil and water management techniques. Moreover, the substations will need equipment to ensure delivery of sufficient services. Existing SWMU staff will need guidance during this critical growth period of the next three years as they face organizational and administrative challenges. Additional training and field work under the tutelage of an experienced U.S. soil conservation expert is needed to ensure that the SWMU is firmly institutionalized and capable of sustaining delivery of its highly needed services after AID terminates its funding support.

The GOTG is committed to support the SWMU. However, because of its dire economic situation and constraints placed on it by its structural adjustment program, the GOTG lacks the financial resources to provide the support needed for the required expansion. USAID can provide this training, advice and equipment through a three-year extension of the SWM project.

Extension of the SWM project is the most effective and efficient method for AID to continue its support for these important natural resource management activities. This will not only help maintain administrative continuity, especially in the planning and management of project activities, but also provide the desired high visibility for natural resources management in The Gambia. Moreover, extension of the project rather than a merge of its activities into the GARD project for example, will enable SWMU to help sustain the momentum of farmers's accepting soil and water conservation practices which are finally taking hold in The Gambia.

SWMU needs to start focussing on applied agronomic research questions associated with its conservation structures in order to realize the capability for greater productivity gains. In this regard, it should collaborate more closely with the GARD project to develop a plan for the routine monitoring and collection of data that would permit the development of variety packages and improved cropping/rotation techniques applicable by Gambian farmers.

List of Recommendations

Recommendation No. 1: That this project be extended for an additional three years with a new PACD of June 30, 1991.

Recommendation No. 2: That AID provide $2,206,000 to fund:

I. Training - Long term, medium term and short term as itemized in Annex 4.3.

II. Technical Assistance

(a) A long term technical advisor for two years of the extension period.

(b) Five short term consultants to assist in various activities during the three year extension, as described in the "Future AID Interventions" Section of this Evaluation Report and itemized in Annex 4.3.

III. Field Equipment

The procurement of three tractors, six four-wheel vehicles, rain gauges, motor-bikes, mopeds, field survey equipment, and various other small equipment and tools as itemized in Annex 4.3 of this Evaluation Report.

IV. Seminars, professional participation etc. as itemized in Annex 4.3.

Recommendation No. 3: That the long term technical advisor provided by AID under the T.A. component be a highly experienced conservationist with particular concentration in agronomy, forestry, hydrology and soils. In addition, he/she must be applications oriented and have strong organizational and administrative skills.

Recommendation No. 4: That AID should cease contributions to recurrent cost items such as fuel and vehicle maintenance. The GOTG should assume full responsibility for recurrent costs as part of its contribution to this successful and worthwhile project.

Recommendation No. 5: That SWMU devote some of its resources to establishment of a data collection and monitoring system as described in the Conclusions Section above.

1.4 Lessons Learned

In following the progress made during the various stages of this project, it became clear that correct implementation is as important, if not more so, to the success of a project as the design of the project itself. This project only began to turn around after a field-oriented technical advisor, very familiar with implementation of soil and water conservation projects, started giving direction to the project. Needless to say, his adaptability in a cross cultural setting and his professional enthusiasm were as important as his technical qualifications in providing the

necessary leadership and inspiring the confidence of Gambian professionals, technicians and farmers alike to try something new.

It also became evident that financial remuneration is not as important an incentive as a sense of ownership, participation and personal involvement. Considerable work was undertaken by farmers without even food for work considerations because the farmers were convinced that their efforts would be successful and that they would reap the results of their own work and be economically better off in the long run.

The SWMP has proved to be a successful project that has already demonstrated it is capable of contributing to increased agricultural production through simple interventions consistent with Gambian farmers' abilities. There is a concensus that much greater production increases are possible if timely and orderly expansion of SWMU's operations can take place, especially with development of improved cultural practices in association with conservation structures.

2.0 PROJECT STATISTICS

Project Title:	Gambia Soil and Water Management
roject Number:	635-0202
Agency:	Ministry of Agriculture and Natural Resources
Account:	Sahel Development Funds
Authorized LOP Amount:	$2,970,000
Initial obligation:	June 29 1978
PACD:	March 29, 1988

The PACD has been extended three times, from the original date of September 30, 1982. The first extension was by the AID/Banjul Representative from September 30, 1982 to September 30, 1983. The second was by the Assistant Administrator for the Africa Bureau, from September 30, 1983 to December 31, 1987. The third extension was authorized by the AID/Gambia Representative from December 31, 1987 to March 29, 1988 with REDSO/WCA's concurrence. Additional funding of $223,000 was also provided under this last amendment of the project agreement.

3.0 EVALUATION TEXT

3.1 Background

3.11 Evaluation Rationale

Envisaged in the Project Paper were three formal evaluations of this project; the first scheduled to be done at the end of the third year (1981) was actually completed in 1982. The second was completed at the end of Phase II in 1985. This evaluation was supposed to be the third formal end-of project evaluation. However, the PACD was revised in July 1987 from December 1987 to March 1988. The evaluation was conducted by REDSO/WCA's General Development Officer, Winfield Collins with the participation of USAID/Gambia's Agricultural Program Specialist, Saihou Jobe, the Ministry of Agriculture's Program Planning and Monitoring Unit (PPMU) Economist, Anthony Taylor and the Department of Agriculture's agronomist Alpha Marong.

The major recommendations of the 1985 evaluation were an extension of the project and assistance with recurrent costs until the Government of The Gambia (GOTG) could increase its own budget support, thereby insuring an institutionalized project base that would provide for sustainability after AID terminates its assistance. Therefore, in reviewing the project progress, this evaluation focussed on questions and issues relating to institutionalization and sustainability.

3.12 Project Description

The Soil and Water Management Project (635-0202) was authorized March 28, 1978. It had several objectives, namely: (1) to halt and reverse environmental deterioration due to the inadequacy of traditional cultivation practices; 2) increase food, forage, wood and cash crops; 3) reduce susceptibility to drought and other weather variations; and to develop the institutional and material capability to deliver educational, technical, and material services to rural populations. The specific purposes of the project were to :

A. Establish a Soil and Water Management Unit within the Ministry of Agriculture and Natural Resources.

B. Develop technology for improved agricultural methods consistent with Gambian abilities and resources.

C. Train Gambian soil and water management specialists and agricultural assistants.

The project grant provided $2,747,000. However, since the 1985 evaluation, the PACD was extended three months and an additional $223,000 was provided, the present LOP amount being $2,970,000. The 1985 evaluation report recommendation was for a longer term extension. However, this was not possible without the approval of

the AID Administrator because the PACD would have exceeded the ten year ceiling within the discretionary authority of the AID Representative.

The project was conceived in three phases. Phase I (three years provided for three SCS specialists, commodities and training and was to have established the SWMU as a functioning, effective and integrated part of the Ministry of Agriculture (MOA). Long term participants were to have been identified, trained (1 year to a BS level), and returned for on-the-job training. Technical manuals in soil and water management were to have been developed, soil, water and vegetation surveys completed, and field activities begun in villages. Assistance was to have been given to Gambia College in agricultural assistant training.

At the completion of Phase II (two years), all Gambian staff were to have been integrated into the SWMU. This phase was to have marked a shift from expatriate to Gambian supervision of SWMU activities. The actual activities to be undertaken in Phase III were to be determined by the second formal evaluation which was scheduled for 1983 but actually conducted in 1985. In the third phase, short term technical and other support as determined were supposed to meld the Gambian staff into a cohesive, effective service agency.

3.13 Project Progress

As demonstrated by the actual pace of accomplishment of project objectives, the implementation schedule developed for the Project Paper was far too ambitious. The reasons why it took much longer to complete long term academic training, have been well documented in the 1985 evaluation report. Over estimation of the academic qualifications of the participants was one of the principal reasons. However, even if it had been possible to train long term participants to the B.S. level in one year, the time required for recruitment, screening and selection of candidates, as well as the time required for proper placement within the civil service structure and for familiarity with actual in-the-field soil and water management problems and constraints would have precluded the possibility of completing the data gathering, analysis and preparation of the various manuals and surveys in the three year time frame as conceived in the Project Paper.

With respect to Phase I, the establishment of the SWMU as a functioning integrated part of the MANR has only recently been accomplished. One half of SWMU's professional staff (4 persons) did not return from academic training in the United States until 1986 and one professional returned as late as May 1987. In addition, the staff positions for the unit were only approved on December 1, 1987, four months before the scheduled PACD.

All Gambian staff has now been integrated into the SWMU as conceived for Phase II. Significant first steps have been made toward the development of technology for improved agricultural methods consistent with Gambian abilities and resources. i.e. farmers in several villages within the five political divisions of The Gambia

are now familiar with practices and techniques for construction of various soil and water conservation structures that have proved effective in increasing production of rice and other crops. However, monitoring and data collection relative to salinity, soil moisture, rainfall frequency and distribution, crop yields etc. remain to be undertaken. Appropriate cropping techniques and technical packages for different varieties of rice and other crops can only be developed after such data have been collected and analyzed.

The farmers who have participated in conservation activities under this project have only resounding praise for the easy applicability of the methods used and their effectiveness not only in conserving soil and water but in increasing their agricultural production beyond their expectations. As a result, despite the fact that the SWMU is now fully staffed, it is unable to cope with the overwhelming number of requests for its services.

With respect to the training of Gambian Soil and Water Management Specialists and Agricultural Assistants, all academic training envisioned under this project has been completed but several long term participants returned as late as 1986/1987 require additional on-the-job training (OTJ) by working on field projects and addressing actual problems under the continuing guidance of a long term technical advisor and various other short term consultants.

3.2 PROJECT INPUTS

3.21 SCS Technical Assistance

Long-Term Technical Assistance In retrospect, the design of the technical assistance component of the project proved to be somewhat inverted. The project paper made provision for an expatriate team of interdisciplinary specialists such as a conservation specialist, soil scientist and a plant ecologist who were all present during the first two to three years of the project. Although they played an important role in setting up the project, their supposed counterparts were away on training in the United States and the lack of suitable counterparts during these early years of the project resulted in an inefficient use of their time and knowledge. A 1982 evaluation made specific recommendations which resulted in scaling down of SCS technical assistance (TA) from three individuals to one and increased training for Gambian staff.

USAID's and MANR's desire to orientate the SWMU to a more practical and service delivering agency led to the replacement of the SCS chief-of-party in 1983, by an SCS engineer (Harvey Metz) with an extremely practical orientation. Upon his arrival, Metz, with the help of the then director of SWMU embarked upon reorientating the SWMU to conduct field work. He has guided the Unit in all conservation works completed to date and has provided on-the-job training in one way or another to practically all the returned participants.

In addition to Metz's input, SCS has provided other technical assistance inputs which contributed tremendously to the development of a slide show and brochures, the establishment of a soil program and the preparation of the final manuscript for the hydrology manual with metric units.

Short-Term Technical Assistance The following table gives a history of SCS short term consultancies which have been offered to the SWMU since the start of the Project. A glance at the Table indicates most of the short term T.A. has taken place since 1985.

TABLE 3-1 HISTORY OF SHORT TERM TECHNICAL ASSISTANCE

Name	Profession	Time of visit	Assistance to SWMU
Raft Johnson	Soil scientist	Nov. - Dec. '80	Staff consultation & training (soil descriptions, soil chemistry and soil mapping); also review of technical aspects of soil phase of project.
Cafford Carter	Plant Ecologist	Dec. - '80	Training relative to plant clippings.
Keith Hoffman	Soil Scientist	Feb. - March '85	Assisted the Soil Survey section in soil review.
Joe [illegible]	Information Specialist	April - May '85	Prepared 2 slide sets: one of soils survey, and one on SWMU activities. Also prepared a brochure or S&W conservation in The Gambia.
Dan Woodward	Hydrologist	Sept. - Oct. '85	Wrote the hydrology section of the Engineering Field Manual.
Horace Smith	SCS Soil Scientist	April - June '87	Assisted in soil reviews, manuscript writing and preparation of soil monoliths.
Earl Cosby	Resource Conservationist	Oct. - Nov. '87	Participated in drafting of the Conservation Planning Manual gave OJT on Resource Conservation Planning.

3. Training

Of the nine participants sent to the U.S., seven received their B.S degrees, one got an M.S. degree and one did not complete his degree requirements, having been forced to return to the Gambia for health reasons. The M.S. holder was appointed director of the unit shortly after his arrival but he retired from public service effective August 1985. All the returned participants had the opportunity of undergoing supervised field work in The Gambia, although as mentioned later under "Achievement of Project Outputs", this on the job experience has been very limited. Ten Gambians received 2 year technical diplomas in agriculture in Nigeria, and they too have benefitted from some in-country and on-the-job training.

Since the 1985 evaluation, five individuals returned from long-term training in the United States and are currently working with the Unit. Of the five, four returned in 1986 and one in 1987. One of the returned agronomists now heads the Unit's Planning Section.

In July 1986, five SWMU personnel including the unit Head attended a course in Remote Sensing and Cartography organized by South Dakota State University at The Gambia Management Development Institute. The Head of the Soil Survey Section attended an advance course on Remote Sensing and Cartography in South Dakota U.S.A. from July 21 to August 29, 1986. The Unit's Head attended the Second West African Integrated Livestock Systems Network Workshop in Sierra Leone (September 19-25, 1986). Another individual from the Soil Survey Section attended the eighth West and Central African Soil Correlation and Land Evaluation Conference in Yaounde, Cameroon in January 1987.

3.23 Commodities

The USAID/Banjul has given operating support to the SWMU since its inception. FAO also provided operating support to a lesser degree. The following commodities have been provided by USAID.

1. Six new vehicles

2. Four tractors

3. Four disc plows

4. Four trailers

5. One loader

6. Spare parts for the above equipment, including one tractor leveling blade

7. Seventy-two different items of field equipment for the engineering soils and forestry sections

8. One set of OMVG aerial photos and six sets of OMVG orthophotos

9. Miscellaneous office supplies and machine repairs

3.5 FUTURE AID INTERVENTIONS

General

Despite the fact that the SWMU has only been able to provide assistance to relatively few villages to date, the project has become enormously popular with Gambian farmers in the last two years because of the proven worth of SWM techniques to farmers who have had the benefit of SWMU's assistance.

In short, the project is now regarded as being very successful and the SWMU is overwhelmed by requests for assistance from farmers all over the country. It is estimated that even if no additional request were received, it would take about eight years with existing staff, equipment and supplies to respond satisfactorily to the current backlog of requests for soil and water management assistance. Therefore, the SWMU must expand its operations and at the same time try to achieve greater operational efficiency in order to maintain credibility with farmers. Given the present economic constraints in The Gambia imposed by its Structural Adjustment and Economic Recovery Programs, the next three years will be critical to the SWMU as it tries to maintain its level of service and expand simultaneously in accordance with the wishes of President Jawara, the Ministry of Agriculture, and particularly the Gambian farmers.

Because of the long finger-like configuration of The Gambia and the fact that its land area straddles the Gambia River without any bridges connecting the north and south banks, communication is difficult. Consequently, service to farmers on a country-wide basis is complicated, time consuming and costly. It is evident that only by decentralized expansion of its operations will the SWMU be able to successfully respond to the huge number of requests for assistance received from widely scattered areas over The Gambia. In this vein, the SWMU plans to establish five additional sub-units at strategically selected locations throughout the Gambia that would permit country-wide coverage with a minimum of logistical difficulty. These sub-units will be staffed with minimum professional staff and greater numbers of highly trained technicians with a broader range of field-oriented technical skills.

