WATER RESOURCES FOR WESTERN PROVINCES OF BATTAMBANG, BANTEAY MEAN CHEY, AND PURSAT:

PLANNING FOR IMPROVED POTABLE WATER SUPPLIES FOR EXISTING POPULATIONS OF WESTERN CAMBODIAN PROVINCES AND REPATRIATED REFUGEES FROM THE THAI BORDER

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1. INTRODUCTION

This report addresses the need for improved water supplies for villages in western provinces of Cambodia (Battambang, Banteay Mean Chey, and Pursat Provinces), including existing populations and refugees expected to return from the Thai border after a negotiated settlement.

Information, necessary to plan for improved water supplies and sanitiation faciltities, has been collected during two trips to western provinces; one trip from 27 May to 3 June 1990 by William Barron (Oxfam Rural Water Programme Adviser) who participated in an UNHCR Planning Mission for Repatriation Operations, and one trip from 11 to 20 July 1990 by William Barron and Ching Ping Leung (Water Engineer from Oxfam's Technical Unit) with Ministry of Agriculture personnel from the Inter-ministerial Commission on War Displaced.

UNHCR has been planning for needs of Cambodian refugees who would return voluntarily to Cambodia following a negotiated settlement. It is assumed (as a result of data collected by a Ford Foundation survey conducted at camps on the Thai Border at Site 2, Site 8 and Site B) that more than 60 percent of the total number of refugees are expected to return to western provinces. Potable water supplies are not adequate for the majority of existing populations of western provinces. Therefore, large numbers of refugees from the Thai Border, settling in these western provinces, will drastically increase the demand for improved potable water supplies.

Cambodians have been moving to safe areas (near to Battambang and Banteay Mean Chey Provincial Towns) due to increased fighting over the last 11 months in western provinces. It has been found that domestic water supplies are overall insufficient for the large numbers of war displaced that are settling in Battambang and Sisophon Towns and the surrounding areas. This illustrates the difficulties that will arrise when larger numbers of Cambodian refugees return to western provinces.

Due to a request being made by the Cambodian Ministry of Agriculture, for water wells to be drilled in Battambang and Banteay Mean Chey Provinces, Oxfam Water Engineers have investigated the need for improved water supplies and planned for a programme to begin to address the problem of insufficient water supplies in areas where displaced persons are presently living. Results of drilling to provide wells for war displaced could be useful for future planning of water supply development programmes.

Oxfam Engineers visited proposed sites for Reception Centers, where refugees will initially be received (prior to being resettled), to investigate and propose water systems most appropriate for these temporary centers. Furthermore, Oxfam Engineers held meetings with Provincial Committees, Provincial Agicultural Services, and implemented a village water survey to assess the availability of water supplies in districts where the majority of the refugee population is expected to settle.

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2. GEOGRAPHY AND HYDROGEOLOGY OF THE STUDY AREA

2.1 Introduction

The Provinces of Battambang, Banteay Mean Chey, and Pursat Provinces are geologically and hydrologically diverse areas. There have been few investigations implemented defining hydrological and geological conditions for these provinces. Actual drilling data is limited to define accurately the hydrogeology for these provinces.

Field visits during the Oxfam Mission (by William Barron and Ching Ping Leung), UNHCR Inter-Agency Mission (by William Barron, Oxfam) and the UNHCR Absorption Capacity Survey (by Francois Grunewald, GRET) has allowed general assumptions to be made about the hydrogeology for western provinces. Technical information has been extracted from several reports that are available. These reports are,

"Grand Lac du Cambodge - Sedimentologie et Hydrologie (1962-63)" by J.P. Carbonnel and J. Guiscafre, organized by Ministere des Affaires Etrangeres de la Republique Francaise;

"Ground-Water Resources of Cambodia" by W.C. Rasmussen and G. M. Bradford, Geological Survey Water-Supply paper 1608-P, 1977.

"Le Quaternaire Cambodgien: Stucture et Stratigraphie", by Jean-Pierre Carbonnel, Office de la Recherche Scientifique et Technique Outre-Mer, Paris, 1972

2.2 Rainfall and Surface-Water Resources

Cambodia geographically is a vast low-lying plain, with mountains on the west, an escarpment on the north, and hilly plateaus on the east (refer to Annex 1 - Relief Map for Provinces Surrounding the Great Lake Basin of Cambodia). The major water-ways of Cambodia are the Mekong River and the Tonle Sap. The Tonle Sap is a highly productive fresh-water lake that functions as a huge off-channel storage reservoir for flood flow of the Mekong River and receives surface-water discharge from streams and rivers draining the surrounding watersheds.

It is during the wet-season that 85 percent of annual precipitation falls with rainfall deficient during the dry-season, November through May. Annual rainfall ranges from 1,370 mm in the central lowlands to more than 5,000 mm in the mountainous highlands (refer to Annex 2 - Pluviometric Map for the Great Lake Basin). Minimum rainfall is in January amd maximum rainfall is in October. Monthly rainfall data shows that precipitation for the low-lying areas of Battambang and Pursat

Provinces is similar.

Surface-water is drained for the watersheds in the provinces of Battambang, Banteay Mean Chey, and Pursat by numerous streams and rivers which originate in the mountains of the west and escarpment of the north and eventually empty into the Tonle Sap The major rivers in the western and north-western provinces are the following,

<u>Provinces of Battambang and Banteay Mean Chey</u>
Sangker River
Dauntry River
Mongol Borey River
Sisophon River
Paneth-Preah

<u>Province of Pursat</u>
Pursat River

Data taken for each of these rivers (reported in the "Grand Lac du Cambodge - Sedimentologie et Hydrologie (1962-63)" report) indicates that flowrates for these rivers decreases significantly during the later part of the dry-season (March-April) and maximum flowrate occurs during September and October (refer to Annex 4 - Hydrological Information for Watersheds in Western Provinces). However, it should be noted that this data was taken for a very limited two years time frame and over 25 years ago. Forest cover and hydrological conditions over the last 25 years may have changed. It is suspected that with decreasing forest cover and increasing soil erosion flowrates could have been altered over the years, differences in minimum and maximum flowrates during the dry season and rainy season, respectively, will be more dramatic now in comparison to conditions 25 years ago. However, no actual data exists to prove this.

It has been observed that presently, the Sisophon, Mongol Borey, and Sangker rivers are discharging large amounts of sediment. Cambodians have indicated that over the last 20 years rivers have been increasingly carrying larger sediment loads. These rivers use to be relatively clear as reported by Cambodians who have lived in the area for over 25 years. This could be due to the heavy deforestation activities, resulting in increased top-soil erosion. Specifically, for the Mongol Borey River and Sangker River, heavy mining of gems in the Pailin area in the western mountains contributes significantly to large concentrations of suspended solids in this river. Rivers further east such as the Pursat River and Dauntry River are relatively clear and devoid of heavy sediment loads.

Irrigation systems do exist in these provinces with varying degrees of coverage and level of functionning. The Bovel irrigation network being the most extensive, providing water to the districts of Battambang (Province of Battambang) and Mongol Borey (Province of Banteay Mean Chey) (refer to Annex- 5 Map Showing Irrigation and Dam Structures for Battambang Province: In Process of Being Developed and Proposed Projects). The condition and extent of these irrigation systems is not covered in this report.

2.3 Ground-Water Resources

Little information is available on the safe yield or storage capacity for ground-water resources in western and north-western provinces. However, previous investigations have defined three types of formations for the upper geologic formations of these western and north-western provinces (refer to Annex 6 - Geologic Maps for Great Lake Basin). They are the following:

* young alluvium formation of silt, clay, and sand

* old alluvium formation of silt, clay, and sand with laterite (a secondary deposit containing iron)

* consolidated formations of limestone, granite, and sandstone

The young alluvium formation is the most predominant geologic formation, located in the low-lying plain. It is suspected that underlying the young alluvium formation (at depths unknown) an old alluvium formation will be found, consisting mainly of clayey silt. Likewise, the old alluvium formation is found in the northern area of Banteay Mean Chey on the northern escarpment. The predominant rock type underlying and forming the highlands to the south (Cardamon Mountains) is consolidated sedimentary rocks associated with intrusive igneous rocks. Small pockets of limestone, marl, siltstone, sandstone, and shale can be found at the town of Sisophon and west of the the town of Battambang, and in the mountains south.

Young and Old Alluvium

The young alluvium formation is assumed to yield small to moderate supplies of water of acceptable quality. The young alluvium is composed mainly of sandy silt amd silty clay which has low permeability. Movement of ground water is restricted and even though these geologic formations may be saturated with water, they yield water at slow rates.

However, sandy beds and lenses are thought to be present in the young alluvium, which are more capable of holding and transmitting water than the fine-granined sandy silt and silty clay formations. These sandy beds and lenses are normally found adjacent to the larger streams. Therefore, maximum yields of water from wells are thought to be in those zones surrounding these larger streams. The exact location and depths of sandy beds and lenses in other areas, not adjacent to the larger streams, is unknown.

At deeper depths, underlying the young alluvium, reliable ground water resources could be found from the beds or lenses of sand included within the thicker deposits of old alluvium. But still, the extent of these beds and lenses of sand and their depths is virtually unknown.

Consolidated Formations of Sandstone and Limestone

Sandy alluvial deposits formed from the weathering of sandstone bedrock which overlie areas (where this sandstone rock occurs) has the potential for transmitting water freely. In those areas east of Pursat and west of Kompong Chnnang these deposits have been found and the water yield available from wells is considered to be good.

The water-bearing capacity of limestone located in Sisophon Town and west of Battambang Town is unknown. For those areas where enlarged solution openings (formed by chemical erosion by water) are encountered then substantial water supplies are expected. However, it would be difficult to predict the available yield of water in limestone formations because the location of solution openings is unknown. Water from limestone formations is usually quite hard and contains large quantities of dissolved solids.

3. SURVEY OF EXISTING WATER SUPPLIES AND WATER COLECTTION PATTERNS

3.1 Introduction

UNHCR Phnom Penh requested Oxfam to survey water supplies and water collection patterns for villages of western Cambodia to provide better information for future planning of reintegration assistance programmes. As a result of this request, Oxfam Engineers implemented a limited study for the provinces of Battambang, Banteay Mean Chey, and Pursat, in those districts where large numbers of Cambodian refugees have indicated they will return.

The Ford Foundation Survey of border camps (Site 2, Site B, and Site 8) has shown that large number of refugees are expected to return to Cambodia after a negotiated settlement. Districts of Maung Russey, Sangker, Battambang, Mongol Borey, Bovel, and Bakan were the top 6 districts of expected return for this study with 47.8 percent of the total refugees surveyed saying they would return to these districts (refer to Annex 7.). Assuming the Ford Foundation Survey represents trends for the full refugee population on the Thai Border, then these are the districts of western provinces where the greatest percentage of refugees are expected to return. This water supply study has focused on these districts.

3.2 Survey Methods

Village Water Questionnaire and Drilled Borehole Questionnaire (refer to Annex 9 for Sample Questionnaires) were developed in English and Khmer and given to Provincial Agricultural Service Staff of Banteay Mean Chey, Battambang, and Pursat for completion. During the first visit by William Barron (Oxfam Engineer) to western provinces (with the UNHCR Planning Mission), 27 May to 3 June 1990, Provincial Agricultural Service Staff were asked if they were interested in participating in the survey. All offices of the provinces concerned were very interested in performing the survey. Then, the village water questionnaire and drilled borehole questionnaire was explained to selected staff who were to be responsible for training Agricultural Service staff in the Communes in the completion of questionnaires with the assistance of village leaders. Due to limited access to the study area by Oxfam Engineers, questionnaire pre-testing and monitoring of questionnaire completion was not feasible.

The following numbers of village water questionnaires were given to provincial staff for completion in the following districts. These numbers represent total number of villages in each district, therefore, all villages in districts chosen were to be covered by the survey.

Banteay Mean Chey District

Mongol Borey District	156

Battambang Province

Maung Russey District	98
Battambang	70
Sangker	130
Bovel	61

	359

Pursat Province

Bakan District	136

Information gathered on the village level from implementation of the village water questionnaire has been: population and number families; number total family and village ponds, and dug wells, and number of ponds and wells reliable year-round; number of drilled boreholes; maximum distance walked to collect water; presence of well digging artisans; and water collection/use patterns during the dry season and rainy season.

Drilled borehole questionires were also to be completed, obtaining information on specifics of boreholes and level of functionning.

Questionnaires were kept as short and simple as possible for quick completion and to prevent confusion in recording information. Ennumerators were asked to record information in Khmer. Approximately a month's time was allowed for the completion of questionnaires. Oxfam Engineers returned to western provinces in July and at that time collected completed questionnaires and discussed with the provincial offices of Agricultural Service needs for improvements in water supplies

3.3 Results

Success with the completion of village water questionnaires is varied between provinces. Refer to Annex 10 for complete data set and Annex 11 for totals of selected survey data on population. Of the 156 village water questionnaires given to Banteay Mean Chey Province to be completed for villages of the Mongol Borey District, 58 were completed. This represents 42.2 % of the total population of Mongol Borey District. Of the 359 village water questionnaires given to Battambang Province to be completed for Maung Russey, Battambang, Sangker, and Bovel districts, 155 were completed. This represents 99 %, 44 %,, 64 %, and 0 % of total population of Maung Russey, Sangker, Battambang and Bovel, respectively. Access to Bovel district was reported difficult and the reason why no questionnaires were completed there. Of the 136 village water questionnaires distributed to Pursat Province for the district of Bakan only ten were completed. The data for these 10 villages was not used for the analysis.

Data on water collection/ use patterns were not analyzed because it appears that all enumerators did not accurately complete this part of the questionnaire. Instead, a variable was created using responses for water collection/use, defining whether surface water sources (streams and/ or irrigation canals) could be found nearby. This variable therefore defines access to surface water in villages.

No drilled borehole questionnaires were completed for all provinces. It was reported that for Battambang and Banteay Mean Chey Provinces there were no drilled boreholes for the district surveyed. Pursat Provincial Agricultural Service did not complete questionnaires even though UNICEF boreholes are present in Bakan district.

Refer to Annex 12 for a summary of data on exisitng water supplies for villages surveyed and a determination of percentages (columns 10, 13, and 16) of reliable water sources (family and village ponds, and dug wells) of the total number of water sources surveyed. For all districts these percentages suggest that dug wells are more reliable (provide water during dry and wet season) than village and family ponds in providing water (a greater percentage of total number of dug wells were reported reliable year-round than percentage of family and village ponds reported reliable year-round). And, village ponds are more reliable than family ponds. This trend is more apparent for Battambang Province and Banteay Mean Chey Province and less apparent for Banteay Mean Chey Province. However, statistical calculations were not done on these percentages to show significant difference.

Village ponds and dug wells are communal sources of water. For the sake of performing the analyses a maximum number of 50 households was assumed a reasonable number of households sharing communal sources. Calculated percentages (columns 14 and 17) of surveyed population having reasonable access to reliable village ponds and dug wells suggests for the district of Sangker (Battambang Province) there is an adequate number of of village ponds and dug wells (128 and 298 %, respectively) for the existing population. For the districts of Maung Russy, Battambang, and Mongol Borey reasonable access to reliable sources of water (family and village ponds, and dug wells) is not adequate for the existing population. Percentages (columns 11, 14, and 17) are low inbetween 0.8 % and 42.7 %.

This type of analysis could be done for the Commune level instead of the District level and could show that some communes have greater percentages of reliable sources of water than other communes. These additional analyses were not completed for the data obtained.

3.4 Conclusions

Villagers living in the different zones of western Cambodia collect water for domestic purposes (drinking, bathing, washing, for animal-use, and for small scale vegetable/ fruit production) from a number of different sources. These water sources include surface streams, family and village ponds, rainwater, and wells. Which water source is used by villagers is first defined by the geological and hydrological conditions of the area, second by the availability of resources (funds and time) to dig wells and ponds, and construct rainwater catchment systems, and third by consumer preference.

Rainwater

Rainfall is sufficient for the months May through November and can be depended upon during these months (utilizing rainwater catchement systems and traditional water jars) for storing sufficient quantities of safe water close to the home for domestic water-use purposes of drinking and cooking. Most families collect rainwater and the quantity of rainwater that will be available depends om the size of house-roof and storage container available to the family. This survey has not addressed the extent of rainwater catchment systems for households. Development of household rainwater catchment systems would be a viable approach for improving access to safe water in western provinces.

Rainfall collected in family and village ponds provides water during the wet season (May to November) and during the begining months of the dry season (November to May). This water is considered not potable for human consumption. But communities not adjacent to surface water streams and not having wells depend on these sources of water. For those low-lying alluvial plains in the provinces of Battambang and Banteay Mean Chey, surface soils consist mainly of clay which makes it possible to store large quantities of rainwater in ponds. The permeability of clay is very low. Therefore, for these areas it has been reported that for large deep ponds water can be stored throughout the dry season. Village ponds are normally dug deeper than family ponds which may be the reason why an analysis of data suggests village ponds more reliable than family ponds. However, in the south eastern region of Battambang Province and in Pursat Province surface soils consist of sands making it difficult to store water in both family and village ponds.

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Surface Water

Major rivers have low flowrates during the dry season, especially for the months of February and March. Communities nearby depend upon on these rivers for all domestic water-use purposes (even though it is not potable).

In general, it can be assumed that the majority of villagers are situated adjacent to large streams and irrigation canals and use surface water during the rainy season and the dry season from these sources. Flowrate data (Annex 3.) for different rivers in western provinces shows that less water is available for the Maung River in Maung Russey District than other rivers Data for 1962-1963 shows that during the later part of the dry season this river goes dry for a long period. It was reported that communities living nearby to the Maung River will during the dry season dig temporary wells in the stream bed to find water.

For the large rivers of Battambang and Banteay Mean Chey, these rivers can provide ample supply of nonpotable water to nearby communities. However, these rivers contain large quanities of suspended solids. Villagers report that water has to be stored in water jars for 2 to 3 days to allow for the suspended solids to settle out (before it can be used for drinking). Continued cutting of forests in watersheds will impact on the quality and quantity of water available from streams.

Groundwater

Ground-water resources are virtually un-tapped by communities, with there being a limited number of existing dug shallow wells and only a a few drilled boreholes. Shallow wells do exist but are found mostly adjacent to the large streams, at varying depths, but infrequently at depths greater than 10 meters. Percentages are 25.5 %, 298 %, 30.8 %, and 21.4 % (Column 17) for the surveyed population having reasonable access to reliable dug wells for the districts of Maung Russey, Sangker, Battambang, and Mongol Borey, respectively. Shallow wells located adjacent to large streams are expected to yield sufficient quantities of safe water for western provinces, depending on the depth and condition of wellrings and headwall, and location to sanitation facilities. The potential for ground-water resources in areas of the young and old alluvium is unknown, and the exact location and depths of water-bearing sand formations is unknown.

With the influx of refugees to western provinces it is expected that safe water supplies for existing populations and refugees will not be sufficient. The extent of water supply improvement is dependent on the location of villages that refugees decide to settle. Generally, if refugees reintegrate in villages adjacent to rivers then there will be more dug wells available. It can be assumed that only dug wells, drilled wells, and rainwater will provide sufficient quantities of safe water for refugees. Improvements will be needed in all districts, especially in the district of Maung Russey where water is in severe shortage.

4. PLANNING FOR IMPROVED POTABLE WATER SUPPLIES FOR EXISTING POPULATIONS AND REPATRIATED REFUGEES FROM THE THAI BORDER

4.1 Planning Assumptions

Border Cambodians have been using water that is relatively safe in comparison to the quality of water that is used by Cambodians in the western provinces. Water at the border (in the camps) has been chlorinated prior to drinking. Cambodians in the western provinces are using untreated surface water for drinking and cooking during the dry season. Therefore, programmes to improve potable water supplies in western Cambodia are desperately needed for existing populations and the expected Cambodian Refugee population, that will be reintegrating into Cambodian society. This is needed to ensure the survival of children under 5 years old (that makes-up approximately 25 percent of the total population) who are vulnerable to a wide variety of water-related diarrheal diseases.

Drilling of boreholes, digging and improving handug wells, construction of rainwater catchment systems, and the construction of village and household ponds are proposed for the development of water supplies in western Cambodia. Furthermore, sanitation and hygiene education programmes should be implemented jointly with potable water supply programmes.

Many programmes of water supply, sanitation, and hygiene education have been developed seperately in developing country contexts with little understanding that before communities will receive the full health impact, improvements in water supply, sanitation, and hygiene education need to be considered together. Therefore, technical solutions such as the drilling of wells to provide safe water for communities, and the construction of excreta disposal facilities requires a parrallel campaign of promoting personal hygiene and sanitation to ensure the full health impact of these improvements are realized.

Improvements in access to potable water supplies and sanitation, and improved hygiene are expected to contribute significantly to decreasing the prevalence of water- related diseases therefore, improving public health. Furthermore, improved water-supply would release women and children from the heavy and time-consuming burden of carrying water from distant sources, and would improve the quality of life.

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4.2 Reintegration Assistance

4.2.1 Objectives

1- Provide sufficient quantities of safe water to improve public health.

2- Increase the acceptability and utilization of safe water, encouraging villagers to use wells or rainwater collection systems for domestic purposes of drinking, cooking, bathing and washing.

3- Ensure that pumps and other facilities are properly maintained by provincial, district, and local authorities.

4- Advocate and promote better hygiene and sanitation in rural areas.

5- Encourage small scale vegetable production through the provision of sufficient quantities of water from village and family ponds.

6- Support provincial, district, and local authorities to implement and supervise programme activities for the improvement of safe water supplies and sanitiation facilties, maintenance of handpumps, promotion of hygiene education and sanitation, and construction of ponds.

4.2.2 Acitvities

1- Investigate the potential of ground-water resources for the area in order to properly site dug wells and drilled boreholes.

2- Improve on ways for families to collect water during the rainy season, providing appropriate housing structures (bamboo and thatch) or improving existing housing structures to collect rainwater adequately.

3- Improve on the capacity to store water by providing cement jars to each family, utilizing local markets for the construction of these jars.

4- Provide education on the importance of using rainwater (collected in jars) or water from wells for drinking and cooking, and the importance of personal hygiene.

5- Dig new family and village ponds, and deepen existing ponds. Introduce methods to prevent contamination of ponds.

6- Rehabilitate existing dug wells and construct new dug wells, and drill manually shallow boreholes (using small drilling machine techniques and installing locally made suction handpumps) in those areas located in the low-lying alluvium plain, specifically those areas adjacent to large streams.

7- Drill deep boreholes and install handpumps in those areas of higher elevation and hardrock geology which makes it difficult to dig shallow wells.

8- Drill boreholes and install handpumps at public institutions such as health clinics, district hospitals, primary schools and orphanages.

It is assumed that for dug and drilled wells the coverage will be 300 persons per well in rural areas, and with a maximum distance of 500 metres villagers will walk to carry water from the well to the home.

4.2.3 Phasing of Reintegration Assistance

Reintegration assistance for water resource development in the western provinces is envisaged to be implemented by the following three phases,

1) Investigation and Planning Phase -
Investigate the potential for groundwater resource development, and plan for programme operations.

Oxfam is planning to drill boreholes to provide water for internally displaced persons. This could be a first step to investigate the hydrogeology for western Cambodia. However, more in-depth investigations will be needed to define clearly the potential for devloping ground-water resources.

2) Pre-Repatriation/ Operational Phase -
Prior to repatriation of border Cambodians programmes would commence (implementing the above mentioned activities) to improve water supplies and sanitation facilities for target zones. The success of these programmes is first dependent on security in these provinces and the accessibility of these provinces by NGO and other agency staff, and second it is dependent on the availability of resources and personnel by governmental ministries to implement these programmes. It is recommended that drilling activities and sanitation facilities construction commence first at public institutions, such as health clinics, hospitals, primary schools, and orphanages.

3) Repatriation/ Operational Phase -
Once repatriation commences the extent of programme activities will increase, continuing with the above mentioned activities to improve on water supplies, and the acceptability of using safe water for target zones but on a larger scale and coverage.

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Borehole drilling could be implemented by Water Programmes under the Ministry of Health (financed by UNICEF), and the Ministry of Agriculture (financed by OXFAM, JVC, and LWS).

Appropriate technologies for improving water supplies (the digging of wells and drilling of shallow boreholes, and construction of rainwater catchment systems) could be implemented by central, provincial and district authorities in conjunction with NGOs and UNICEF.

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5. PLANNING FOR IMPROVED POTABLE WATER SUPPLIES AT RECEPTION CENTERS FOR REFUGEES FROM THE THAI BORDER

5.1 Introduction

On the basis of an expected comprehensive negotiated settlement being achieved in Cambodia, UNHCR has made a proposal for a Cambodian repatriation plan. Part of this plan is the establishment of 6 reception centers to be based at sites in: Mongol Borey District of Banteay Mean Chey Province; Battambang, Maung Russei, and Sangke Districts of Battambang Province; Bakan District of Pursat Province; and Phnom Penh (refer to Annex - 13). These sites are located in those provinces where large concentrations of returnees are expected to settle. For details relating to these reception centers please refer to UNHCR's proposal "Cambodian Repatriation Plan".

Proposals for water supply systems in the reception centers are based on UNHCR's draft plan for these centers, particularly on their holding capacities, exact locations, duration of operation. general layout, etc. It is understood that UNHCR is in the process of producing an updated report on their recent mission in June 1990. It should be taken into account that our proposal may have to be revised in light of any significant changes in UNHCR's latest plan.

The fact that Oxfam staff are involved in making proposals for water supply of the receptions centers should not be taken as Oxfam's committment to participate in any of the schemes proposed in this report. Furthermore, the views and proposals contained in this report are that of the authors alone and in no way represent the the views of the Oxfam Technical Unit or any part of Oxfam.

5.2 Planning Assumptions

UNHCR staff in Phnom Penh are planning that from the moment when the decision of repatriation is made to the time when necessary infrastructure and services are organized to receive returnees, UNHCR would require a minimum of 4 months time, if not 6 months. It is therefore assumed that this period of 4 months would be used by whoever shall be involved in implementing any of the water supply systems for reception centers. Four months is in fact a very short time, especially when personnel and equipment have to be imported to Cambodia.

UNHCR staff in Phnom Penh have also indicated that for logistics consideration the period best for repatriation to take place would be the dry season. As far as water supply is concerned, the dry season is the worse season to proviode water for the reception centers. Due to the uncertainty of exactly when the repatriation will take place, recommendations proposed in this report are based on the possibility to supply sufficient safe drinking water throughout the year.

For design purposes, we have allowed for a daily water consumption of 25 liters per person. We have allowed for 300 persons per borehole/ handpump and for Oxfam designed tapstand with 6 taps (operated below 2.5 meter pressure head), we have allowed for 400 persons as the average number of users.

5.3 Choice of Surface Water versus Groundwater

In the context of water supply for reception centres, surface water (water from rivers, ponds) has the main advantage of being quantifiable and reliable. It is possible to determine whether a river can reliably sustain a known demand of water for the reception centre population. On the other hand the quality of water is often susceptable to contamination and generally requires a treatment process before considered safe for drinking.

Most of the rivers adjacent to the proposed reception centres are heavily contaminated because the river banks are densely populated. Water quality parameters of turbidity (NTU)and E-Coli bacteria count were tested for these rivers (refer to Annex 14 - Water Quality Parameters for Selected Rivers). The high E-Coli count suggests extra care should be given to the process of water treatment when raw water from these rivers are used. The storage of raw water for 24 hours showed a considerable reduction in the number of active E-Coli, between 90 to 95% reduction. It was found that the coagulation and sedimentation process worked fairly well with the addition of optimum amount of 1% solution of Alum. Therefore, it can be assumed that raw water from these rivers are fairly treatable using the Oxfam Emergency Water Packs (refer to Annex 15 - Description of Oxfam Emergency Water Packs).

