CEER- E60 REPORT OF CONSULTING EPIDEMIOLOGIST FOR BLUE NILE HEALTH PROJECT, SUDAN. SUBMITTED BY HENRY NEGRON APONTE, MD, DIVISION OF ENVIRONMENTAL HEALTH, CENTER FOR ENERGY AND ENVIRONMENT RESEARCH, UNIVERSITY OF PUERTO RICO, USA, 1979.

CEER- E69 REPORT OF CONSULTING EPIDEMIOLOGIST FOR BLUE NILE HEALTH PROJECT by Henry Negron Aponte, MD. October 26 through November 5, 1979, Barakat and Khartoum, Sudan. Puerto Rico Department of Health and Environmental Health and Impact Division, Center for Energy and Environment Research, Caparra Heights Station, Puerto Rico 00985.

I. Introduction

The Blue Nile Health Project is divided into 3 zones. In the Rahad Scheme, presently available control measures will be used to prevent malaria and bilharzia transmission from becoming a serious problem (Map 1). In the 2 million acres of the Gezira-Managil Scheme, improved methods and strategies will be gradually applied on an operational basis, as they become available from present knowledge and from the Study Zone (Table 1). The Study Zone near Abu Usher in the northern Gezira will be given an intensive epidemiological baseline survey in 1980, before the introduction of an integrated comprehensive control strategy to decrease the water-associated diseases. The Study Zone includes 55 villages in blocks 26 and 27 of the Mahereiba Council on Wadhabuba Group IV where control will be started in 1981, and 28 villages in other parts of the Gezira, Managil Scheme, which will be monitored (Area 6-H) (Untreated Surveillance Areas until 1985). This consultant participated in the planning sessions and this report covers the period during and after the meeting of the First Scientific Advisory Group (SAG-1) for the Blue Nile Health Project. It includes specific recommendations for items not completely covered in SAG-1, the size of epidemiological samples to be taken in each Zone, the manner of selection of the samples, the timing of the sampling, and the age-groups to be involved. These recommendations are aimed at achieving

The most cost-effective manner of evaluating human disease transmission is the project. For the evaluation of Bilharzia transmission, the most useful and sensitive measure of changes in transmission will be achieved by a yearly prevalence survey of a specific age group with the measurement of the rate of passage of Schistosoma eggs per gram in the excreta. From this, it will be possible to calculate the total Schistosome egg output of the human population in the endemic zones. This parameter is more useful and reliable than estimates of incidence. See Appendix 6.

2. LOCATION OF BLUE NILE IRRIGATION SYSTEMS AND PROPOSED PROJECT IN GEZIRA-MANAGIL. Junaid Scheme STUDY AREA ABU USHER 9 20 40 60 Kilometers.

Page 3 is unclear and appears to have typographical errors.

It's more sensitive to changes in transmission than incidence or prevalence, which could be due to therapy or other control measures.

1.2 Calculation of sample sizes

The following calculations indicate the estimated numbers of persons and villages to be sampled, the estimated workload, and the number of microscopists needed.

Rahad Area: From the Rahad area, 8 villages out of 30 have been selected. From these, a sample of 10% of the people and all the school children should be tested for malaria, S. haematobium and other parasites, as recommended at SAG-I. I recommend that the concept of village area should be applied. A census of all the people in the village areas should be conducted, and maps with households and members of families should be prepared. The census sheet shown on page 2 will be the document where all participants, their personal information is recorded.

Results will be collected from each survey yearly. This document will be used by the statistical unit for follow-up tabulation and analysis and should be stored in cardboard. The individuals who conduct the census can use the same data sheet, made from plain mimeograph paper. Sample collectors can also use this sheet, which should accompany the sample to the laboratory. Each sample should be appropriately identified with a number that includes: Area number (one digit, Rahad=1, Monitor=2, Study Zone=3); Block Number (three digits); Village area number (two digits); Household number (three digits); and Household member number (two digits from 1 to 10 or more). This will provide an eleven-digit identification number for each participant.