3.51 Decentralized Expansion Plan

Wider service capability within the framework of greater cost effectiveness can be accomplished by decentralizing and developing three principal SWM stations, i.e. two such stations in addition to the one already existing at Yundum, in Western Division. These two principal stations will be located at Sapu in McCarthy Island Division (MID) and at Kerewan in North Bank Division (NBD); also three secondary stations at Jenoi in Lower River Division (LRD), at Basse in Upper River Division (URD) and at Kuntaur (MID). (See map on following page). The plan is to eventually have one engineer, one agronomist (resource conservationist) and one soil scientist in addition to three highly trained technicians in each principal SWM station i.e. Yundum, Sapu and Kerewan; also to have each of the

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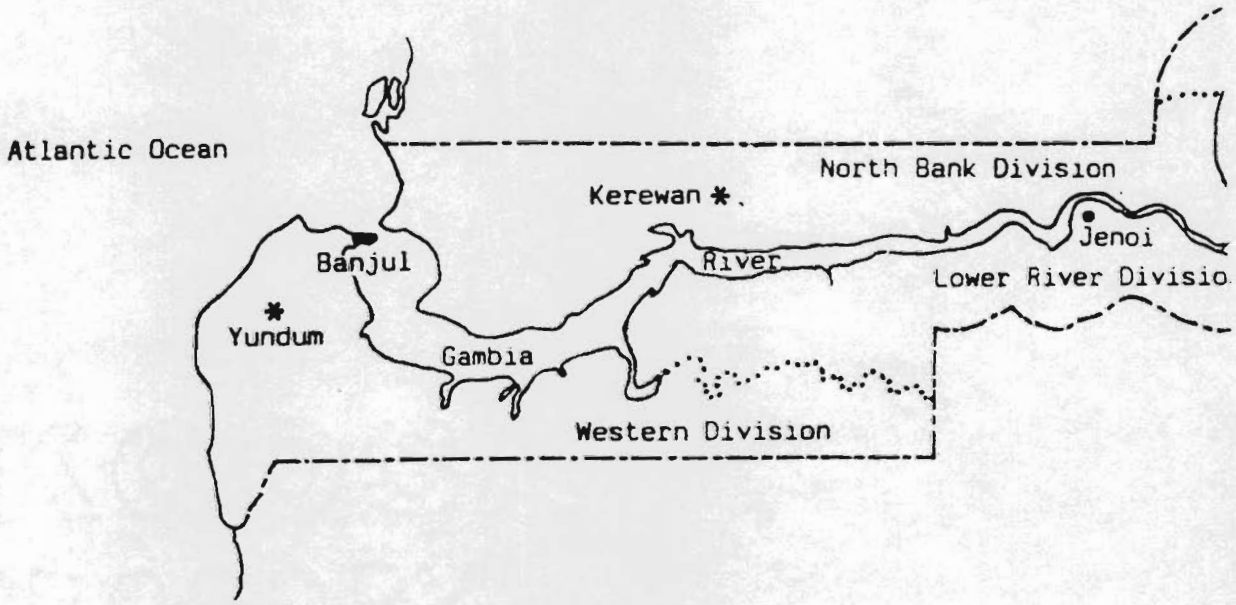

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Legend

Country Boundary

Divisional Boundary

Principal Station *

Secondary Station •

THE GAMBIA

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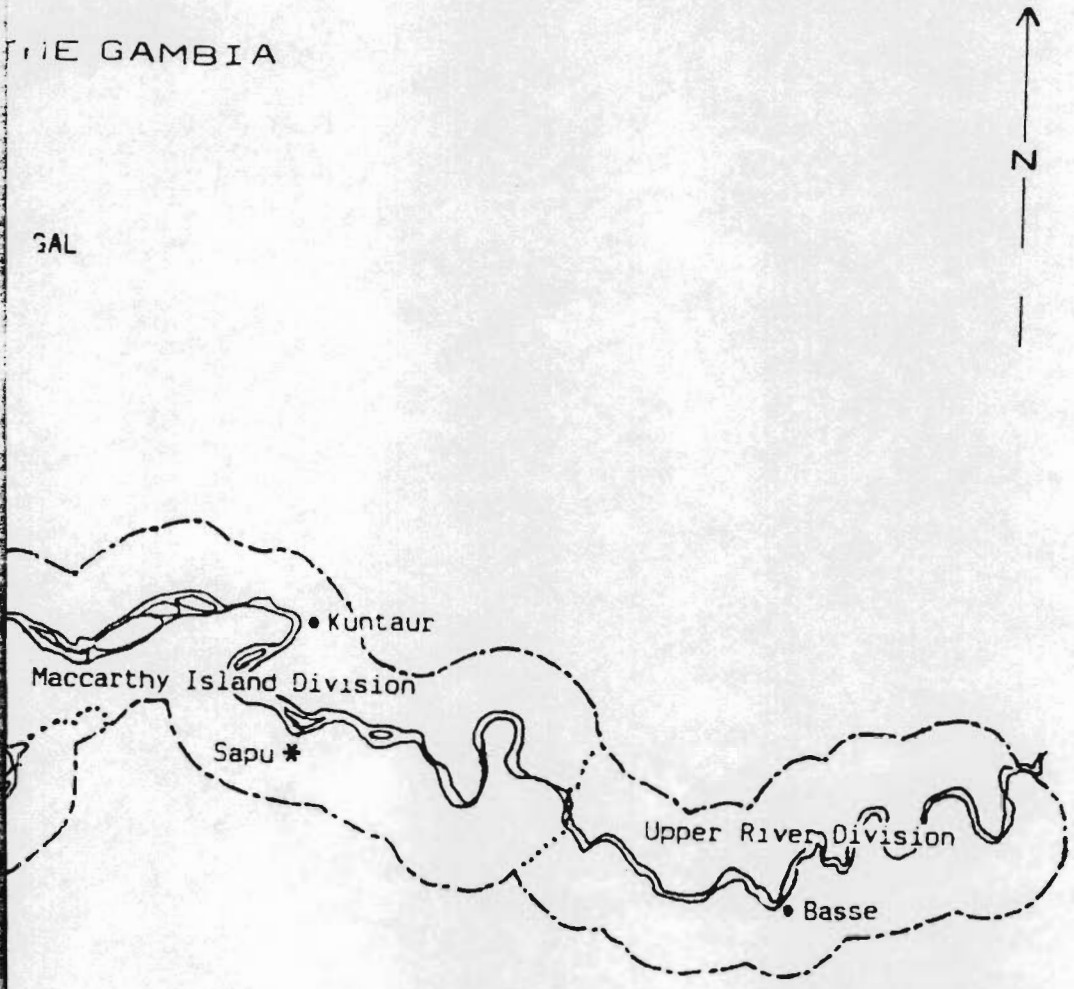

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secondary stations at Jenoi, Basse and Kuntaur staffed with an agronomist or resource conservationist head and two highly trained technicians representing a broad range of conservation skills. One additional soil scientist and one additional agronomist will be needed to concentrate on the national soil survey activities and assist with countrywide organization and administration of soil and agronomic programs. Therefore, a total of four soil scientists, four agronomists, three engineers and fifteen technicians will be needed to satisfy the requirements of the decentralized expansion plan. There are presently two soil scientists, two agronomists, one engineer, and a range management specialist in the SWMU at Yundum in addition to seven technicians and the Head of the SWMU.

Therefore, two engineers, two soil scientists and two agronomists will have to be trained to a B.S. level, and eight additional technicians will have to be trained to assume a broad range of conservation functions. Field oriented training in the range of skills contemplated could be accomplished at a school that focuses on varied conservation skills such as the Trade School associated with Nebraska University from which SCS recruits a large part of its technicians. In this way, trained technicians would have diverse management and conservation skills as opposed to the narrow agricultural techniques offered by the school in Nigeria where technicians were previously trained. Returned technicians would be able to assume responsibility for a range of tasks now undertaken by professionals encompassing engineering and soil surveys as well as structure layouts.

As can be seen from the map, the station at Kerewan will be able to handle most of the requests from farmers on the north bank. It will be autonomous, being fully staffed with professionals in resource conservation, engineering and soil science. Any difficult or special problems beyond the staffing capability of the secondary stations at Kuntaur and Basse will be referred to the professional staff at Sapu. Similarly, special problems within Jenoi's jurisdiction will be referred to the professional staff at Yundum.

SWMU plans to establish the first of these sub units at Sapu in late 1988. It will be headed by one of the two conservation planners presently at Yundum, and be staffed additionally with one of SWMU's soil scientists and two of its technicians including an engineering technician. The plan is for this sub-unit to handle as many as possible of the requests coming from the eastern part of the country. Critical support will be provided from the unit at Yundum. One or two of the tractors presently in use at Yundum will be made available to Sapu. In addition, three vehicles can be purchased with AID funds and made available to Sapu. The plan is to distribute the equipment and vehicles available to Yundum and Sapu among the sub-units when they have been established. Distribution will be made in accordance with workload in the areas serviced by the respective sub-units. Eventually, as the Sapu sub-unit expands its operation, it will need to be staffed with a professional engineer.

It is anticipated that SWM stations at Jenoi and Basse will be established starting in 1992 and at Kerewan and Kuntaur perhaps a year or two later. Adequate time will be allowed after the establishment of the station at Sapu to permit familiarization with organizational and administrative problems before establishing another sub-unit. Although the timeframe for establishment of additional sub-units is somewhat tentative, training of professionals and technicians must be undertaken immediately since training is a long term exercise. Even if the sub-units are not established within the anticipated time frame, SWMU can use all the trained personnel available to it because of the overwhelming workload which it has and will probably have in the foreseeable future.

For the reasons mentioned above, the SWMU will need continued guidance of both long term and short term consultants to guide it through the critical growing period of the next three years as it faces challenging organizational and administrative questions at the same time that its "core" professionals and technicians will be seeking additional technical "seasoning". OJT and short term field orientation tours will be required for those professionals who missed the opportunity during their academic studies in the United States as well as for that core of intensively trained technicians that will have to assume greater responsibility relative to conservation planning, design, analysis and field layouts. Expanded SWM operations will also necessitate additional equipment, tools and supplies. Finally, SWMU will have to start addressing certain applied agronomic research/extension questions associated with installation of its conservation structures in order to realize the capability for greater agricultural productivity gains in The Gambia.

It is logical that AID continue to support the project to the limited extent of the required interventions as described above because an abrupt cut off of AID funding at this time would slow the growth momentum of the soil and water conservation philosophy and practice which have finally taken hold in The Gambia. Termination of funding support at this time would be extremely detrimental to its growth at a time when expansion of operations is sorely needed to maintain credibility with farmers. In view of the impressively large economic returns estimated for this project, and the relatively low capital inputs required, (see Annex 4.1) not to mention the enthusiasm, involvement and self help attitude of the farmers, withdrawal of funding and other required support at this time would be a great opportunity missed to make a significant contribution to the economic development of The Gambia. The required AID interventions are discussed below in greater detail.

3.52 Technical Assistance

Based on interviews held with the present long term TA, the Director and Deputy Director of SWMU, and officials at various levels in the Ministry of Agriculture and Natural Resources, there is a concensus of opinion that a long term technical advisor will be needed for at least two years.

Such a person will have to be a highly experienced Conservationist with particular concentration in agronomy, forestry, hydrology and soils. He/she must also be applications oriented and have strong organizational and administrative skills. In this way there will be some assurance that the two agronomists who returned in July 1986 (SWMU Conservation Planners) will have continuous OJT opportunities with more concentration on agronomic matters which will become more important as applied agronomic research questions come into focus. This is not to down play the importance of continued guidance with respect to agricultural engineering problems, but only to point out that agronomic problems will come more into focus as greater coordination takes place with projects such as GARD which will begin to accumulate data that can be made useful to farmers through coordinated extension efforts of SWMU and the Extension Service.

Short term technical assistance will be needed with respect to development of conservation policy related to Soil and Water within the framework of a National Conservation Policy for Natural Resources in The Gambia. The short term technical advisor will be required to coordinate with responsible individuals in the Ministries of Natural Resources and Health, which has responsibility for Environment in order to assure that there is adherence to the guidelines outlined in the National Environmental Management Act for The Gambia signed into law in March 1987.

Short term assistance may also be required to consult on any special engineering problems that may arise. Similarly, short term consultancies are anticipated for a Soil Scientist and a Forester. To get a better idea of the Technical Assistance Program envisioned See Annex 4.3, Summary of Planned Activities and Costs Requiring AID assistance.

3.53 Additional Training

Besides the OJT that will be provided through T.A. as described above, some SWMU professionals, including the two agronomists were supposed to receive field orientation by working with appropriate SCS Districts during the summer while on training in the United States. They did not in fact receive such field observation and are still in need of the opportunity to see for themselves actual conservation measures and practices being implemented in the field. This opportunity for OJT should be given to them. They will then be better able to relate the theory to what's on the ground and will therefore benefit much more from subsequent consultation or advice. A ten-week guided visit and work practice sessions with appropriate SCS Districts will fulfill this function. Several agricultural assistants or technicians have demonstrated great capability to absorb more intensive training and are targeted to assume greater responsibility in the plan to expand SWMU operations. It is felt that with similar OJT training for these technicians, their professional scope will be enhanced and they will be quite effective in their expanded technical roles.

Not to be ignored are study tours of projects in West Africa or other tropical areas where similar projects have been constructed or implemented. For example, SWMU agronomists could benefit from a field trip to study management techniques and research activities on retention structures constructed under the Basse Casamance Project in Senegal. Study tours of soil and water management measures on upland areas in Senegal or Burkina Faso and discussions with researchers associated with these projects could provide useful "field" education to SWMU agronomists. To the extent that such study tours could provide equivalent OJT to SWMU professionals and technicians, they should be encouraged as an alternate to the more expensive SCS guided visits in the U.S.

As mentioned earlier two engineers, two soil scientists and two agronomists will need long term training in connection with the planned expansion.

3.54 Soils Laboratory

Further, an adequately equipped Soils Laboratory staffed with competent professionals is urgently needed to serve the testing and analysis needs of the SWMU, the GARD project and the Department of Agriculture in the MANR. As mentioned above, a report on the equipment and personnel needs for such a lab will be presented soon by a consultant funded under the GARD project. Provision of needed equipment and training should be undertaken immediately when the needs are made known. Procurement of equipment could be done either under the GARD project or the SWMU Project but it should be done soon to avoid the great delay experienced by having to send soil samples to the United States for testing. Several months are lost because of the slow turn around time involved. This reduces considerably the efficiency of operation and in those cases where quick results are needed to make time-critical decisions, opportunities are totally lost.

3.55 Equipment And Supplies

By the end of FY 1988/89, SWMU may find it necessary to scrap three vehicles purchased in 1978/79 due to the high cost of maintenance. In addition three new vehicles and three new tractors will be needed to cover the office (sub-unit) opened at Sapu for better coverage of farmers in need of assistance. Seven motorcycles and seven mopeds will also be required. Project experience has shown that this equipment is necessary to complement and improve the effectiveness of village self-help efforts (e.g. manual labor) but in no way will its use e.g. tractors, displace those efforts. One of the real strengths of this project is the enthusiasm, cooperation, commitment and hard work displayed by the farmers themselves.