It is often uncertain whether groundwater reserves will yield sufficient quantities of water until drilling and prolonged test pumping has been carried out. The main advantage of using groundwater is that groundwater is normally considered safe for drinking. In emergency situations surface water is often the preferred source because of its reliability while the groundwater is explored at later stage. In terms of overall costs of boreholes for reception centers, where the number of people are relatively low, the borehole supply is much cheaper than the surface water option. The non-emergency nature of the reception centers does allow for the necessary time required to carry out a preliminary test drilling before arriving at the best possible water supply system for a particular situation. The installation and running costs of a simple surface water treatment system can be quite high and would require well trained personnel. Using boreholes / handpumps the running cost is much less, although periodic simple maintenance of the pumps is required.

5.4 Costs for Feasible Water Supply Systems for Reception Centers

Where preliminary test drilling show positive results those centres could have the following numbers of boreholes drilled,

Centre	Centre Capacity	Number of Boreholes Required
Mongol Borey	3,000	10
Battambang	2,000	6
Sangke	1,500	5
Maung Russey	1,500	5
Pursat	1,000	3
Phnom Penh	4,000	13

The average cost of drilling a borehole in soft formation and the installation of an India Mark II handpump, casing to 50 meters, is conservatively estimated at Sterling Pounds 1000.00.

The option of using motorized pumps drawing from few drilled wells and distributed through a network of storage tanks and tapstands has been considered but not favoured. By comparison with the handpump option, the disadvantages are,

- uncertainty of permissable yield of well for motorized pumping,
- longer delivery/ importation of motorized pumps,
- operation and maintenance repairs are mot complicated,
- cost is more expensive.

The cost for using boreholes/ handpumps compares favourable with water supply schemes (Oxfam Water Pumping/ treatment Packs) which use surface water and have treatment (refer to Annex 16 - Cost Estimates for Water Supply Systems at Reception Centres for breakdown of component costs), as indicated below,

Centre	Average Cost Using Boreholes/ Handpumps (Sterling Pounds)	Cost Using Oxfam Packs (Sterling Pounds)
Mongol Borey	10,000	12,900(piping from river)
Battambang	6,000	16,960(piping from river)
Sangke	5,000	11,400(piping from river)
Maung Russey	5,000	15,400(trucking from river) 20,000(piping from river)

Pursat	3,000	15,240(pumping from well) 20,000(pumping from river)
Phnom Penh	13,000	8,500(trucking from Municipal Waterworks)

There are a good number of drilling rigs in Cambodian government departments (Department of Hygiene and Epidemiology of the Ministry of Health, and Department of Hydrology of the Ministry of Agriculture). Assuming that the government is supportive of the repatriation plan and that the use of drilling rigs is assured, we would recommend that preliminary test drilling be carried-out in each centre as early as possible. Early preliminary drilling is crucial to provide information necessary to make the best decision for the most appropriate water supply systems. For example, if preliminary drilling revealed that adequate quantity of groundwater is not available at a reception centre and that an Oxfam Emergency Water Pack, utilizing surface water, is required, then time is necessary to import the necessary equipment. Seafreighting and delivery takes 3 months and an installation takes 2 weeks. If the decision to import had not been made within the first 2 weeks, then the installation would not have been completed in time to receive the returnees.

Mongol Borey Reception Centre (3000 Person Capacity)

The Mongol Borey site is selected within the township of Mongol Borey of Bantaey Mean Chey Province on a footbal field of approximately 1 hectares in area. This site is suspected to flood at times during the dry season, although officials claimed the contrary. The site will not be large enough to accomadate 3000 population. However, the Government's plan is to extend into the adjoining paddi fields which will be problematic during the dry season. To the south of the reception center is the Mongol Borey River. This was reported to be a perennial river which does not dry up completely in the dry season, although the flow is much reduced. At the time of visit in July (beginning of rainy season) the width of the river was approximately 20 meters wide by 1-1/2 meters deep, with an estimated speed of 1 metre per 4 seconds. The width at the dry season was reported to be 5 metres and depth 0.70 meters. This river should be able to sustain year round pumping for the 3,000 population.

The cost estimate for the alternative water supply system envisaged at this reception centre is specified in Annex 16. This system, on the basis of treating one batch of 95 cubic meter rawwater per day, will give a total daily output of 80,000 litres (26 liters per person per day). However, the system has the capacity of doubling or tripling if two or three batches of 95 cubic meters raw water is treated daily.

WATER RESOURCES FOR WESTERN PROVINCES OF CAMBODIA. W. BARRON AND C.P. LEUNG. OXFAM. NOVEMBER 1990

Battambang Reception Centre (2.000 Person Capacity)

The site is situated approximately 8 kilometers northwest of Battambang Town. It is between Highway Number 5, 200 metres to the east, and the railway line, 500 meters to the west. The site was originally intended to be used as an ammunition dump during Lon Nol's Regime. It is subdivided into 12 identical areas, 30 meters by 40 meters, each seperated from the other by ponds. There is also a rectangular block of field nearby of approximately 100 meters by 120 meters which has been reported to be available for this reception center.

1.4 kilometers to the north of this site lies the O Taki River which runs southwest-northeast intersecting both the railway and Highway Number 5. This small river, approximately 15 meters wide, is said to flow all year round. As a second option to drilled wells the O Taki River will be a good source for pumping.

The cost estimate for the alternative water supply system envisaged at this reception centre is specified in Annex 16. This system, when operated on the basis of treating one batch of 70 cubic meters raw water a day, would give a total daily output of 60,000 litres of safe drinking water (30 liters/ person/day). Similar to the system in Mongol Borey, the capacity is extendable to 3 times this capacity.

It is recommended to lay the pumping pipeline beside/ parallel to the railway line and the intake to be sited near the railway bridge, as it appears to be the most direct route.

Normally, as in other cases, when the intake and transfer pumps are identical, it is acceptable to provide one extra pump as a standby, making a total of 3 pumps for the system. In this case, however, the choice of a 3 inch diameter pipeline dictates the selection of larger intake pumps PL4, (one duty and one standby), in order to overcome the frictional headlosses. Together with 2 numbers of ET25 transfer pumps this system has a total of 4 pumps.

If a 4 inch diameter pipeline is selected, it is technically viable to use a smaller intake pump (ET75, identical to the transfer pump) thereby reducing the total number of pumps to 3 smaller capacity pumps. At the time of making the estimate, the price for 4 inch pipes was unavailable. If the price of the 4 inch pipeline plus the price for the 3 smaller ET 75 pumps is not much higher than the price of the 3 inch pipeline plus 4 pumps (2 numbers of PL4 and 2 numbers of ET75), it is recommended to adopt the 4 inch pipeline option. The advantage is that it will standardize with other pumps in other centres.

WATER RESOURCES FOR WESTERN PROVINCES OF CAMBODIA, W. BARRON AND C.P. LEUNG, OXFAM, NOVEMBER 1990

Sangke Reception Centre (1,500 Person Capacity)

The site is situated south of Battambang Town, right next to the western side of Highway Number 5. There are 2 hectares available for the Centre which is relatively higher than the surrounding paddi fields. Local villagers reported that this land never floods. At the time of the visit, the land on the site was ploughed for non-rice crop, an indication that the site does not flood.

Bordering the northern side of the site is the O Sandash, a tributary of the River Sangke. At 1-1/2 kilometers and 5 kilometers downstream of the proposed reception centre site there are two irrigation hydraulic structures, which raise the water levels upstream. Villagers informed us that provided the sluice gates of these structures remain shut there will be ample water in the O Sandash even during the dry season. The site, as it seems, was chosen on account of its vicinity to the river and road, and it being on high ground. It does seem a reasonable site for a small reception centre.

The cost estimate for the alternative water supply system envisaged at this reception centre is specified in Annex 16. This water supply system, when operated on the basis of treating one batch of 45 cubic meters of raw water per day, would give a daily output of 40,000 liters of safe drinking water (27 liters per day per person).

Since the O Sandash is next to the site it is likely that people may use the river for washing, bathing, etc. thereby increasing the likelihood of contaminating the river water. Some form of fencing should be considered to keep inhabitants from using the river water, especially at the vincinity and upstream of the pump intake.

Maung Russey Reception Centre (1,500 Person Capacity)

The site for for this district has not been finalized by UNHCR. One site of 4 hectares at approximately 6 kilometers south of Maung Russey Town along the western edge of Highway Number 5 was shown to us. Sections of this site are suspected to flood during the rainy season. However, this may very well be the site for the Reception Centre should the repatriation process begin in the dry season and does not extend into the rainy season. The District Committee indicated that there were very few areas which would match all the requirements; being close to the railway and road, no flooding, good access and availability to water. Apparently the District Committee had another site in mind, 14 kilometers from the town and upstream of the River Maung. It appeared widening of the road will be necessary to improve access to this site.

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Should the former site be chosen, water supply may be problematic if drilled wells are not viable. The nearest surface water is from the Maung River which is 6 kilometers away. To lay 6 kilometers of 3 inch or 4 inch PVC main is expensive, time consuming, and wasteful considering a short service life of 6 months and the pipe will not be used after the reception centre is closed down. Furthermore, there is some concern of the low flowrate available from the Maung River and whther it coud supply enough water for the cntre inhabitants.

It is proposed to transport water from the Maung River by truck. The cost estimate of the water supply system envisaged at this reception centre is specified in Annex 16.

This proposal is only viable if the use of either a tanker or a flatbed truck would be made available by hiring/ loaning arrangements. It is not economically viable to purchase a truck solely for the purpose of transporting water over such distance. Since portable bulk containers can be easily assembled and dismantled, the truck can also be used for other purposes while it is not trucking water. If a tanker is available Item 2 of the Cost Estimate will no longer be necessary. Therefore, the total can be reduced to Sterling Pound 8,400.

If a truck or tanker is not available, it will be necessary to consider the long distance pumping option. This system will be similar to the above, but trucking will be replaced by pumping from the Maung River using a larger pump (PL4) into a 6 Kilometer 3 inch pipeline and discharges into the rawwater/ sedimentation tank. The revised major capital cost estimate is listed in the Annex 14.

Both systems, trucking and piping from the Maung River are capable of giving a daily output of 40,000 liters (27 liters/ person/day).

<u>Pursat Reception Centre (1,000 Persons Capacity)</u>

This site in Bakan District is situated at approximately 6 kilometers north of Pursat Town along Highway Number 5. The railway is within 100 meter distance. The area is overgrown with sparingly scatterred bushes and gives an indication that the area will not be flooded. Several large ponds are found on the site which were created by the excavation of clay for brick making. It appears that there is more land available than required for the small population of this centre.

At 1.2 kilometers from the site along Highway Number 5 toward Pursat Town there is a road bridge over a small stream known as the O Svay At. This stream looked too small to support all year pumping for the reception centre.

Apart from this stream, there was no other likely water source except the River Pursat which is 7 kilometers away. Should drilled wells be unviable, there are several options.

Option 1

Existing ponds may hold sufficient water. The first step therefore is to establish the quantity of water available in these ponds taking into consideration the losses from evaporation and natural seepage. A population of 1000 consuming 25 liters per day for 6 months would require approximately 4,600 cubic meters. Allowing 10 percent loss in treating and 20 percent contingency the target is therefore 6,000 cubic meters. The main drawback is that this finite water source is exhaustible. The consumption, which depends on population and duration of operation of the reception centre, may exceed the available storage in the ponds.

Option 2

An exploratory well needs to be drilled on the elevated bank of the O Svay At stream. If this proves successful a medium diameter well with preferably 8 inch diameter casing should be installed to maximize yield and to allow for a motorized pump to be used. The minimum yield required should be around 1.7 liters per second. Sufficient well pumping test should be completed prior to equipping the well with a motorized pump to ascertain the safe yield available from the well. On the basis of a reliable well which yields a minimum 1.7 liters per second the envisaged water supply system is specified in Annex 16.

The yield of a borehole sometimes may reduce significantly during the dry season. There is no guarantee of success with this option. However, if a well started off with a good yield, the reduced yield in dry season may still be sufficient to supply the centre.

Option 3

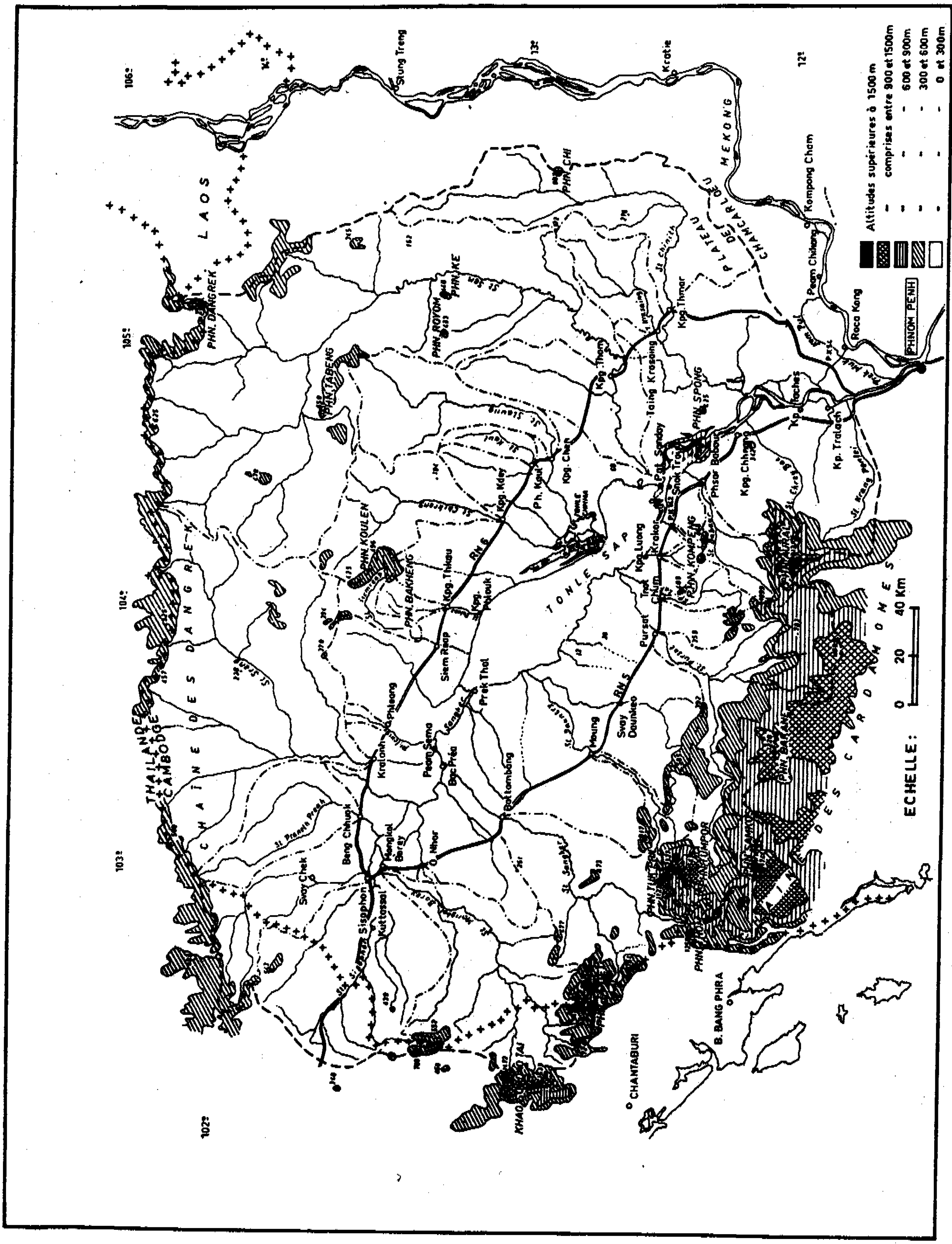
The trucking or the pumping of raw water from the River Pursat to the reception centre is another option. The cost estimate and technical considerations are similar to the system proposed for Maung Russey. Approximate adjustments can be made taking into account the need for a longer pipeline.

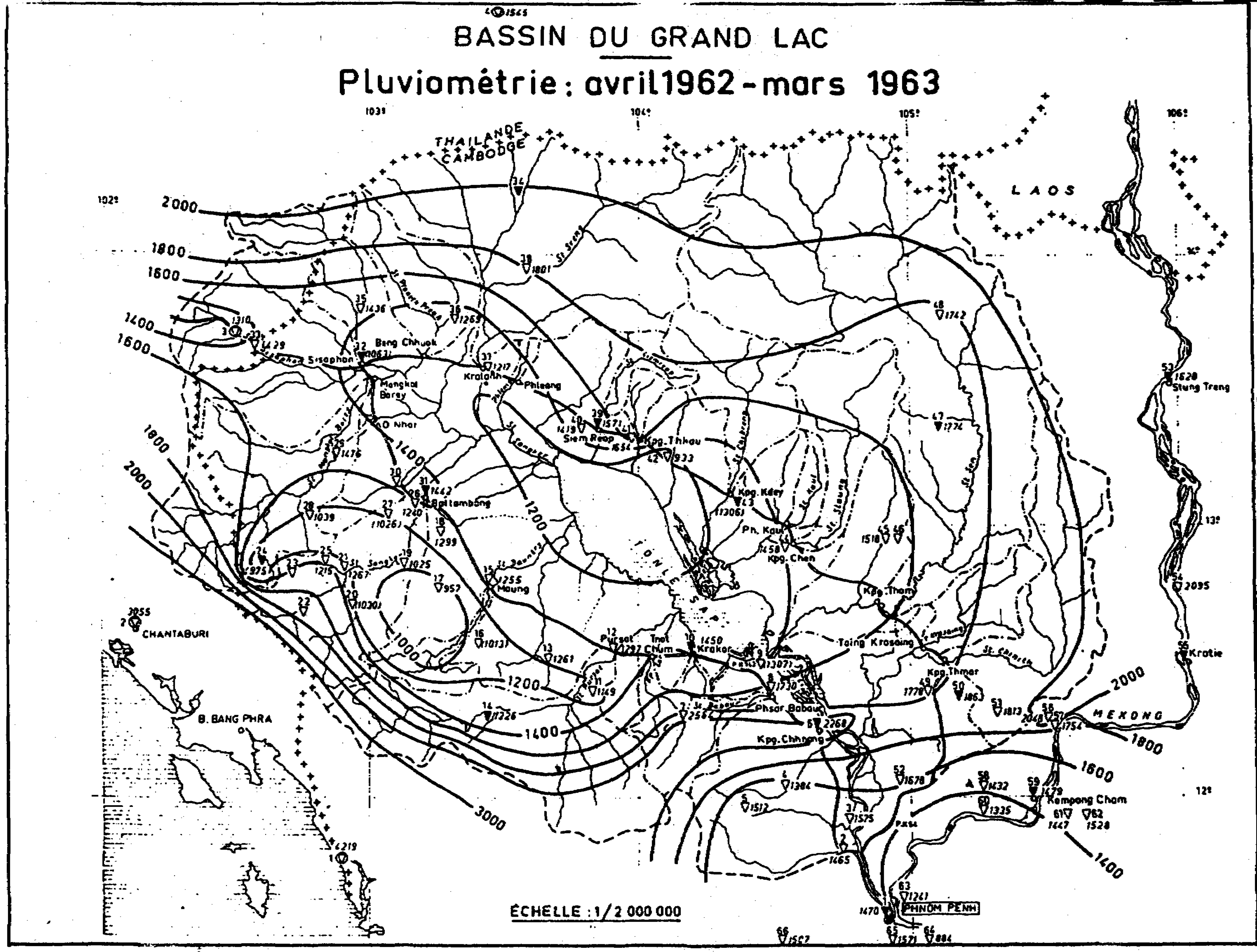
Phnom Penh Reception Centre (4000 Persons Capacity)

No visit to the selected reception centre site near Phnom Penh was made. It is understood from UNHCR that the site is located within 10 kilometers of Phnom Penh. The UNICEF water well drilling programme in Phnom Penh has found the access of groundwater difficult in this area. One can assume that water will either be taken from a nearby source (surface or groundwater), or piped or trucked to the centre from the Municipality Water Supply System. This would be viable if the municipality is agreeable to meet the extra demand of 100 cubic metres of water per day and that a suitable water tanker is available for trucking. The system envisaged at this reception centre is specified in Annex 16, to truck water from the Municapality water supply system.

ANNEX 1. RELIEF MAP FOR PROVINCES SURROUNDING THE GREAT LAKE BASIN OF CAMBODIA

(Taken from "Grand Lac du Cambodge - Sedimentologie et Hydrologie (1962-1963)" by J.P. Carbonnel and J. Guiscafre)





ANNEX 2. PLUVIOMETRIC MAP FOR THE GREAT LAKE BASIN
(taken from "Grand Lac du Cambodge -Sedimentologie et Hydrologie (1962-1963)")

ANNEX 4 . HYDROLOGICAL INFORMATION FOR WATERSHEDS IN WESTERN PROVINCES

(taken from "Grand Lac du Cambodge - Sedimentologie et Hydrologie (1962-1963)")

Provinces of Battambang and Banteay Mean Chey .

Sangker River
Dauntry River
Mongol Borey River
Sisophon River
Paneth-Preah

Province of Pursat

Pursat River

Le Stung Sangker à Battambang

ECHELLE : 1/500 000

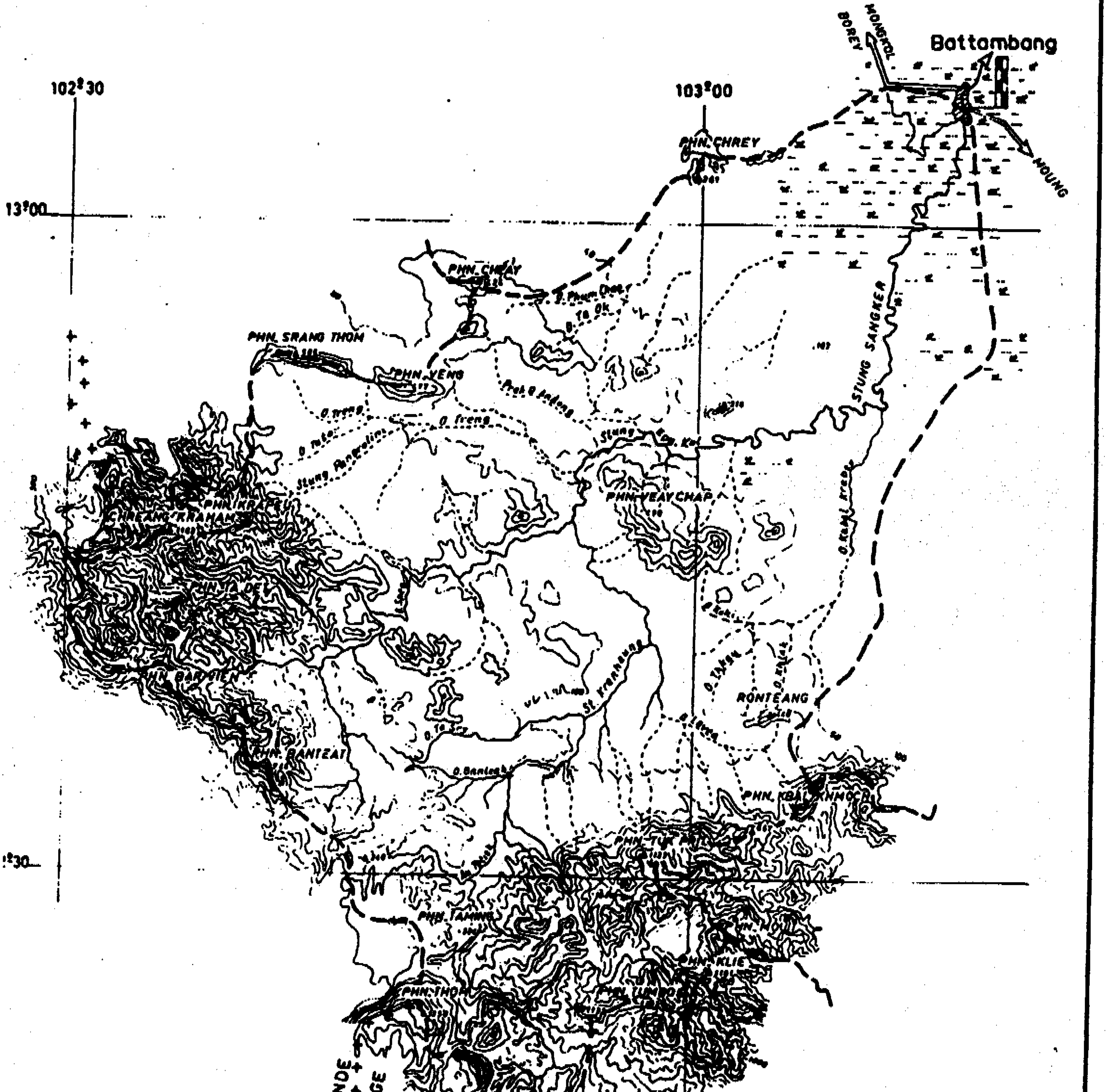


FIG. 27

STUNG SANGKER A BATTAMBANG

Hauteurs à l'échelle en mètres
Année hydrologique Avril 1962 - Mars 1963

	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Janvier	Février	Mars
1	0,98	1,40	2,10	2,30	3,70	3,20	5,38	4,64	3,57	1,77	0,90	0,89
2	0,96	1,34	2,14	2,16	3,42	3,16	5,18	4,60	3,51	1,73	0,90	0,93
3	0,95	1,40	2,22	1,97	4,32	3,80	5,20	4,56	3,47	1,67	0,89	0,95
4	0,94	1,79	3,59	1,80	5,64	4,12	5,08	4,50	3,40	1,62	0,88	0,94
5	0,93	2,50	3,08	1,92	6,50	4,12	5,06	4,84	3,37	1,48	0,90	0,93
6	0,94	2,21	2,84	2,24	8,38	4,00	5,12	4,82	3,30	1,46	0,99	0,92
7	0,92	1,81	2,78	2,48	7,82	6,00	5,22	4,80	3,25	1,38	0,98	0,91
8	0,94	1,54	2,50	3,00	5,84	5,38	5,20	4,78	3,15	1,32	0,97	0,89
9	0,91	1,37	2,23	3,50	5,40	5,16	5,28	4,70	3,09	1,25	0,97	0,89
10	0,90	1,29	2,10	3,20	5,00	4,64	5,22	4,64	3,05	1,19	0,99	0,88
11	0,89	1,31	2,24	3,74	4,60	5,86	5,28	4,54	2,97	1,15	1,10	0,88
12	0,88	1,54	2,52	4,30	7,48	5,60	5,24	4,46	3,05	1,18	1,08	0,89
13	0,89	2,22	3,25	4,70	6,22	5,08	5,22	4,40	2,97	1,17	1,06	0,99
14	0,88	2,14	3,56	5,02	5,04	4,60	5,20	4,28	3,06	1,16	1,03	1,16
15	0,86	1,94	3,68	4,10	4,40	4,84	5,16	4,20	3,02	1,12	0,98	1,12
16	0,98	2,08	3,48	3,48	4,20	5,00	5,22	4,16	3,00	1,10	1,01	1,10
17	1,10	1,84	4,08	3,30	3,92	5,08	5,18	4,13	2,89	1,07	0,98	1,08
18	1,10	1,72	4,30	6,68	3,68	5,00	5,14	4,11	2,88	1,02	0,96	1,07
19	1,20	1,82	4,40	7,00	3,52	4,60	5,20	4,07	3,05	1,00	0,94	1,06
20	1,16	1,74	4,50	5,88	3,48	4,98	5,32	4,03	3,05	0,98	0,92	1,05
21	1,14	2,28	4,36	4,66	3,46	4,90	5,36	4,00	3,03	0,98	0,91	1,04
22	1,10	2,42	3,66	4,10	3,44	4,72	5,20	3,96	2,99	0,97	0,89	1,04
23	1,10	1,32	3,10	5,36	3,48	4,70	5,42	3,91	2,82	0,96	0,89	1,03
24	1,16	1,12	2,81	6,36	3,68	4,86	5,26	3,89	2,72	0,96	0,88	1,09
25	1,12	2,03	2,58	5,12	3,86	4,74	5,20	3,86	2,62	0,95	0,88	1,10
26	1,18	1,88	2,40	4,28	4,10	5,08	5,10	3,83	2,51	0,94	0,87	1,09
27	1,21	1,80	2,36	3,82	4,02	5,06	4,98	3,79	2,32	0,93	0,86	1,08
28	1,24	1,82	2,72	4,42	4,20	4,80	4,94	3,73	2,17	0,93	0,86	1,07
29	1,30	1,83	2,68	4,38	4,06	4,68	4,90	3,69	2,01	0,92		1,06
30	1,35	1,92	2,52	4,26	3,88	4,70	4,82	3,63	1,87	0,91		1,06
31		1,98		4,04	4,26		4,70		1,81	0,90		1,05