The census sheet should include the name of the person conducting the census and collecting the samples. The date of the census, collection of samples, and laboratory testing should be noted, along with the village area name. Eight village areas in the Rahad will have a population of 8 to 10,000 people. From these 10,000 people, the age group of 2 to 9 years would include approximately 2,580 children (10 x 258%). The number of slides to be derived from this population will be 2,580 x 2, which equals 5,160 slides. This work will be completed by two microscopists within one year.

The age group of 2 to 9 years is preferred for evaluation because it is a total population segment where all individuals should be sampled. This should yield a better answer than a 10% sample, which could be highly variable and erratic since diseases such as malaria, schistosomiasis, and other parasites are not evenly distributed throughout the population. If the rest of the population is to be diagnosed for treatment purposes as a preventive measure and funds to purchase drugs are available, then the entire population should be examined. If the goal is to determine when autochthonous infection in Rahad begins, I recommend expanding the sample by age groups according to your capacity to hire and train microscopists.

Increases and at the same time, treat all positives as they are found. A vertical sample of the population should indicate who is passing the greatest number of eggs, but you must corroborate this fact with water pollution and water contact practices of these individuals with high egg counts. Are they the main contributors to the continuity of the parasite cycle? See Appendix 1.

Migrant workers coming to Rahad during the months of January and February amount to 50,000 or an increase of half of the population which exists there now (90,000). The malaria programme treats all migrant laborers that come in through the official hiring system. For schistosomiasis several questions must be answered: Where do they come from? Is their place of origin endemic or not? To what disease? Have they been to the Gezira or any other endemic area before? On the basis of these questions, a decision must be taken whether to make a diagnosis on him or not. As a means of checking the truth of their answers, to the above questions, I would test 8 percent of the supposedly negative population to verify the assumption. The first year in the Rahad, since there are no snails present in the irrigation system, I would investigate the cost and time of doing diagnosis and treat selectively vs. the cost and time of mass drug treatment of migrants. In the malaria programme during October 1978 in seven villages surveyed within the Rahad, out of an approximate population of 75,000 people, a sample of 824 children were found to have a positive rate of 0.9% for parasitemia. I was informed that during 1979 a positive rate of 20% was found, but there are no details on the type of sample taken and where or who were the most severely affected. Dr. Haridi will investigate. Dr. Itamid Amin is training 10 or 11 microscopists for the Rahad Area starting November 10 or 12, 1979. With this number of microscopists in Rahad they will be able to produce 10 x 500, 500 x 20=10,000 slides/month or more which would be about 2,500 individuals.

Tests for S. mansoni and haematobium were conducted, where 4 slides would be processed per individual. In a span of 2 months, 5,000 individuals can be diagnosed, that is probably the amount of migrant labor present in the 8 selected villages.

It should be noted that one of the villages sampled by the malaria program has 2 to 3,000 inhabitants. It is an old established village named Khiari. This is the maximum size village which the Program should be involved with, unless there is no other choice and transmission is present.

8. Monitor Areas (Gezira-Hanagil)

The consensus of the opinion in the Scientific Advisory Group was for the surveillance sample to be taken in 28 village areas from the 18 Groups of the Gezira-Hanagil Irrigation System (Total villages 1,936). After examining the prevalence survey performed by the malaria program, where 9 councils and 29 villages within them are sampled, deriving from each of them 20 to 100 slides from children of 2 to 9 years of age, it appears that this sample is insufficient for malaria as well as for Schistosomiasis (See Appendix 4).

The following is recommended for the Gezira-Hanagil Irrigation System:

A minimal monitoring sample (if finances permit, a larger number of villages should be monitored) from 16 Groups. A listing of existing permanent, registered villages with approximate population from the Malaria Program should be made and located on a map of the Gezira Board. Two villages from each Group should be selected in the following manner:

NOTE: ALL villages or towns with more than 3,000 population should be excluded from this selection. The reasoning is that towns with more than 3,000 people are too complex in their mobility, have a better socio-economic status and are less than ten percent of the total villages in the Gezira-Managil area.

*Groups/Irrigation Block Area- Not to be confused with Councils. (See Appendix #6).

Select from a random table the number that will correspond to the first village and locate it on the map for each.