Additionally, some twenty rain gauges will be required to start collecting adequate pluviometric data to better plan and design conservation structures. The present rain gauge network has many gaps relative to the watersheds that need to be covered. The rainfall distribution is also somewhat erratic geographically as well as time-wise, hence the need for such gauges. Field equipment

such as PH meters, hydrometers, transits, spades, shovels, wheelbarrows and audiovisual equipment will be needed for expanded operations. Estimated costs are shown in Annex 4.3.

3.56 Research/Extension Activities

No one would deny that the construction of water conservation measures installed to date by the SWMU has changed the runoff characteristics and the water regime in the farm areas affected. In the case of retention dikes in particular, the water regime has been changed for the better since soil moisture conditions have been improved by a higher water table and a greater availability of water where drought conditions prevailed previously. However, there are criteria other than water regime affecting rice production systems such as drainage conditions, topography, soils texture, and soils hydrology groupings.

It is essential, therefore, that some analysis be undertaken of the way in which the combination of these variables must be treated when the water regime changes in order to maximize the full potential of the watershed areas where crops are cultivated. While acknowledging that improved cultural practices will have positive results on the production of agricultural crops such as maize, groundnuts, sorghum, millet and findo that are grown on Gambian uplands, rice is the cereal which is most consumed in the Gambia (fifty two percent of total cereal consumption) and the major crop produced in the watershed areas affected by SWMU's conservation structures. Therefore, for the sake of convenience, the discussion will be limited to the possibilities of increasing rice production through relevant applied research and extension efforts to advise farmers on the use of the water-improved land. Gambian swamps and adjacent watersheds can be classified into four categories, viz;

(1) Uplands where short duration rice and direct seeding methods would be conducive to greater productive efficiency and higher yields;

(2) Hydromorphic i.e. saturated but drought prone soils, suitable for direct seeding of rice, preferably of short duration.

(3) Shallow flooded lowlands that are prone to both drought and submergence. Both direct seeding and transplanting are possible in this zone, and both short and medium maturing varieties could be suitable depending on the rainfall intensity and distribution as well as antecedent ground conditions in a given season at any specific time.

(4) Deep flooded lands with submergence of 50cm to 100cm, suitable for medium and long term varieties.

Because of the importance of available data such as ground moisture or water table conditions, drainage conditions, predictability of rainfall, and known soil types in determining where these four zones as described above may be on the ground, it is essential that the collection and monitoring of such data be systematized so that

appropriate variety packages can be developed and field tested through farmers' plots. To date, the SWMU has concentrated on the planning and engineering aspects of needed conservation measures; also in organizing farmer groups, collaborating with and training farmers to install and maintain these measures. Virtually no baseline data exists by which quantitative measurement can be made of the extent to which agronomic conditions have been improved by the structures constructed or of any consequent increase in agricultural productivity. This kind of data is needed to verify assumptions made in determining economic benefits or to confirm empirical data. Unless hard evidence of this kind is made available in the not too distant future, it will be difficult for the GOTG to continue to maintain the needed budget support of this project, given the weak financial and economic situation existing in The Gambia.

Therefore, the SWMU must devote some of its resources to development of a data collection and monitoring system. The SWMU should collaborate closely with the GARD Project to determine the format and the schedule for collection of needed data. A routine data collection program can be developed that is simple enough to allow existing field staff in the SWMU project to monitor and collect data. In this way yields can be measured under controlled conditions to determine the best varieties to be cultivated during any given season.

Traditional swamp rice production practices have resulted in low agricultural productivity. A research effort is needed to develop for different watershed swamps in The Gambia, suitable cropping systems combining compatible crops with the best available improved short and medium duration rice varieties.

Modern technologies such as the use of improved short duration rice varieties, mechanization in connection with land preparation, seeding and weeding; water control, use of fertilizers, herbicides, and crop protection, would make it possible to develop alternative cropping systems e.g. rotational, mixed and relay cropping, which can greatly aid in extending more intensive use of swamp lands for increased food production.

To develop these cropping systems for the different watersheds, research efforts must be undertaken relative to selection of suitable varieties of rice and other crops, appropriate mechanization, optimum planting dates, optimum planting densities, planting methods, methods of weed control, fertilizer use (source, rate, method and time of application).

To cite an example, land could be prepared with a mold board plow instead of plowing with a hoe, and seeding could take place with a supereco seeder instead of manual seeding. Preliminary results from GARD research-managed plots indicate that there is a potential for up to 50 percent increase in yields by the use of the more efficient mold board plow and supereco seeder over traditional hand plowing and manual seeding. Although only one year's results are available, differently treated adjacent plots at Ndemban, with similar rainfall

and soil conditions showed that rice cultivated using the mold board plow and supereco seeder that permitted more efficient weeding had yields of 4.8 ton/hectare as compared with yields of 3.2 ton/hectare where traditional plowing, seeding and hoeing were done. It may be significant that in each case yields were higher than the average yields for all rainfed swamp rice in The Gambia as monitored over a period of seven years, however, statistically no valid comparison can be made since the measurement at Ndemban is more representative of a point source as compared to an entire population in the case of the countrywide measured average. Nevertheless, it cannot be denied that only through analysis of consistently collected data will one be able to determine which cropping techniques are superior and the extent to which such improved cropping techniques produces higher yields than traditional methods.

Although contour berms have demonstrated convincingly in some areas their potential for inhibiting erosion and its resultant impoverishment of the soil, many farmers are still plowing uphill perpendicular to the contour berms. This could result in destruction of the berms themselves as the runoff is concentrated in the plowed furrows and impact with erosive force on the berms. In short, the desired effect is being thwarthed by the continuance of such traditional plowing. This could be accounted for in two ways, viz (1) the farmers do not believe that it serves any useful purpose to change their habits, not being convinced of how in fact contour berms function to retard erosion; and therefore drawing their own conclusions about the futility of engaging in much more work intensive contour plowing, or (2) they did not understand what they were told about contour plowing and its importance when taken in conjunction with contour berms. In either case, ways should be explored of demonstrating in the field, in the presence of farmers, how contour plowing is done. The resultant effect at the end of a rainy season vis-a-vis the effect of traditional uphill plowing can then be observed by all interested farmers. Perhaps as suggested by a professional staff member of SWMU, arrangements for contour plowing of a willing farmer's property located close to an access roadway could be made through the village conservation committee and adequate publicity be given to the plowing event established for a fixed time prior to the anticipated rains. Alternatively, contour plowing can be programmed as part of agreed upon on-farm trials.

Another area where some applied research should be developed is in the area of control gates for retention structures. This is a difficult and controversial area because farming is done on a cooperative basis but some people are attributed upland areas, others hydromorphic areas, and yet others submerged land. It is therefore difficult to decide in a cooperative framework whether or when the gates should be opened, not knowing with any certainty whether or how much additional rain and runoff will be forthcoming. On the other hand, if it were possible to decide how much eventual submergence or ground moisture conditions certain areas would eventually have, variety packages and improved cropping/rotation techniques could be worked out at the start of the growing season. Therefore, in areas where salinity and ground moisture conditions have been monitored, experiments could be set up if fairly uniform

rainfall distribution patterns are prevalent. Some analysis will have to be done of course of existing rainfall records to determine which areas are more suitable to conduct controlled experiments. Gates would be installed on watersheds in fairly close proximity to hydrologically similar watersheds without gates. An important aspect of this research will be socioeconomic. It is envisaged that farmers who are assigned plots more upland from retention structures would be reluctant to agree to the opening of the gates under any conditions, and so ways will have to be explored to convince farmers to try the use of gates. It must also be remembered that significant results will only emerge during drought conditions, since yields could be equivalent with or without gates during good rainfall years. In any event, the debate as to whether gates can lead to improved crop yields could only be settled after several years of data collected under controlled conditions. Hence, the importance of initiating the research as early as possible. The GARD and SWMU Projects should coordinate closely and collaborate with similar projects to develop a plan for the routine monitoring and collection of data by existing field staff. The resources required for monitoring of the activities and collection of data can be shared between the two projects.

Besides the installation of gates, monitoring and good maintenance of these structures, as well as thorough levelling of the land would give good water control with more uniform flooding depth. Of course the costs of such levelling relative to estimated benefits would have to be taken into account. Nevertheless, water control would offer considerable scope for much greater increase in the productivity of swamp lands, permitting the establishment of sound cropping systems with controlled cropping plans and planting schedules for various varieties of rice under predictable conditions of flooding.

Conclusions Despite the progress made under this project over the last two years, there is need for additional technical assistance, on-the-job training and provision of field equipment and tools as well as complementary short term training for some professionals and technicians presently within the SWMU. In addition, long term training is needed for two more engineers, two more soil scientists and two more agronomists.

Although the GOTG has finally made the commitment to support the SWMU, as is evident in the Public Service Commission decision of December 1, 1987 to approve all SWMU staff positions, and President Jawara's public statement of support of the SWMU on November 25, 1987, the dire economic situation in the Gambia, especially during this austere period of its structural adjustment and economic recovery programs, realistically precludes GOTG's provision of the financial resources needed to provide the required technical assistance, training and equipment. Thus, provision of AID funding support is required to afford the SWMU the training, technical guidance and administrative support to assure orderly and timely expansion of its operations in accordance with the demands placed on the SWMU by Gambian farmers.

Further, the SWMU and GARD Projects should intensify coordination and collaborate to effect the orderly collection and analysis of hydrologic and soils data including salinity, and soils classifications, rainfall frequencies and distribution; and undertake applied research relative to the development of improved cultural practices.

The use of control gates should be investigated to determine the extent to which they could contribute to improvement of cultural methods and resultant increased crop yields.

3.6 SUMMARY CONCLUSIONS

Conclusions Despite the progress made under this project over the last two years, there is need for additional technical assistance, on-the-job training and complementary short term training for some professionals and technicians presently within the SWMU.

The project has gained considerable popularity among Gambian farmers but lacks the institutional and material capability to deliver services to the rural population to a level sufficient to maintain credibility with farmers. Only by decentralized expansion of its operations as it presently envisions i.e. five additional sub-units strategically located throughout the country to permit more logistically convenient, cost effective service delivery, will the SWMU be able to respond successfully to the large number of requests for assistance it has received from throughout The Gambia.

In order to permit the needed expansion, additional training, technical assistance, field equipment and vehicles will have to be provided. Training will encompass long term training in the United States for two agronomists, two soil scientists and two engineers; medium term training for eight persons in soil and water conservation practices and techniques; and short term field oriented training for fifteen persons.

The Technical Assistance component will consist of: an experienced field oriented conservationist to provide needed OJT, technical advice and consultation, and to guide the SWMU for at least the next three years through a critical growing period as it faces challenging organizational and administrative problems; and five short term consultants to assist in various activities over a two year period.

The field equipment and vehicles will include three tractors to complement the manual labor contributed by farmers, six four-wheel vehicles, motorbikes, mopeds, rain gauges survey transits, and an assortment of tools.

Despite the GOTG's strong support of the project, the GOTG lacks the financial resources to fund the material and technical support to permit the needed expansion. It is logical that AID provide the funding required to afford the SWMU the training, technical guidance and administrative support to assure orderly and timely expansion of its operations in accordance with the demands by Gambian farmers.

SWMU must devote some of its resources to establishment of a data collection and monitoring system and begin to collect data on a routine basis on salinity, soil moisture conditions, rainfall patterns and distribution, crop yields (before and after structure installation). Acquisition of this data would permit future analysis to determine to what extent various cropping techniques, use of different crop varieties, mechanization and other agricultural practices affect agricultural production.

Closer collaboration is needed between the SWMU and GARD projects on applied agronomic questions. SWMU and GARD should also collaborate and provide the needed equipment and technical training to adequately equip a soils laboratory as soon as needs are made known by the consultant who undertook the recent assessment of needs.

3.7 LIST OF RECOMMENDATIONS

Recommendation No. 1: that the SWMU project be extended for three additional years with a new PACD of June 30, 1991, to provide the needed training, technical assistance, equipment and vehicles described above.

Recommendation No. 2: That AID provide $2,206,000 to fund:

I. Training - Long term, medium term and short term as itemized in Annex 4.3.

II. Technical Assistance

(a) A long term technical advisor for two years of the extension period.

(b) Five short term consultants to assist in various activities during the three year extension, as described in the "Future AID Interventions" Section of this Evaluation Report and itemized in Annex 4.3.

III. Field Equipment

The procurement of three tractors, six four-wheel vehicles, rain gauges, motor-bikes, mopeds, field survey equipment, and various other small equipment and tools as itemized in Annex 4.3 of this Evaluation Report.

IV. Seminars, professional participation etc. as itemized in Annex 4.3.

Recommendation No. 3: That the long term technical advisor provided by AID under the T.A. component be a highly experienced conservationist with particular concentration in agronomy, forestry, hydrology and soils. In addition, he/she must be applications oriented and have strong organizational and administrative skills.

Recommendation No. 4: That AID should cease contributions to recurrent cost items such as fuel and vehicle maintenance. The GOTG should assume full responsibility for recurrent costs as part of its contribution to this successful and worthwhile project.

Recommendation No. 5: That SWMU devote some of its resources to establishment of a data collection and monitoring system as described in the Conclusions Section above.

Attachment 2 to Annex 4.1
(Excerpt from report Water Controlled Rice Production
In The Gambia) By Christine Elias
July 1987

6. Economic Analyses[20]

The objective of the following cost-benefit analyses is to assess the economic returns to investment in riceland development for the different projects considered in this study. Having highlighted in Section 5 the factors which have affected program development and outcome in the case study villages, the economic analyses of each project will provide an additional factor which government policy makers and donors can use in defining a feasible rice development strategy. A separate analysis has been undertaken, using a standardized format, for each of the following projects:

- Soil and Water Management Unit (SWMU) - Water-Controlled Rice Production
- GTZ/DWR Rainfed Rice Improvement - Water-Controlled Rice Production
- Freedom From Hunger Campaign (FFHC) Swamp Rice Development Improved Access

Although the standardized format facilitates comparison of cost and returns, it must be stressed that each project addresses the production constraints of a particular ecology. Each must therefore be considered on its own merits, not as a possible alternative for another. For Jahally-Pacharr, the cost-benefit analysis carried out by Euroconsult on behalf of the Ministry of Agriculture is used.

In common with all analytical tools, cost-benefit analysis has limitations. It depends heavily on the accuracy of the information used and the validity of the assumptions made. In order to be realistic, analysis has been conducted for the range of cost levels and production increases that a project might experience. These are discussed in detail below. A further limitation is the strictly economic valuation of project costs and benefits used in the analyses. These may not accurately reflect the value government or donors attach to increased food production security in rural areas, or the local sustainability of project designs. It should also be pointed out that social implications of the projects, and their income distribution effects have not been considered in this analysis.

[20] The economic analyses were prepared by Petra Mueller-Glodde and Duncan Boughton.

6.1 Estimation of Project Costs

For each project, three types of costs are incurred. These are:

- initial land development costs;
- recurrent costs of maintaining structures; and
- incremental costs of rice production.

The first two types are discussed below and the third will be considered together with the estimation of project benefits.