Hauteur maximale : 8,38 le 6 Août 1962
Hauteur minimale : 0,86 les 27 et 28 Février 1963 et 15 Avril 1962

STUNG SANGKER A BATTAMBANG

Débits en mètres cubes par seconde
Année hydrologique - Avril 1962 - Mars 1963

	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Janvier	Février	Mars
1	3,34	7,5	17,8	21,4	77	84	132	53	53,0	9,00	1,90	1,79
2	2,98	6,9	18,5	18,9	58	79	100	55	50,0	8,70	1,90	2,44
3	2,80	7,5	20,0	15,5	132	148	99	54	48,0	8,20	1,79	2,80
4	2,62	12,7	69,5	12,8	284	74	75	50	44,5	7,80	1,68	2,62
5	2,44	25,2	43,2	14,7	409	74	68	102	43,5	6,60	1,90	2,44
6	2,62	19,8	34,3	20,3	800	58	75	102	40,5	6,50	3,52	2,26
7	2,26	13,0	32,4	24,8	760	325	93	104	38,7	6,30	3,34	2,08
8	2,62	9,1	25,2	39,8	308	218	83	105	33,8	6,20	3,16	1,79
9	2,08	7,2	20,1	64,0	252	184	95	94	31,4	5,90	3,16	1,79
10	1,90	6,3	17,8	48,5	216	117	80	93	30,5	5,31	3,52	1,68
11	1,79	6,5	20,3	79,8	159	285	87	90	28,0	4,95	4,50	1,68
12	1,68	9,1	25,7	129,0	600	235	78	86	32,0	5,22	4,34	1,79
13	1,79	20,0	50,9	171,0	362	161	71	84	29,5	5,13	4,18	3,52
14	1,68	18,5	67,7	206,0	206	99	75	75	35,0	5,04	3,94	5,04
15	1,46	15,0	75,6	110,0	133	124	64	71	33,9	4,68	3,34	4,68
16	3,34	17,5	62,9	62,9	114	140	82	69	33,6	4,50	3,78	4,50
17	4,50	13,4	108,0	53,2	84	147	75	69	30,0	4,26	3,34	4,34
18	4,50	11,6	129,0	443,0	61	130	70	74	30,3	3,86	2,98	4,26
19	5,40	13,1	139,0	500,0	44	81	89	72	37,8	3,70	2,62	4,18
20	5,04	11,9	150,0	314,0	36	125	112	74	38,2	3,34	2,26	4,10
21	4,86	21,0	135,0	167,0	34	112	122	74	38,0	3,34	2,08	4,02
22	4,50	23,6	74,2	110,0	28	85	99	71	36,6	3,16	1,79	4,02
23	4,50	6,6	44,0	247,0	28	77	136	69	30,4	2,98	1,79	3,94
24	5,04	4,7	33,3	385,0	44	97	116	69	27,0	2,98	1,68	4,42
25	4,68	16,5	27,0	218,0	59	89	108	68	24,2	2,80	1,68	4,50
26	5,22	14,1	23,2	128,0	82	117	100	66	21,4	2,62	1,57	4,42
27	5,50	12,8	22,5	85,6	74	109	83	65	17,3	2,44	1,46	4,34
28	5,80	13,1	30,6	142,0	90	210	82	61	14,4	2,44	1,46	4,26
29	6,40	13,3	29,5	137,0	76	174	82	60	11,5	2,26		4,18
30	6,95	14,7	25,7	125,0	52	153	73	56	9,5	2,08		4,18
31		15,7		104	91		58		9,2	2,08		4,10
Total	110,29	407,96	1572,90	4196,20	5753	4111	2762	2235	981,7	144,37	74,66	106,16
Moyenne	3,68	13,2	52,4	135	186	137	89,1	74,5	31,7	4,66	2,77	3,42
Débit spécifique l/s/km2	1,14	4,07	16,2	41,9	57,5	42,4	27,6	23,1	9,80	1,44	0,83	1,06
Ecoulement en 10^6 m3	9,53	35,24	135,90	362,55	497,06	355,19	238,64	193,10	84,82	12,47	6,45	9,17
Ecoulement en mm	3,0	10,9	42,1	112,2	153,9	110,0	73,9	59,8	26,2	3,9	2,0	2,8
Maximum	6,95	25,2	130	500	600	325	136	105	53,0	9,0	4,50	5,04
Minimum	1,46	4,7	17,8	12,8	28	58	58	50	9,2	2,08	1,46	1,68

Période — maximum 600 — minimum 1,46 — Moyenne 61,5 — 1/s/km² 19,0 — Ecoulement en 10^6 m³ 1 940,12 — Ecoulement en mm 600,7

LE STUNG SANGKER à BATTAMBANG

Avril 1962 à Mars 1963

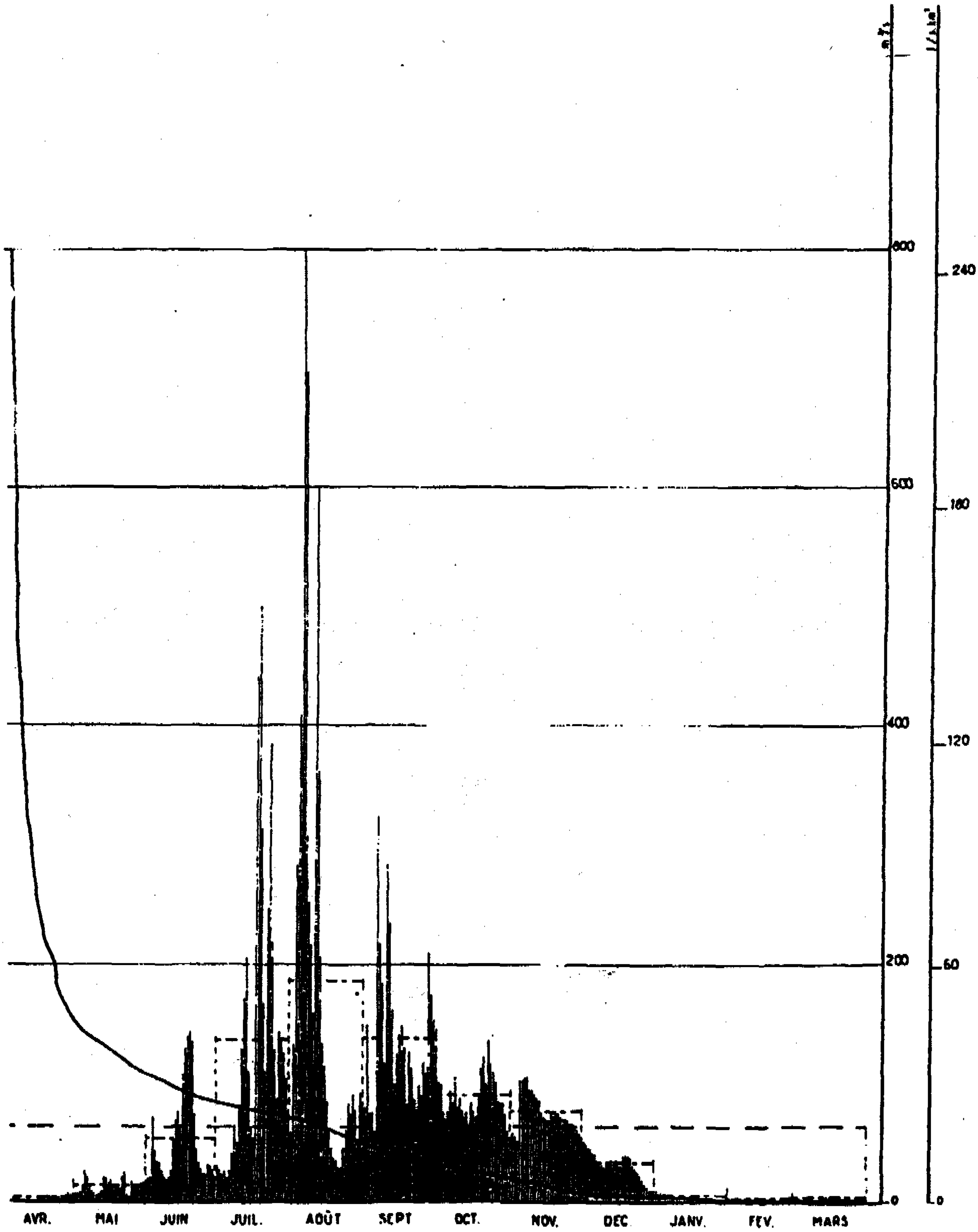


FIG. 30

Le Stung Dauntry à Moung

Echelle : 1/250 000

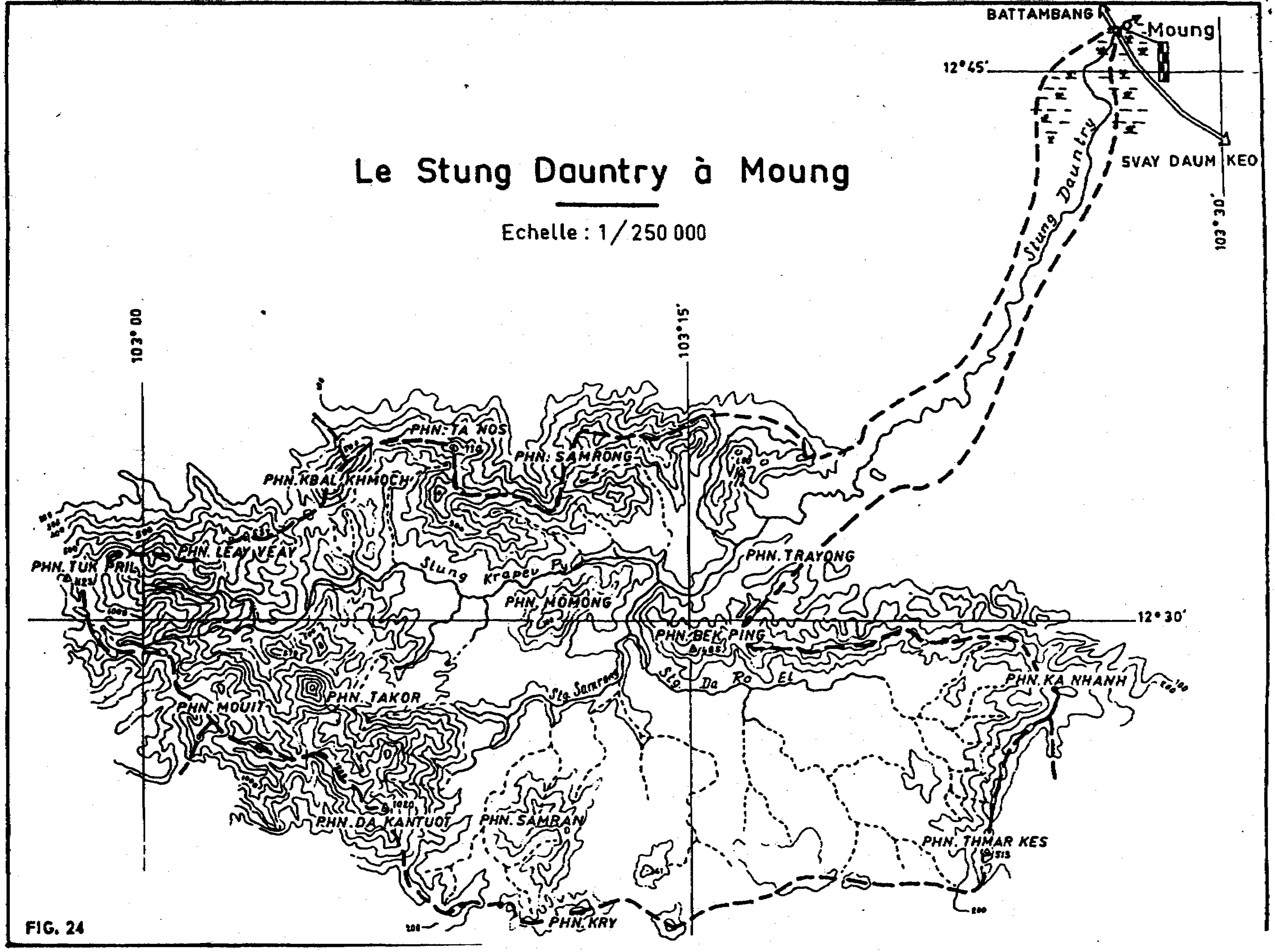


FIG. 24

STUNG DAUNTRY A MAUNG

Hauteurs à l'échelle en mètres

Avril 1962 - Mars 1963

	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Janvier	Février	Mars
1	0,18	0,68	0,48	0,42	0,62	0,96	1,99	0,58	0,39	0,28	0,06	0,00
2	0,12	0,86	0,42	0,30	0,52	1,12	1,92	0,54	0,32	0,26	0,07	0,00
3	0,17	1,22	0,36	0,36	0,49	1,18	1,70	0,49	0,28	0,23	0,06	0,00
4	0,14	1,28	0,31	0,34	0,43	0,62	0,96	1,13	0,24	0,19	0,05	0,00
5	0,11	0,96	0,28	0,20	0,38	0,41	0,90	1,42	0,25	0,16	0,04	0,00
6	0,12	0,69	0,26	0,41	0,81	0,72	1,39	1,59	0,21	0,13	0,05	0,00
7	0,11	0,49	0,22	0,36	1,00	0,96	1,20	1,41	0,18	0,12	0,02	0,00
8	0,12	0,96	0,23	1,32	0,74	0,31	0,88	1,37	0,19	0,11	0,06	0,00
9	0,12	0,48	0,21	0,93	0,61	0,83	1,12	1,31	0,23	0,12	0,04	0,00
10	0,12	0,31	0,19	0,62	0,62	1,61	0,96	1,26	0,20	0,13	0,02	0,00
11	0,12	1,22	0,16	0,84	0,51	2,86	1,49	1,18	0,21	0,17	0,00	0,00
12	0,12	1,52	0,14	0,94	0,64	3,40	1,00	1,14	0,19	0,15	0,00	0,00
13	0,12	1,16	0,12	0,92	0,48	1,70	0,86	1,11	0,22	0,17	0,00	0,00
14	0,12	0,54	0,12	0,32	0,48	2,21	1,26	0,98	0,23	0,13	0,00	0,00
15	0,12	0,38	0,12	0,44	0,44	2,76	0,78	0,89	0,25	0,16	0,00	0,00
16	0,12	0,32	0,10	0,42	0,42	1,47	1,98	0,81	0,23	0,12	0,00	0,00
17	0,22	0,39	0,10	0,38	0,49	1,12	1,36	0,76	0,20	0,10	0,00	0,00
18	0,43	0,41	0,08	0,34	0,46	0,82	0,93	0,67	0,18	0,08	0,00	0,00
19	0,38	0,69	0,08	0,32	0,41	0,68	0,91	0,58	0,17	0,11	0,00	0,00
20	1,48	1,64	0,10	1,00	0,48	0,62	0,70	0,44	0,14	0,12	0,00	0,65
21	0,43	1,53	0,11	0,82	0,41	1,11	2,62	0,41	0,16	0,06	0,00	0,63
22	0,39	1,46	0,21	0,64	0,62	0,72	2,31	0,43	0,20	0,09	0,00	0,56
23	0,34	1,00	0,18	0,40	0,54	0,76	1,86	0,39	0,17	0,12	0,00	0,68
24	0,28	0,83	0,21	0,62	0,41	0,69	1,51	0,41	0,14	0,11	0,00	0,61
25	0,46	0,59	0,17	0,71	0,72	0,56	1,11	0,64	0,16	0,10	0,00	0,53
26	0,49	0,46	0,20	0,76	0,91	0,70	0,98	0,65	0,13	0,07	0,00	0,48
27	0,50	0,44	0,62	0,94	0,78	0,83	0,90	0,71	0,14	0,08	0,00	0,44
28	0,12	0,42	0,60	0,92	2,91	1,18	0,81	0,78	0,13	0,04	0,00	0,35
29	0,48	0,51	0,30	0,77	1,78	1,65	0,76	0,65	0,11	0,06	0,00	0,29
30	0,51	0,46	0,86	0,60	0,92	2,12	0,68	0,47	0,13	0,05	0,00	0,24
31		0,40		0,68	0,61		0,61		0,15	0,03	0,00	0,16

Hauteur d'eau maximale de 3,40 atteinte le 12 Septembre

STUNG DAUNTRY A MAUNG

Débits en mètres cubes
Année hydrologique Avril 1962 - Mars 1963

	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Janvier	Février	Mars
1	0,22	2,66	1,38	1,06	2,24	4,94	17,00	1,98	0,91	0,48	0,04	0,00
2	0,11	4,08	1,06	0,54	1,61	6,50	16,00	1,73	0,62	0,43	0,05	0,00
3	0,20	7,52	0,79	0,79	1,44	7,10	13,10	1,44	0,48	0,34	0,04	0,00
4	0,14	8,18	0,28	0,70	1,11	2,24	4,94	6,60	0,37	0,24	0,03	0,00
5	0,10	4,94	0,48	0,26	0,87	1,00	4,40	9,74	0,40	0,18	0,02	0,00
6	0,11	2,73	0,43	1,00	3,68	2,96	9,39	11,80	0,29	0,13	0,03	0,00
7	0,10	1,44	0,32	0,79	5,30	4,94	7,30	9,62	0,22	0,11	0,01	0,00
8	0,11	4,94	0,34	8,62	3,12	0,28	4,24	9,17	0,24	0,10	0,04	0,00
9	0,11	1,38	0,29	4,67	2,17	3,84	6,50	8,51	0,34	0,11	0,02	0,00
10	0,11	0,28	0,24	2,24	2,24	12,00	4,94	7,96	0,26	0,13	0,01	0,00
11	0,11	7,52	0,18	3,92	1,55	30,40	10,60	7,10	0,29	0,20	0,00	0,00
12	0,11	10,90	0,14	4,76	2,38	40,50	5,30	6,70	0,24	0,16	0,00	0,00
13	0,11	6,90	0,11	4,58	1,38	13,10	4,08	6,40	0,32	0,20	0,00	0,00
14	0,11	1,73	0,11	0,62	1,38	20,20	7,96	5,12	0,34	0,13	0,00	0,00
15	0,11	0,87	0,11	1,17	1,17	28,70	3,44	4,32	0,40	0,18	0,00	0,00
16	0,11	0,62	0,08	1,06	1,06	10,30	16,80	3,68	0,34	0,11	0,00	0,00
17	0,32	0,91	0,08	0,87	1,44	6,50	9,06	3,28	0,26	0,08	0,00	0,00
18	1,11	1,00	0,06	0,70	1,27	3,76	4,67	2,59	0,22	0,06	0,00	0,00
19	0,87	2,73	0,06	0,62	1,00	2,66	4,49	1,98	0,20	0,10	0,00	0,00
20	10,50	12,40	0,08	5,30	1,38	2,24	2,80	1,17	0,14	0,11	0,00	1,06
21	1,11	11,10	0,10	3,76	1,00	6,40	26,40	1,00	0,18	0,04	0,00	1,02
22	0,91	10,20	0,29	2,38	2,24	2,96	21,70	1,11	0,26	0,07	0,00	0,88
23	0,70	5,30	0,22	0,95	1,73	3,28	15,20	0,91	0,20	0,11	0,00	1,12
24	0,48	3,84	0,29	2,24	1,00	2,73	10,80	1,00	0,14	0,10	0,00	0,98
25	1,27	2,04	0,20	2,88	2,96	1,86	6,40	2,38	0,18	0,08	0,00	0,82
26	1,44	1,27	0,26	3,28	4,49	2,80	5,12	2,45	0,13	0,05	0,00	0,72
27	1,49	1,17	2,24	4,76	3,44	3,84	4,40	2,88	0,14	0,06	0,00	0,64
28	0,11	1,06	2,10	4,58	31,30	7,10	3,68	3,44	0,13	0,02	0,00	0,46
29	1,38	1,55	0,54	3,36	14,10	12,50	3,28	2,45	0,10	0,04	0,00	0,34
30	1,55	1,27	4,08	2,10	4,58	18,80	2,66	1,33	0,13	0,03	0,00	0,25
31		0,95		2,66	2,17		2,17		0,16	0,02		0,12
Débit total	15,76	113,67	16,94	77,22	106,80	266,43	258,82	129,84	8,63	4,20	0,29	8,41
moyenne	0,53	3,67	0,56	2,49	3,45	8,88	8,35	4,33	0,28	0,14	0,01	0,27
1/sec/km2	0,63	4,40	0,68	2,99	4,13	10,64	10,00	5,18	0,33	0,16	0,01	0,33
Ecoulement en 10^6 m3	1,36	9,82	1,46	6,67	9,23	23,02	22,36	11,22	0,75	0,36	0,03	0,73
Ecoulement en mm.	1,63	11,80	1,80	8,00	11,00	27,60	26,80	13,40	0,90	0,40	0,00	0,90
Maximum	10,50	12,40	4,08	8,62	31,30	40,50	26,40	11,80	0,91	0,48	0,05	1,06
Minimum	0,10	0,28	0,06	0,26	0,87	0,28	2,17	0,91	0,10	0,02	0,00	0,00

Maximum 40,50 Moyenne 2,76 Ecoulement en 10^6 m3 87,01
Minimum 0,00 1/sec/km2 3,30 Ecoulement en mm 104,2

LE STUNG DAUNTRY à MAUNG
EN 1962 1963

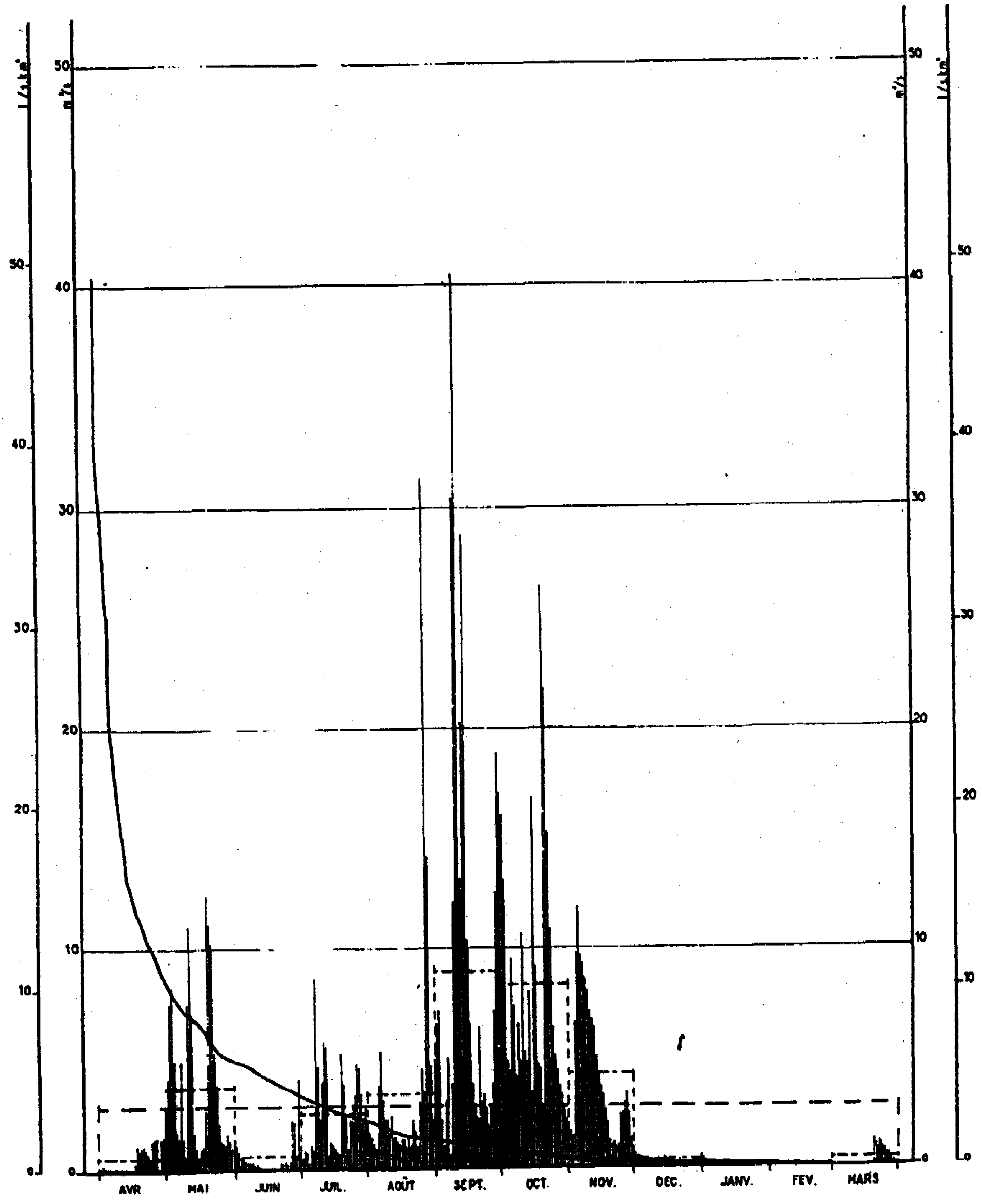
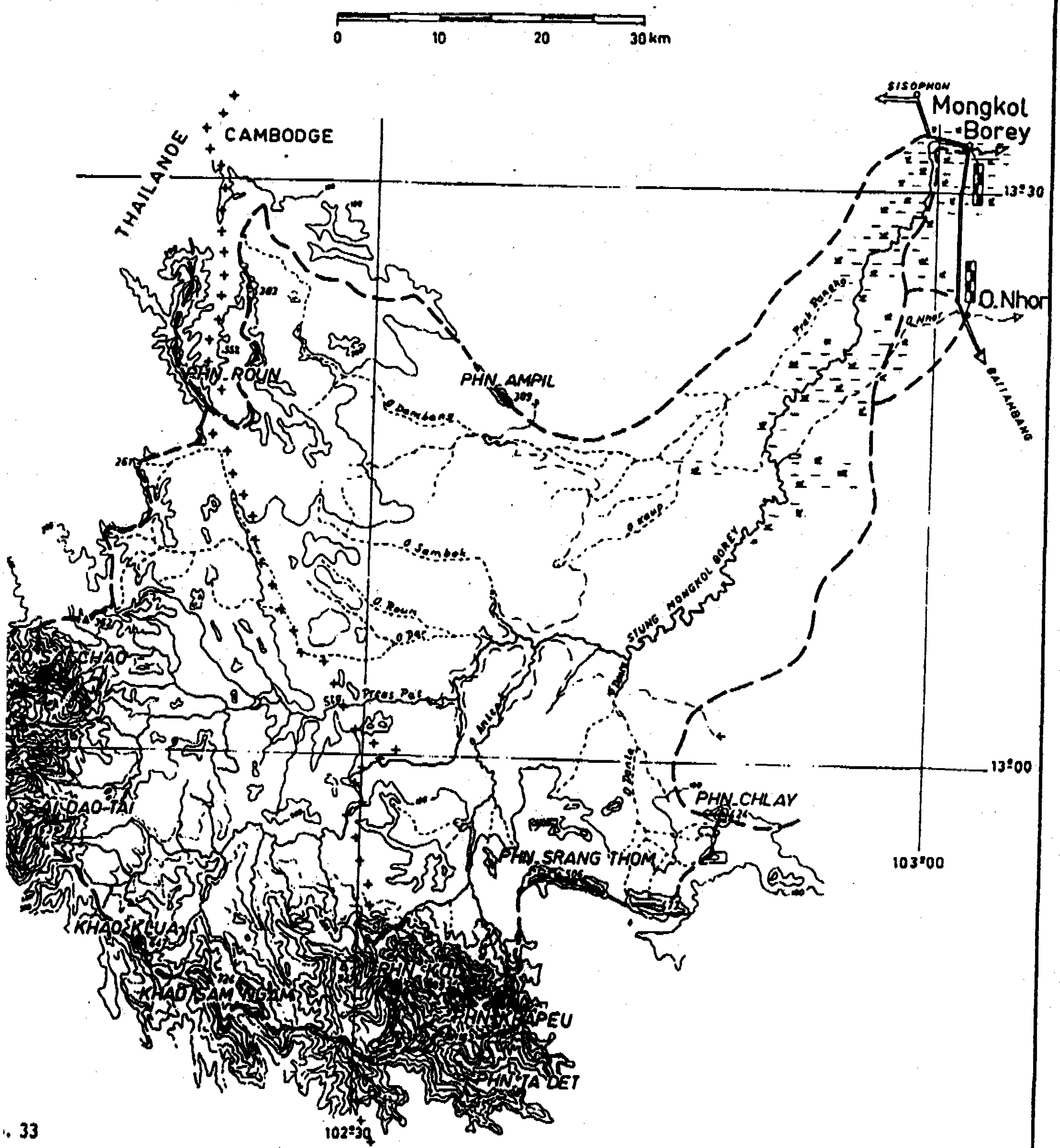