Group* Once the first village is located on the map, select the village that is farthest away from the first as the second village to be monitored in that group. The reasoning is that if both villages are selected at random, they might be next to each other, and an even distribution of the monitoring villages would not be possible. With such a small number of villages to monitor, an even distribution should provide the best estimate. Otherwise, a representative sample (which would be too large and, with the available information, impossible to select) would have to be procured in time. The 28 villages would yield a population of approximately 28,000 people: 28 x 258 = 7,224 children. Thus, the sample size for the 28 village areas (of 2 to 9-year-old children) would be 7,224. These 7,224 children would generate 7,224 x 536,120 slides. One microscopist reviews 50 slides per day, and in nine months, he would review 50 x 100 slides, therefore 2120 / 5 = 16 or six (6) microscopists are needed to perform the work derived from 28 village areas sampling 2 to 9-year-old children, in one year. Two months of the year, these microscopists can be moved to the Study Area to help conduct the survey of the migrant labour. Note: the microscopists are calculated on the basis of coping with the workload generated by the surveys performed and can be used for other services in hospitals or health centers. If such a responsibility is given to them, some arrangement must be made to fulfill the commitment of the Study Area and the monitored area workloads, which have not taken into consideration the existing malaria program microscopists, since their present participation in the annual “See Appendix 6.

10 Prevalence survey is limited to 5 microscopists for 10 to 15 days. The rest of the time, they are doing slides from hospitals and health centers from people who have a fever and are suspected of having malaria (case detection).

C. Study Zone

According to the malaria main office, Wad Nedani, the blocks have the following characteristics: Block 26 Registered villages 2 Unregistered villages.

Office of Bridges (Block) °Total population 19,748. No. of families 3,209. Block 27 Registered villages, unregistered villages 6. Offices and bridges (block) 9. Total population 10,470. No. of families 1,939.

If twenty village areas are to be selected from the existing fifty registered villages and the surrounding unregistered villages, temporary labour camps and scattered thatched households, that would be 40% of the village areas in which a sector of the population would be monitored (2 to 9 year olds from the existing households). The age group of 2-9 year olds was selected to test for malaria from the malaria data (Dr. Haridl, see Appendix 2 and 5). The village areas are mapped and the households are located and numbered. The malaria spraying data is used to identify families living in households and a census to obtain pertinent information is conducted.

From this census, the households and families to be examined in each village area are marked and the population determined (2 to 9 year olds). An estimate of the population to be examined in the study area is as follows: Block 26 has from 20,000 to 24,000 (in 23 villages) permanent population (from malaria spraying data), 6,000 migrant transient labourers (fellata etc.) are estimated. Block 27 has from 10,000 to 16,000 (in 17 villages) permanent population (from malaria spraying data), 4,000 migrant transient labourers are estimated.

Thus, for the permanent population, a minimum of 40,000 people and a maximum of 50,000 people in 40 villages in blocks 26 and 27 are estimated. The number of children to be examined of 2 to 9 years of age would be: 40% of 40 x 258 = 1,128 or 40% of 50 x 256 = 5,160.

One blood smear for malaria is taken. One faecal sample for ova and parasites is obtained and one urine sample for S. haematobium is collected.

See Appendix 1 for Life Table Estimate. 258 children per 1000 population. The amount of slides derived from the samples is as follows: Malaria 1, S. mansoni 3, S. haematobium. Total Number of slides.

Per person: 5

In the Study Area for the permanent population, the total number of slides to be collected are: Max. 5,160 x $225,500 Min. 4,128 x $220,640. One microscopist can review 50 slides per day, so the number of slides reviewed in nine months will be 50 x 140=7,000 slides. To review the slides of the Study Area, we would need a minimum of 2,5800 microscopists.

During the months of January and February when the migrant labor is picking cotton, all activities should move towards this population. If we estimate that there will be a population of laborers in the Study Area of 10,000 people, the available four microscopists should be able to process 8,000 slides during the two months. This would amount to 17% of the work load of slides that can be derived from this population.