Initial land development costs

In all three project cases, the total riceland area brought under development in a given year is made up of a number of small schemes that vary in size. For example, in the case of SWMU a total of 89 hectares was improved during 1986 in 14 schemes. Unfortunately, it is not possible for any of the projects, at present, to calculate development costs on a per scheme basis. Only the total costs in a given year can be determined. Rather than opting for the "model scheme" approach, which would be hypothetical, the cost-benefit analyses have been carried out on a per hectare basis.

The average development costs per hectare are determined for each project by summing all development costs incurred during 1986, divided by the total area improved in the same period. These costs include technical assistance, national staff, office costs, vehicles, fuel, equipment, construction materials, and village labor. A detailed breakdown for each project appears in Annex F and a summary in the economic analysis tables 6.1 -6.3. Foreign exchange costs, such as technical assistance, are converted into dalasis at the average exchange rate during 1986, following the floatation of the dalasi in January.[21] Vehicles and fuel are costed free of import duty and tax.

Because villagers can derive income from activities such as vegetable gardening or house building during the dry season, when land development takes place, the opportunity cost of labor used in construction must be included in the economic analysis. This is estimated to be D2.50 per man-day, 45% of the average daily wage during the growing season when income earning activities are more abundant and the demand for laborers is high.

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[21] 1 US Dollar = D6.50
1 Pound Sterling = D9.45
1 DM = D3.00

Table 4.1
ECONOMIC ANALYSIS IMPROVED SWAMP RICE

YEARS	1	2	3	4	5	6	7	8	9	10
INCREMENTAL RICE OUTPUT										
TOTAL AREA (ha)	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00
YIELD/HA (ton/ha)	1.50	2.00	2.50	2.50	3.00	3.00	3.00	3.00	3.00	3.00
TOTAL OUTPUT	166.50	222.00	277.50	277.50	333.00	333.00	333.00	333.00	333.00	333.00
DAL/TON (Dal 000)	0.52	0.48	0.55	0.61	0.65	0.69	0.73	0.73	0.72	0.72
TOTAL INCOME (Dal 000)	86.41	107.45	153.74	170.39	215.45	229.10	241.76	241.43	241.09	240.43
TOTAL INCOME (-10%)	77.77	96.70	138.36	153.35	193.91	206.19	217.58	217.28	216.98	216.38
TOTAL INCOME (-20%)	69.13	85.96	122.99	136.31	172.36	183.28	193.41	193.14	192.87	192.34
INCREMENTAL CASH COSTS										
LABOR (Dal 000)	65.02	65.02	65.02	65.02	65.02	65.02	65.02	65.02	65.02	65.02
SEED (Dal 000)	2.33	3.11	3.89	3.89	4.66	4.66	4.66	4.66	4.66	4.66
FERTILIZER COSTS										
QUANTITY (tons)	4.16	5.55	6.94	6.94	8.33	8.33	8.33	8.33	8.33	8.33
COST/TON (Dal 000)	1.00	1.10	1.10	1.10	1.20	1.20	1.20	1.20	1.20	1.20
VALUE (Dal 000)	4.16	6.11	7.63	7.63	9.99	9.99	9.99	9.99	9.99	9.99
TOTAL INCREMENTAL CASH COSTS	71.51	74.23	76.53	76.53	79.67	79.67	79.67	79.67	79.67	79.67
PROJECT COSTS										
STAFF COSTS	29.00									
FUEL	24.70									
VILLAGE LABOR	0.00									
TECH ASSISTANCE	127.50									
EQUIPMENT	36.98									
TOTAL PROJECT COSTS	218.18									
NET BENEFITS	-203.27	33.22	77.20	93.85	135.78	149.43	162.09	161.75	161.42	160.76
NET BENEFITS (-10%)	-211.91	22.47	61.83	76.81	114.24	126.52	137.91	137.61	137.31	136.71
NET BENEFITS (-20%)	-220.56	11.73	46.45	59.77	92.69	103.61	113.74	113.47	113.20	112.67

	10 YEARS	20 YEARS
NPV @ 15%	294.32	482.24
NPV @ 15% (-10%)	198.44	366.68
NPV @ 15% (-20%)	112.56	251.13
IRR	42%	44%
IRR (-10%)	34%	37%
IRR (-20%)	26%	30%

YEARS	11	12	13	14	15	16	17	18	19	20
INCREMENTAL RICE OUTPUT										
TOTAL AREA (ha)	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00	111.00
YIELD/HA (ton/ha)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
TOTAL OUTPUT	333.00	333.00	333.00	333.00	333.00	333.00	333.00	333.00	333.00	333.00
VAL/TON (Dal 000)	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
TOTAL INCOME (Dal 000)	239.76	239.09	239.09	239.09	239.09	239.09	239.09	239.09	239.09	239.09
TOTAL INCOME (-10%)	215.78	215.18	215.18	215.18	215.18	215.18	215.18	215.18	215.18	215.18
TOTAL INCOME (-20%)	191.81	191.28	191.28	191.28	191.28	191.28	191.28	191.28	191.28	191.28
INCREMENTAL CASH COSTS										
LABOR (Dal 000)	65.02	65.02	65.02	65.02	65.02	65.02	65.02	65.02	65.02	65.02
SEED (Dal 000)	4.66	4.66	4.66	4.66	4.66	4.66	4.66	4.66	4.66	4.66
FERTILIZER COSTS										
QUANTITY (tons)	8.33	8.33	8.33	8.33	8.33	8.33	8.33	8.33	8.33	8.33
COST/TON (Dal 000)	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
VALUE (Dal 000)	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99	9.99
TOTAL INCREMENTAL CASH COSTS	79.67	79.67	79.67	79.67	79.67	79.67	79.67	79.67	79.67	79.67
PROJECT COSTS										
STAFF COSTS										
FUEL										
VILLAGE LABOR										
TECH ASSISTANCE										
EQUIPMENT										
TOTAL PROJECT COSTS										
NET BENEFITS	160.09	159.42	159.42	159.42	159.42	159.42	159.42	159.42	159.42	159.42
NET BENEFITS (-10%)	136.11	135.51	135.51	135.51	135.51	135.51	135.51	135.51	135.51	135.51
NET BENEFITS (-20%)	112.14	111.60	111.60	111.60	111.60	111.60	111.60	111.60	111.60	111.60

Table 6.1

ECONOMIC ANALYSIS OF WATER - CONTROLLED RICE PRODUCTION
SOIL AND WATER MANAGEMENT UNIT (SWMU)

YEAR	1	2	3	4	5	6	7	8	9	1
INCREMENTAL RICE OUTPUT										
ICR. YIELD/Ha (ton/ha) SCENARIO 1	0.50	1.00	1.50	1.90	1.90	1.90	1.90	1.90	1.90	1.9
ICR. YIELD/Ha (ton/ha) SCENARIO 2	0.50	1.00	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.4
ICR. YIELD/HA (ton/ha) SCENARIO 3	0.50	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.9
B /TON	1029.00	1140.00	1202.00	1278.00	1348.00	1346.00	1345.00	1341.00	1337.00	1333.0
TOTAL INC. INCOME/Ha SCENARIO 1	515.00	1140.00	1803.00	2428.00	561.00	2557.00	2556.00	2548.00	2540.00	2533.0
TOTAL INC. INCOME/Ha SCENARIO 2	515.00	1140.00	1683.00	1789.00	1887.00	1884.00	1883.00	1877.00	1872.00	1866.0
TOTAL INC. INCOME/Ha SCENARIO 3	515.00	1026.00	1082.00	1150.00	1213.00	1211.00	1211.00	1207.00	1203.00	1200.0
INCREMENTAL PRODUCTION COSTS/Ha (I.P.C.)										
LABOR	371.00	371.00	371.00	371.00	371.00	371.00	371.00	371.00	371.00	371.0
SEED	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.0
TOTAL INCREMENTAL PRODUCTION COSTS/Ha	395.00	395.00	395.00	395.00	395.00	395.00	395.00	395.00	395.00	395.0
PROJECT COSTS/Ha										
TECH ASSISTANCE (T.A.)	2805.00									
OFFICE COSTS	90.00									
STAFF COSTS	369.00									
VEHICLES	911.00									
TRACTOR	406.00									
TRUCK	0.00									
FUEL	192.00									
EQUIPMENT	116.00									
CONSTRUCTION MATERIALS	0.00									
VILLAGE LABOR -	470.00									
1.0 TOTAL PROJECT COSTS (T.P.C.)	5353.00									
2.0 T.P.C. WITH PAID VILLAGE LABOR	4883.00									
3.0 T.P.C. WITHOUT T.A.	2548.00									
4.0 T.P.C. WITH DECREASING OVERHEAD (D.O.)	3125.00									
5.0 T.P.C. WITH D.O. & WITHOUT T.A.	1722.00									
MAINTENANCE COSTS/Ha	0.00	188.00	94.00	94.00	94.00	94.00	94.00	94.00	94.00	94.(
MAINTENANCE WITH D.O. COSTS/Ha	0.00	110.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.(

10 YEARS

	1.0 T.P.C.	2.0 T.P.C. WITH PAYED VILLAGE LABOR	3.0 T.P.C. WITHOUT T.A.	4.0 T.P.C. WITH D.O.	T.P.C. WITH D.O. AND WITHOUT T.A.
NPV @ 15% 1	2305.97	2714.66	4745.10	4434.67	5554.67
NPV @ 15% 2	408.55	817.24	2847.68	2537.24	3757.24
NPV @ 15% 3	-1890.68	-1481.98	548.45	238.02	1458.02
IRR 1	26%	29%	54%	46%	78%
IRR 2	17%	20%	42%	36%	63%
IRR 3	3%	5%	21%	17%	39%

Table 6.2

ECONOMIC ANALYSIS OF WATER - CONTROLLED RICE PRODUCTION
GTZ/DMR RAINFED RICE IMPROVEMENT PROJECT

YEAR	1	2	3	4	5	6	7	8	9	10
INCREMENTAL RICE OUTPUT										
INCR. YIELD/HA (ton/ha) SCENARIO 1	0.50	1.00	1.50	1.90	1.90	1.90	1.90	1.90	1.90	1.90
INCR. YIELD/HA (ton/ha) SCENARIO 2	0.50	1.00	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
INCR. YIELD/HA (ton/ha) SCENARIO 3	0.50	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P /TON	1029.00	1140.00	1202.00	1278.00	1348.00	1346.00	1345.00	1341.00	1337.00	1333.00
TOTAL INC. INCOME/Ha SCENARIO 1	515.00	1140.00	1803.00	2428.00	2561.00	2557.00	2556.00	2548.00	2540.00	2533.00
TOTAL INC. INCOME/Ha SCENARIO 2	515.00	1140.00	1683.00	1789.00	1887.00	1884.00	1883.00	1877.00	1872.00	1866.00
TOTAL INC. INCOME/Ha SCENARIO 3	515.00	1026.00	1082.00	1150.00	1213.00	1211.00	1211.00	1207.00	1203.00	1200.00
INCREMENTAL PRODUCTION COSTS/Ha (I.P.C.)										
LABOR	371.00	371.00	371.00	371.00	371.00	371.00	371.00	371.00	371.00	371.00
SEED	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
TOTAL INCREMENTAL PRODUCTION COSTS/Ha	395.00	395.00	395.00	395.00	395.00	395.00	395.00	395.00	395.00	395.00
PROJECT COSTS/Ha										
TECH ASSISTANCE (T.A.)	3184.00									
OFFICE COSTS	64.00									
STAFF COSTS	460.00									
VEHICLES	634.00									
TRACTOR	127.00									
TRUCK	98.00									
FUEL	155.00									
EQUIPMENT	216.00									
CONSTRUCTION MATERIALS	253.00									
VILLAGE LABOR	275.00									
1.0 TOTAL PROJECT COSTS (T.P.C.)	5526.00									
2.0 T.P.C. WITH PAID VILLAGE LABOR	5579.00									
3.0 T.P.C. WITHOUT T.A.	2342.00									
4.0 T.P.C. WITH DECREASING OVERHEAD (D.O.)	3289.00									
5.0 T.P.C. WITH D.O. & WITHOUT T.A.	1697.00									
MAINTENANCE COSTS/Ha	0.00	153.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00	77.00
MAINTENANCE WITH D.O. COSTS/Ha	0.00	92.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00

10 YEARS

	1.0 T.P.C.	2.0 T.P.C. WITH PAYED VILLAGE LABOR	3.0 T.P.C. WITHOUT T.A.	4.0 T.P.C. WITH D.O.	5.0 T.P.C. WITH D.O. AND WITHOUT T.
NPV @ 15% 1	2239.00	2193.99	5008.28	4336.21	5720.55
NPV @ 15% 2	342.36	296.17	3110.95	2439.78	3823.13
NPV @ 15% 3	-1956.36	-2001.05	811.73	139.56	1523.91
IRR 1	25%	25%	59%	44%	75%
IRR 2	17%	17%	47%	34%	57%
IRR 3	3%	2%	25%	16%	40%

Table 6.3

ECONOMIC ANALYSIS OF SWAMP RICE DEVELOPMENT
(IMPROVED ACCESS)
FREEDOM FROM HUNGER CAMPAIGN (FFHC)

YEAR	1	2	3	4	5	6	7	8	9	10
INCREMENTAL RICE OUTPUT										
ICR. YIELD/HA (ton/ha) SCENARIO 1	0.50	1.00	1.50	1.90	1.90	1.90	1.90	1.90	1.90	1.90
ICR. YIELD/HA (ton/ha) SCENARIO 2	0.50	1.00	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
ICR. YIELD/HA (ton/ha) SCENARIO 3	0.50	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
[illegible]/TON	1023.00	1140.00	1202.00	1278.00	1348.00	1346.00	1345.00	1341.00	1337.00	1333.00
TOTAL INC. INCOME/Ha SCENARIO 1	515.00	1140.00	1803.00	2428.00	2561.00	2557.00	2556.00	2548.00	2540.00	2533.00
TOTAL INC. INCOME/Ha SCENARIO 2	515.00	1140.00	1683.00	1789.00	1887.00	1884.00	1883.00	1877.00	1872.00	1866.00
TOTAL INC. INCOME/Ha SCENARIO 3	515.00	1026.00	1082.00	1150.00	1213.00	1211.00	1211.00	1207.00	1203.00	1200.00
VARIATION FROM TOTAL INC. INCOME/Ha SCENARIO 3										
TOTAL INC. INCOME (-10%)	464.00	923.00	974.00	1035.00	1092.00	1090.00	1090.00	1086.00	1083.00	1080.00
TOTAL INC. INCOME (-20%)	412.00	821.00	866.00	920.00	970.00	963.00	969.00	966.00	962.00	960.00
INCREMENTAL PRODUCTION COSTS/Ha (I.P.C.)										
LABOR	371.00	371.00	371.00	371.00	371.00	371.00	371.00	371.00	371.00	371.00
SEED	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
TOTAL INCREMENTAL PRODUCTION COSTS/Ha	395.00	395.00	395.00	395.00	395.00	395.00	395.00	395.00	395.00	395.00
PROJECT COSTS/Ha										
TECH ASSISTANCE (T.A.)	470.00									
OFFICE COSTS	21.00									
STAFF COSTS	187.00									
VEHICLES	185.00									
TRACTOR	22.00									
TRUCK	145.00									
FUEL	63.00									
EQUIPMENT	72.00									
CONSTRUCTION MATERIALS	[illegible]									
VILLAGE LABOR	[illegible]									
1.0 TOTAL PROJECT COSTS (T.P.C.)	[illegible]									
2.0 T.P.C. WITH PAID VILLAGE LABOR	2035.00									
3.0 T.P.C. WITHOUT T.A.	1053.00									
MAINTENANCE COSTS/Ha	0.00	60.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00

10 YEARS

	1.0 T.P.C.	2.0 T.P.C. WITH PAID VILLAGE LABOR	3.0 T.P.C. WITHOUT T.A.
NPV @ 15% 1	5946.00	[illegible]	[illegible]
NPV @ 15% 2	4048.57	[illegible]	4457.27
NPV @ 15% 3	1749.35	1207.81	[illegible]
NPV @ 15% (-10%)	1222.07	737.33	1637.77
NPV @ 15% (-20%)	708.22	[illegible]	1116.72
IRR 1	88%	[illegible]	
IRR 2	[illegible]	[illegible]	[illegible]
IRR 3	47%	[illegible]	[illegible]
IRR (-10%)	37%	[illegible]	[illegible]
IRR (-20%)	28%	[illegible]	[illegible]

The impact on project economic returns of potential reductions in per hectare overhead costs as a result of experience gained in the pilot phase, or higher village labor costs (for example where financial incentives are provided), is assessed through sensitivity analysis which is discussed in Section 6.3.