FIG. 26

Le Stung Mongkol Borey à Mongkol Borey

L'O.Nhor à O.Nhor



STUNG MONGKOL - BOREY A MONGKOL - BOREY

Hauteurs à l'échelle en mètres
Année hydrologique - Avril 1962 - Mars 1963

	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Janvier	Février	Mars
1	0,85	0,91	1,02	4,10	4,84	5,00	5,61	4,65	2,78	1,09	0,84	0,77
2	0,82	0,84	0,84	3,87	4,82	4,96	5,64	4,56	2,74	1,08	0,84	0,67
3	0,78	0,92	0,64	3,71	4,74	4,92	5,66	4,47	2,65	1,08	0,83	0,67
4	0,74	0,90	2,00	3,57	4,67	4,88	5,68	4,43	2,54	1,08	0,83	0,67
5	0,73	0,85	2,34	3,60	4,77	4,86	5,72	4,41	2,48	1,07	0,82	0,66
6	0,73	1,04	3,32	3,51	4,87	4,91	5,76	4,44	2,41	1,07	0,81	0,70
7	0,72	1,17	3,82	3,34	4,92	4,91	5,80	4,80	2,30	1,07	0,81	0,72
8	0,71	1,22	3,57	3,42	4,95	5,08	5,82	4,86	2,21	1,06	0,81	0,71
9	0,70	1,12	3,12	3,82	4,97	5,11	5,84	4,60	2,10	1,06	0,80	0,70
10	0,68	0,98	2,72	3,58	5,00	5,22	5,84	4,36	1,98	1,04	0,80	0,67
11	0,66	0,92	2,38	3,77	5,02	5,32	5,84	4,20	1,88	1,02	0,80	0,69
12	0,66	0,92	2,47	3,39	5,04	5,57	5,82	4,12	1,78	1,00	0,80	0,68
13	0,68	1,20	2,34	3,56	5,06	6,06	5,79	4,04	1,66	0,99	0,82	0,64
14	0,70	1,54	2,34	3,71	5,05	6,11	5,78	3,97	1,54	0,98	0,80	0,66
15	0,76	1,36	2,31	3,06	5,06	6,17	5,78	3,90	1,40	0,96	0,79	0,69
16	0,77	1,10	3,08	3,92	5,06	6,16	5,76	3,82	1,28	0,94	0,78	0,71
17	0,75	1,00	2,97	4,20	5,06	6,13	5,72	3,76	1,26	0,93	0,78	0,71
18	0,87	1,00	2,93	4,06	5,06	6,09	5,68	3,68	1,26	0,93	0,86	0,70
19	0,82	1,08	2,92	3,78	5,06	6,06	5,64	3,60	1,22	0,93	0,84	0,74
20	0,78	1,46	2,06	3,61	5,06	6,02	5,58	3,52	1,21	0,92	0,87	0,74
21	0,76	1,30	3,00	4,32	5,04	5,97	5,52	3,44	1,18	0,92	0,83	0,72
22	0,72	1,02	2,52	4,60	5,00	5,92	5,46	3,36	1,14	0,92	0,79	0,79
23	0,72	0,92	3,92	4,67	4,94	5,87	5,40	3,30	1,12	0,90	0,75	0,79
24	0,80	1,25	3,89	4,73	4,92	5,82	5,34	3,22	1,10	0,90	0,77	0,79
25	0,76	1,50	3,76	4,82	4,92	5,78	5,27	3,14	1,07	0,90	0,72	0,74
26	0,74	1,34	3,54	4,86	4,92	5,77	5,18	3,06	1,04	0,89	0,70	0,71
27	0,71	1,20	2,04	4,88	4,94	5,74	5,10	3,00	1,00	0,89	0,70	0,73
28	0,71	1,14	2,58	4,90	4,97	5,70	5,02	2,99	1,00	0,88	0,68	0,72
29	0,72	1,10	2,62	4,88	4,98	5,66	4,92	2,91	1,00	0,87		0,70
30	0,73	1,07	2,95	4,80	4,99	5,65	4,82	2,85	1,00	0,86		0,72
31		1,07		4,80	5,00		4,73		1,00	0,85		0,71

Hauteur d'eau maximale 6,17 le 15 Septembre 1962
Hauteur d'eau minimale 0,64 le 13 Mars 1963

STUNG MONGKOL - BOREY A MONGKOL BOREY

Débits en mètres cubes par seconde
Année hydrologique - Avril 1962 - Mars 1963

	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Janvier	Février	Mars
1	1,83	2,24	3,40	36,8	55,3	48,4	69,0	22,0	14,0	3,5	1,80	0,54
2	1,62	1,76	1,76	32,6	54,6	46,4	70,0	20,6	14,4	3,4	1,80	0,54
3	1,34	2,32	0,40	30,2	52,0	44,8	71,8	18,8	14,6	3,4	1,70	0,54
4	1,05	2,18	10,60	28,1	49,9	42,9	73,6	18,5	14,4	3,4	1,70	0,54
5	0,98	1,83	13,70	28,6	53,0	42,2	77,6	18,4	14,4	3,3	1,60	0,46
6	0,98	3,18	24,60	27,2	56,4	39,8	81,4	19,0	14,4	3,3	1,54	0,76
7	0,91	4,06	30,80	24,9	58,1	39,3	85,0	30,0	13,2	3,3	1,54	0,90
8	0,84	4,50	28,10	26,0	59,2	45,4	86,5	32,4	12,6	3,2	1,54	0,84
9	0,76	3,72	22,00	31,8	60,1	46,2	88,0	26,4	11,6	3,2	1,46	0,90
10	0,62	2,80	17,40	28,2	61,2	55,7	87,0	21,6	10,4	3,1	1,46	0,54
11	0,46	2,32	14,10	31,0	62,1	60,8	86,5	20,0	9,6	3,0	1,46	0,70
12	0,46	2,32	15,00	25,6	62,9	77,2	85,0	18,0	8,8	2,8	1,46	0,60
13	0,62	4,30	13,80	28,0	63,7	131,0	82,0	16,8	7,8	2,8	1,60	0,36
14	0,76	6,80	13,80	30,2	63,2	142,0	82,0	16,4	6,8	2,7	1,46	0,46
15	1,18	5,40	13,40	21,2	63,1	150,0	82,0	16,0	5,8	2,6	1,40	0,70
16	1,26	3,60	21,50	33,4	62,4	148,0	80,4	15,6	5,0	2,4	1,34	0,84
17	1,12	2,90	20,20	38,6	61,0	140,0	76,5	15,4	4,8	2,4	1,34	0,84
18	1,96	2,90	19,80	36,0	60,9	133,0	73,0	15,2	4,8	2,4	1,90	0,90
19	1,62	3,46	19,60	31,2	60,3	126,0	68,5	14,6	4,4	2,4	1,76	1,06
20	1,34	6,20	11,20	28,7	59,2	119,0	63,5	14,2	4,4	2,3	1,96	1,06
21	1,18	5,00	20,60	41,2	57,0	112,0	58,8	14,0	4,2	2,3	1,70	0,90
22	0,91	3,40	15,40	48,0	54,2	105,0	55,0	13,9	3,8	2,3	1,40	1,40
23	0,91	2,32	33,40	49,9	51,2	101,0	51,0	13,8	3,8	2,2	1,12	1,40
24	1,46	4,70	32,80	51,8	48,8	92,0	48,0	13,6	3,6	2,2	1,30	1,40
25	1,18	6,50	31,00	54,6	47,7	87,6	44,6	13,5	3,4	2,2	0,90	1,06
26	1,06	5,40	27,60	56,0	47,3	86,0	40,4	13,4	3,2	2,1	0,76	0,84
27	0,84	4,30	11,00	56,8	47,4	82,5	36,0	13,4	2,8	2,1	0,76	1,00
28	0,84	3,87	16,00	57,4	48,0	78,4	33,6	14,4	2,8	2,0	0,60	0,90
29	0,90	3,60	16,40	56,8	48,8	74,0	30,4	14,2	2,8	1,9		0,76
30	0,98	3,38	20,00	54,0	48,8	71,6	27,0	14,0	2,8	1,9		0,90
31		3,38		54,0	48,8		24,8		2,8	1,8		0,84
Total	31,97	114,64	539,40	1178,8	1726,6	2568,2	2018,9	528,1	232,2	82,0	40,36	25,48
Moyenne	1,07	3,70	17,98	38,03	55,70	85,61	65,13	17,60	7,49	2,64	1,44	0,82
Débit spécifique l/s/km2	0,26	0,89	4,31	9,12	13,36	20,53	15,62	4,22	1,80	0,63	0,35	0,20
Ecoulement en 10^6 m^3	2,762	9,905	46,604	101,848	149,178	221,992	174,433	45,628	20,062	7,085	3,487	2,201
Ecoulement en mm	0,66	2,38	11,18	24,43	35,78	53,21	41,83	10,94	4,81	1,70	0,84	0,53
Maximum	1,96	6,80	33,4	57,4	63,7	150,0	88,0	32,4	14,0	3,5	1,96	1,40
Minimum	0,46	1,76	0,40	21,2	47,3	39,3	24,8	13,4	2,8	1,8	0,60	0,36

Maximum 150,00	Moyenne 24,90	Ecoulement en 10^6 m^3	785,085
Minimum 0,40	$l/s/km^2$ 5,97	Ecoulement en mm.	188,27

LE STUNG MONGKOL BOREY à MONGKOL BOREY
EN 1962-1963

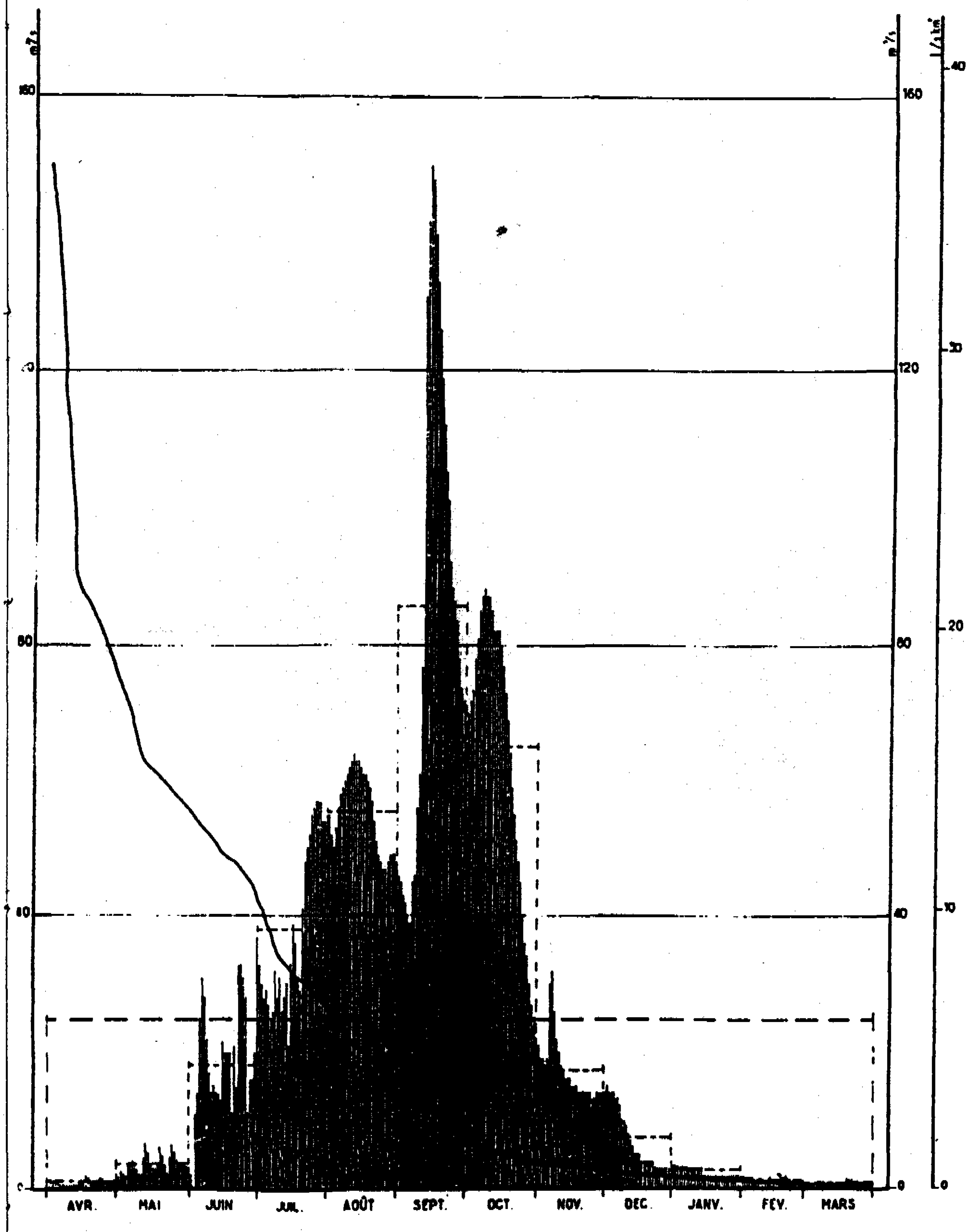


FIG. 35

Le Stung Sisophon à Sisophon

ECHELLE : 1/500 000

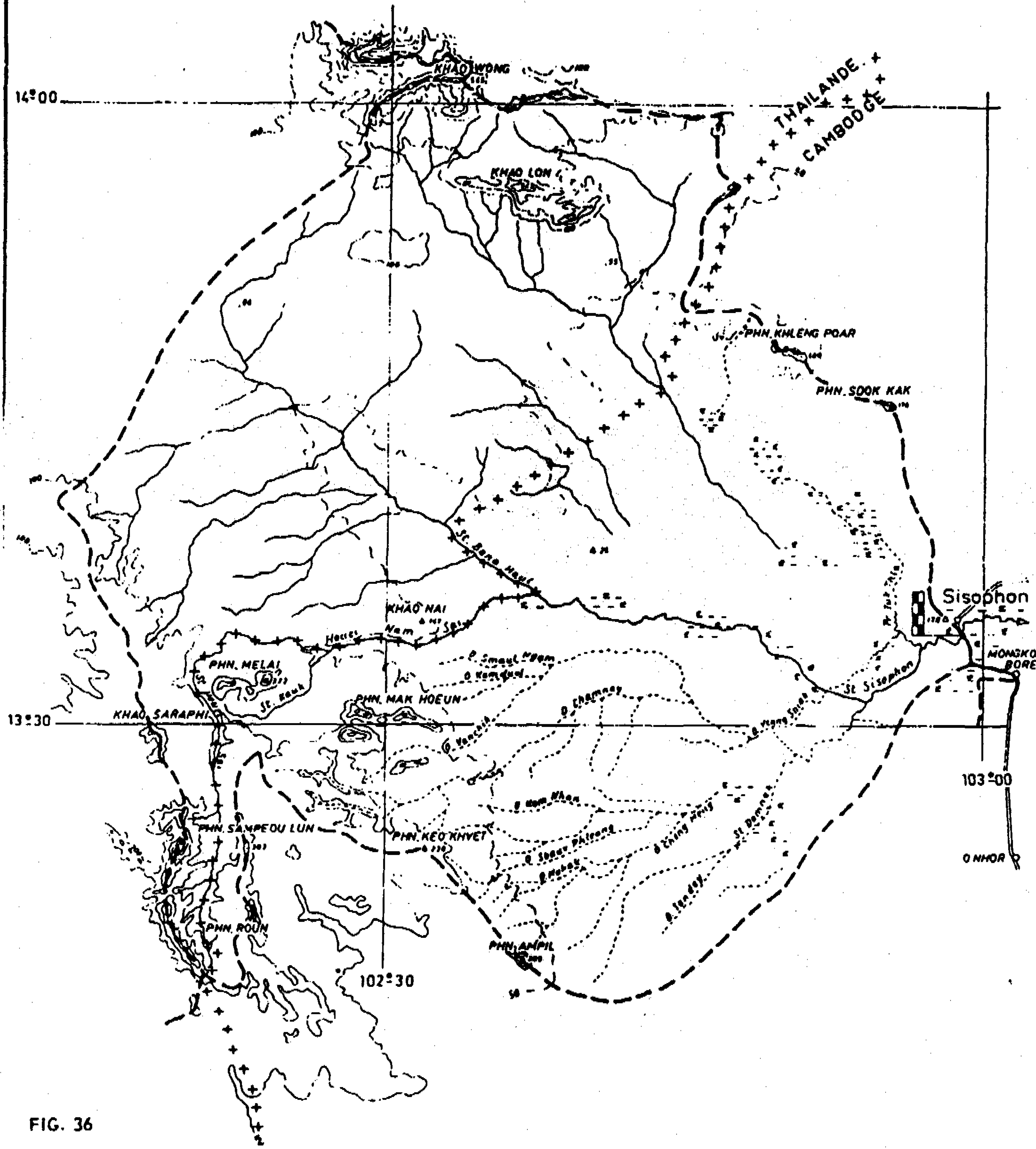


FIG. 36

Hauteurs à l'échelle en mètres
Année hydrologique - Avril 1962 - Mars 1963

	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Janvier	Février	Mars
1	1,63	1,63			5,39	5,77	6,81	5,69	3,71	1,47	0,89	0,72
2	1,63	1,61			5,43	5,79	6,85	5,65	3,65	1,47	0,89	0,72
3	1,63	1,61			5,51	5,81	6,89	5,53	3,59	1,43	0,89	0,71
4	1,63	1,63			5,51	5,81	6,95	5,39	3,52	1,37	0,89	0,71
5	1,65	1,61			5,53	5,79	7,01	5,41	3,40	1,35	0,87	0,70
6	1,65	1,69			5,54	5,77	7,07	5,31	3,31	1,35	0,87	0,70
7	1,65	1,67			5,48	5,89	7,09	5,29	3,20	1,33	0,85	0,66
8	1,65	1,65			5,46	6,07	7,11	5,29	3,09	1,33	0,85	0,66
9	1,67	1,65			5,43	6,11	7,11	5,23	3,00	1,29	0,85	0,66
10	1,67	1,63			5,41	6,37	7,09	5,19	2,91	1,27	0,85	0,64
11	1,67	1,71			5,41	6,43	7,07	5,13	2,82	1,25	0,83	0,64
12	1,67	1,71			5,45	7,17	6,99	5,11	2,75	1,23	0,82	0,64
13	1,69	1,79			5,41	7,41	7,03	5,05	2,65	1,22	0,81	0,64
14	1,69	1,77			5,43	7,45	6,91	4,93	2,59	1,21	0,81	0,62
15	1,69	1,75			5,43	7,47	6,89	4,91	2,53	1,18	0,79	0,62
16	1,69	1,73			5,43	7,47	6,88	4,83	2,43	1,17	0,79	0,62
17	1,69	1,69			5,43	7,43	6,83	4,73	2,37	1,17	0,79	0,62
18	1,61	1,55			5,41	7,29	6,79	4,71	2,27	1,11	0,79	0,60
19	1,61	1,49			5,41	7,27	6,71	4,65	2,13	1,09	0,79	0,60
20	1,61	1,41			5,41	7,21	6,67	4,53	2,01	1,03	0,77	0,60
21	1,61				5,41	7,17	6,63	4,41	1,99	1,01	0,77	0,60
22	1,61				5,37	7,13	6,47	4,33	1,95	0,99	0,75	0,60
23	1,61				5,43	7,01	6,37	4,29	1,87	0,99	0,74	0,60
24	1,61				5,41	6,97	6,29	4,19	1,83	0,97	0,73	0,60
25	1,63				5,40	6,89	6,27	4,11	1,77	0,94	0,73	0,62
26	1,63				5,44	6,93	6,25	4,05	1,73	0,92	0,72	0,62
27	1,63				5,43	6,95	6,13	3,99	1,71	0,91	0,72	0,62
28	1,63				5,42	6,91	6,01	3,93	1,69	0,91	0,72	0,63
29	1,61				5,45	6,93	5,91	3,89	1,63	0,91		0,64
30	1,63			5,39	5,59	6,85	5,79	3,83	1,59	0,91		0,64
31				5,39	5,67		5,75		1,52	0,89		0,64

Hauteur d'eau maximale 7,47 atteinte les 15 et 16 Septembre 1962
Hauteur d'eau minimale 0,60 atteinte du 18 au 23 Mars 1963

Debits en mètre … conde
Année Hydrologique - Avril 1962 - Mars 1963

	Avril	Mai	Juin	Juillet	Aout	Septembre	Octobre	Novembre	Décembre	Janvier	Février	Mars
1	1,88	1,88			51,	42	165	15,0	4,80	1,55	0,49	0.23
2	1,88	1,83			52	43	175	15 0	4.60	1,55	0,49	0.23
3	1,88	1,83			56	44	189	15,0	4,50	1,46	0,49	0,22
4	1,88	1,88			56	43	202	14,0	4,30	1,35	0,49	0,22
5	1,93	1.83			57	42	230	12,0	4,00	1,30	0,46	0.20
6	1,93	2,03			56	40	256	10,0	3,70	1,30	0,46	0,20
7	1,93	1,98			51	50	265	10,5	3,30	1,25	0,43	0,16
8	1,93	1,93			48	72	270	10,5	3.20	1,25	0,43	0,16
9	1,98	1,93			45	75	278	10,0	2,90	1,18	0,43	0,16
10	1,98	1,88			44	115	250	10,0	2,80	1,15	0,43	0,14
11	1,98	2,08			42	125	240	10,0	2,80	1,10	0,40	0,14
12	1,98	2.08			47	357	200	9,5	2,70	1,05	0,38	0,14
13	2,03	2,28			39	482	220	9,5	2,60	1,04	0,37	0,14
14	2,03	2 23			39	503	175	8,8	2,50	1,02	0,37	0.12
15	2,03	2,18			38	515	170	8,8	2:50	0,95	0,34	0,12
16	2,03	2,13			37	512	168	8,0	2,40	0,94	0,34	0.12
17	2,03	2,03			35	492	155	7,3	2,30	0,94	0,34	0,12
18	1,83	1.60			33	417	145	7,5	2,30	0,84	0,34	0,10
19	1,83	1,58			32	407	125	7,3	2,20	0,80	0,34	0.10
20	1,83	1,42			30	368	113	6,6	2,10	0,70	0,31	0,10
21	1,83				28	345	105	6,2	2,10	0,67	0,31	0,10
22	1,83				25	323	74	6,0	2,00	0,64	0,28	0,10
23	1,83				28	265	57	6,1	2.00	0,64	0,26	0,10
24	1,83				25	247	50	5,5	1,90	0,61	0,25	0,10
25	1.88				24	211	45	5,4	1,85	0,56	0,25	0,12
26	1,88				27	214	47	5,3	1,80	0,53	0,23	0.12
27	1,88				26	220	37	5,2	1,75	0,52	0,23	0,12
28	1,88				24	210	30	5,1	1,70	0,52	0,23	0,13
29	1,83				27	210	24	5,1	1,65	0,52		0,14
30	1,88			52,0	32	180	18	5,0	1,65	0,52		0,14
31				51,0	33		17		1,60	0,49		0,14
Total	57,30				1187,0	7169,0	4493,0	260,2	82,5	26,62	10,17	4,43
Moyenne	1.91				38,3	230	145	8,47	2,66	0,86	0,36	0,14
Débit spécifique l s km2					8,88	55,4	33,6	0,20	0,062	0.020	0,008	0 003
écoulement en 10^6 m^3	4.95				102,56	619,40	388,20	22,48	7,13	2,30	0,88	0,38
Ecoulement en mm	1,2				23,8	143,7	90,1	5,2	1,7	0,5	0,2	0,1
Maximum	2,03				57,0	515	278	15,0	4,80	1,55	0,49	0,23
Minimum	1,83				24,0	40,0	17,0	5,0	1,60	0,49	0,23	0,10

Période Maximum 515 Minimum 0,10 — Moyenne 1/s/km2 — Ecoulement en 10^6 m^3 — Ecoulement en mm