For malaria, no slides need to be taken and all should be treated when they come into the area. For Schistosomiasis mansoni and haematobium, the persons will be questioned during the census as to their place of origin and if they have been to the Gezira or other endemic areas before. According to information given in Sudan, this would eliminate approximately 30-40% of the population. Although a sample of these so-called negatives should be done to ascertain the judgment, this would leave 6 to 7,000 people to examine. If four (4) slides are derived per person, that would mean that the 8 microscopists could do one quarter of these samples, and the microscopists would have to be increased to 16 during two months.

Probably during the first year of work, an investigation should be performed to determine if it would be more economical (depending on the cost of the drug) to treat them all at the very beginning, since it is known that S. haematobium is more prevalent in this population. This may help to bring down the cost of control with Hetifonate. It also may be possible that during the two months (January and February) of cotton picking when the migrant workers are present in the Study Zone, the microscopists of the...

reviewed:

Monitoring area and quality control can help to manage the workload in the Study Zone.

9. Quality Control
The malaria program reviews all positive malaria slides and 10% of the negatives. This system should be continued for three diseases involved: malaria, Schistosomiasis haematobium, and Schistosomiasis mansoni. Therefore, a special group should be established to perform this responsibility under the direction of either Dr. Asim Hussein or Dr. Osman Zubeir.

1. The number of malaria slides derived from Rahad, Monitor (G-M), and Study Area will be as follows:

Area Number of 2 to 9-year-olds:
Rahad: 2,580
Monitor (G-M): 7,224
Study Zone: 5,169
Total Malaria: 14,968 Slides per year

Positive malaria slides to be reviewed: 14,964 x .186* =2,783 slides
Negative slides to be reviewed: (14,964 - 2,783) x .10=1,008 slides,
Total malaria slides to be reviewed: 1,791 slides.

*Average percent of positive cases for malaria in 2 to 9-year-olds from life curve and malaria prevalence (Appendix 1 and 3).

2. The number of positive S. mansoni slides derived from Rahad, Monitor (G-M), and Study Area will be as follows:

Number of positive 2 to 9-year-olds:
Rahad: 2,580 x .20% x 3 = 516 x 3 = 1,548
Monitor (G-M): 7,224 x .3524* x 3= 2,549 x 3 = 7,629
Study Zone: 5,160 x .3524* x 3 = 1,816 x 3 = 5,489
Total S. mansoni: 14,626 slides.

Positive slides to be reviewed. Negative slides for S. mansoni to be reviewed: (14,964 x 3)- 14,626 x .10 = 3,027 slides.
Total S. mansoni slides to be reviewed: 17,653 slides.

*Estimated 20% prevalence for Rahad.
*Average percent of positive cases for mansoni in 2 to 9-year-olds from Life curve and S. mansoni prevalence (Appendix 1 and 2).

3. The number of positive S. haematobium slides derived from Rahad, Monitor (G-4), and Study Area will be as follows:

Number of positive 2 to 9-year-olds:
Rahad Monitor (G-M): 14,964 x .10** = 1,496

Study Zone: Total S. haematobium slides to be reviewed.

Negative slides for S. haematobium to be reviewed: (14,964 - 1,496) x .10 = 1,397 slides.
Total S. haematobium slides to be reviewed.

Reviewed = 2,843 slides. See Appendix 5.

As for the amount of slides to be derived in two months from migrant labour in the Study Zone, the following calculations can be made:

Average S. mansoni slides = 7,500 x 3 = 22,500 slides.

Average S. haematobium slides = 1,500 x 1 = 1,500 slides.

Positive slides for S. mansoni = 2,000 x .15* = 300 slides.

Positive slides for S. haematobium = 7,300 x .02 = 146 slides.

Total number of positive slides to be reviewed = 5,550 slides.

Number of negative slides to be reviewed = (29,500 - 5,550) = 23,950 slides.

Total number of slides from migrant labour to be reviewed in the Study Zone = 7,945 slides.

Total slides reviewed will be 3,791 + 17,4659 + 2,68 + 7,985 = 22,292 slides.

To review these slides, we would need: 22,292 slides / 5 microscopists.