Maintenance costs

The structures put in place during land development, which have an expected life of at least ten years, will require periodic maintenance. For the first year, after construction, during which time any defects are most likely to become apparent, a provision of 10% of key cost items (staff, vehicles, tractor, truck, fuel) is made. For the succeeding years, allowance is made for an average annual maintenance cost of 5%.

6.2 Estimation of Project Benefits and Incremental Costs of Rice Production

Project benefits

Project benefits are determined by the quantity of additional rice produced as a result of land development and its economic value. The increase in rice production is determined by the yield gain per hectare and the area over which it is obtained. These parameters will be discussed in turn. Because any benefits of improved food security as a result of the reduction of risks associated with rainfed rice production (drought stress in particular) are difficult to assess, no attempt has been made to value it in this analysis.

The experience of the projects shows that an expansion of the area cultivated is to be expected following land development.[22] Although the projects have not sought to measure the area cultivated before construction, their staffs consider an assumption that 75% of the area improved was cultivated before, and 100% afterwards, to be reasonable and representative.

Reliable data on yields per hectare before land development is not available, although crop cuts were taken from case study household fields in both improved and unimproved areas in 1986 (see Annexes A - D). In order to offset this weakness in the data base, economic returns for each project have been determined over a range of per hectare yield gains or increments. The best estimate of yield per hectare before developments is 0.8 t/ha. Taking account of the fact that only 75% of the area was cultivated before development the average yield per hectare over the whole area subsequently utilized was 0.6 t/ha.

From this baseline three yield scenarios were projected. Scenario 1, the best case, assumes the potential average yield realistically attainable with existing technology of 2.5 t/ha is achieved. This represents an increment of 1.9 t/ha. Scenario 3, the worst case, assumes a rather conservative yield of

[22] The case of FFHC differs from the others in this regard and the implications are considered in Section 6.4.

only 1.5 t/ha, an increment of 0.9 t/ha. Scenario 2 represents a mid-point between the two. These are summarized in Table 6.4.

Table 6.4
Project Yield Scenarios for Economic Analyses

	Yield without project (t/ha) (75% X 0.8)	Yield with project (t/ha)	Yield increment (t/ha)
Scenario 1	0.6	2.5	1.9
Scenario 2	0.6	2.0	1.4
Scenario 3	0.6	1.5	0.9

Yield increments are not assumed to be achieved immediately but at a maximum rate of 0.5 tons per hectare per year. Thus the full yield increment for scenario 1 is achieved only in year 4, and that for scenario 3 in year 2.

As a precaution against potential production risks, scenario 3 has been subjected to sensitivity analysis to assess the impact on economic returns of yields falling below this level. Some of the case study experiences -- e.g., Beeta, where rainfall distribution was very poor; and Bwiam, where an excessive rain ruptured the dike -- justify such precautions.

The economic value of rice is based on World Bank farmgate price projections (Agricultural Development Project II appraisal report), adjusted for the average US dollar/dalasi exchange rate in 1986.[23]

Incremental costs of rice production

On the vast majority of unimproved rainfed riceland in The Gambia, labor and seed are the only inputs used. Neither the benefits nor the costs of improved technology are included here in order to assess the economic returns to land development independently from any subsequent investments.

Although no new inputs are considered, the anticipated expansion of the area cultivated from 75% to 100% will require corresponding increases in the amount of labor and seed. Using the labor requirement of 270 man-days (given in Land Resources Study 22) for each hectare cultivated, 25% of this total labor requirement is assumed to be the increment required to bring 100% of project-affected land into production. This is costed at the average daily wage of D5.50. The increase in total labor allocated to rice is not expected to result in a reduction in area or yields of other crops for the following reasons:

- although the total labor requirement for rice production increases with area and yield levels, in the case of SWMU and GTZ, that for the peak period activity of weeding is reduced as improved water control suppresses weed growth. In the case of FFHC time savings are made throughout the season as a result of improved field access;

[23] See Annex F for a copy of these farmgate price projections and adjustments.

- opportunities exist : hiring additional labor on a daily wage basis;

- labor supply has shown itself to be elastic in response to opportunitie for increased production of priority crops.

A corresponding increase in seed has been allowed for, i.e., 25% of the recommended rate of 80 kg/ha at a cost of D1.20/kg.

6.3 Project Returns and Sensitivity Analysis

Cost-benefit analysis is used to derive two measures of the value of a project to the national economy. These are the Internal Rate of Return (IRR) and the Net Present Value (NPV).

The IRR is the maximum rate of interest that a project could afford to pay for the resources used and still break even after recovering the investment and operating costs.

The NPV is the present value of the net benefit stream generated by a project (calculated by subtracting year-by-year costs from the benefits) discounted at an interest rate which reflects the opportunity cost of capital to the economy. For The Gambia, this discount rate is 15%, the minimum rate at which projects will be included in the Public Investment Program.[24]

In the cost-benefit analysis tables, the NPV is given on a per hectare basis. This figure must be multiplied by the total area improved to arrive at the NPV of the project. The relationship between the IRR and the NPV is readily apparent. So long as the IRR exceeds the discount rate of 15% the NPV per hectare is positive and indicates an acceptable investment to the Public Investment Program under current restraints. If the IRR is lower than 15% the NPV per hectare becomes negative.

As mentioned earlier these two measures are calculated for each project under all three production scenarios to test the sensitivity of project economic returns to the level of yield increase per hectare achieved. It is also necessary to test the sensitivity of economic returns to possible changes in project costs. Altogether five project cost structures are examined for their impact on IRR and NPV:

1.0 total project costs with village labor used in construction valued at its opportunity cost (T.P.C.);

2.0 total project costs with village labor used in construction costed according to the financial incentives or daily wage actually paid[25] (T.P.C. with paid village labor);

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[24]This condition has been re-iterated in the World Bank's Letter of Development Policy, dated August 1st, 1986.

[25]In the case of SWMU no payments were made either in cash or kind.

3.0 total project costs less technical assistance costs (T.P.C. without T.A.),

4.0 total project costs less 50% of overhead costs incurred in both development and maintenance (the justification being that once experience has been gained during a pilot phase more land can be brought under development with the same personnel and equipment) (T.P.C. with D.O.);

5.0 total project costs less technical assistance and 50% of overhead costs incurred in development and maintenance (T.P.C. with D.O. and without T.A.);

6.4 Results of the Economic Analyses

The calculation of Net Present Values and Internal Rates of Return for the three yield scenarios and five possible cost structures provides a framework within which project returns can be assessed. For each project a summary table is presented and discussed, on the basis of 10 years. Additional sensitivity analysis has been carried out to assess the impact on returns if potential risks should pull yields below the level of scenario 3.

Economic analysis of SWMU Water-Controlled Rice Production

For cost structures 1.0 and 2.0 (Total Project Costs with labor valued at opportunity cost and amounts actually paid respectively) the NPV is positive and IRR greater than 15% for yield scenarios 1 and 2 (Table 6.5). Under scenario 3 (yield increment of 0.9 t/ha) the IRR falls to 3% and 5% with negative NPVs. To sustain these levels of project cost and remain economically attractive, a yield of 2 t/ha (1.4 t/ha increment) is required. Costing village labor required for construction at its opportunity cost, as opposed to the amount actually paid (which was zero for this project), has no significant effect on economic viability.

For cost structures 3.0 and 4.0 (Total Project Costs without technical assistance and with a 50% decrease in overheads respectively) the NPVs are positive for all three yield scenarios. An average yield of 1.5 t/ha (incremental yield of 0.9 t/ha) is sufficient to result in an attractive economic return. The prospect of decreasing overheads (cost structure 4.0) is realistic as the experiences gained during the pilot phase could result in more efficient use of staff and equipment. Cost structure 3.0 is equally valid as technical assistance is intended to be withdrawn in 1988 with national staff assuming full responsibility for the program.

A general trend can be observed that as project cost structures are decreased, IRRs increase and the project can remain viable under the lower yield scenario 3. For the lowest cost structure 5.0 (technical assistance excluded together with a 50% reduction in overhead costs) a fall in yields of almost 30% below scenario 3 can be absorbed before the NPV becomes negative. An average yield of 1.3 t/ha (0.7 t/ha increment) will provide an acceptable return.

TABLE 6.5
SOIL AND WATER MANAGEMENT UNIT (SWMU)
ECONOMIC ANALYSIS OF WATER-CONTROLLED RICE PRODUCTION
TEN-YEAR DISCOUNT PERIOD

	1.0 TOTAL PROJECT COSTS (TPC)		2.0 TPC WITH PAID LABOR		3.0 TPC WITHOUT TECH.ASST.		4.0 TPC WITH DECREASING OVERHEAD		5.0 TPC W/O T.A.,DECR. OVERHEAD	
	NPV	IRR	NPV	IRR	NPV	IRR	NPV	IRR	NPV	IRR
SCENARIO 1	+	26%	+	29%	+	54%	+	46%	+	78%
SCENARIO 2	+	17%	+	20%	+	42%	+	36%	+	65%
SCENARIO 3	-	3%	-	5%	+	21%	+	17%	+	39%
SCENARIO 3 (-10%)	-		-		+	15%	-	12%	+	30%
SCENARIO 3 (-20%)	-		-		-	9%	-		+	22%
SCENARIO 3 (-30%)	-		-		-		-		-	13%
SCENARIO 3 (-40%)	-		-		-		-		-	

Economic analysis of GTZ/DWR Rainfed Rice Production Project

The results for this project (given in Table 6.6) are almost exactly the same as for SWMU above. There are no changes in the circumstances under which NPVs are positive and IRRs vary by only a few percentage points.

Economic analysis of FFHC Swamp Rice Development (improved access)

In the case of FFHC, the incentives paid to village workers have resulted in a larger area becoming accessible (by means of footpaths and causeways) than is actually cultivated by farmers (to date, about 60% of the developed land is being cultivated). For this analysis, the assumption is made that 80% of the area is cultivated during the first 10 years, implying a 20% reduction in benefits.

For cost structure 1.0 (Table 6.7), with labor valued at opportunity cost, it can be seen that despite a 20% reduction in benefits below scenario 3, the project yields a positive NPV and a healthy IRR of 37%. If the total area cultivated does reach 80%, this cost structure can absorb a 30% reduction in benefits, implying an average yield of only 1.23 t/ha (0.63 t/ha increment) and remain economically attractive.

When village labor is costed at the value of the incentives given (cost structure 2.0), as opposed to its opportunity cost, the project yields a lower IRR at each yield scenario. This reflects the fact that the incentives given are considerably higher than the opportunity cost derived for labor in the dry season. Nevertheless, the project remains an attractive investment even if production gains should fall 20% below scenario 3. This requires an average yield of 1.3 t/ha (0.7 t/ha increment). Due to the value of the incentives a further 10% fall in benefits would result in a negative NPV (IRR 11%).

If costs of technical assistance are excluded (cost structure 3.0) the highest IRRs are achieved for all scenarios. The project can absorb a 40% reduction in benefits below the conservative scenario 3 and still yield a positive NPV (IRR 17%). Such a reduction implies average yields of 1.14 t/ha (increment 0.54 t/ha). Further reductions would result in a negative NPV.

Cost structures assuming a reduction in overheads are not presented because the scale at which FFHC is already operating, opening in excess of 800 ha per year, do not offer scope for further efficiencies in the use of staff and equipment.

Economic analysis of Jahaly-Pacharr Tidal Irrigation Component

A cost benefit analysis of tidal-irrigated rice cultivation under this project was carried out in 1986 by Euroconsult. The assumptions used in this study need to be compared briefly with those for the previous three projects.

The approach to estimating project development and maintenance costs was similar, although returns were calculated over a 35-year period. Past investments in major infrastructure (including access roads, housing and project buildings, irrigation infrastructure, dikes, canal structures and land levelling) were costed at 1986 prices.

TABLE 6.6
GTZ/DWR RAINFED RICE IMPROVEMENT PROJECT
ECONOMIC ANALYSIS OF WATER-CONTROLLED RICE PRODUCTION
TEN YEAR DISCOUNT PERIOD

	1.0 TOTAL PROJECT COSTS(TPC)		2.0 TPC WITH PAID LABOR		3.0 TPC WITHOUT TECH. ASST.		4.0 TPC WITH DECREASING OVERHEAD		5.0 TPC W/O T.A., DECR. OVERHEAD	
	NPV	IRR	NPV	IRR	NPV	IRR	NPV	IRR	NPV	IRR
SCENARIO 1	+	25%	+	25%	+	55%	+	44%	+	79%
SCENARIO 2	+	17%	+	17%	+	47%	+	34%	+	67%
SCENARIO 3	-	3%	-	2%	+	25%	+	16%	+	40%
SCENARIO 3 (-10%)	-		-		+	19%	-	11%	+	32%
SCENARIO 3 (-20%)	-		-		-	12%	-		+	23%
SCENARIO 3 (-30%)	-		-		-		-		-	14%
SCENARIO 3 (-40%)	-		-		-		-		-	

TABLE 6.7
FREEDOM FROM HUNGER CAMPAIGN (FFHC)
ECONOMIC ANALYSIS OF SWAMP RICE DEVELOPMENT (IMPROVED ACCESS)
TEN YEAR DISCOUNT PERIOD

	1.0 TOTAL PROJECT COSTS (TPC)		2.0 TPC WITH PAID LABOR		3.0 TPC WITHOUT TECH. ASS.	
	NPV	IRR	NPV	IRR	NPV	IRR
SCENARIO 1	+	88%	+	69%	+	121%
SCENARIO 2	+	75%	+	57%	+	106%
SCENARIO 3	+	47%	+	33%	+	69%
SCENARIO 3 (-10%)	+	37%	+	26%	+	55%
SCENARIO 3 (-20%)	+	28%	+	19%	+	42%
SCENARIO 3 (-30%)	+	18%	-	11%	+	30%
SCENARIO 3 (-40%)	-	9%	-		+	17%

Fut yields were projected on the basis of the consultant's present knowledge of potential yield levels, given proper management and maintenance. These are 4 t/ha and 5 t/ha in the wet and dry season respectively, with 20% of the area double cropped. A value of production of D1000/ha per year was assumed for the without project situation. Additional inputs necessary to realize these yields (land preparation, small tools, seeds, fertilizer, threshing and transport) are included in incremental costs of production.