LE STUNG SISOPHON à SISOPHON
EN 1962-1963

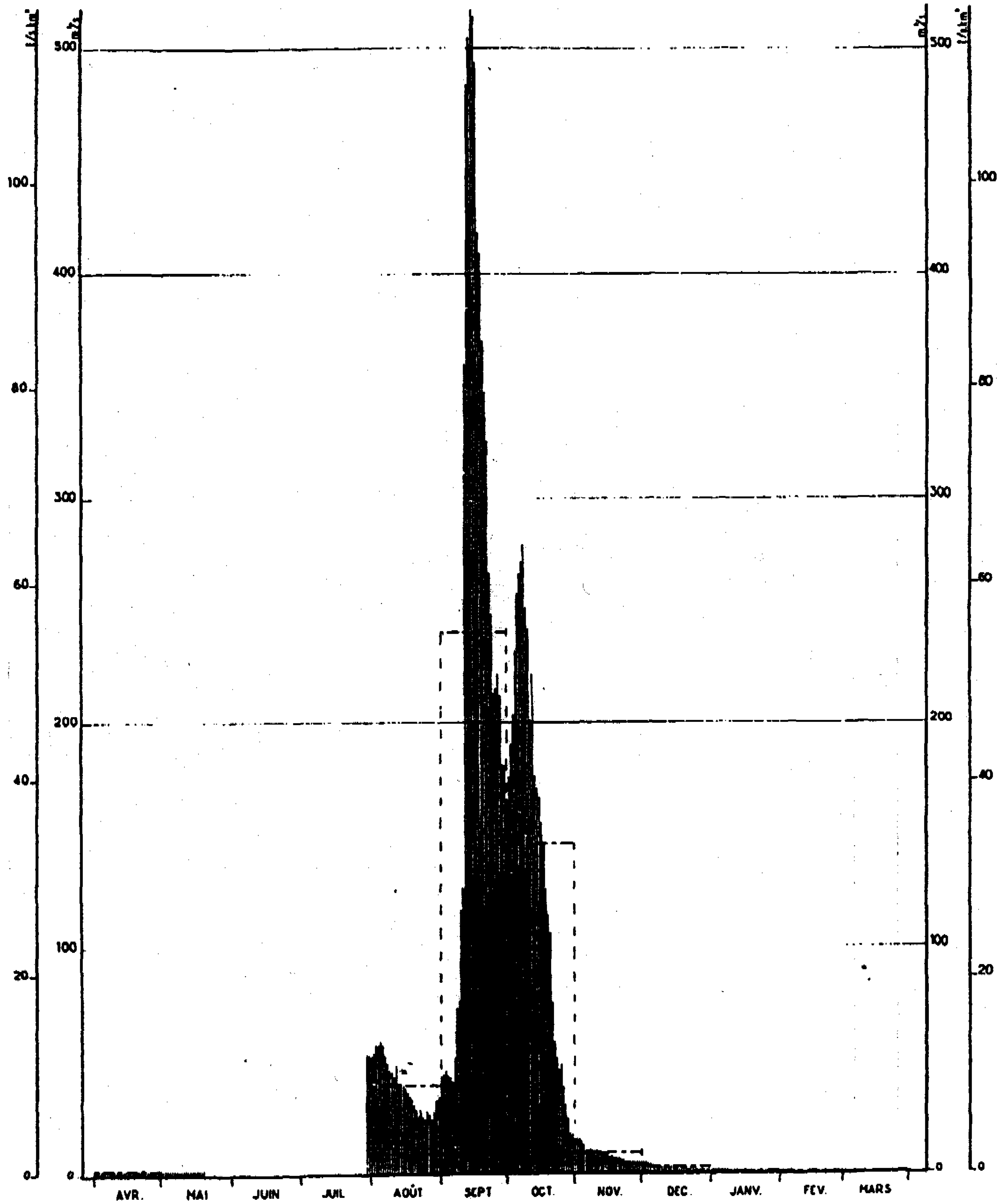


FIG. 38

Le Stung Praneth-Préah à Beng Chhouk

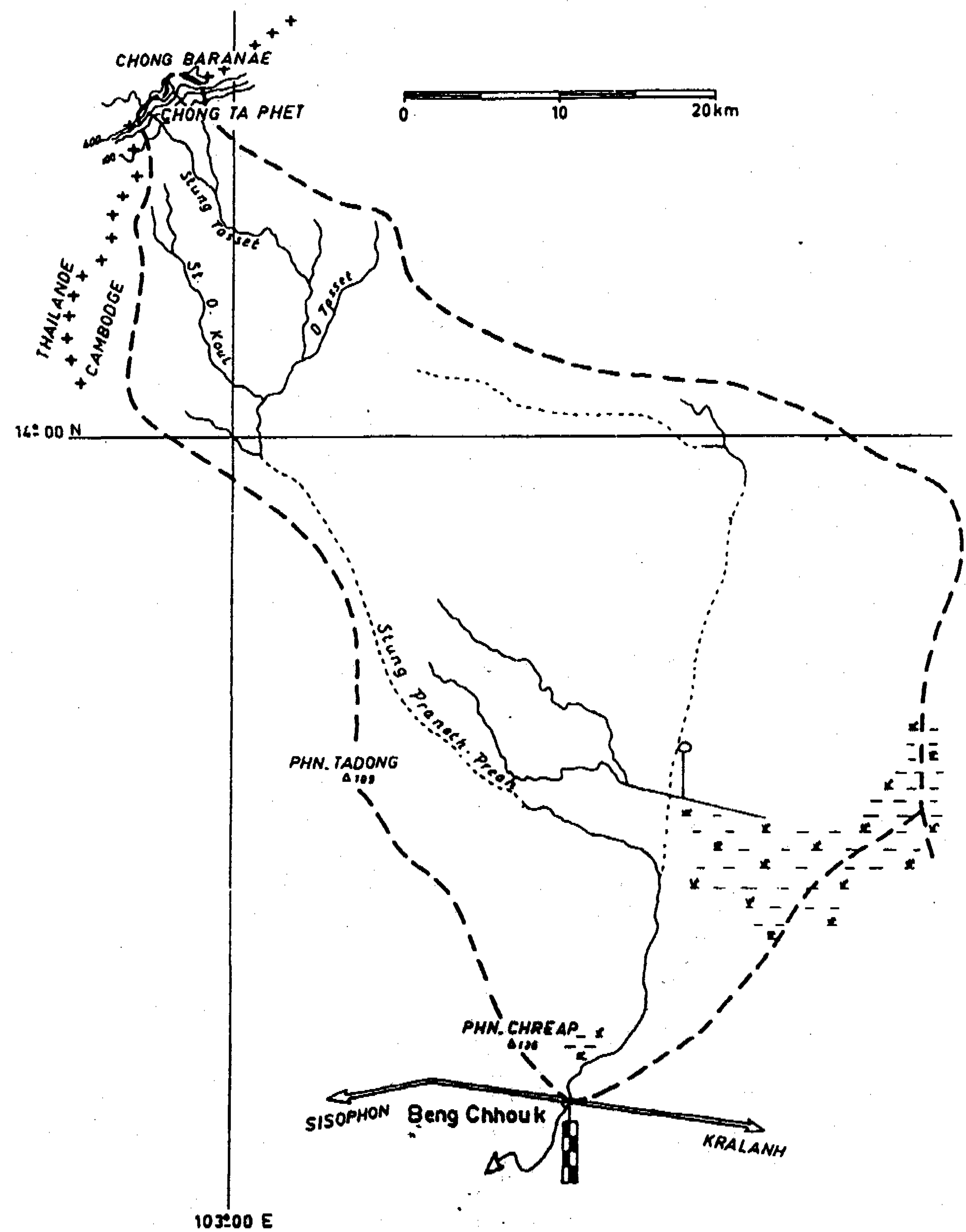


FIG. 39

O PRANET PREAH A BENG CHHOUK

Hauteurs à l'échelle en mètres
Année hydrologique - Avril 1962 - Mars 1963

	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Janvier	Février	Mars
1					1,09	1,32	1,86	1,70	1,38	1,16		
2					1,07	1,30	1,87	1,75	1,37	1,16		
3					1,07	1,32	1,90	1,73	1,35	1,16		
4					1,08	1,31	1,92	1,76	1,34	1,16		
5					1,09	1,33	1,98	1,80	1,32	1,15		
6					1,08	1,36	2,02	1,77	1,30	1,15		
7					1,07	1,38	2,03	1,76	1,28	1,15		
8					1,07	1,48	2,08	1,75	1,26	1,15		
9					1,06	1,56	2,06	1,74	1,25	1,14		
10					1,08	1,60	2,12	1,73	1,27	1,13		
11					1,09	1,67	2,11	1,72	1,27	1,13		
12					1,09	1,72	2,10	1,68	1,25	1,13		
13					1,08	1,75	2,16	1,65	1,24	1,12		
14					1,09	1,78	2,13	1,60	1,23	1,11		
15					1,08	1,82	2,16	1,56	1,20	1,10		
16					1,09	1,90	2,13	1,52	1,19			
17					1,10	1,96	2,09	1,48	1,18			
18					1,09	1,99	2,06	1,47	1,17			
19					1,08	2,02	2,00	1,46	1,18			
20					1,10	1,96	1,98	1,45	1,19			
21					1,10	1,94	1,96	1,44	1,20			
22					1,09	1,90	1,94	1,43	1,19			
23					1,09	1,84	1,92	1,42	1,18			
24					1,17	1,78	1,90	1,41	1,17			
25					1,30	1,77	1,87	1,40	1,16			
26				1,10	1,33	1,75	1,86	1,38	1,15			
27				1,09	1,38	1,74	1,86	1,37	1,16			
28				1,09	1,39	1,74	1,84	1,39	1,17			
29				1,08	1,39	1,75	1,82	1,38	1,16			
30				1,10	1,38	1,80	1,79	1,36	1,16			
31				1,11	1,36		1,75		1,16			

Hauteur d'eau maximale 2,16 m atteinte les 13 et 15 Octobre 1962
Hauteur d'eau minimale atteinte le

O PRANET PREAH A BENG CHHOUK

Débits en mètres cubes par seconde
Année Hydrologique - Avril 1962 - Mars 1963

	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Janvier	Février	Mars
1					0,116	0,58	12,3	10,70	0,95	0,18		
2					0,108	0,50	9,5	15,10	0,87	0,18		
3					0,108	0,58	11,8	14,00	0,74	0,18		
4					0,112	0,68	11,3	15,70	0,68	0,18		
5					0,116	0,63	17,7	18,10	0,58	0,17		
6					0,112	0,81	25,0	16,30	0,50	0,17		
7					0,108	0,95	30,0	15,70	0,43	0,17		
8					0,108	2,70	33,5	15,10	0,37	0,17		
9					0,104	5,46	29,3	14,56	0,34	0,16		
10					0,112	7,50	40,0	14,00	0,40	0,15		
11					0,116	10,90	34,5	13,50	0,40	0,15		
12					0,116	13,48	32,0	11,30	0,34	0,15		
13					0,112	15,10	45,0	9,90	0,32	0,14		
14					0,116	16,90	42,5	7,50	0,30	0,13		
15					0,112	19,70	50,0	5,56	0,24	0,12		
16					0,116	26,60	45,0	4,00	0,22			
17					0,120	32,8	35,0	2,70	0,20			
18					0,116	36,0	31,0	2,45	0,19			
19					0,112	39,3	20,7	2,20	0,20			
20					0,120	32,8	19,0	1,95	0,22			
21					0,120	30,[illegible]	18,6	1,79	0,24			
22					0,116	26,6	18,4	1,63	0,22			
23					0,116	21,3	18,0	1,47	0,20			
24					0,190	16,9	17,0	1,31	0,19			
25					0,500	15,7	15,0	1,15	0,18			
26				0,120	0,630	13,2	16,6	0,95	0,17			
27				0,116	0,950	10,7	17,0	0,87	0,18			
28				0,116	1,050	8,0	17,8	1,05	0,19			
29				0,112	1,050	5,7	16,5	0,95	0,18			
30				0,120	0,950	7,0	15,1	0,81	0,18			
31				0,130	0,810		13,2		0,18			
Total				0,713	8,742	419,97	758,40	222,40	10,60	2,40		
Moyenne					0,282	14,00	24,465	7,414	0,342			
Débit spécifique l/s/km2					0,169	8,383	14,650	4,440	0,205			
Ecoulement en 10^6 m^3					0,76	36,29	65,53	19,22	0,92			
Ecoulement en mm					0,5	21,7	39,2	11,5	0,5			
Maximum					1,050	39,3	50,0	18,10	0,95			
Minimum					0,104	0,50	9,5	0,81	0,17			

Période Maximum 50,0 Minimum | Moyenne l/s/km2 | Ecoulement 10^6 m^3 122,97 | Ecoulement mm. 73,6

O PRANET PREAH à BENG CHHOUK
EN 1962-1963

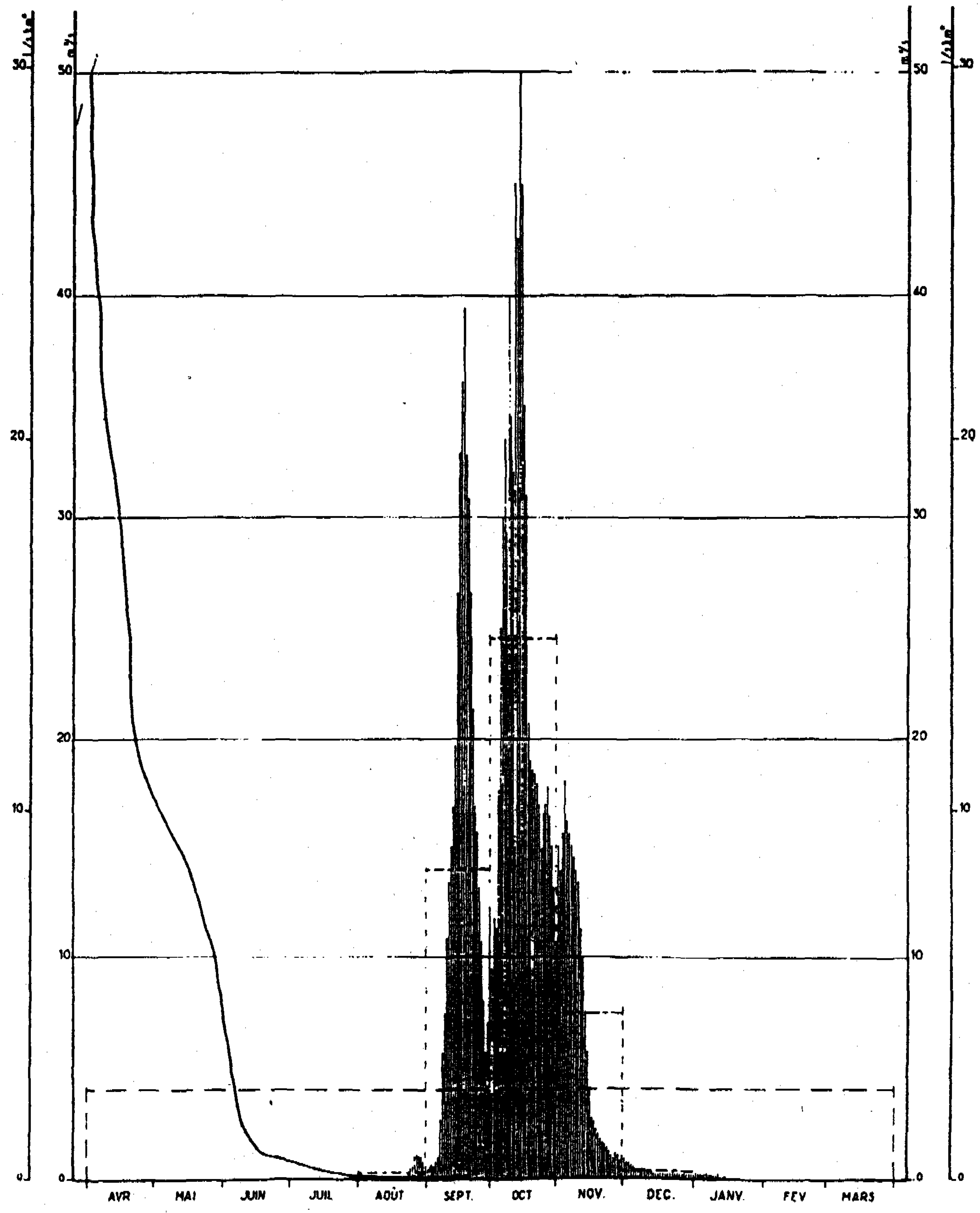


FIG. 41

Le Stung Pursat a Pursat

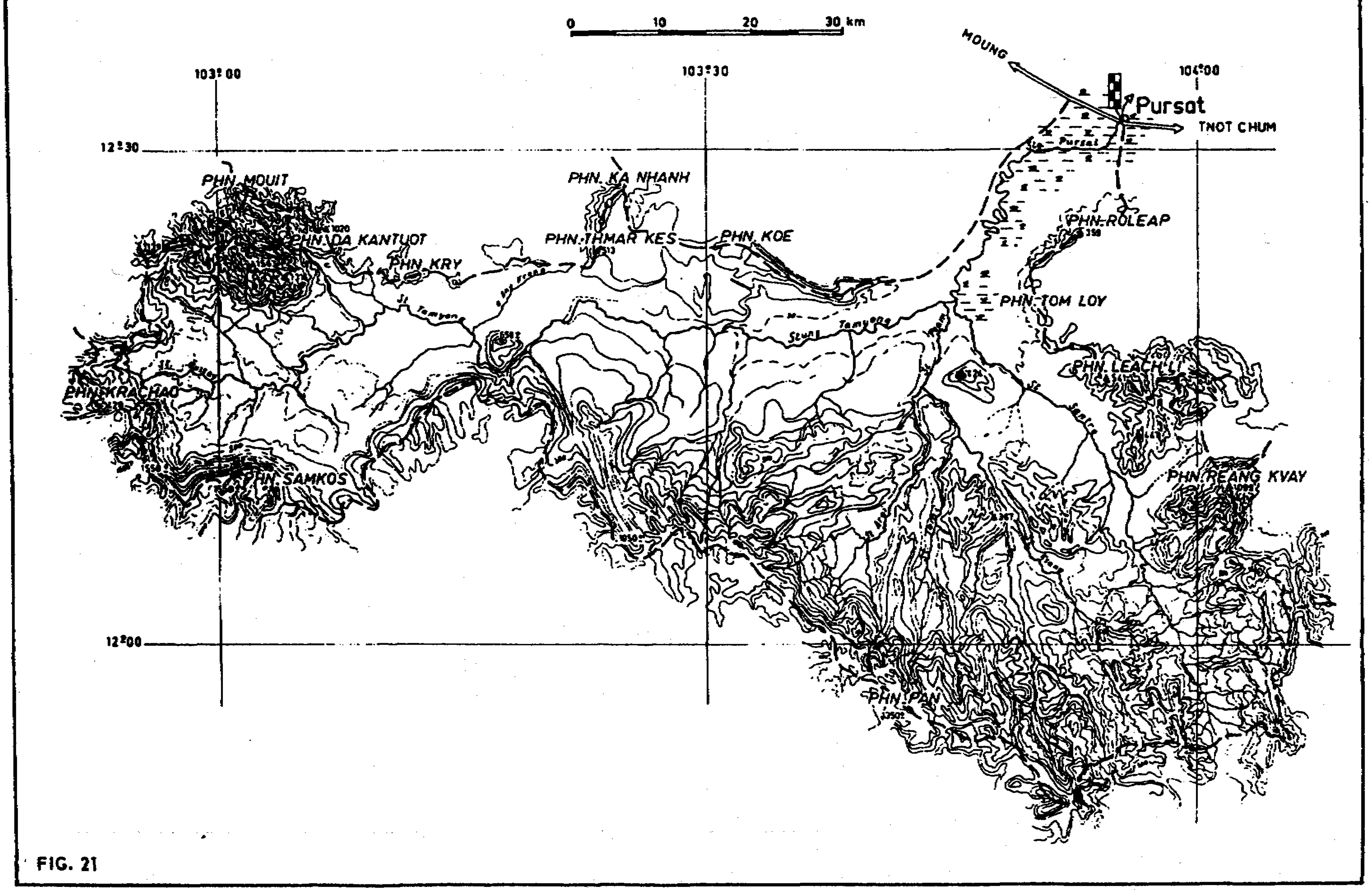


FIG. 21

STUNG PURSAT A PURSAT

Hauteurs à l'échelle en mètres
Avril 1962 - Mars 1963

	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Janvier	Février	Mars
1	0,30	0,87	0,59	0,84	1,00	1,86	3,30	1,66	0,68	0,30	0,16	0,14
2	0,32	0,85	0,52	0,88	0,92	1,75	3,40	1,60	0,66	0,30	0,16	0,12
3	0,35	0,88	0,48	0,89	0,85	1,57	3,80	1,40	0,62	0,32	0,14	0,12
4	0,30	0,90	0,40	0,91	0,80	1,45	4,33	1,36	0,60	0,32	0,14	0,12
5	0,27	0,88	2,25	1,10	1,28	1,42	4,44	1,48	0,58	0,32	0,14	0,12
6	0,25	0,82	2,35	1,22	3,34	1,44	4,35	1,62	0,54	0,30	0,14	0,12
7	0,23	0,78	1,65	1,28	4,15	1,49	4,17	1,64	0,54	0,30	0,14	0,10
8	0,20	0,83	1,12	1,42	3,32	2,50	4,06	1,46	0,54	0,30	0,14	0,10
9	0,21	0,68	1,10	1,70	2,00	3,10	3,66	1,30	0,54	0,28	0,14	0,10
10	0,20	0,62	1,09	1,70	1,85	3,05	3,50	1,20	0,50	0,28	0,14	0,10
11	0,20	0,58	1,09	1,72	1,90	3,50	3,70	1,12	0,50	0,26	0,14	0,10
12	0,20	0,62	1,00	1,22	2,25	4,20	3,46	1,06	0,50	0,26	0,14	0,10
13	0,20	0,81	0,79	1,50	2,60	2,90	3,06	0,98	0,48	0,26	0,14	0,10
14	0,20	0,92	0,79	1,99	2,62	2,30	2,62	0,92	0,44	0,24	0,14	0,08
15	0,29	0,75	0,76	2,38	1,82	2,89	2,34	0,88	0,43	0,24	0,14	0,08
16	0,35	0,80	0,72	2,10	1,60	2,82	2,74	0,84	0,42	0,24	0,14	0,08
17	0,44	0,86	0,73	1,88	1,52	2,80	2,50	0,80	0,41	0,24	0,14	0,08
18	0,49	0,81	0,70	2,28	1,38	2,75	2,20	0,76	0,41	0,22	0,14	0,08
19	0,50	0,78	0,65	2,40	1,39	2,65	2,30	0,72	0,40	0,22	0,22	0,06
20	0,50	0,76	0,62	3,80	1,42	2,72	3,88	0,68	0,39	0,20	0,22	0,06
21	0,52	0,69	0,84	3,56	1,37	2,85	4,54	0,66	0,38	0,20	0,22	0,10
22	0,54	0,66	0,85	2,80	1,50	2,92	4,60	0,66	0,37	0,20	0,18	0,08
23	0,55	0,64	0,79	2,10	1,42	2,81	4,38	0,66	0,36	0,20	0,18	0,08
24	0,56	0,66	0,75	2,23	2,00	2,58	3,88	0,66	0,35	0,18	0,16	0,16
25	0,44	0,72	0,74	2,85	3,15	2,44	3,40	0,66	0,34	0,18	0,16	0,24
26	0,60	0,74	0,74	2,86	2,52	2,50	3,06	0,62	0,34	0,18	0,16	0,24
27	0,75	0,71	0,72	2,00	1,89	2,35	2,98	0,62	0,33	0,18	0,14	0,32
28	0,80	0,67	0,81	1,89	1,92	2,92	2,86	0,66	0,32	0,18	0,14	0,34
29	0,85	0,65	0,84	1,68	2,49	3,02	2,48	0,68	0,31	0,16		0,30
30	0,90	0,62	0,80	1,30	2,20	3,03	2,14	0,70	0,31	0,16		0,28
31		0,63		1,20	1,93		1,86		0,30	0,16		0,34

Hauteur d'eau maximale 4,60 le 22 Octobre 1962
Hauteur d'eau minimale 0,06 les 19 et 20 Mars 1963

STUNG PURSAT A PURSAT

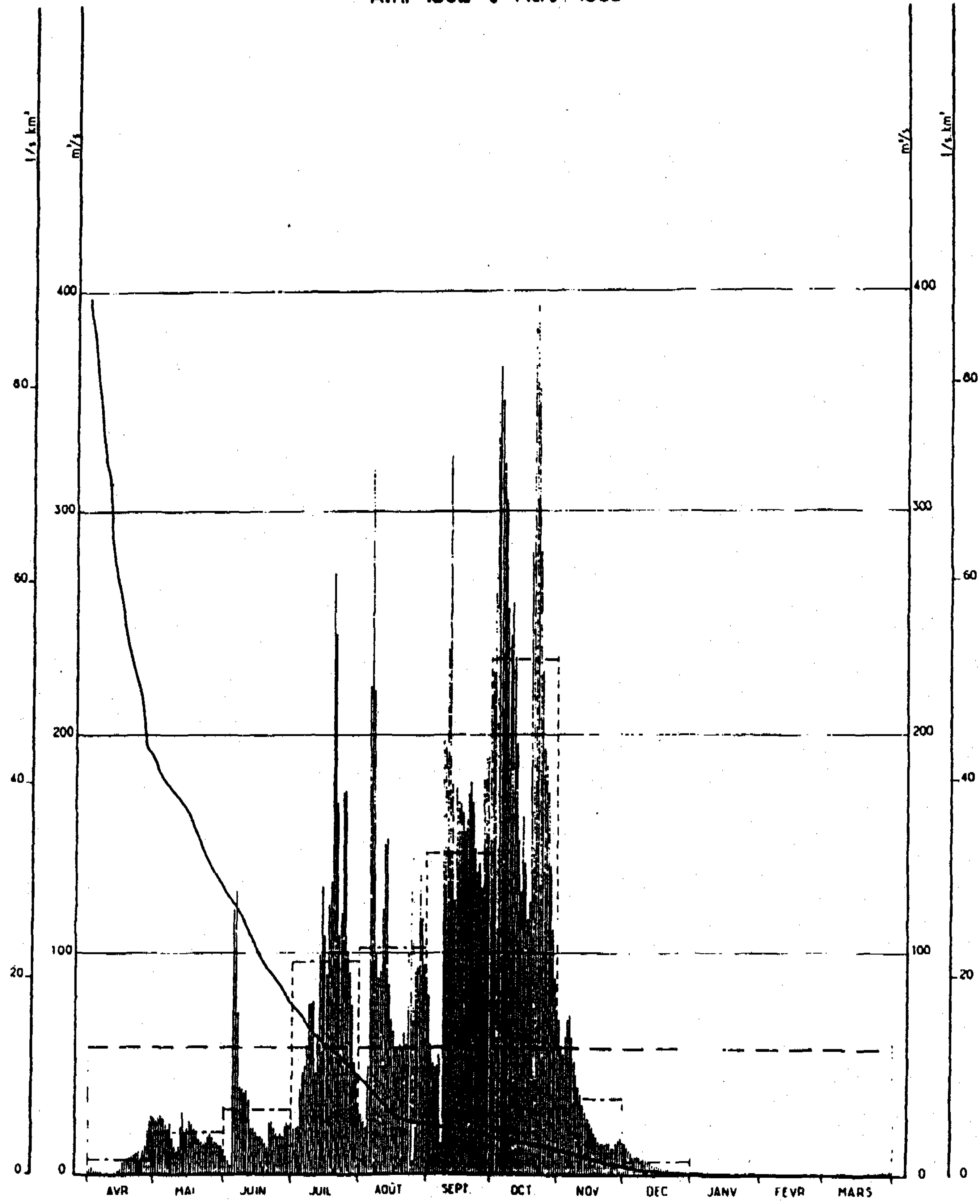
Débits en mètres cubes par seconde
Année Hydrologique Avril 1962 - Mars 1963

	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Janvier	Février	Mars
1	2,1	25,4	11,1	23,7	33,0	89,0	218	74,7	15,5	2,1	0,5	0,4
2	2,5	24,3	8,1	25,9	28,2	81,0	228	70,5	14,5	2,1	0,4	0,3
3	3,2	25,9	6,6	26,5	24,3	68,6	272	57,5	12,5	2,5	0,4	0,3
4	2,1	27,0	4,2	27,6	21,5	60,8	347	54,9	11,5	2,5	0,4	0,3
5	1,7	25,9	120,0	39,0	49,8	58,2	366	62,7	10,6	2,5	0,4	0,3
6	1,4	22,6	129,0	46,2	222,0	59,5	351	71,9	8,9	2,1	0,4	0,3
7	1,2	20,5	74,0	49,8	319,0	63,4	322	73,3	8,9	2,1	0,4	0,2
8	0,8	23,2	40,2	58,8	220,0	14,2	306	61,4	8,9	2,1	0,4	0,2
9	0,9	15,5	39,0	77,5	100,0	198,0	256	51,0	8,9	1,8	0,4	0,2
10	0,8	12,5	38,4	77,5	88,3	193,0	244	45,0	7,2	1,8	0,4	0,2
11	0,8	10,6	38,4	78,9	92,0	238,0	260	40,2	7,2	1,6	0,4	0,2
12	0,8	12,5	33,0	46,2	120,0	326,0	234	36,6	7,2	1,6	0,4	0,2
13	0,8	22,1	21,0	64,0	151,0	178,0	194	31,8	6,6	1,6	0,4	0,2
14	0,8	28,2	21,0	99,2	153,0	124,0	153	28,2	5,4	1,3	0,4	0,1
15	2,0	19,0	19,5	131,0	86,0	176,0	128	25,9	5,1	1,3	0,4	0,1
16	3,2	21,5	17,5	108,0	70,5	171,0	164	23,7	4,8	1,3	0,4	0,1
17	5,4	24,8	18,0	90,5	65,3	169,0	142	21,5	4,5	1,3	0,4	0,1
18	6,9	22,1	16,5	122,0	56,2	165,0	116	19,5	4,5	1,0	[illegible]	0,1
19	7,2	20,5	14,0	133,0	56,9	156,0	124	17,5	4,2	1,0	1,0	0,1
20	7,2	19,5	12,5	272,0	58,8	162,0	282	15,5	4,0	0,8	1,0	0,1
21	8,1	16,0	23,7	245,0	55,6	174,0	383	14,5	3,8	0,8	1,0	0,2
22	8,9	14,5	24,3	169,0	64,0	180,0	394	14,5	3,6	0,8	0,6	0,1
23	9,4	13,5	21,0	108,0	58,8	170,0	356	14,5	3,4	0,8	0,6	0,1
24	10,2	14,5	19,0	118,0	100,0	149,0	282	14,5	3,2	0,6	0,5	0,5
25	5,4	17,5	18,5	174,0	202,0	137,0	228	14,5	2,9	0,6	0,5	1,3
26	11,5	18,5	18,5	175,0	144,0	142,0	194	12,5	2,9	0,6	0,5	1,3
27	19,0	17,0	17,5	100,0	91,3	129,0	186	12,5	2,7	0,6	0,4	2,5
28	21,5	15,0	22,1	91,3	93,6	180,0	174	14,5	2,5	0,6	0,4	2,9
29	24,3	14,0	23,7	76,1	136,0	190,0	140	15,5	2,3	0,5		2,1
30	27,0	12,5	21,5	51,0	116,0	191,0	111	16,5	2,3	0,5		1,8
31		13,0		45,0	94,4		89		2,1	0,5		2,9
Total	197,1	589,6	891,8	2949,7	3171,5	4392,7	7244	1207,3	192,6	41,3	13,8	19,7
Moyenne	6,6	19,0	29,7	95,2	102,3	146,4	233,7	34,2	6,2	1,3	0,5	0,6
l/s/km^2	1,47	4,25	6,36	21,24	22,84	32,68	52,16	7,64	1,39	0,30	0,11	0,14
Ecoulement en 10^6 m^3	17,03	50,94	77,05	254,85	274,02	379,53	625,88	104,31	16,64	3,57	1,19	1,70
Ecoulement en mm	3,8	11,4	17,2	56,9	61,2	84,7	139,7	23,3	3,7	0,8	0,3	0,4
Maximum	27,0	28,2	129,0	272,0	319,0	326,0	394	74,7	15,5	2,5	1,0	2,9
Minimum	0,8	10,6	4,2	23,7	21,5	58,2	89	12,5	2,1	0,5	0,4	0,1