NOTE: Only the Study Zone migrant labour slides WILL have quality control done, unless there is more personnel to perform the test. This trial shows that under the limitation of time, the therapy trial for migrant labour diagnosis and therapy from the point of view of cost and time should be considered.

The total number of microscopists per year of workload is as follows:

Rana Area: 2

Monitor Area (C-#): 5

Study Zone: 5

Quality Control: 5

Total: 17 microscopists

*Percentages informed by Dr. My A. Amin. (From C. H. Teesdale and H. A. Amin, Appendix 5).

As for the timing of sampling and laboratory facilities, the timing of the sampling will have to depend on the available personnel to procure and process the samples. The economical problem which will limit sample size will limit timing. Prevalence and egg counts per gram of feces each year should answer all epidemiological questions, as far as evaluation is concerned, as long as all or nearly all people selected in the sample are tested. If more than one survey is done per year, seasonal transmission can be assessed, if present. This could be so for malaria and for S. haematobium, especially during or after the rainy season, but not for S. mansoni. In the Study Area where intense surveillance will be important and if the

If the economy permits, a prevalence, incidence, and egg count per gram of feces would allow for a more thorough analysis at double the cost. Furthermore, it would provide good training for the personnel and the organization of the task would be improved for future years. The surplus personnel would be used to increase the age group studied and also to follow up cohorts. All of this depends on the economy (money). The laboratory facilities should be located at Rahad for that area, Abu Usher for blocks 26 and 27, and at Wad Hedani for Quality Control. If possible, for the Monitor Area (C-1), the microscopists should be strategically located to minimize travel time. It might be feasible to place them in rural hospitals, provided that services to the hospitals are done, as long as it does not interfere with the main responsibility of the program. A centralized laboratory is very ideal as long as transportation and gasoline are available since the cost would increase. The quality of work and management of personnel would be improved in a central laboratory, but decentralized laboratories can maintain good quality of work, when quality control is well performed and timely. Continued training and unknown test samples, unknown to the microscopists but known to the central laboratory, should be periodically given to the microscopists from the central laboratory as part of their routine, to see how well they perform. Studies that should be conducted in this project as soon as possible include a comparative study in Dr. Anin's laboratory of (a) the formal-ether fecal examination modified by Ms. W. Knight, (b) the Teesdale-Anin modified Kato method, and (c) the sedimentation method by Hoffman, in egg passers of high, medium, and low quantity (1,000+, 500, and 50 eggs or less). Approximately 1,000 or more stools should be run (50 stools/day, one month for each test, and 3 months of work for the total comparative trial). This study would determine the specificity and sensitivity of all the tests and would.

The following text serves as a reference for future work, especially if control is successful in the Cezira-Hanagil and Rahad Schemes. The problem of defining a village area is not as simple in the Gevirs as it is in Rahad. This is very important when trying to evaluate control efforts by means of prevalence, incidence, and changes in egg load within the studied population.

It's well known that a newborn gives an indication of the home environment since most of their time is spent there. As the child starts to walk within the house and outside, their environment increases in size. As soon as they reach school age and start walking to school, their environment expands again, encompassing the area around their school. Thus, as time goes by, the size of their environment increases in relation to various circumstances of their development.

If we are to evaluate children aged 2 to 9, it would be crucial to understand the size of the environment they represent. If the age groups are increased, which would logically enhance the sample size, the environment in which the sampled individuals move should be the unit evaluated every time this is done in each community.

A study of this complex behavioral pattern should be conducted to understand the results found by the diagnostic tests. It may be possible that tenants with land in various areas work several days in one area and several days in another. The same could happen to a laborer or a traveling merchant in a village or any adult in the village. Additionally, students of intermediate and higher educational levels often leave their villages for school. These people's environments are quite large and do not represent their village's endemic status.

The data derived from hospitals and health centers should be analyzed and morbidity studies for diseases such as malaria and schistosomiasis should be conducted. This will take advantage of this information for the proper planning of health services.