World Bank projections were used as a basis for deriving two farmgate paddy prices:

(i) "Low" price: based on a 25% quality discount for local rice vis-a-vis Thai 5% broken, and a milling efficiency of 60%;

(ii) "High" price: based on a 15% quality discount for local rice and a milling efficiency of 66%.

The "high" price assumes the establishment of a new, modern, and more efficient mill in the neighborhood of Sapu.

The analysis was carried out using three exchange rates: 1US dollar = D7.25, D10.00, and D15.00 respectively. Only the economic returns for the first rate are presented here as that most closely approximates the average actual rate during 1986 of 1US dollar = D6.50. Sensitivity analysis was carried out for a 5% decrease in benefits together with a 5% increase in costs, and for a 10% decrease in benefits together with a 10% increase in costs. The Internal Rates of Return obtained are set out below. In all cases the Net Present Value is negative using a 15% discount rate.

	"Low" Rice Price	"High" Rice Price
Expected benefits and costs	3.8%	7.7%
Benefits - 5%, Costs + 5%	2.1%	6.2%
Benefits - 10%, Costs +10%	0.2%	4.6%

If the donor contributions during the investment phase are excluded the IRR is reported to be in excess of 40%. The proportion of total costs that these contributions represent is not stated.

7. COLLECTIVE PROJECT EXPERIENCES

The previous sections have described the history, geographic and ecological coverage, technical design, and economics of the water-control structures of each project. Through the case studies, these project components were examined in the context of participating villages and from the perspective of individual households. In Annexes A-D, the farming system in general and the rice sub-system in particular are defined for each case study village. Linkages between the rice and upland groundnut/cereal sub-systems are also discussed in these annexes.

ANNEX 4.2

Long-[illegible] Sustainability And Continuation Of Soil And Water Management Activities

General

As the Soil and Water Management Project approaches its PACD, it is appropriate to reflect on whether the Project is sufficiently institutionalized to continue to serve its specific purposes after AID terminates its funding and other support. An analysis of the degree of institutionalization has been made in the light of the specific purposes of the project enumerated below:

1. Establish a Soil and Water management Unit within the Ministry of Agriculture and Natural Resources.

2. Develop technology for improved agricultural methods consistent with Gambian abilities and resources.

3. Train Gambian soil and water management specialists and agricultural assistants.

It is also appropriate to examine the recurrent cost implications of this project and the GOTG's willingness or ability to assume such costs; in other words the priority or importance ascribed to the project by the GOTG. Therefore, an analysis of recurrent costs including future projections is undertaken below.

In order to provide a realistic context in which one can view the priority that should be attached to the SWM Project and the GOTG's ability to fully assume recurrent costs, an update on the overall economic outlook is presented as an introduction to the recurrent cost analysis.

Economic Outlook For more than a decade, The Gambia's economy has been characterized by unfavorable imbalances, both internal and external in nature. These imbalances take the form of a widening gap between falling revenues and rising expenditures on the one hand; and, the balances of trade and payments deficits on the other. Realizing the serious implications of these imbalances, the government has embarked on several Structural Adjustments and Economic Recovery Programs (SAP & ERP). The purposes of these programs, are to revamp the economy, stimulate agricultural production and ensure growth with equity. In the wake of the SAP and ERP, the immediate impacts of the measures are a short-term increase in the prices of both imported and locally produced goods; increased cost of borrowing; and lay-offs of workers in both the public and private sectors. At the same time, agricultural production has been picking up as a result of the increment in producer prices; however, the contraction of government expenditure and depressed budgetary allocations have curtailed recurrent cost contribution to most projects. Nonetheless, government considers it essential to continue providing funds for the recurrent operations

of such projects as SWM, in order to achieve increased agricultural output.

Given the structural nature of the economy, the agricultural sector is and would remain the lead sector. It is expected to play a pivotal role in both short and long-term development efforts. The national development priorities are documented in an interim plan entitled the Public Investment Programme (PIP). This document details a collection of investment projects that are to be implemented until 1988 when the third five year development plan will be launched. During the last donors' conference on the agricultural sector which took place in Banjul from 21-22 October 1987, it was noted that over 30 percent of the Public Investment Programme is devoted to agriculture, which exceeds the UN conference recommendation of a 25 percent allocation of public investment to agriculture.

The projected sectoral allocations under the PIP are: 1) agriculture and natural resources 36.4%; 2) transport and communications 34.7% 3) public utilities 14.4%; and 4) social service sectors 10.8%. As with the first and second five year plans, the emphasis in the PIP is on rural development and welfare. A review of agriculture and rural development under the ERP indicates that sectoral allocations to the agriculture sub-sector have been increasing.

Recognizing the impressive, significant and beneficial activities of the SWMU project, the President of The Republic inaugurated the First Conservation District in November, 1987 organized with the advice and encouragement of the SWMU, thus emphasizing the important role of this vital institution in the economic development process of the country. Also, in his 1987 presidential address on the opening of Parliament, the president commended the activities being carried out by SWMU and pledged his commitment to support the government's effort in these areas of great national importance.

Recurrent Costs Table A 4.2-1 on the following page illustrates how USAID and GOTG have contributed to recurrent costs associated with the SWM Project for fiscal years 1984/85 - 1987/88. As indicated in the totals (bottom row) of the table, except for FY 85/86, USAID's contributions to recurrent costs have been greater than GOTG's. However, it is apparent that vehicle maintenance and vehicle replacement represent a large portion of USAID's contribution and, in fact, of total recurrent costs. This emphasizes the need for timely routine maintenance of vehicles and the importance of replacing vehicles when it becomes apparent that they have exhausted their useful life. If AID replaces in 1988/89 three remaining vehicles purchased in 1978/79 which are costly to maintain, the cost to the GOTG of vehicle maintenance and replacement will be substantially reduced.

If, additionally, AID were to provide funds for tools and field equipment for an expanded SWMU operation, the recurrent cost burden to the GOTG would be considerably lightened, even though an additional sub-unit would have been added at Sapu. This is so because transport costs would be considerably reduced for SWMU

TABLE 4 4.2-1

HISTORICAL RECURRENT COSTS (DALASI)

Item	FY 84/85 GOTG'S CONTRIB.	FY 84/85 USAID'S CONTRIB.	FY 84/85 TOTAL	FY85/86 GOTG'S CONTRIB.	FY85/86 USAID'S CONTRIB.	FY85/86 TOTAL	FY86/87 GOTG'S CONTRIB.	FY86/87 USAID'S CONTRIB.	FY86/87 TOTAL	FY87/88 GOTG'S CONTRIB.	FY87/88 USAID'S CONTRIB.	FY87/88 TOTAL
	15,209	4,391	19,600	19,177	17,323	36,500	55,550	46,500	102,050	36,000	44,645*	80,645
Salaries	75,160		75,160	48,100	-	48,100	65,250	-	65,250	102,650	-	102,650
Other Allows.	25,280	-	25,280	17,700	-	17,700	29,820	-	29,820	24,850	-	24,850
Veh. Mtce.	25,280	162,386	187,666	25,280	26,110	51,390	32,410	68,324	100,734	12,000	54,118*	66,118
T.A. Utils.	14,400	-	14,400	16,000	-	16,000	21,600	-	21,600	21,600	-	21,600
Per Diem (Night Allows.)	5,000	-	5,000	5,500	-	5,500	19,190	-	19,190	45,400	-	45,400
Veh. Repl.	-	-	-	-	-	-	-	139,600	139,600	-	145,000	145,000
Tools & Field Equip.	-	77,665	77,665	-	10,374	10,374	-	43,417	43,417	-	6,685*	6,685
Stic. Supp' incl. station	5,000	18,330	23,330	325	1,330	1,655	8,000	3,040	11.040	8,000	3,872*	11,872
Mtce. of stc. equip.	3,000	-	3,000	3,000	-	3,000	6,313	5,685	11,998	8,000	5,691*	13,691
Totals	168,329	262,772	431,101	135,082	55,137	190,219	238,133	306,566	544,699	258,500	260,011	518,511

NOTE: GOTG Fiscal Year starts July 1 and ends June 30.

* These are not final FY figures. They only represent expenditures paid by USAID for July - December 1987.

service to farmers in the eastern part of the country from the logistically convenient location at Sapu rather than from Yundum. It is estimated that recurrent costs would average about 400,000 Dalasi in the next three to five years.

In general, the GOTG has been shouldering the costs of recurrent expenditures except for those items mentioned above. It is also apparent that GOTG's allocations for recurrent cost have been increasing especially with respect to salaries and per diem. However, the GOTG will have to increase its overall recurrent cost allocations by sixty percent or more if it is to assume full responsibility for recurrent costs.

On the other hand, given the importance that the GOTG attaches to agriculture (36 percent of the PIP is devoted to agriculture) and the significant role the SWMP is playing in the economic development process of the country, a recurrent cost level of about 400,000 Dalasi (roughly $60,000) is not beyond the GOTG's ability to pay and represents a small percentage of the resources ($330,000) to be provided by the GOTG in accordance with the terms of the Project Agreement.

Recommendation AID should provide funding for the purchase of three replacement vehicles in addition to the vehicles for the proposed new SWM sub-unit at Sapu.

Recommendation AID should cease contributions to recurrent costs for the Project. The GOTG should assume full responsibility for recurrent costs.

ANNEX 4.3

SUMMARY OF PLANNED ACTIVITIES AND ESTIMATED COSTS REQUIRING AID ASSISTANCE

I.	Training		
a)	Long term - 5 persons @ $28,000/yr. X 4 yrs.	= $	560,000
	- 1 person (engr.) @ $28,000/yr X 3 yrs.	= $	84,000
b)	Medium term - 8 persons @ $25,000/yr. X 2 yrs.	= $	400,000
c)	Short term - 15 persons X 10 wks. X $800/wk.	= $	120,000
	Subtotal	= $	1,164,000
II.	Technical Assistance		
a)	Long term Tech. Advisor - Agr. Conservationist for 2 yrs.	= $	220,000
b)	Short term T.A.		
(1)	Engr. Tech. 20mw/yr. X 2yrs. + transp. & perdiem	= $	86,000
(2)	Agr. Engr. - 6 mw/yr. X 2yrs + transp. & perdiem	= $	30,000
(3)	Soil Scientist - 12 mw/yr X 2yrs. + transp. & perdiem	= $	54,000
(4)	Res. Cons. Plann. - 6 mw/yr. X 2 yrs. + transp. & perdiem	= $	30,000
(5)	Env. Planner - 26 mw + transp. & perdiem	= $	58,000
	Subtotal	= $	478,000
III.	Field Equipment & Vehicles		
a)	3 tractors for Sapu	= $	90,000
b)	6 vehicles (3 for Sapu plus 3 replacements)	= $	108,000
c)	Hydrometers, transits & other survey equipment	= $	80,000
d)	200 wheelbarrows	= $	14,000
e)	200 shovels & pails	= $	6,000
f)	20 rain gauges	= $	1,500

g)	7 motorbikes	= $ 7,000
h)	7 mopeds	= $ 3,500
	Subtotal	= $ 310,000
IV.	Seminars & Professional Participation In Conferences, Familiarization Tours etc.	= $ 100,000
	Total	= $2,052,000
	Contingency 7.5%	= $154,000
	Grand Total	= $2,206,000

ANNEX 4.4

Scope Of Work For The Evaluation Of The Soil And Water Management Project

I. Background

The project began in March 1978 with several objectives: 1) to halt and reverse environmental deterioration due to the inadequacy of traditional cultivation practices; 2) increase food forage, wood and cash crop; 3) reduce susceptibility to drought and other weather variations; and, to develop the institutional and material capability to deliver educational, technical, and material services to rural populations. The specific purposes of the project were to:

A. Establish a soil and water management unit within the Ministry of Agriculture and Natural Resources.

B. Develop technology for improved agricultural methods consistent with Gambian abilities and resources.

C. Train Gambian soil and water management specialists and agricultural assistants.

An evaluation in 1982 determined that the project design was sound and that progress in achieving the objectives was being made. However, the 1982 evaluation recommended a change in the level and mix of technical assistance and training, the establishment of demonstration sites, and detailed description of responsibilities for the Soil and Water Management Unit (SWMU) the Government Of The Gambia (GOTG) and AID.

Another evaluation in 1985 assessed the extent to which the project purposes had been achieved, the impact on farmers, adequacy of the institutional arrangements and the constraints.

It was determined that while the economic benefits of the project were established, the work performed was impressive and technically correct, and the SWMU was well on its way to becoming an important service agency, the goal of institutionalization of the services would not be met by the PACD.

It was found that the SWMU has the potential for making significant improvements in Gambian agricultural production but that more time was needed to train staff and additional financial resources were needed for commodities and budget support. Thus, the major recommendations were an extension of the PACD and assistance with recurring costs, until the GOTG could increase its own budget support.

Based on the recommendations of the 1985 evaluation the PACD was extended for 3 months and an additional $223,000 was provided to the project. While the intent was a longer term extension, any period longer than 3 months would have exceeded a 10 year LOP and would

need the approval of the AID Administrator. Thus, the 3 month extension of the PACD was to give the Mission time to request and get approval for a two year extension of the PACD from the AID administrator. In order to update the 1985 evaluation and to provide information for the requested extension of the PACD, USAID Banjul needs an assessment of the project and an identification of specific needs during the two year extension.

II. Purpose

The purpose of this evaluation is to:

A. Measure the extent to which previous recommendations have been implemented, whether the desired results were achieved and if not why not;

B. Determine the extent to which previously noted constraints have been addressed and removed;

C. Identify the obstacles to institutionalization of Soil and Water Management Unit as an effective, sustainable unit within the GOTG.

D. Recommend what level of assistance is required to institutionalize the soil and water conservation capability, specific activities that offer the best potential for this, and the financial and technical resources required.

III. Work Plan and Outputs

The evaluation team will consist of a project development officer from REDSO/WCA, a USAID Banjul agricultural project assistant, a GOTG agronomist, and a GOTG planner. The team will review project documents including the project paper, the 1982 and 1985 evaluations, progress reports and other documents. This will be followed by selected site visits, assessment of SWMU capabilities through interviews, review of work plans and strategies and evaluation of GOTG commitment to continued support of the project. The evaluation will be conducted during the period December 1-15, 1987. The REDSO PDO will take the lead in preparing the final evaluation report.

A draft report will be prepared at the end of the period and left with USAID. The report will be left on disc, one copy of the disc will stay with USAID Banjul, another copy will go with the PDO. After review and comments of USAID and the GOTG a final report will be issued.

ANNEX 4.5

EVALUATION TEAM ACTIVITY SCHEDULE

Week 1

Tues, Dec. 1	Orientation by USAID/Gambia and familiarization with available documents.
Wed, Dec. 2	Initial contacts & prelim. discussions with PPM Asst. Dir. Johm, DOA Asst Dir. Ceesay, PPMU Econ. Taylor, SCS Tech. Advisor Metz & SWMU Dept. Director Fye.
Thurs, Dec. 3	Continued familiarization with documentation.
Fri, Dec. 4	Draft activity schedule; hold planning/concertation meeting among evaluation team members. Also, draft report outline.