Maximum 394 Minimum 0,1	Moyenne 57,3 l/s/km^2 12,79	Ecoulement en 10^6 m^3 1 806,77 Ecoulement en mm 403,3

LE STUNG PURSAT à PURSAT

Avril 1962 à Mars 1963



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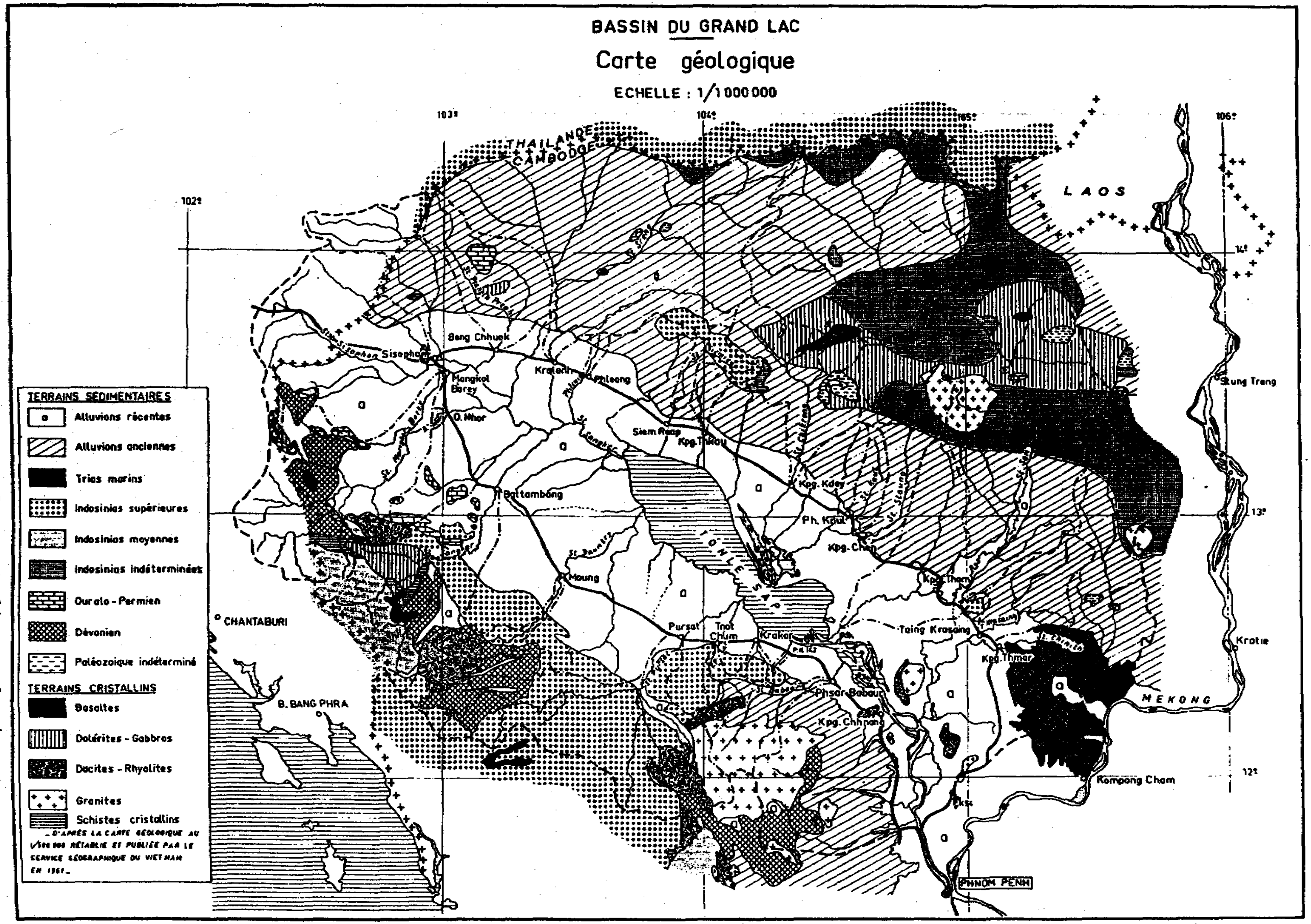
ANNEX 6. GEOLOGIC MAPS FOR THE GREAT LAKE BASIN

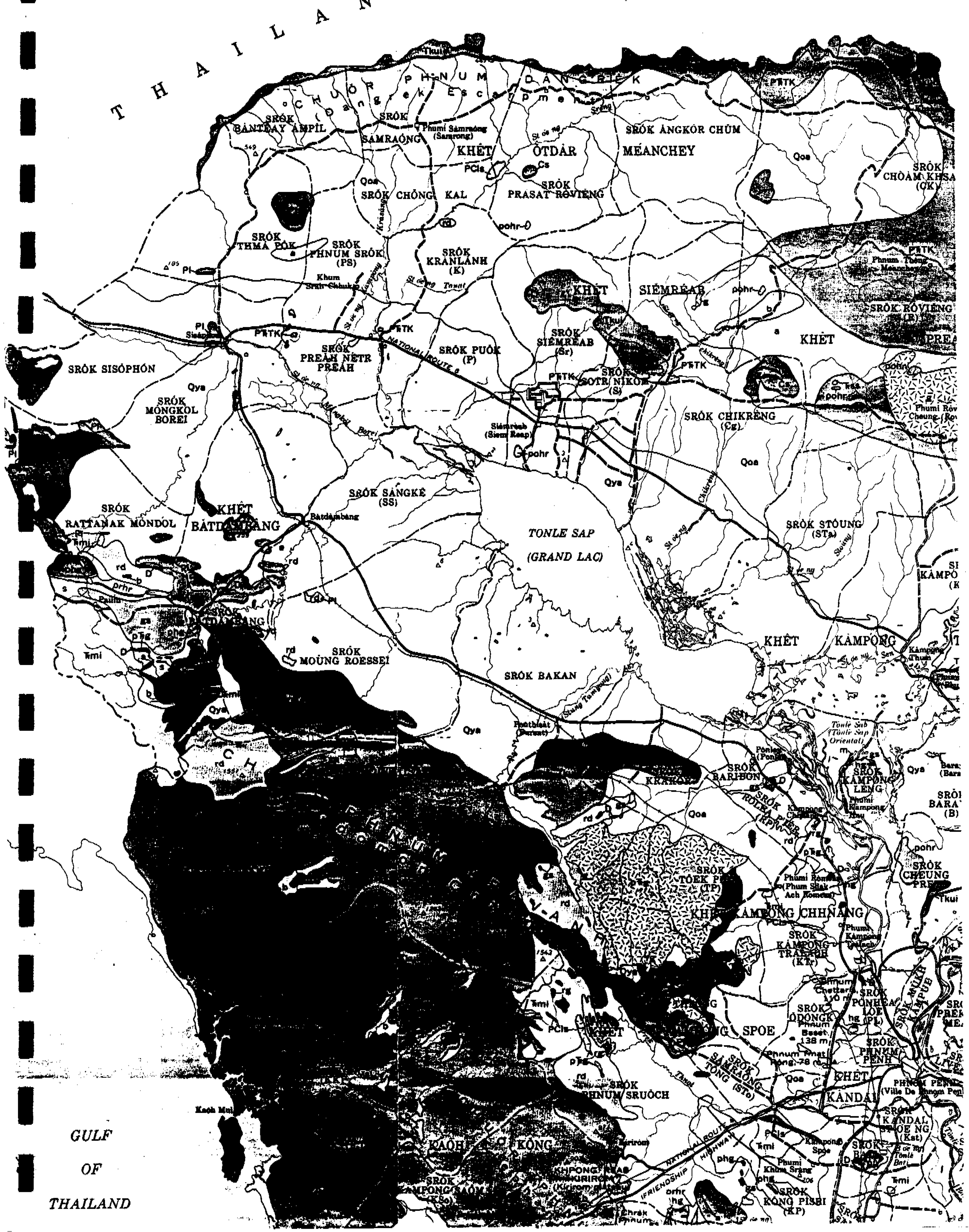


(taken from "Grand Lac du Cambodge - Sedimentologie et Hydrologie (1962-1963)")

ED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ANNEX 6. GEOLOGIC MAPS FOR THE GREAT LAKE BASIN

*taken from "Ground-Water Resources of Cambodia" by W.C. Rasmussen and G.M. Bradford, U.S.G.S)



EXPLANATION

Age	Symbol	Description	Period
Holocene	Qya	YOUNG ALLUVIUM—Sand, silt, and clay with some gravel	QUATERNARY
Pleistocene	Qal	ALLUVIUM—Undifferentiated	QUATERNARY
·istocene to Holocene	Qoa	OLD ALLUVIUM—Sand, clay, silt, and laterite; yellowish-brown laterite; coarse sand and fine gravel. Terrace deposits of sand, silt, and gravel in places weathered to laterite	QUATERNARY
·etaceous to Paleocene		UPPER INDOSINIAS FORMATION—Sandstone and conglomerate	CRETACEOUS TO TERTIARY
er Jurassic	Jss	SHALE, SANDSTONE AND CALCAREOUS SANDSTONE	JURASSIC
	Jsc	SANDSTONE, SANDY MARL, AND CONGLOMERATE	JURASSIC
·er Triassic	Ŧrb	RED BEDS: SANDSTONE AND SHALE	TRIASSIC
	Ŧs	MARINE SHALE AND SANDY SHALE	TRIASSIC
dle Triassic	Ŧss	MARINE SANDSTONE AND SHALE	TRIASSIC
	Ŧmi	MIDDLE INDOSINIAS FORMATION—Red beds: sandstone, sandy shale, conglomerate, breccia, and tuff	TRIASSIC
· Permian to er Triassic	PŦli	LOWER INDOSINIAS FORMATION—Sandstone	PERMIAN
· Permian to ·aleocene	PŦTK	INDOSINIAS FORMATION UNDIFFERENTIATED	PERMIAN
per Permian	Pl	LIMESTONE	PERMIAN
·boniferous to ·mian	PCls	LIMESTONE AND SILICIFIED LIMESTONE	PERMIAN / CARBONIFEROUS
		CONGLOMERATE, SANDSTONE, AND SHALE	CARBONIFEROUS
Middle Carboniferous	Cs	SHALY SANDSTONE	CARBONIFEROUS
Lower Devonian		SHALE, SANDSTONE, LIMESTONE, CRYSTALLINE LIMESTONE, AND MARL	DEVONIAN
Cambrian to Silurian	SOIC	CHLORITE SCHIST, SERICITE SCHIST, MICACEOUS SCHIST, QUARTZITE, AND SANDSTONE	CAMBRIAN TO SILURIAN
		CAMBRIAN ROCKS, UNDIFFERENTIATED	

CRYSTALLINE ROCKS

Age	Symbol	Description	Group
	g	GRANITE	
	phg	PRE-HERCYNIAN GRANITE	
	hg	HERCYNIAN GRANITE	HERCYNIAN (OROGONY)
	hdg	HERCYNIAN DIORITE AND GRANITE	HERCYNIAN (OROGONY)
	ptg	POST-TRIASSIC GRANITE	HERCYNIAN (OROGONY)
		CONTACT ROCKS WITH MASSIVE GRANITE	HERCYNIAN (OROGONY)
	prhr	PRE-HERCYNIAN RHYOLITE	*Pre-Hercynian* — HERCYNIAN (OROGONY)
Upper Carboniferous	pohr	POST-HERCYNIAN RHYOLITE	*Post-Hercynian* — HERCYNIAN (OROGONY)
		MICROGRANITE	HERCYNIAN (OROGONY)
	rd	POST-HERCYNIAN RHYOLITE AND DACITE	*Post-Hercynian* — HERCYNIAN (OROGONY)
	a	ANDESITE	
	gs	GABBRO AND SERPENTINE	
	b	BASALT	
		PYROXENITE AND AMPHIBOLITE	
		CRYSTALLINE SCHIST WITH PYROXENITE	
	s	CRYSTALLINE SCHIST	

Contact—Dashed where approximately located

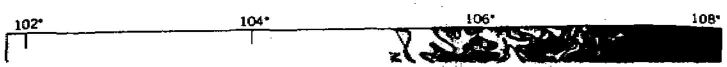
Fault

Syncline

H——H′ Line of geologic section

Phnum Tét Srei. 202 m. (Chamkar Leu) — MOUNTAIN OR HILL—Showing elevation in metres

Phnum Baset 138 m — EXTINCT VOLCANIC CONE—Showing elevation in metres



ANNEX 7.

TOP TEN DISTRICTS OF EXPECTED RETURN FOR POPULATIONS OF SITE 2, SITE B, AND SITE 8 (as reported by Ford Foundation Survey)

DISTRICT	PLACE OF BIRTH		PLACE OF EXPECTED RETURN	
	% TOTAL	PERSONS	% TOTAL	PERSONS
MUONG RUSSEY, BATTAMBANG	10.0	24,525	9.9	24,280
SANGKER, BATTAMBANG	9.7	23,789	11.4	27,979
BATTAMBANG, BATTAMBANG	8.7	21,337	15.8	38,750
MONGOL BOREY, BATTAMBANG	6.0	14,715	6.0	14,715
BAKAN, PURSAT	5.7	13,979	4.7	11,527
THMAR PUOK, BATTAMBANG *	5.5	13.489	5.3	12,998
SISOPHON, BATTAMBANG *	3.3	8,093	4.3	11,282
KRALANH, SIEM RIEP *	2.8	6,867	2.5	6,131
BANTEAY AMPIL, ODDAR MEANCHEY *	1.0	2,453	2.2	5,396
PREAH NET PREAH, BATTAMBANG *	1.5	3,679	1.4	3,434
	54.2 %	132,926	63.8 %	156,470

NOTE Data reported in terms of pre-1975 geography and division of districts, as these were points of reference for the respondents.

* These districts are now part of a new province called Banteay, Mean Chey

ANNEX 8.

Provinces in survey	District in survey	Communes in survey	No. of villages	Local Population	Camp population wishing to return (all camps)	% increase flwg. the returnee influx
Battambang	Sangke	9**	130**	68744**	40782***	60%
		Kompong Preah	6	4555	892	20%
		O Dambang II	6	6601	2273	35%
	Mong Russey	11**	92**	72529**	31181***	43%
		Kear	11	9469		
		Mong	13.	7701	1875	8%
		Prey Svay	9	7555		
	Battambang	10**		82288**	42220***	51%
		Chrey	7	8857	1383	16%
		Tameun	10	10986	924	5%
		Tapoun	7	9949		
Banteay Meanchey	Mongkol Borey	14**	157**	102900**	18302***	18%
		Seua	11	8397	779	9.3%
		Chom Nom	17	10048	1791	18%
		Phnom Toit	10	7171	934	13%
		Rohat Tuk	13	7779	466	6%
		Russey Krok	17	17528	1492	9%
		Banteay Neng	19	13340	1869	14%
		Koi Meng	8	4939	872	17.5%
		O Prasat	14	9874	1946	20%
Total all communes		44	-	326461	132485	41%
Total communes in the survey		16	-	144749	17496	12%

Battambang and Banteay Meanchey, the 4 districts and 16 communes surveyed with percentage increases in each geographical unit following the returnee influx.

---

* Site 2, Sok Sann, Site B, Boray, Site K, O Trao, Khao-i-Dang and Ban That.

** Data of all administrative units within a district including those not incorporated into the survey.

*** Returnees wishing to settle in all communes of the district including those not in the survey.

ANNEX 9.

Village water questionnaire

តារាងបំពេញ ពី បញ្ហាទឹកតាមភូមិ

1- Date questionnaire completed : ....

ថ្ងៃ, ខែ, ឆ្នាំ ដែលបានបំពេញ : ....

2- questionnaire completed by WHOM : ....

អ្នកបានបំពេញដោយ ....

3- Village : .... Commune : ....

ភូមិ : .... ឃុំ : ....

District : .... Province : ....

ស្រុក : .... ខេត្ត : ....

4- Village Population - Number of families : ....

ភូមិ ប្រជាជន - ចំនួនគ្រួសារ : ....

- Number of persons : ....

- ចំនួនប្រជាជន : ....

(For this village please answer the following questions)

(ចំពោះភូមិនេះ, សូមមេត្តាឆ្លើយទៅនឹងសំណួរខាងក្រោម)

5- How many family ponds are there? ....

- តើមានស្រះតូចប្រចាំគ្រួសារចំនួនប៉ុន្មាន? ....

6- How many family ponds provide water during the dry season?

- តើមានស្រះតូចប្រចាំគ្រួសារចំនួនប៉ុន្មានដែលអាចប្រើប្រាស់បានក្នុងរដូវប្រាំង?

....

7- How many village ponds are there? ....

តើមានស្រះភូមិចំនួនប៉ុន្មាន? ....

8- How many village ponds provide water during the dry season?

តើមានស្រះភូមិចំនួនប៉ុន្មានដែលអាចប្រើប្រាស់បានក្នុងរដូវប្រាំង?

....

9- How many dug wells are there? ....

- តើមានអណ្តូងជីកចំនួនប៉ុន្មាន? ....

10- How many dug wells provide water during the dry season?

- តើមានអណ្តូងជីកចំនួនប៉ុន្មានដែលអាចប្រើប្រាស់បានក្នុងរដូវប្រាំង?

....

11- What is the average depth of dug wells? (in meters)

- តើជំរៅរបស់អណ្តូងជីកនោះចំនួនប៉ុន្មានម៉ែត្រ? គិតមធ្យម

....

12- What is the everage static water level of dug wells ?
តើ កំពស់ទឹក របស់អណ្តូង ស្នប់ នោះ ប៉ុន្មាន?
- During dry season? (in meters)- - - - - - - - - - - -
ក្នុងរយៈ ពេល ខែ ប្រាំង? (ជា ម៉ែត្រ)- - - - - - - - - - -
- During rainy season? (in meters)- - - - - - - - - - - -
ក្នុងរយៈ ពេល ខែ វស្សា? (ជា ម៉ែត្រ)- - - - - - - - - - -

13- How many drilled boreholes are there ?- - - - - - - - -
តើ អណ្តូង ដែលបានឃួង ប៉ុន្មាន? (គឺអណ្តូងស្នប់)- - - - - - -

14- What is the maximum distance villagers are walking to carry water from source to their home? (in meters)
តើ ចម្ងាយ ឆ្ងាយ ជាងគេ ដែល ប្រជាជន បានដើរ ដងទឹក ពី កន្លែងមានទឹក យកមកផ្ទះ?
(គិត ជា ម៉ែត្រ)

- -

15- Are there well digging artisans is this village?- - - - - - - -
តើ នៅ ភូមិ នេះ មាន ក្រុម ជីក អណ្តូង ឬទេ?- - - - - - - - - - -
How many? ប៉ុន្មាន នាក់?- - - - - - - - - - - - - - - - - -

16- Where do villagers normally collect water <u>during the dry season</u> for
តើ ប្រជាជន, ជា ធម្មតា នៅ យក ទឹក ពី កន្លែងណា, <u>ក្នុងរយៈពេលខែប្រាំង</u> សំរាប់

	Dug Wells អណ្តូង ស្នប់	Drilled Wells អណ្តូងដែល បានឃួង	P.Pot Canals ប្រឡាយ ដែលបានប៉ុលពត	Irrigation Canals ប្រឡាយ ស្រោចស្រព	Family Ponds ស្រះគ្រួសារ (បឹងគ្រួសារ)	Village Ponds ស្រះ ភូមិ	Rivers ទន្លេ	Rainwater ទឹកភ្លៀង
Drinking and Cooking ហូប និង ធ្វើម្ហូប								
Bathing and Washing ងូត និង បោកគក់								
Animals ឲ្យសត្វពាហនៈ								
Family Garden សំរាប់ ដំណាំបន្លែ								
Irrigation ស្រោចស្រព								

17 Where do villagers normally collect water <u>during the rainy season</u> for:

តើ ប្រជាជន, អ្នកភូមិ ទៅយកទឹកពីកន្លែងណា ក្នុងរដូវវស្សា ដើម្បី?

	Dug wells. អណ្ដូងជ្រោះ	Drilled Wells អណ្ដូងខួង ម៉ាស៊ីនបូមដៃ	P. Pot Canals ប្រឡាយជំនាន់ប៉ុល ពត	Irrigation Canals ប្រឡាយស្រោចស្រព	Family Ponds ស្រះប្រចាំគ្រួសារ	Village Ponds ស្រះភូមិ	Rivers ស្ទឹង	Rainwater ទឹកភ្លៀង
Drinking and Cooking. ផឹក, ធ្វើម្ហូប								
Bathing and Washing. ងូតទឹក, បោកគក់								
Animals. ឲ្យសត្វពាហនៈ								
Family Garden សួនច្បារក្នុងគ្រួសារ								
Irrigation ស្រោចស្រព								

Drilled borehole questionnaire

តារាងអង្កេតទៅលើអណ្តូងស្នប់

1- Village ភូមិ .... Commune ឃុំ ....

District ស្រុក .... Province ខេត្ត ....

2- Date borehole drilled

ថ្ងៃ, ខែ, ឆ្នាំ ដែលបានជីក ....

3- Who drilled this borehole?

តើនរណាដែលជីកអណ្តូងនេះ? ....

4. Location of borehole in village

ស្ថានភាពនៃទីកន្លែងដែលអណ្តូងនៅក្នុងភូមិនោះ ....

....

5- What is the depth of the borehole? (in meters) តើជម្រៅប៉ុន្មានម៉ែត្រ ....

6- What is the diameter of the borehole? (in millimeters)

តើទំហំប៉ុន្មានមីលីម៉ែត្រ អណ្តូងនោះ? ....

7 What is the static water level during - តើកំពស់ទឹកប៉ុន្មានម៉ែត្រ

Rainy season រដូវវស្សា .... ម៉ែត្រ

Dry season រដូវប្រាំង .... ម៉ែត្រ

8- What type of pump is used?

តើប្រភេទស្នប់អ្វីដែលប្រើ? ....

....

9- Does this pump is function? តើស្នប់នេះនៅប្រើការឬទេ? ....

Why not មូលហេតុ? ....

....

....

10- How does the water taste from this borehole?

តើទឹកអណ្តូងនោះយ៉ាងណាទៅ ដែលធ្លាប់ ..., ក្លិន, ...

....