The original text contains a mixture of valid sentences and unintelligible strings of characters. Here is the corrected part of the text:

"Budgeting and distribution of human and material resources are crucial. The malaria program does a lot of diagnosis of malaria throughout the Gezira. I believe that this information would help tremendously in the planning of malaria control efforts. The same can be said for other diseases. Finally, I wish to thank all the people, both nationals and international, as well as WHO personnel who helped me through these two weeks of work in Sudan."

Unfortunately, the rest of the text appears to be encoded or corrupted and cannot be corrected without further context or information.

I'm sorry, but the provided text seems to be a mix of random characters and symbols. It doesn't form coherent sentences or convey a clear message. Please provide clear and structured text for me to assist you further.

The text is not clear. They may be rolled over to expose the spine by moving the 'coverslip', or they may be viewed under higher power (X 100). Scanning is done at X 40 magnification. Initial prevalence studies indicated that villagers, although keen at first to be examined, soon became unenthusiastic when asked for further re-examinations. There would be too large a proportion who would not cooperate in subsequent re-examinations. Evaluation was therefore based on incidence and prevalence rates in younger school children, aged 7-10 years. However, as can be seen from Table 1 and Fig. 1, the prevalence of the disease was so high in these children that there were too few children found negative to constitute sufficient numbers to make up new cohorts for future examinations in incidence studies, unless a very large number of schools were included in the study. The personnel required for this work was not available and, instead, it was decided to investigate the 3-6 year old pre-school children in certain villages to help make up the negative cohorts. It is important to note that prevalence was higher in the area where chemical control (by Fresco) was to be applied. Schistosoma haematobium infection tended to be focal and generally much less prevalent than S. mansoni infection and was not included in the assessment (Table 2).

Table 1. Prevalence of Schistosoma mansoni infection in children aged 3-10 years in the control non-treated area.

Table 2. Prevalence of Schistosoma haematobium infection in children aged up to 10 years in the latter part of 1973.

When conversions (+ to -) and reversions (- to +) are considered (Table 4), a trend towards a reduction in prevalence in the treated area is evident. This must be held in light of the fact that there was a higher prevalence rate in the treated area originally. The trend in the non-treated area is for a rise in prevalence.

4. Prevalence of Schistosomiasis in Geta: An examination conducted over two months in 1995 revealed significant findings. Table 5 presents the results from re-examination of those children that tested positive at the beginning of the assessment. The trend indicates a reduction in the intensity of the infection in the treated area. The infection with Schistosoma mansoni in Geta school children was reassessed 21 months after the beginning of the assessment. There was a significant reduction in some areas compared to those where no method of eradication has been applied. One exception was a village (Aidaid) which showed an increase in the intensity of infection as measured by egg load.

Preliminary assessment of the molluscicide control measures in the Gezira irrigated area in Sudan, using a thick smear stool examination technique, indicates that after only 21 months in a longitudinal study there was a reduction in prevalence where chemicals have been applied to the canals. The intensity of infection, measured by egg loads, has also dropped in the treated area. Meanwhile, in the non-treated area, prevalence and intensity of infection are rising.

7. INCIDENCE AND PREVALENCE OF SCHISTOSOMA MANSONI

Obtaining stool samples from school children was relatively simple since discipline is strict and the teachers are very willing to cooperate. If a child was not able to produce a sample, no pressure was put upon him to do so and it was collected on a subsequent visit. For the 3-6 year old children, it was necessary to number the houses in the village and approach each one in turn to ask for cooperation. Each child was given a card bearing his name, age, serial number, and house number, and he was asked to deliver his sample to the dispensary in the container provided. Older brothers and sisters were asked to help whenever possible and on arrival.

The children were rewarded with sweets for providing stool samples. Those unable to produce a sample were also rewarded to minimize the production of borrowed or animal stools in order to obtain the reward. Without this incentive system, the response was very poor, and the success of collection depended heavily on it.

Three slides with 25mg of stool were examined for each stool specimen. If the sample was negative, another three slides were examined from a subsequent day's stool. This procedure was repeated on the third day before a child was considered negative. For reassessment every 6 months, only one stool sample was taken into account due to the workload involved. However, in the final assessment, three stool samples will again be examined to identify negatives.