Week 2

Mon, Dec. 7	Visit project sites upcountry; interview farmers & Agr. Assistants & hold in depth discussions with SWMU Director & T.A. Advisor Metz
Tues, Dec. 8	Same as Mon, Dec. 7.
Wed, Dec. 9	Discussions with Perm. Sec. of Min. of Water Resources & Perm Sec. MANR.
Thurs, Dec. 10	Meet with Josh Posner, GARD. Discussion with SWMU staff. Obtain budget cost figures and update of activities accomplished.
Fri, Dec. 11	Interview SWMU participants. Seek data on planned activities and estimated costs.

ANNEX 4.6

SOIL AND WATER MANAGEMENT UNIT
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
PROJECT # 635-0202

ANNUAL REPORT
July 1st, 1986 to June 30th, 1987

Ministry of Agriculture
Yundum, The Gambia

Week 3

Mon, Dec. 14	Start writing report. Obtain recurrent cost data.
Tues, Dec. 15	Concertation meeting among team members.
Wed, Dec. 16	Continue writing text and appendices.
Thurs, Dec. 17	Editing of draft report.
Fri, Dec. 18	Continue writing and editing.
Sat, Dec. 19	Complete draft of report.

GENERAL

The end of 1986/87 fiscal year also marks the end of the third year of application of soil and water conservation practices in The Gambia. An Annual Plan of Operations was drawn up with a view to make 100% utilization of the Gambian staff since all those (except one) on training abroad would have returned by the beginning of the fiscal year. The APO objectives are as follows:

1. To improve management and operations.
2. To increase the conservation knowledge of field workers.
3. To provide conservation awareness at all levels.

SWMU continues to place emphasis on the following:

A. On-the-job training and education of the unit's personnel in soil and water conservation and problem identification including the planning, design, and construction of soil and water conservation structures.

B. Training and education of farmers in the application of soil and water conservation practices.

C. Education of the Gambian public: students, officials of The Gambian Government, and Non-Governmental organizations in soil and water conservation.

SWMU has participated in other activities such as organizing educational and promotional programs, distributing rice seed, purchased by SWMU through USAID and made available to farmers in new project areas, and extending assistance to other projects, Departments of the Government, and Non-Governmental Organizations.

The SWMU staff participated in some courses and seminars held both locally and abroad.

A number of foreign and local visitors have been received by the unit. These include both consultants and fact finders. Tours to some of the project sites were organized for the visitors.

Climatic, soil, and budgetary constraints, as well as staff retrenchment and transfers have been some of the major problems that have affected the SWMU's productivity. The unit's personnel persisted with an appreciably high working morale to achieve the unit's goals and objectives.

ACCOMPLISHMENTS

SWMU's achievements in relation to the goals set are as follows:

I. Rehabilitation of rainfed ricelands, including saline affected areas.

II. Upland conservation to control soil erosion and increase water infiltration for crop production.

III. Continuation of OMVG's Soil Survey Program.

IV. Increasing the Gambian public's awareness and understanding of soil and water conservation through educational and/or promotional activities using visual and audio-visual aids, lectures, and meetings.

V. Assistance to other agencies of The Gambia Government and to Non-Governmental Organizations associated with land use or land rehabilitation.

I. Rehabilitation of rainfed ricelands, including saline affected areas.

Thirty villages located throughout The Gambia requested for assistance with the problem of salt intrusion and/or water retention. A prioritization survey was conducted from December 15-25, 1986. This resulted in the selection of twelve of the thirty villages that requested soil and water conservation assistance. (See appendix for the basis of priority ratings and selections). Due to various constraints (to be discussed), only seven of the original twelve villages have actually received assistance. The accomplishments in the seven villages are projected in Table 1 which follows.

Some villages received assistance in the form of repairs. Damage to structures caused by heavy storms were reported by the villages: Jarrol, NDemban, Arongkon, Wassadu, and Bullenghat.

TABLE 1

SOIL AND WATER CONSERVATION WORK IN REHABILITATION OF RAINFED AND SALINE AFFECTED RICELANDS

RICELAND REHABILITATION DIKES

Village	Type of Dike	No.	Total Length (M)	Vol. of Earth Moved (M^3)	Area Benefited (Ha)	Avg. Daily Attendance
Kwinella	Dual Purpose	2	1460	7271	27.4	400
Foni Darsilame	" "	1	569	926	2.4	53
Foni Jiramba	" "	1	346	1557	6.5	34
Balangarr	" "	1	1057	1969	75.0	193
Bakendik	" "	1	119	455	14.0	72
Kampassa	" "	1	142	680	2.7	144
Kanmamudu	Water retention	1	216	670	2.5	141
GRAND TOTAL		8	3909	13528	130.5	148

II. Upland conservation to control soil erosion and increase water infiltration for crop production.

Since the results of upland conservation are not seen immediately, farmers reception of its application is not as outstanding as the reception of water retention and salinity dikes for riceland reclaimation. The areas of activity include:

A. CONTOUR BERMS. These ridges along the contour reduce the slope length which helps the infiltration of water and the control of erosion.

B. GULLY CONTROL STRUCTURES. Rock and Brush in alternating layers are put into a gully or waterway to control further erosion. Sediment from the drainage area silts in a gully creating an area which a farmer can cross. Degradation is controlled and excess water is safely removed without further land damage.

C. DIVERSIONS AND WATERWAYS. Diversions are constructed to safely remove excess water from the uplands to an outlet or waterway. This practice is used extensively to protect crops in the low areas. Waterways are constructed to carry excess water from diversions or contour berms down the slope to the lowlands.

D. MANAGEMENT PRACTICES. The construction of mechanical conservation practices alone, in most cases, cannot completely control erosion. Other practices such as strip cropping, contour tillage, brush fallow, and windbreaks are also necessary to effectively complete soil and water conservation control.

The following Table 2 summarizes these areas of activities:

TABLE 2
UPLAND SOIL AND WATER CONSERVATION STRUCTURES
CONTOUR BERMS AND GULLY CONTROL STRUCTURES

Village	Type of Structure	No.	Total	Protected	Benefited
Sare-Ngai	Contour Berms	5	3,500m	20	30
Sintet	Contour Berms	3	1,500m	11	20
TOTAL		8	5,000m	31	50
Sare-Ngai	Rock & Brush Dam	2			
Waterway & Gully Control Structures planned for August in Sintet					

III. OMVG's Soil Survey Program.

The OMVG Regional Pedological Studies of The Gambia River Basin forms an integral part of the 1986/87 soil survey program. The entire soil section was in the field performing this exercise from March 1 to April 15, 1987. The study included both banks of the Sandugu Bolong. Starting from the border with the Republic of Senegal, it stretches along the north bank of the River Gambia to the Bani swamp where the 1985/86 study ended. On the south bank, all the hydromorphic areas between Sankuley- Kunda and Bansang, and the areas around Sare-Soffi were covered. A total of 1294.52 hectares was surveyed. The soils in these areas were

production with the following crops in view: rice, banana, maize, and sugar cane. A full report on the surveyed area is being processed and will be forth coming.

IV. Educational and promotional activities to help increase The Gambian public's awareness and understanding of soil and water conservation.

In accordance with the previous evaluation report which placed emphasis on the need to publicize the unit, several activities have been conducted.

A. COMMISSIONING OF A CONSERVATION DISTRICT. All the necessary preparations for the commissioning ceremony of the Foni Jarrol Conservation District had been arranged, but the event was delayed by administrative protocol beyond the unit's influence. However, the following items have been completed for this event:

1. Five cement monuments were made at specific sites to dedicate barrages to certain people who showed inspiration, leadership, and support to the members of the community.

2. Six small certificates of achievement were made for a number of individuals from the community who were instrumental in the completion of the construction works.

3. A large certificate with an emblem depicting SWMU's work was created. This was to be received by the head of the district (Chief/Sefo) in appreciation of the hard work and participation of the community as a whole.

4. All the other district chiefs and divisional commissioners were invited to attend. Influential farmers identified by the various extension circles were also invited.

5. SWMU received materials and funds from several individuals, organizations and government institutions to support the event.

B. NATIONAL ENVIRONMENTAL DAY FAIR. SWMU participated in a National Environmental Day Fair to help create public awareness about the need for soil and water conservation work in The Gambia. The following materials were presented:

1. Three posters were displayed; photographs showing the unit's field activities, drawings showing soil and water conservation problems and solutions in The Gambia, and an illustration showing a typical soil profile.

2. Demonstration boxes showing the advantages of conservation farming were displayed.

3. A slide-show about the unit's activities was provided.

C. CONSERVATION HANDBOOK. This handbook was designed specifically to educate field workers in SWMU conservation techniques. A draft was printed and distributed to test the book's application in the field before a final printing is produced.

D. BIBLIOGRAPHY LIST OF AGRICULTURE BOOKS. A list of agriculture books was compiled, and will be ordered for the library at The Gambia College for use by students and the general public.

V. Assistance to other Government and Non-Government agencies.

SWMU has provided technical assistance to the following agencies:

A. ACTION-AID THE GAMBIA. A technical feasibility study of land reclamation and development in Kiang West District was carried out in the month of April. The study included twelve villages: Kantong Kunda, Sankandi, Jula Kunda, Manduar, Tankular, Burong, Janneh Kunda, Misira Tenda, Jiffarong, Bajana, Jattaba, and Sandeng. The soils study provided information on salinity levels, soil reaction, exchange acidity, and hydrologic soil groups. The engineering information provided information on design and conservation rehabilitation needs, average watershed slope, drainage area, benefited area, peak discharge rate of a design storm, and tentative design of a structure. A total drainage area of 10,078.0 hectares has been investigated. An

estimated 488 hectares could be directly benefited by the recommended water retention and/or anti salt-intrusion dikes, along with an unknown quantity of upland conservation.

B. ITC TMF Gambia. Assistance was provided to identify rangeland sites. This in effect, is to assist the center in better planning of the range management program.

C. DEPARTMENT OF HYDROMETEOROLOGICAL SERVICES. An exercise similar to the work done for ITC was carried out at the airport.

D. GARD PROJECT. Topographic surveys, benchmark soil surveys, and soil sampling for fertility analysis were carried out for the GARD Project.

Training and Education

SWMU places a great deal of emphasis on training and education of the personnel who work with the unit as well as the Gambian public (farmers, students, and other Gambian officials) in soil and water management problems and practices.

A. PROFESSIONAL TRAINING ABROAD. The remaining SWMU personnel on training abroad (USA) have returned to The Gambia, and are currently working with the unit. They are as follows:

1. Saul Secka, BS Agriculture, Mr. Secka joined the unit on July 8, 1986. He is currently the head of the unit's planning section.

2. Ebrima Sonko, BS Irrigation and Soils. Mr. Sonko joined the unit of August 11, 1986. He is currently the head of the engineering section of the unit.

3. Kebba Bojang, BS Soil Science. Mr. Bojang joined the unit on May 28, 1987. It is anticipated that Kebba may become the assistant head of the soils survey section of the unit.

Except Kebba, who returned very recently, the other two individuals have had the opportunity of working closely with

the more experienced field trained officers. Training has been carried out on a day-to-day basis under the guidance of the technical advisor, Harvey Metz.

B. SWMU PERSONNEL TRAINING. Members of staff have participated in courses offered by other institutions.

1. July 14 to July 28, 1986. Sidi Jarju (current head of the unit), John Fye, Babou Camara, Sissawo Gassama, and Ebrima Saidy attended a course on REMOTE SENSING AND CARTOGRAPHY organized by South Dakota State University at the Management and Development Institute of The Gambia.

2. July 21 to August 29, 1986. John Fye (current head of the soil survey section) attended an advanced course on REMOTE SENSING AND CARTOGRAPHY at the Remote Sensing Institute in Brookings, South Dakota, USA.

3. September 19 to September 25, 1986. Sidi Jarju attended a SECOND WEST AFRICAN INTEGRATED LIVESTOCK SYSTEMS NETWORK WORKSHOP held in Freetown, Sierra Leone. The course was titled "The introduction, intensification, and diversification of the use of animal power in West African farming systems: implications at farm level", and the emphasis was on draft animal power in farming systems. The course was sponsored by Farming Systems Support Project in collaboration with other organizations.

4. November 18 to November 24, 1986. SWMU's soil survey team consisting of John Fye, Babu Camara, Ebrima Saidy and Junkung Ceesay hosted a course on SOIL CLASSIFICATION AND CORRELATION organized by FAO/OMVG. Participants from Senegal, Guinea Conakry, and Guinea Bissau attended the course.

5. January 19 to January 28, 1987. Babou Camara of the soil survey section attended the 8TH WEST AND CENTRAL AFRICAN SOIL CORRELATION AND LAND EVALUATION CONFERENCE held in Yaonde, the Republic of Cameroon.

C. COMMUNITY TRAINING. SWMU personnel have provided sessions about soil and water conservation to various local groups.

1. March 20, 1986. Sidi Jarju gave a lecture to the senior instructors from the twenty-five Agricultural Demonstration Centers formerly known as Mixed-Farming Centers. This was followed by a visit to one of the water conservation structures.

2. March 20, 1987. Sidi Jarju gave a similar lecture to assistant instructors from the same centers at Wellingara (Western Division).

3. March 28, 1987. Sidi Jarju gave a lecture "Introduction to Soil and Water Management in The Gambia" to finalists and semi-finalists of Nusrat High School. A slide show of SWMU's work accompanied the lecture.

4. April 7, 1987. Sidi Jarju accompanied by Lesa Langan (Peace Corps Volunteer) gave a lecture to the Brikama Secondary Technical School students (Western Division) on "The role of SWMU in Gambian Agricultural Development". A slide show was also provided.

5. April 15 to May 10, 1987. Sidi Jarju visited the following primary and secondary technical schools to make arrangements for the possible formation of soil and water conservation clubs: Brikama Secondary Technical School, Koloro Primary School, Sibanor Primary School, and Kwinella Primary School.

6. May 26 to June 23, 1987. SWMU personnel conducted formal classes (lectures and field practicals) at The Gambian College on soil and water conservation.

Consultants

The following consultants visited the unit during 1986/87.

1. March 2, 1987. IFAD consultants Bruce Withers, Civil Engineer, and V. Altarelli Herzog, Socio-Economist, visited the unit and discussed the possibility of having the unit's help in implementing their project within the SWMU system.

2. April 8 to June 7, 1987. Mr. Horace Smith, Soil Scientist from the USA, worked with the soil survey section of the unit. During this time, he assisted in soil descriptions and manuscript writing, and extraction and mounting of soil monoliths for some of the most common soils series in The Gambia. A review of the soil survey section with suggestions for possible changes, and planning and implementation of short and long term plans for the section were also provided.

3. May 12 to 30, 1987. Dr. Fred Madison, Soil Scientist from University of Wisconsin, worked with Horace Smith and the soil survey section on the coordination of soil survey priorities for GARD and SWMU.

Visits and Visitors

July 8, 1986. A team of eleven US Science teachers and a librarian visited the unit for a briefing on SWMU activities in The Gambia.

October 6, 1986. Barry Burnett from USAID/Washington visited the unit's headquarters, and had discussions with the unit Supervisor, the Technical Advisor.