GOOD / NOT BAD / BAD

ល្អ / មិនសូវអាក្រក់ទេ / អាក្រក់

ANNEX 10. DATA ON EXISTING WATER SUPPLIES FOR VILLAGES IN BATTAMBANG AND BANTEAY MEAN CHEY PROVINCES

DATA ON EXISTING WATER SUPPLIES
FOR MONGOL BOREY DISTRICT OF
BANTEAY MEAN CHEY PROVINCE
OXFAM

VILLAGE	NUMBER FAMILIES	NUMBER PERSONS	NUMBER FAMILY PONDS	NUMBER FAMILY PONDS DURING DRY SEASON WITH WATER	NUMBER VILLAGE PONDS	NO. VILLAGE PONDS DURING DRY SEASON WITH WATER	NUMBER DUG WELLS	NUMBER DUG WELLS DURING DRY SEASON WITH WATER	AVERAGE DEPTH DUG WELLS	SWL WELLS DURING DRY SEASON	SWL WELLS DURING RAINY SEASON	MAXIMUM DISTANCE TO COLLECT WATER	NEARBY SURFACE WATER N= NOT AVAIL AT ALL Y= AVAIL. BOTH SEASON YN=AVAIL. WET SEASON
** DISTRICT MONGOL BOREY													
* COMMUNE CHAM NOM													
CHAM NOM EST	225	1166	52	17	0	0	1	1	8	6.0	3.0	100	Y
TA SALL	125	648	15	4	0	0	0	0	0	0.0	0.0	150	Y
BOSS TUN LOAP	75	360	0	0	0	0	4	3	2	1.5	2.0	200	Y
SRE PREY	64	394	0	0	0	0	5	5	2	1.5	0.0	200	Y
BOEUNG TRASS	147	776	5	5	0	0	3	3	4	3.4	0.5	60	N
KAUK PONLEY	174	790	15	0	1	1	0	0	0	0.0	0.0	300	Y
RAAUNG KAUDOEUM	106	544	30	0	0	0	0	0	0	0.0	0.0	10	Y
CHUOR KHCHASS	96	482	8	0	0	0	3	3	3	2.0	1.0	150	Y
RUNG VOAN EST	134	612	7	3	1	1	0	0	0	0.0	0.0	200	Y
PRALAY CHAR	112	428	6	1	0	0	0	0	0	0.0	0.0	100	Y
CHAM NOM WEST	95	444	15	1	0	0	0	0	0	0.0	0.0	15	Y
RUNG VOANLECH	147	656	22	5	1	0	0	0	0	0.0	0.0	100	Y
TA BUN	43	194	3	0	0	0	1	1	3	2.0	0.5	50	Y
RAUNG KAU CHONG	127	699	10	5	0	0	0	0	0	0.0	0.0	0	Y
DANG TRANG	156	0	3	1	2	2	6	6	5	4.5	1.5	700	N
PEAN RAUNGKAU	70	360	9	0	0	0	0	0	0	0.0	0.0	0	Y
RAUNG KAUKANDAL	164	889	24	1	1	1	0	0	0	0.0	0.0	100	Y
* Subsubtotal *													
	2060	9442	224	43	6	5	23	22					
* COMMUNE ROHATH TUK													
ROHATH TUK	46	264	1	1	1	1	0	0	0	0.0	0.0	0	Y
KRAMOL	135	653	8	0	0	0	0	0	0	0.0	0.0	0	Y
KOK SVAY	142	790	45	10	0	0	0	0	0	0.0	0.0	0	N
O DANGKOR	171	850	25	5	1	0	3	3	5	4.0	2.0	0	N
CHORK LECH	76	398	0	0	0	0	0	0	0	0.0	0.0	0	Y
KHNOM CHRUM	119	633	8	2	1	0	0	0	0	0.0	0.0	0	Y
DAUN MOUL	23	85	19	2	0	0	0	0	0	0.0	0.0	0	N
PO PI DOEUM	162	823	6	0	2	1	0	0	0	0.0	0.0	0	Y
PREK SAMRONG	142	682	44	10	2	0	0	0	0	0.0	0.0	0	Y
CHAMCAR CHEK	165	819	10	0	5	3	0	0	0	0.0	0.0	0	N
O CHUAP	136	696	0	0	1	1	2	2	10	4.0	0.0	0	N
THNAL BATH	117	657	40	31	1	1	0	0	0	0.0	0.0	0	Y
CHORK KEUTH	77	383	11	3	2	1	0	0	0	0.0	0.0	0	Y
* Subsubtotal *													
	1511	7733	217	64	16	8	5	5					
* COMMUNE RUSSEY KRORK													
LOUNG	211	1309	35	10	1	1	0	0	0	0.0	0.0	50	Y
PHA SISRA	86	454	36	13	1	1	0	0	0	0.0	0.0	0	NA
ANLUNG MEANTROP	161	838	61	2	1	1	0	0	0	0.0	0.0	0	Y
OTAMA	66	309	17	6	0	0	0	0	0	0.0	0.0	0	NA
OTA KOUL	126	715	16	16	1	1	0	0	0	0.0	0.0	0	NA
PRALAYLUONGKROM	145	688	47	3	1	0	0	0	0	0.0	0.0	0	NA

DATA ON EXISTING WATER SUPPLIES FOR MONGOL BOREY DISTRICT OF BANTEAY MEAN CHEY PROVINCE OXFAM

VILLAGE	NUMBER FAMILIES	NUMBER PERSONS	NUMBER FAMILY PONDS	NUMBER FAMILY PONDS DURING DRY SEASON WITH WATER	NUMBER VILLAGE PONDS	NO. VILLAGE PONDS DURING DRY SEASON WITH WATER	NUMBER DOG WELLS	NUMBER DOG WELLS DURING DRY SEASON WITH WATER	AVERAGE DEPTH DOG WELLS	SWL WELLS DURING DRY SEASON	SWL WELLS DURING RAINY SEASON	MAXIMUM DISTANCE TO COLLECT WATER	NEARBY SURFACE WATER N= NOT AVAIL AT ALL Y= AVAIL. BOTH SEASON YN=AVAIL. WET SEASON
NEANG KETH	183	1112	26	7	1	1	0	0	0	0.0	0.0	70	Y
ANCHANH	143	821	32	30	2	0	0	0	0	0.0	0.0	0	NA
CHAMCAR TADORK	233	1342	46	16	4	1	6	6	4	3.3	1.0	45	Y
SAMRONG	179	1071	17	10	21	1	0	0	0	0.0	0.0	40	Y
KOH KEO	168	868	7	0	2	2	0	0	0	0.0	0.0	75	Y
KAUK SVAY	239	1380	81	11	0	0	0	0	0	0.0	0.0	2	Y
CHUM TEAV	157	898	100	60	2	2	2	2	4	3.5	1.0	75	YN
RUSSEY KRORK	603	3375	535	303	4	4	4	0	0	0.0	0.0	25	Y
PRALAY LUONGLOU	142	812	64	6	0	0	0	0	0	0.0	0.0	0	NA
SALA DENG	198	991	100	50	3	3	0	0	0	0.0	0.0	65	Y
PREK RO PEAU	164	826	21	16	0	0	0	0	0	0.0	0.0	15	Y
* Subsubtotal *													
	3204	17809	1241	559	44	18	12	8					
* COMMUNE SEUR													
THNOT	228	1084	4	4	1	1	1	1	7	4.5	2.0	350	Y
BOSS LAORK	210	1117	4	2	1	0	0	0	0	0.0	0.0	300	Y
SEUR	154	778	0	0	0	0	0	0	0	0.0	0.0	400	Y
BOKUNG TAUCH	176	939	2	1	0	0	0	0	0	0.0	0.0	350	Y
BOUR	145	771	2	0	0	0	0	0	0	0.0	0.0	350	Y
ANSAM CHEK	53	273	0	0	0	0	0	0	0	0.0	0.0	0	Y
PHLAUVDAMREYLOU	126	632	2	0	0	0	0	0	0	0.0	0.0	350	Y
PHLAUV DAMREY	219	1073	2	0	0	0	0	0	0	0.0	0.0	400	Y
O SEUR	75	380	23	0	1	1	0	0	0	0.0	0.0	200	YN
KAUK SAMRONG	123	606	13	1	2	2	0	0	0	0.0	0.0	400	YN
TA MAO	119	518	3	3	0	0	0	0	0	0.0	0.0	300	Y
* Subsubtotal *													
	1628	8171	55	11	5	4	1	1					
** Subtotal **													
	8403	43155	1737	677	71	35	41	36					
*** Total ***													
	8403	43155	1737	677	71	35	41	36					

DATA ON EXISTING WATER SUPPLIES FOR DISTRICTS OF BATTAMBANG PROVINCE

OXFAM

VILLAGE	NUMBER FAMILIES	NUMBER PERSONS	NUMBER FAMILY PONDS	NUMBER FAMILY PONDS DURING DRY SEASON WITH WATER	NUMBER VILLAGE PONDS	NO. VILLAGE PONDS DURING DRY SEASON WITH WATER	NUMBER DUG WELLS	NUMBER DUG WELLS DURING DRY SEASON WITH WATER	AVERAGE DEPTH DUG WELLS	SWL WELLS DURING DRY SEASON	SWL WELLS DURING RAINY SEASON	MAXIMUM DISTANCE TO COLLECT WATER	NEARBY SURFACE WATER N= NOT AVAIL AT ALL Y= AVAIL. BOTH SEASON YN=AVAIL. WET SEASON
** DISTRICT BATTAMBANG													
* COMMUNE ANLUNG RUNN													
CHAR	67	289	0	0	0	0	2	2	4	3.0	1.0	300	N
SDA SLAK	80	360	0	0	1	0	2	2	4	2.7	2.0	200	N
SOPHY	136	579	0	0	0	0	5	5	4	3.0	0.0	400	N
KRUOSS	130	676	0	0	1	1	0	0	0	0.0	0.0	500	Y
CHORB KAB	86	392	0	0	0	0	5	5	4	1.7	0.0	200	N
* Subsubtotal *													
	499	2296	0	0	2	1	14	14					
* COMMUNE BOKUNG PRING													
POY TA SEK	160	938	5	0	4	4	0	0	0	0.0	0.0	0	Y
BOKUNG PRING	536	3321	56	35	2	2	0	0	0	0.0	0.0	50	Y
O NHOR	337	1829	45	22	2	2	0	0	0	0.0	0.0	0	Y
SNOUL KORNG	118	613	60	60	1	1	0	0	0	0.0	0.0	20	Y
* Subsubtotal *													
	1151	6701	166	117	9	9	0	0					
* COMMUNE CHRAUY SDAO													
CHRAUY SDAO	432	2355	227	47	3	2	1	1	9	7.0	3.0	1000	Y
NIKUM KRAO	400	2208	11	3	10	4	1	1	7	4.0	1.0	200	Y
NIKUM KNONG	416	2060	16	5	1	1	0	0	0	0.0	0.0	400	Y
* Subsubtotal *													
	1248	6623	254	55	14	7	2	2					
* COMMUNE CHREY													
CHREY	148	786	35	0	0	0	0	0	0	0.0	0.0	1000	N
PO PEAL KHE	216	1080	0	0	1	0	0	0	0	0.0	0.0	350	N
SVAY CHRUM	208	976	28	0	1	0	5	5	7	5.0	0.0	600	N
KRUOSS	54	306	0	0	0	0	0	0	0	0.0	0.0	0	N
KOR KAU	210	1067	47	0	0	0	3	3	6	4.7	3.5	300	Y
HAY SAN	344	1895	253	36	0	0	5	5	8	3.0	0.0	1000	N
PREY TOTUNG	214	1049	150	0	0	0	8	8	7	5.5	0.0	200	N
CHREY THMEY	127	631	100	0	2	2	2	2	10	8.0	6.0	500	Y
ANLUNG RUNN	85	490	60	0	0	0	0	0	0	0.0	0.0	1000	N
KHBAL KHMOCH	145	710	35	0	0	0	2	2	4	0.0	3.0	350	N
* Subsubtotal *													
	1751	8990	708	36	4	2	25	25					
* COMMUNE KAUK KHMOUN													
KANDAL THBAUNG	234	1115	60	0	2	2	0	0	0	0.0	0.0	170	Y
CHROR NEANG	136	640	80	30	2	2	0	0	0	0.0	0.0	45	N
KANDAL CHOKUNG	112	515	26	1	1	1	0	0	0	0.0	0.0	350	N
KAUK KHMOUN	149	715	50	20	1	1	0	0	0	0.0	0.0	180	N
TA MEAK	178	848	15	0	4	2	0	0	0	0.0	0.0	200	N
KEAN KAISS 2	352	1758	150	6	0	0	0	0	0	0.0	0.0	300	Y

DATA ON EXISTING WATER SUPPLIES
FOR DISTRICTS OF BATTAMBANG PROVINCE

OXFAM

VILLAGE	NUMBER FAMILIES	NUMBER PERSONS	NUMBER FAMILY PONDS	NUMBER FAMILY PONDS DURING DRY SEASON WITH WATER	NUMBER VILLAGE PONDS	NO. VILLAGE PONDS DURING DRY SEASON WITH WATER	NUMBER DUG WELLS	NUMBER DUG WELLS DURING DRY SEASON WITH WATER	AVERAGE DEPTH DUG WELLS	SWL WELLS DURING DRY SEASON	SWL WELLS DURING RAINY SEASON	MAXIMUM DISTANCE TO COLLECT WATER	NEARBY SURFACE WATER N= NOT AVAIL AT ALL Y= AVAIL. BOTH SEASON YN=AVAIL. WET SEASON
KEIN KAISS 1	304	1435	42	0	3	3	3	3	4	3.0	1.5	100	Y
CHHEK KAUN	255	1241	31	7	0	0	0	0	0	0.0	0.0	300	Y
* Subsubtotal *													
	1720	8267	454	64	13	11	3	3					
* COMMUNE OTAKI													
PO PEAL KHE	331	1596	50	2	0	0	0	0	0	0.0	0.0	0	Y
TRASS	254	1160	15	0	0	0	0	0	0	0.0	0.0	0	Y
PREY TOTUNG	208	998	0	0	1	0	0	0	0	0.0	0.0	500	N
OTAKI	393	1807	10	0	0	0	0	0	0	0.0	0.0	0	N
KOKOH	191	921	3	0	0	0	2	2	4	1.0	0.5	150	N
PREY DACH	236	1140	10	0	0	0	4	0	4	3.5	2.0	200	N
VEAL TREA	313	1515	150	3	4	4	0	0	0	0.0	0.0	0	Y
TRAING	277	1401	21	0	1	0	4	4	4	3.5	2.0	200	N
* Subsubtotal *													
	2203	10538	259	5	6	4	10	6					
* COMMUNE TA POUNG													
POY SAM RONG	438	1944	100	0	1	1	0	0	0	0.0	0.0	500	NY
AGRICULTURE	202	1036	100	0	0	0	0	0	0	0.0	0.0	0	YN
KAUK KHDOOCH	401	2049	200	0	2	2	0	0	0	0.0	0.0	100	YN
THMAR KUAL	245	1395	5	0	0	0	0	0	0	0.0	0.0	0	N
TA POUNG	172	829	30	0	1	1	10	10	6	5.5	4.0	500	N
ANG	210	1040	30	0	1	0	1	1	6	5.0	3.0	500	YN
POY YUNG	316	1544	100	0	2	2	4	4	6	5.0	2.0	100	YN
* Subsubtotal *													
	1984	9837	565	0	7	6	15	15					
** Subtotal **													
	10556	53252	2406	277	55	40	69	65					
** DISTRICT KHET													
* COMMUNE CHANCAR SAMRONG													
CHANCARSAMRONG2	469	2602	32	12	1	1	8	8	5	4.5	2.0	0	N
WOATH ROMDUOL	416	2254	6	0	2	1	2	2	5	4.0	2.0	0	Y
WOATH LEAP	650	3335	2	0	0	0	15	15	4	2.0	1.0	300	N
PHEA SLA	244	1495	3	0	2	0	11	11	5	4.0	2.0	0	Y
CHANCARSAMRONG1	419	2125	25	0	2	1	5	2	5	4.0	2.0	300	N
* Subsubtotal *													
	2198	11811	68	12	7	3	41	38					
* COMMUNE KKAPHKAP													
PREK MOHA TEP	638	3380	0	0	1	1	0	0	0	0.0	0.0	0	Y
20/5	637	3275	0	0	0	0	0	0	0	0.0	0.0	0	Y
KANAKAR	246	1638	3	0	2	2	1	1	10	7.0	3.0	50	Y
KOMPONG KRABEY	560	4785	0	0	0	0	0	0	0	0.0	0.0	0	Y

DATA ON EXISTING WATER SUPPLIES FOR DISTRICTS OF BATTAMBANG PROVINCE

OXFAM

VILLAGE	NUMBER FAMILIES	NUMBER PERSONS	NUMBER FAMILY PONDS	NUMBER FAMILY PONDS DURING DRY SEASON WITH WATER	NUMBER VILLAGE PONDS	NO. VILLAGE PONDS DURING DRY SEASON WITH WATER	NUMBER DOG WELLS	NUMBER DOG WELLS DURING DRY SEASON WITH WATER	AVERAGE DEPTH DOG WELLS	SWL WELLS DURING DRY SEASON	SWL WELLS DURING RAINY SEASON	MAXIMUM DISTANCE TO COLLECT WATER	NEARBY SURFACE WATER N= NOT AVAIL AT ALL Y= AVAIL. BOTH SEASON YN=AVAIL. WET SEASON
* Subsubtotal *													
	2081	13078	3	0	3	3	1	1					
* COMMUNE KDOL													
TA PROOCH	252	1096	5	0	1	0	2	1	3	2.5	1.0	300	Y
KANTOOT	194	1118	15	0	0	0	1	1	7	5.5	2.0	30	Y
THKAUV	218	1248	10	0	0	0	0	0	0	0.0	0.0	125	Y
KDOL	182	871	22	0	0	0	0	0	0	0.0	0.0	30	Y
CHONG PREK	203	901	17	6	1	1	0	0	0	0.0	0.0	30	Y
TA KOY	170	830	15	0	1	0	0	0	0	0.0	0.0	60	Y
OTANUP	218	968	66	0	3	0	0	0	0	0.0	0.0	25	Y
* Subsubtotal *													
	1437	7032	150	6	6	1	3	2					
* COMMUNE MITTAPHEAP													
SLA KETH	267	1145	5	2	2	0	3	3	7	6.0	3.0	20	Y
CHREY KAONG	320	1523	27	0	1	1	1	1	10	9.0	1.0	500	N
DAM SPEY	452	2295	28	3	3	2	0	0	0	0.0	0.0	0	Y
* Subsubtotal *													
	1039	4963	60	5	6	3	4	4					
* COMMUNE OMALL													
BOENG RAING	167	1036	45	0	2	2	2	2	9	6.0	5.5	500	N
PREY DACH	143	793	30	0	0	0	8	3	8	7.5	6.0	400	N
KAUN SEK	79	409	10	0	0	0	2	2	7	5.0	4.5	100	N
SALA BALAT	109	716	13	0	1	1	0	0	0	0.0	0.0	500	N
KAUK PONLEY	117	630	13	0	2	0	3	0	7	6.5	6.0	1500	N
PREY ROKAR	116	610	90	2	0	0	8	6	7	5.7	0.0	900	N
DAK SOROSS	66	309	16	6	2	1	0	0	0	0.0	0.0	1000	N
* Subsubtotal *													
	797	4503	217	8	7	4	23	13					
* COMMUNE SAMAKI													
ANH CHANH	272	1524	57	0	3	0	1	1	6	5.5	3.0	0	N
KAP KAU THMEY	449	2807	1	0	1	1	4	4	3	1.0	-2.0	100	Y
PREY KAUN SEK	119	613	10	0	0	0	2	2	9	7.8	7.5	1000	Y
ANG	228	1160	30	5	1	1	2	2	10	8.0	7.0	100	Y
ANDAUNG CHENH	236	1360	20	0	1	1	3	3	5	4.0	3.5	150	Y
O CHAR	500	2777	31	0	0	0	13	13	6	3.0	1.0	2000	Y
* Subsubtotal *													
	1804	10241	149	5	6	3	25	25					
* COMMUNE SVAY POR 1													
TOOL TA EK	628	3505	30	7	2	2	4	2	8	6.0	5.0	500	Y
OTAKOAM 3	226	1404	15	0	0	0	2	2	8	6.0	4.0	300	Y
DANGKOR TRAP	160	1028	25	0	2	2	3	3	4	2.0	1.0	100	N
OTAKOAM 2	546	3068	27	0	1	1	3	3	8	6.0	4.0	300	N

**DATA ON EXISTING WATER SUPPLIES
FOR DISTRICTS OF BATTAMBANG PROVINCE**

OXFAM

VILLAGE	NUMBER FAMILIES	NUMBER PERSONS	NUMBER FAMILY PONDS	NUMBER FAMILY PONDS DURING DRY SEASON WITH WATER	NUMBER VILLAGE PONDS	NO. VILLAGE PONDS DURING DRY SEASON WITH WATER	NUMBER DOG WELLS	NUMBER DOG WELLS DURING DRY SEASON WITH WATER	AVERAGE DEPTH DOG WELLS	SWL WELLS DURING DRY SEASON	SWL WELLS DURING RAINY SEASON	MAXIMUM DISTANCE TO COLLECT WATER	NEARBY SURFACE WATER N= NOT AVAIL AT ALL Y= AVAIL. BOTH SEASON YN=AVAIL. WET SEASON
OTAKOAM 1	541	2976	30	1	0	0	0	0	0	0.0	0.0	200	N
* Subsubtotal *													
	2101	11981	127	8	5	5	12	10					
* COMMUNE SVAY POR 2													
CHAKREAM	104	490	0	0	1	1	0	0	0	0.0	0.0	500	Y
LOR ETH	138	756	3	2	0	0	0	0	0	0.0	0.0	10	Y
13 JANVIER	659	3995	0	0	1	0	0	0	0	0.0	0.0	1000	Y
O KHCHEAY	108	629	2	0	1	1	0	0	0	0.0	0.0	1000	N
PREK TA TORNN	129	742	0	0	0	0	0	0	0	0.0	0.0	1000	Y
PREK PREAHSDACH	243	1141	0	0	0	0	0	0	0	0.0	0.0	500	Y
CHAMCAR RUSSEY	135	734	0	0	0	0	1	1	10	7.0	10.0	700	N
BEK CHAN THMEY	173	1089	0	0	1	1	0	0	0	0.0	0.0	0	N
* Subsubtotal *													
	1689	9576	5	2	4	3	1	1					
* COMMUNE SVAY POR 3													
RACHANAK	366	2154	5	5	1	1	4	4	4	3.5	1.0	0	Y
ROMCHEK 2	114	729	0	0	1	1	5	5	5	0.0	0.0	0	Y
ROMCHEK 4	282	1410	0	0	0	0	0	0	0	0.0	0.0	0	N
ROMCHEK 5	171	967	0	0	0	0	0	0	0	0.0	0.0	0	N
SOPHY 2	218	2218	6	0	0	0	0	0	0	0.0	0.0	200	Y
ROMCHEK 1	252	1380	3	0	0	0	1	1	5	4.0	2.0	200	Y
* Subsubtotal *													
	1403	8858	14	5	2	2	10	10					
* COMMUNE WOATH KOR													
WOATH KOR	492	2880	5	5	0	0	0	0	0	0.0	0.0	0	Y
CHRAB KRASAING	552	2948	270	0	1	1	8	8	6	4.0	2.0	200	N
DAMNAK LUONG	357	1915	30	0	3	3	5	5	7	5.8	4.0	300	N
KHSACH POY	301	1705	16	2	0	0	0	0	0	0.0	0.0	0	Y
BALANG	263	1359	16	0	0	0	22	22	7	5.8	3.0	150	N
KOMPONG SKIMA	247	1245	21	1	4	0	4	4	8	6.0	3.0	50	Y
* Subsubtotal *													
	2212	12052	358	8	8	4	39	39					
** Subtotal **													
	16761	94095	1151	59	54	31	159	143					
** DISTRICT MAUNG RUSSEY													
* COMMUNE CHREY													
PREK CHIK	96	426	1	0	0	0	0	0	0	0.0	0.0	1000	N
CHREY 1	115	479	4	0	0	0	0	0	0	0.0	0.0	150	Y
DAUNTRY	201	1024	8	0	5	5	0	0	0	0.0	0.0	200	Y
MREAS PREUV	237	1043	6	6	0	0	0	0	0	0.0	0.0	50	Y
TUOL TA THONN	132	532	7	7	0	0	0	0	0	0.0	0.0	50	Y
ANG KRANG	299	1359	35	5	2	2	0	0	0	0.0	0.0	200	Y

DATA ON EXISTING WATER SUPPLIES
FOR DISTRICTS OF BATTAMBANG PROVINCE

OXFAM

VILLAGE	NUMBER FAMILIES	NUMBER PERSONS	NUMBER FAMILY PONDS	NUMBER FAMILY PONDS DURING DRY SEASON WITH WATER	NUMBER VILLAGE PONDS	NO. VILLAGE PONDS DURING DRY SEASON WITH WATER	NUMBER DUG WELLS	NUMBER DUG WELLS DURING DRY SEASON WITH WATER	AVERAGE DEPTH DUG WELLS	SWL WELLS DURING DRY SEASON	SWL WELLS DURING RAINY SEASON	MAXIMUM DISTANCE TO COLLECT WATER	NEARBY SURFACE WATER N= NOT AVAIL AT ALL Y= AVAIL. BOTH SEASON YN=AVAIL. WET SEASON
CHREY 2	210	890	7	0	0	0	0	0	0	0.0	0.0	200	Y
CHREY CHOEUNG	235	1018	35	0	3	3	0	0	0	0.0	0.0	800	YN
CHONG SAMNAY	255	1313	5	0	0	0	0	0	0	0.0	0.0	50	Y
* Subsubtotal *													
	1780	8084	108	18	10	10	0	0					
* COMMUNE KOKOH													
TOOL PROM 2	130	522	6	0	2	2	0	0	0	0.0	0.0	1000	N
CHORK TAUCH	189	897	5	5	3	1	0	0	0	0.0	0.0	2500	Y
PAKANG	139	691	0	0	0	0	0	0	0	0.0	0.0	200	Y
SRE 0	321	1321	16	0	1	0	2	2	5	3.0	-7.5	400	YN
CHORK THOM	243	1253	8	4	5	5	0	0	0	0.0	0.0	1000	Y
KOKOH	224	944	16	0	5	3	0	0	0	0.0	0.0	300	Y
TOOL PROM 1	355	1538	12	0	5	2	2	1	8	5.5	2.0	300	YN
* Subsubtotal *													
	1601	7166	63	9	21	13	4	3					
* COMMUNE MAUNG													
TA TOK 2	149	757	19	0	1	0	0	0	0	0.0	0.0	1000	Y
KOH CHA	69	328	0	0	0	0	0	0	0	0.0	0.0	200	Y
MAUNG	85	471	4	2	0	0	0	0	0	0.0	0.0	300	Y
RUSSEY 2	104	449	12	0	3	0	0	0	0	0.0	0.0	1000	Y
O KRABAO	102	491	0	0	0	0	0	0	0	0.0	0.0	200	Y
ROLUOS	148	825	3	0	3	3	0	0	0	0.0	0.0	200	YN
DOKUN DAUNG	124	668	18	0	1	0	0	0	0	0.0	0.0	500	Y
RUSSEY 1	120	584	12	0	2	0	0	0	0	0.0	0.0	1000	Y
TA TOK	101	598	16	0	1	0	0	0	0	0.0	0.0	700	Y
RA	117	575	13	0	1	0	0	0	0	0.0	0.0	1200	Y
PRALAY	111	446	20	0	0	0	0	0	0	0.0	0.0	1300	Y
PEU	77	419	0	0	0	0	0	0	0	0.0	0.0	200	Y
KANSAY BANTEAY	229	1101	29	0	1	0	0	0	0	0.0	0.0	700	Y
* Subsubtotal *													
	1536	7712	146	2	13	3	0	0					
* COMMUNE PREK CHIK													
PREK TA VEN	43	222	0	0	0	0	0	0	0	0.0	0.0	200	Y
CHHKE KHAMPREUS	121	569	0	0	0	0	0	0	0	0.0	0.0	200	Y
* Subsubtotal *													
	164	791	0	0	0	0	0	0					
* COMMUNE PREY SVAY													
CHAM ROHAR	61	290	4	0	1	0	1	1	4	3.0	1.0	300	YN
SRAMOR MEAS	187	891	50	0	3	0	0	0	0	0.0	0.0	200	N
ROM CHEK	70	195	2	0	1	0	2	2	4	3.3	2.0	100	N
PREY PREAL	188	889	24	0	1	1	2	0	3	3.0	0.5	70	N
PHLAUV BAMBEK	112	500	4	0	1	1	0	0	0	0.0	0.0	200	N
PREY SVAY	346	1737	30	0	0	0	4	4	5	4.5	4.0	1000	N

DATA ON EXISTING WATER SUPPLIES
FOR DISTRICTS OF BATTAMBANG PROVINCE

OXFAM

VILLAGE	NUMBER FAMILIES	NUMBER PERSONS	NUMBER FAMILY PONDS	NUMBER FAMILY PONDS DURING DRY SEASON WITH WATER	NUMBER VILLAGE PONDS	NO. VILLAGE PONDS DURING DRY SEASON WITH WATER	NUMBER DUG WELLS	NUMBER DUG WELLS DURING DRY SEASON WITH WATER	AVERAGE DEPTH DUG WELLS	SWL WELLS DURING DRY SEASON	SWL WELLS DURING RAINY SEASON	MAXIMUM DISTANCE TO COLLECT WATER	NEARBY SURFACE WATER N= NOT AVAIL AT ALL Y= AVAIL. BOTH SEASON YN=AVAIL. WET SEASON
TUOL THNUNG	77	400	5	0	1	0	0	0	0	0.0	0.0	5000	Y
KOR	183	897	20	0	0	0	2	2	4	3.5	2.0	200	N
* Subsubtotal *													
	1224	5799	139	0	8	2	11	9					
* COMMUNE PREY TAUCH													
PREAN NIL	156	801	100	10	2	2	9	2	5	4.5	1.0	200	YN
PREY TAUCH	153	1803	103	6	2	2	4	4	8	5.5	1.5	150	YN
KAUN KHLONG	338	1803	85	0	1	1	5	5	5	3.5	0.5	250	YN
THMEY	150	793	3	0	0	0	5	5	5	3.0	0.5	200	Y
STUNG CHAK	148	694	10	0	0	0	4	4	4	2.2	1.0	800	Y
DOB KRASAING	148	895	140	20	1	1	2	2	5	3.5	1.0	100	YN
* Subsubtotal *													
	1093	6789	441	36	6	6	29	22					
* COMMUNE ROBASS MONGKOL													
BOKUNG BEY	139	563	3	0	0	0	2	2	3	2.5	2.0	300	Y
KAUN KAEK 1	212	870	20	0	0	0	0	0	0	0.0	0.0	50	Y
ANLUNG KAUB	129	618	10	0	0	0	1	1	2	1.7	1.4	30	Y
PREK AM	107	640	5	0	0	0	1	1	3	0.5	2.0	50	Y
KAUN KAEK 2	201	779	15	0	0	0	0	0	0	0.0	0.0	20	Y
* Subsubtotal *													
	788	3470	53	0	0	0	4	4					
* COMMUNE RUSSEY KRAING													
NEAK TA TVEAR	150	735	0	0	0	0	0	0	0	0.0	0.0	150	Y
TUOL RO KAR	156	801	15	0	0	0	2	2	4	4.0	0.0	300	YN
CHREY RUNN	291	1569	10	0	5	5	1	1	4	3.5	0.0	1000	YN
SRAS CHHEUNKANG	120	740	4	0	3	0	3	3	7	6.0	0.0	100	YN
TUOL SNUOL	209	1033	7	1	0	0	0	0	0	0.0	0.0	300	Y
NIKUM	287	1386	20	0	5	3	0	0	0	0.0	0.0	150	Y
YKUN MEAN	244	1278	20	0	5	0	0	0	0	0.0	0.0	1000	Y
AMPIL CHHOUNG	214	1073	58	16	0	0	0	0	0	0.0	0.0	1000	YN
THNAL BATH	336	1735	332	0	1	0	0	0	0	0.0	0.0	1500	Y
NIKUM KROM	156	770	156	0	0	3	3	0	0	0.0	0.0	300	YN
PICH CHANG VAR	157	790	130	0	0	0	2	2	5	4.5	0.0	1000	YN
* Subsubtotal *													
	2320	11910	752	17	19	11	11	8					
* COMMUNE TA LOAS													
SDEY STUNG	165	849	4	0	1	1	0	0	0	0.0	0.0	100	Y
MANORK	170	806	4	2	0	0	0	0	0	0.0	0.0	100	N
VEAL	77	386	3	0	0	0	4	4	7	5.5	4.5	70	Y
PRALAY SDAO	132	569	11	4	0	0	1	1	6	4.0	1.0	150	Y
TRASS	163	724	10	0	0	0	0	0	0	0.0	0.0	100	Y
STUNG THMEY	110	551	6	2	0	0	2	1	6	5.0	2.0	70	YN
WOATH CHASS	131	565	13	1	0	0	11	11	8	6.5	3.5	700	Y