The assessment of the 36-year-old children began six months after the school children, and it is considered too early to place any significance on the results collected so far. The results of the remaining tables, therefore, involve only the school children 21 months after the beginning of the assessment period.

Table 3 shows a difference in the incidence rates of about 10% between the treated and non-treated areas. This does not appear significant. However, when the number of conversions (negative to positive) is considered...

(Table 3: Incidence of Schistosoma mansoni infection in a certain school, 21 months after being assigned a specific status. Results are shown for both treated and non-treated boys and girls.)

Appendix 6-1: Gezira-Managil Irrigation System (Gezira Board Irrigation Groups)

Group Number - Block - Block Name - Number of Village Areas and Name Number

1 - South 1 - Heg Absalla
2 - Fanat 2 - El Guubshan, Wad Taaman
3 - El Hosh
4 - El Remetab
5 - Wad El Atat
6 - Wad El Haddad
7 - Center 8 - Hamed Bentni
8 - Seed Farm
9 - Barakat
10 - Barwish
11 - Kunor
12 - El Radna
13 - Abel Hakan
14 - El Medina
15 - Orga
16 - Nur-El-Vin
17 - El Messellemia
18 - Tayiba
19 - El Siteint
20 - El Tebub
21 - Wad El-Bur
22 - Abdel Galit
23 - Wad Saadalia
24 - Abdel Rahman
25 - Wad Hussein
26 - El Nigiana Sea

APPENDIX 6-2 Gezire-Managil Irrigation System (Gezira Board Irrigation Groups)

Group Number | Block Number | Block Name | Number of Village Areas and Home

IV - Wadhadouba | 25 | Wad Sulfa | 26
dolga | 23 | 27 | Istaritna av
28 | EL Rukn | 10% | Wad El Fadi

105 | EL Hadaat | Se V = WadeIshail | 29
C1 Mulela | 30 | Feteis | 31
Amara Kassir | 32 | EL Keteir | 2
Turks | 38 | EL Fawar | VI ~ North
25 | Un De Garst | 36 | De Beiba
37 | Turabi | 38 | Meitig
39 | Kade | 40 | EL Laota
92 | Ruweina | oe VII North West | 41
Abu Gin | 42 | EL Guelz | 43
EL Sudetra | EL Faragin | 45 | Abu Ldeina
46 | Bagiga | 9% = Wadel | €1 Kereit
98 | ‘Abu Quta | ee

APPENDIX 6-3 Gezira-Managil Irrigation System (Gezira Board Irrigation Groups)

Group Number | Block Number | Block Name | Number of Village Areas and Home

VII-Mikasitt | 37 | anad Halle | 48
Abu Digin | 49 | rad | 86
ad AbD | 85 | EL Tonsa | 26
EL Keratied | 97 | EL Nassein | Sa
DX-tuda | 50 | Wad EL Zein | SL
EL Malan | 52 | Shandt | 90
Fereigab | 91 | surnam | 93
Cozel Rehia | 103 | Abdel Magi | eae
23 | € Geltes | 5 | Ras EL FAL
55 | El teins | 56 | Hab Rowe
58 | EL cadia | 59 | EL Kermit
6 | EL Tayer | a | XL-Tahanta
97 | Shatter | 60 | el th teeta
56 | EL Sheweirit | 87 | Un Shadida
88 | Weheiia | 8 | nate | Sa

APPENDIX 6-4 Managil Irrigation System (Gezira Board Irrigation Group)

Group Number | Block Number | Block Name | Number of Village Areas and Home

elmer | 64 | Abu Hana | 65
Kartoub | 66 | EL Hashabe | 67
Un Higletga | 7 | Affan | 72
Fingeirat | i | MUII-Matut | 68
Agouba | EL Tamad | 7 | e
zatir | 3 | e | naytr
7% | Et Yebet | 75 | Rahana
7% | Um Sineita | 77 | Dishewat | rer
XIVecomisi | 78 | EL aut | 79

cabouga | 80 | Abu EL kettik | 81
RanJouk | 62 | Tuwenat | 29
Kuwatit | 100 | Wa Cetatta | 101
sagaat | 102 | EL Waho | Se