November 11, 1986. A team of officials from USAID/Dakar, William Hanmink, Economist, Jean lebloas, Planning Engineer, and Francis Can, Research and Extension Coordinator, visited SWMU projects in the Foni Jarrol district.

April 14 to April 18, 1987. Harvey Metz, John Fye, and Ebrima Sonko, and other SWMU staff visited soil and water conservation projects in the Cassamance, Senegal, and Guinea Bissau.

April 24, 1987. John Mardock, a GARD consultant from Wisconsin,

Dignitaries

The Presidential "Meet the Farmers Tour" visited SWMU project sites in September, and US Ambassador Horowitz visited project sites in November, 1986.

Constraints

SWMU has again worked under a series of constraints during the 1986/87 Fiscal Year. These constraints are as follows:

A. BUDGETARY CONSTRAINTS. The unit faced a series of budgetary constraints:

1. The night allowance allocation of 3,000 dalasis was inadequate. This allocation was the smallest in all of the Ministry of Agriculture. SWMU night allowance requirements are 2,500 dalasis per month for a peak work period of seven months. 19,192 dalasis was required for the unit's work this year. The additional 16,192 dalasis was contributed by ADP II Project, Brikama Area Council, Agricultural Engineering Unit, Extension Aids Unit, and Crop Protection Service.

2. The operation and maintenance of vehicle allocation for SWMU was 32,410 dalasis. 75% of this amount was used for the purchase of fuel alone. SWMU's operational fleet consists of 5 tractors, 2 landrovers, 3 Nissan Patrol vehicles, 2 Toyota Landcruiser pickups, and 8 motorcycles. Considering SWMU's recurrent involvement in the farm land development program with the goal of increasing yields and saving the soil, USAID came to the rescue in this area of expenses. See Appendix 2 and 3 for comparisons.

3. A ten night per month ceiling for night allowance had to be waved for SWMU. SWMU personnel average twenty- five nights per month at field worksites. It was difficult to have this ruling waved by the Ministry of Finance.

4. It was difficult to receive permission to hire tractor drivers when necessary because of the unavailability of wages

B. SOCIAL, POLITICAL, AND RELIGIOUS CONSTRAINTS. A variety of other constraints affected the unit as well:

1. Traditional circumcision festivals occured in Western Division during the most active period of SWMU's field operations. This season it was difficult to get the farmers to cooperate in projects because of these activities.

2. General elections for The Gambia took place this year. Political campaigns either delayed or cancelled programs in many areas.

3. Ramadan (fast month) came at a very hot and dry period (May/June) this year. At all locations, work was limited to the early hours of the day. This extended the completion time for many projects considerably.

3. Climatic constraints in the form of early rains reduced SWMU's upland conservation activity. Consequently, very few contour berms were constructed.

Summary

SWMU has finished its first year working as a unit under the leadership of the new unit head Sidi Jarju.

The unit has experienced many hardships and set backs which can be expected from a new unit. It has rebounded to the challenges like true professionals.

At the present time the unit is under-staffed. The present staff is not appointed to their proper grades, and the present budget is not adequate to carry out the mandates set down by the Gambia Government, or to service half the requests for assistance received from farmers, other agencies and projects.

The personnel of the unit have gained a great deal of experience this past year in dealing with the soil and water management problems that they have encountered. Since this is a new

encounter, many farmers and Government officials lack the knowledge of solving soil and water management problems. The unit has to work very hard to try to break the tradition of bad farming practices which in many places is destroying the uplands and silting in the swamplands.

With the limited staff, the unit cannot expand to all parts of the country. They must depend on the agricultural assistants in the extension service to help carry out the program. In many cases the agricultural assistants have a very heavy work load and they are reluctant to take on new responsibilities that they are not familiar with. This places extra burdens on the unit because they must train the extension personnel as well as try to convert farmers to new conservation techniques.

The unit believes that the best way to solve this problem is not only to work with the present farmers and agricultural assistants, but to start planting the seed in the minds of the future conservationists. The SWMU personnel have lectured at the Gambia College on soil and water conservation problems and activities. Talks have been given to local schools in hopes of developing conservation clubs.

Lesa Langan has joined SWMU on a short term basis to assist the unit in developing educational and promotional materials on soil and water conservation.

The soil survey section of the unit has had its third consultant to assist in the soil survey program. This section, under the leadership of John Fye, is developing into a very competent section, and is one of the finest in West Africa.

The planning section under the leadership of Saul Secka has had to carry a very heavy load in conservation application this past year. The unit has requested a Resource Conservation Planner who is expected to arrive in September to assist this section in conservation planning techniques. With a bit more training and experience this section has the capability to meet its challenges.

The engineering section under the leadership of Ebrima Sonko is the most understaffed section. The work load is extremely heavy.

Surveys, design layouts, and construction requirements are more than the section can handle. This section needs at least three more well trained personnel to carry out a successful program.

The administrative section under the head of the unit Sidi Jarju is also understaffed. The unit head has to spend too much of his time doing things that a much less qualified person could do. He needs more time to concentrate on the working of the unit, and less time doing menial errands done by him because of the lack of staff.

The unit also has a space problem. The office is too small to accommodate the various sections.

Although the unit has faced many challenges this past year, and worked under many handicaps, there is a feeling that goals have been achieved, and that a great deal of valuable experience in many disciplines have been gained. The unit is looking forward to a more productive year with the next fiscal year.

Respectively submitted

Sidi Jarju

ANNEX 4.7

LOGICAL FRAMEWORK
FOR
SUMMARIZING PROJECT DESIGN

Est Project Completion Date 1978
Date of this Summary June 1977

Project Title GAMBIA SOIL AND WATER MANAGEMENT

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program Goal: The broader objective to which this project contributes: a) Halt/reverse environmental deterioration due to inadequacy of traditional agricultural/pastoral methods. b) Increase/stabilize production of food/forage/wood/cash crops; reduce susceptability to drought, other weather variations. c) Improve institutional capability of GOTG to deliver educational, technical material services to rural population.	Measures of Goal Achievement: a) Reduced soil compaction, surface run-off and erosion on cultivated lands. b) Adoption of techniques to utilize animal manures, crop residues etc., to improve soil conditions. c) Reduction of burning of animal manures and plant residue. d) Aggregate agricultural production increases or decreases less than previously anticipated under adverse conditions. e) Villages and farmers recognize value of the services provided and request assistance from th unit	a) Field observations by specialists. b) Observations of field AI's c) National production estimates. d) Requests for services received from villages and farmers.	Concerning long term value of program/project a) Proper soil/water management is an essential foundation of overall agricultural development program and desired environmental quality.) Appropriate soil/water management chnology can be developed in the ambian cultural and ext. e) Soil/water management is and will remain a high priority of GOTG.
Project Purpose: a) Establish a soil and water management unit within Ministry of Agriculture and National Resources. b) Develop technology for improved agriculture/pastoral methods consistent with Gambian abilities and resources. c) Train Gambian soil and water management specialists and Agricultural Assistants to functional levels of competence in developing solutions to soil and water problems.	Conditions that will indicate purpose has been achieved. End of project status. a) Unit under Gambian direction comprising 10-15 trained specialists. b) Soil/water technical manual printed and adopted by MANR. c) Appropriate soil/water management training courses in operation within MANR training program. d) Village planning and action process developed and documented in training aids and technical manuals.	a) MANR Budget. b) AID evaluation of unit's activities and effectiveness. c) Technical reviews of soil/water management by USDA-SCS. d) Interviews with graduates of training programs.	Affecting purpose to goal link: a) MANR and GOTG will provide adequate policy direction, budgetary support and coordination to enable unit to operate effectively. b) Soil/water management technology developed will be achievable within the financial, physical, (mechanization) and cultural means of Gambian farmers. c) Appropriate techniques and concepts will be accepted by Gambian farmers as being in their own best interests.
Outputs: a) Functioning, trained soil/water management staff, both at headquarters and in field. b) Soil/water management manual to document technology and action process. c) Resource inventories, (soil, vegetative, hydrologic surveys) for selected villages as basis for soil/water management planning.	Magnitude of Outputs necessary and sufficient to achieve purpose. a) Manual printed and distributed in adequate quantity for users. b) 10-15 villages assisted with village planning and action process. c) 3-4 Administrative leaders trained. 8-10 technical specialists trained on the job. 8 specialists completed academic training in US. 100-125 Agricultural Assistants trained in general concepts.	a) Visit cooperating villages to evaluate extent of acceptance. b) Feedback from Agricultural Assistants on value and utility of technical manual. c) Training certificate received training records, Student's evaluations of courses	Affecting output to purpose link: a) Technical capability for development of manual will exist in unit staff as supplemented by short-term consultants. b) Village planning and action process can gradually overcome the cu... vation and reluctance to adopt new te... niques characteristic of Gambian villagers. c) Agricultural Assistants will find soil/water management technology a useful and valuable addition to their
Inputs: Activities and Types of Resources a) Expatriate team of interdisciplinary specialists (conservation planner, soil scientist, plant ecologist). b) Short-term consultants. c) Long-term training abroad. d) Local training. e) Commodities and misc. sup... f) Housing of US team.	Level of Effort/Expenditure for each activity. a) 3 US technical staff for 3 years (9 M/Y Phase I) = $720,000; (4 M/Y Phase II)=$360,000. b) 24 man/months of short-term consultants Phase I = $180,000; 12 m/m Phase II $102,000; 48 m/m Phase III $480,000. c) Funding for 8 Gambians to be trained abroad Phase I, 4 in Phase II = $120,000. d) On-site efforts of US team to produce local training inputs. e) Commodities: vehicles, office and lab. equipment, household furnishings, technical library, $71,800, total. f) Construction of 3 houses - $180,000	a) AID Controller Records b) Project records and reports. c) GOTG/MANR Budgets/Reports	Affecting input to output link: technical skills. a) MANR will recruit and assign qualified staff to SWMU. b) US team leader and MANR officials can select qualified candidates and arrange appropriate training program. c) Adequate supplies, commodities, and equipment can be scheduled, purchased and delivered on-site on a timely basis. d) GOTG can and will provide inputs (including personnel, maintenance and support) as shown in project description and financial plan.

DEVELOPMENT HYPOTHESES

If Purpose, Then Goal

If Outputs, Then Purpose

If Inputs, Then Outputs

MANAGEABLE INTEREST

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ANNEX 4.8

LONG TERM TRAINING

PARTICIPANT	DISCIPLINE	81	82	83	84	85	86	87	88		COMMENTS
Samuel Davies	Resource Mgt.			(XXXXXXXXXXXXXXXX)(//) M.S.							Retired from GOTG.
Sidi N. Jarju	Ag. Eng. (Mech.)			(XXXXXXXXXXXXXXXXXXX)(/////////) B.S.							Returned to SWMU.
John S. Fye	Soil Science		(XXXXXXXXXXXX)(/////////////////////////////////) B.S.								Returned to SWMU.
Sissano S. Gassama	Range Science		(XXXXXXXXXXXXXXXXXXXXXXXXXXXX)(/////////////////) B.S.								Returned to SWMU.
Matarr Cham	Forestry			(XXXXXXXXXXXXXXXXXXX)(/////////////////) B.S.							Needs to complete B.S.
Ebrima O. Sonko	Ag. Eng. (S & W)			(XXXXXXXXXXXXXXXXXXXXXXXXXXXX)(/////////) B.S.							Returned to SWMU.
Sulayman Secka	Agronomy			(XXXXXXXXXXXXXXXXXXXXXXXXXXXX)(/////////) B.S.							Returned to SWMU.
Kabir S. Sonko	Agronomy			(XXXXXXXXXXXXXXXXXXXXXXXXXXXX)(/////////) B.S.							Returned to SWMU.
Kebba Bojang	Soil Science			(XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX)///) B.S.							Needs more OJT.
Tamara S. Badjie	General Ag.			(XXXXXXXXXXXXXXXX)					2yr. diploma (Nigeria)		Dept. of Water Resources.
Nyan[illegible]ldeh	General Ag.			(XXXXXXXXXXXXXXXX)					2yr. diploma (Nigeria)		Training Unit.
Babo [illegible]mara	General Ag.			(XXXXXXXXXXXXXXXX)(/////////////////)					2yr. diploma (Nigeria)		Returned to SWMU.
Dembo Jaiteh	General Ag.			(XXXXXXXXXXXXXXXX)					2yr. diploma (Nigeria)		Seconded to Extension.
Dodou Jallow	General Ag.			(XXXXXXXXXXXXXXXX)(/////////////////)					2yr. diploma (Nigeria)		Returned to SWMU.
Sheriff Kolley	General Ag.			(XXXXXXXXXXXXXXXX)					2yr. diploma (Nigeria)		Seconded to Cotton Project.
Kebba Manka	General Ag.			(XXXXXXXXXXXXXXXX)(/////////////////)					2yr. diploma (Nigeria)		Returned to SWMU.
Ebrima Saidy	General Ag.			(XXXXXXXXXXXXXXXX)(/////////////////)					2yr. diploma (Nigeria)		Returned to SWMU.
Yaya Sarr	General Ag.			(XXXXXXXXXXXXXXXX)(/////////////////)					2yr. diploma (Nigeria)		Returned to SWMU.
Ebrima Senghore	General Ag.			(XXXXXXXXXXXXXXXX)(/////////////////)					2yr. diploma (Nigeria)		Returned to SWMU.

(XXXXXXXXXXXXXXXX) Long-term training.

(/////////////////) OJT received.

APPENDIX 1

SWMU's APPROVED BUDGET FOR FISCAL YEAR 1986/87
DETAILS OF EXPENDITURE

Head 15, Sub-head 12 (Soil and Water Management)

		Requested Budget	Approved Budget
010	Salaries	67,274	65,250
020	Allowances	21,830	23,020
030	Wages	6,625	6,800
105	Night Allowances	10,540	3,000
170	Miscellaneous Office Expenses	16,400	8,000
210	Vehicle Operation/Maintenance	37,000	32,410
	TOTALS	159,669	138,480

APPENDIX 2

USAID CONTRIBUTION TOWARDS:

OPERATION AND MAINTENANCE OF SWMU VEHICLES

Expenditure on Fuel (Diesel & Petrol)

July 1986	4,485.25
August 1986	4,300.00
September 1986	344.25
October 1986	1,925.37
November 1986	4,660.57
December 1986	3,001.05
TOTAL	D14,846.49
January 1987	1,198.16
February 1987	4,561.97
March 1987	5,923.66
April 1987	7,414.97
May 1987	8,465.70
June 1987	4,088.60
TOTAL	D31,653.06
GRAND TOTAL	D46,499.55

APPENDIX 3

USAID CONTRIBUTION TOWARDS:

OPERATION AND MAINTENANCE OF SWMU VEHICLES

Expenditure on Maintenance (Parts Purchase Included)

July 1986	1,376.00
September 1986	6,558.61
November 1986	3,429.74
December 1986	1,376.89
TOTAL	D12,741.24
March 1987	34,389.41*
May 1987	9,123.75
June 1987	5,791.50
TOTAL	49,304.66
GRAND TOTAL	D62,045.90

* Includes complete overhaul of Nissan Patrol-SWMA 1, D31,932.44.

USAID also purchased one Nissan Patrol at D153,000.00.