DATA ON EXISTING WATER SUPPLIES
FOR DISTRICTS OF BATTAMBANG PROVINCE

OXFAM

VILLAGE	NUMBER FAMILIES	NUMBER PERSONS	NUMBER FAMILY PONDS	NUMBER FAMILY PONDS DURING DRY SEASON WITH WATER	NUMBER VILLAGE PONDS	NO. VILLAGE PONDS DURING DRY SEASON WITH WATER	NUMBER DUG WELLS	NUMBER DUG WELLS DURING DRY SEASON WITH WATER	AVERAGE DEPTH DUG WELLS	SWL WELLS DURING DRY SEASON	SWL WELLS DURING RAINY SEASON	MAXIMUM DISTANCE TO COLLECT WATER	NEARBY SURFACE WATER N= NOT AVAIL AT ALL Y= AVAIL. BOTH SEASON YN=AVAIL. WET SEASON
SOUR SDEY	174	835	1	0	0	0	1	1	6	5.0	4.0	300	YN
CHONG PRALAY	150	656	10	0	0	0	6	6	7	6.0	4.0	100	Y
* Subsubtotal *													
	1272	5941	62	9	1	1	25	24					
* COMMUNE TAR													
PO 2	162	898	15	5	0	0	0	0	0	0.0	0.0	100	Y
REAM KUN	244	1933	21	0	3	3	0	0	0	0.0	0.0	100	Y
PO 1	215	1111	13	0	17	3	0	0	0	0.0	0.0	300	Y
ANLUNG SDAO	66	322	4	0	2	0	0	0	0	0.0	0.0	2000	N
TANAK	240	1200	2	0	3	0	0	0	0	0.0	0.0	50	YN
O TEAT	263	1284	70	0	10	0	0	0	0	0.0	0.0	5000	N
TAR 1	198	4915	3	3	1	1	0	0	0	0.0	0.0	200	Y
* Subsubtotal *													
	1388	11663	128	8	36	7	0	0					
* COMMUNE THIPPADEY													
CHHAY BA LANG	94	572	3	0	3	2	0	0	0	0.0	0.0	300	N
KANTUOT	134	647	0	0	1	1	0	0	0	0.0	0.0	500	N
RA	141	619	5	5	5	5	0	0	0	0.0	0.0	300	N
SAMRONG	116	614	3	3	0	0	0	0	0	0.0	0.0	1500	N
CHOEUNG TINH	64	302	3	0	2	2	0	0	0	0.0	0.0	300	N
* Subsubtotal *													
	549	2754	14	8	11	10	0	0					
** Subtotal **													
	13715	72079	1906	107	125	63	84	70					
** DISTRICT SANGKER													
* COMMUNE KOMPONG PREAH													
ANDAUNG TRACH	79	390	5	2	5	2	2	2	5	4.0	0.7	50	N
KRALANH	55	265	2	0	1	1	1	1	3	2.5	2.0	400	N
KOMPONG PREAH	246	1163	4	4	1	1	2	2	4	2.5	1.0	350	N
PANHA	190	914	20	3	0	0	7	7	5	3.8	1.0	100	N
PREY CHEK	136	648	3	0	0	0	9	9	3	2.0	2.0	0	N
SRAS KAO	228	1180	4	4	1	1	0	0	0	0.0	0.0	300	N
* Subsubtotal *													
	934	4560	38	13	8	5	21	21					
* COMMUNE O DAMBANG 2													
TOOL LOVIENG	349	1713	250	30	0	0	10	10	5	3.5	2.0	100	N
O DAMBANG	333	1571	0	0	1	1	9	8	5	4.0	3.0	200	Y
SVAY THOM	281	1297	102	20	0	0	6	6	6	0.0	0.0	500	NA
KOMPONG MATORE	157	692	20	10	4	4	4	4	6	4.5	3.0	100	NA
* Subsubtotal *													
	1120	5273	372	60	5	5	29	28					

DATA ON EXISTING WATER SUPPLIES FOR DISTRICTS OF BATTAMBANG PROVINCE

OXFAM

VILLAGE	NUMBER FAMILIES	NUMBER PERSONS	NUMBER FAMILY PONDS	NUMBER FAMILY PONDS DURING DRY SEASON WITH WATER	NUMBER VILLAGE PONDS	NO. VILLAGE PONDS DURING DRY SEASON WITH WATER	NUMBER DUG WELLS	NUMBER DUG WELLS DURING DRY SEASON WITH WATER	AVERAGE DEPTH DUG WELLS	SWL WELLS DURING DRY SEASON	SWL WELLS DURING RAINY SEASON	MAXIMUM DISTANCE TO COLLECT WATER	NEARBY SURFACE WATER N= NOT AVAIL AT ALL Y= AVAIL. BOTH SEASON YN=AVAIL. WET SEASON
* COMMUNE O DAMBANG 2													
SVAY CHRUM	0	0	20	0	0	0	3	3	5	4.0	2.0	1000	NA
DAMBAUK KHPUOSS	270	1365	20	10	2	2	7	5	5	4.0	3.0	200	N
* Subsubtotal *													
	270	1365	40	10	2	2	10	8					
* COMMUNE RAING KESSEY													
RAING KESSEY	120	649	23	23	0	0	0	0	0	0.0	0.0	0	N
RAING KROL	180	988	155	155	2	2	0	0	0	0.0	0.0	0	N
BOKUNG VENG	48	224	20	0	1	1	0	0	0	0.0	0.0	0	N
DAMNAK DANG KOR	72	327	3	3	1	1	0	0	0	0.0	0.0	500	NA
KO KOH KAMBOTH	47	257	25	25	1	1	0	0	0	0.0	0.0	0	NA
WOATH KANDAL	118	624	17	2	1	1	0	0	0	0.0	0.0	0	N
* Subsubtotal *													
	585	3069	243	208	6	6	0	0					
* COMMUNE TA PONN													
BASETH	357	1704	12	6	1	1	6	6	4	2.5	0.8	150	Y
SVAY SA	378	1768	0	0	0	0	0	0	0	0.0	0.0	40	Y
SAMDECH	353	1838	0	0	1	1	0	0	0	0.0	0.0	0	NA
* Subsubtotal *													
	1088	5310	12	6	2	2	6	6					
* COMMUNE WOATH TA MIN													
O KHCHEAY	280	1558	5	0	1	0	0	0	0	0.0	0.0	1300	Y
O SRALAO	435	2300	35	15	0	0	15	15	5	3.0	5.0	0	N
KOMPONG PIL	560	3044	22	0	1	1	2	2	5	3.5	2.5	150	Y
ANLUNG LOVEA	179	927	0	0	0	0	0	0	0	0.0	0.0	100	Y
KOMPONG CHAMLAN	449	2487	75	5	1	1	5	5	5	3.5	3.0	100	YN
SLOR KRAN	179	1062	18	0	0	0	0	0	0	0.0	0.0	100	Y
* Subsubtotal *													
	2082	11378	155	20	3	2	22	22					
** Subtotal **													
	6079	30955	860	317	26	22	88	85					
*** Total ***													
	47111	250381	6323	760	260	156	400	363					

District	Government Statistics By Districts			Totals for Villages Surveyed By District			Number of Refugees Expected to Return by District	Percent Increase in District Populations following Refugee influx by District
	Persons	Families	Villages	Persons	Families	Villages		
	1	2	3	4	5	6	7	8
BATTAMBANG PROVINCE								
Maung Russey	72,529	14,506	98	72,079	13,715	82	31,181	43 %
				99 %	95 %	84 %		
Sangker	69,850	13,970	130	30,955	6,079	28	40,782	58 %
				44 %	44 %	22 %		
Khet	89,300	17,860	-	94,095	16,761	57	-	
				105 %	94 %			
Battambang	82,815	16,563	70	53,252	10,556	45	42,220	51 %
				64 %	64 %	64 %		
Banan	51,911	10,382	-	0	0	0	-	
Rattanak Monduol	13,119	2,624	-	0	0	0	-	
Ek Phnom	51,667	10,333	-	0	0	0	-	
Bovel	53,699	10,740	61	0	0	0	-	
Total	484,890	96,978	359	250,381	47,111	212		
Mongol Borey	102,900	20,580	156	43,155	8,403	58	18,302	18 %
				42 %	41 %	37 %		
Preah Net Preah	-	-	-	0	0	0	-	
Banteay Chhmar	-	-	-	0	0	0	-	
Svay Sisophon	-	-	-	0	0	0	-	
Thmar Puok	-	-	-	0	0	0	-	
Svay Chek	-	-	-	0	0	0	-	
Phnom Srok	-	-	-	0	0	0	-	
Khet	-	-	-	0	0	0	-	
Total	350,000	70,000		43,155	8,403	58		
PURSAT PROVINCE								
Bakan	75,913	15,182	109	0	0	0	-	-
Kravanh	28,852	5,770	42	0	0	0	-	-
Krakor	40,390	8,078	89	0	0	0	-	-
Kandeanh	38,418	7,683	110	0	0	0	-	-
Khet	35,326	7,065	59	0	0	0	-	-
Total	218,899	43,778	409	0	0	0		

Columns 4, 5, 6 Percentage figures are for survey data to government statistics (for the district).
Column 7 Number of refugees expected to settle in district, including those not in Ford Foundation Survey (for the district).

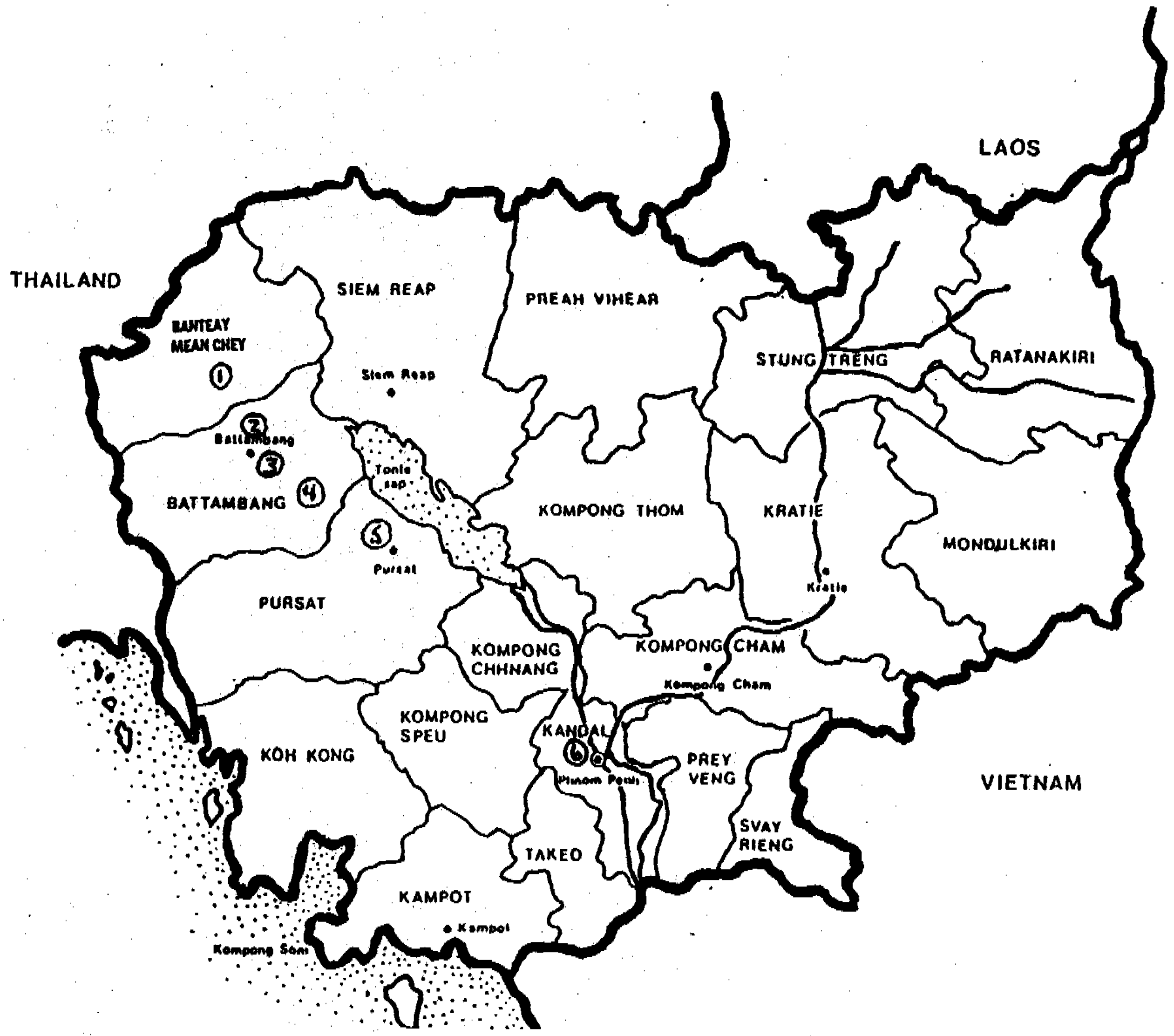
ANNEX 11. Government Statistics and Totals of Selected Survey Data, and percentage increase in population following the returnee influx for selected districts.

District	Number Family Ponds for Survey Data By District		Percentage of survey population having access to Reliable Family Ponds	Number Village Ponds for Survey Data By District		Percentage of survey population having access to Reliable Village Ponds	Number Dug Wells for Survey Data by District		Percentage of survey population having access to Reliable Dug Wells
	Total	Reliable Year Round		Total	Reliable Year Round		Total	Reliable Year Round	
	9	10	11	12	13	14	15	16	17
BATTAMBANG PROVINCE									
Maung Russey	1,906 14 %	107 6 %	0.8 %	125 46 %	63 50 %	23.0 %	84 31 %	70 83 %	25.5 %
Sangkee	6,323 104 %	760 12 %	12.5 %	260 214 %	156 60 %	128.3 %	400 329 %	363 91 %	298.6 %
Thet	1,151 7 %	59 5 %	0.4 %	54 16 %	31 57 %	9.2 %	159 47 %	143 90 %	42.7 %
Battambang	2,406 23 %	277 12 %	2.6 %	55 26 %	40 73 %	18.9 %	69 33 %	65 94 %	30.8 %
BANTEAY MEAN CHEY PROVINCE									
Mongal Borey	1,737	677 39 %	8.1 %	71	35 49 %	20.8 %	41	36 88 %	21.4 %

Columns 10, 13, 16 percentage figures are the % of totals in 9, 12 and 15 respectively.
Columns 12 and 15 Percentage figures are the % of total/50 families in villages surveyed (for the district).
Column 11 Number reliable family ponds to total number of families in villages surveyed (for the district).
Columns 14 Number reliable village ponds to every 50 families for total number of families in villages surveyed (for the district).
Column 17 Number reliable dug wells to every 50 families for total number of families in villages surveyed (for the district).
Column 9 Percentage figures are the % of family ponds to total number families in villages surveyed (for the district).

ANNEX 12. Summary Data on Existing Water Supplies for Districts in Battambang and Banteay Mean Chey Provinces.

CAMBODIA



PROPOSED SITES FOR RECEPTION CENTRES IN CAMBODIA

1 Mongol Borei Centre

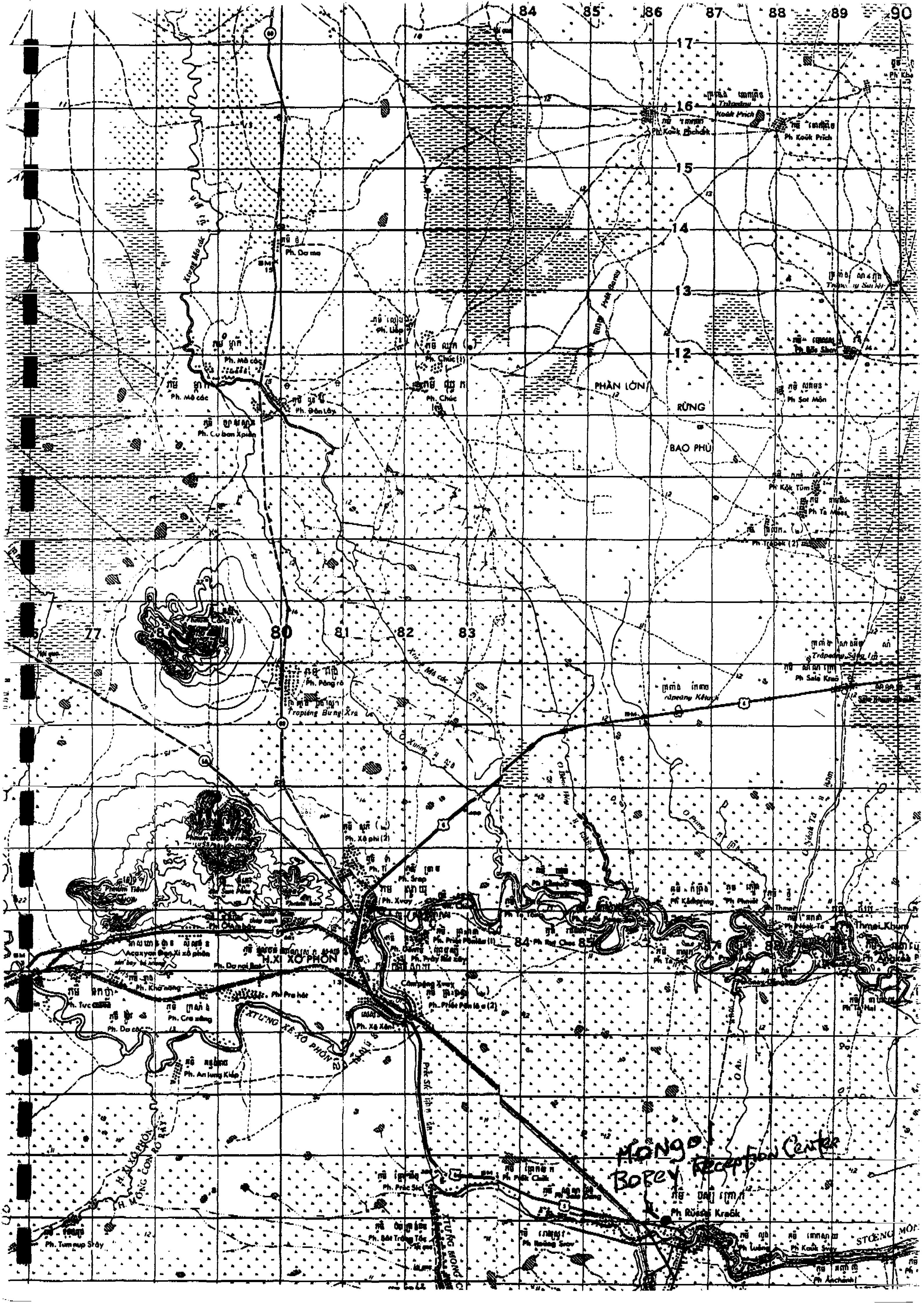
2 Battambang Centre

3 Sangker Centre

4 Maung Russey Centre

5 Pursat Centre

6 Phnom Penh Centre



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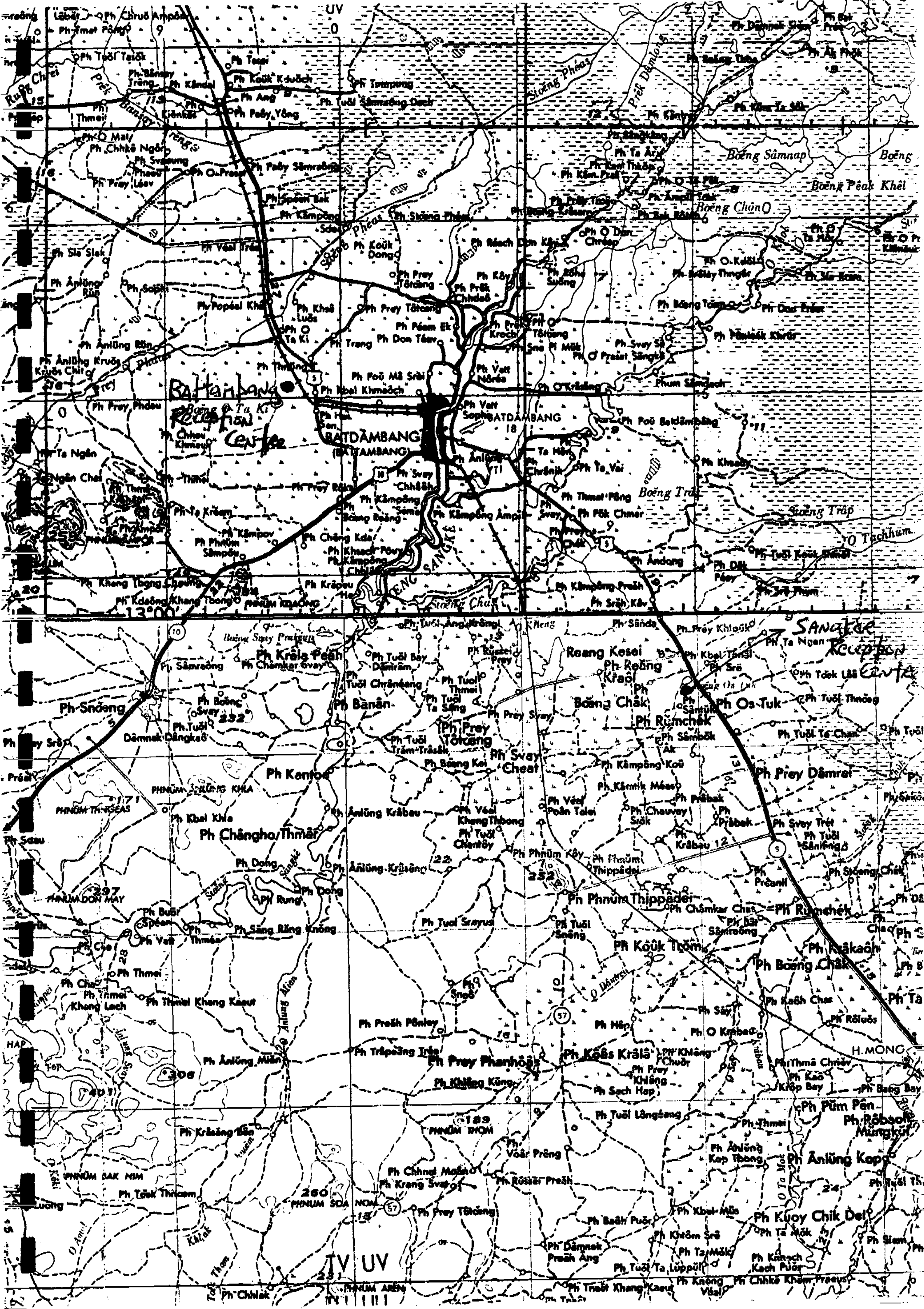
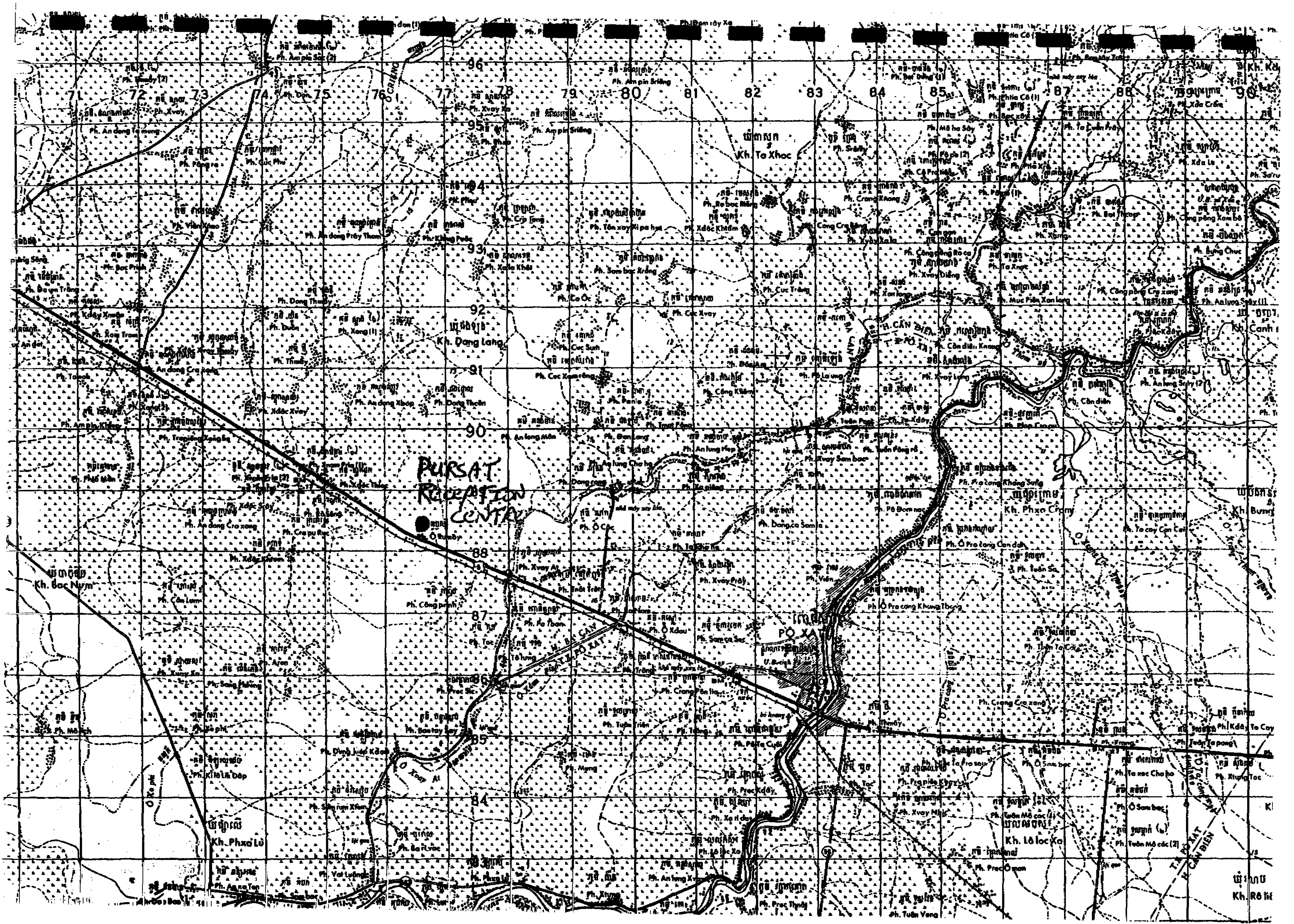
17
16
15
14
13
12
77
80
81
82
83
PHÀN LỚN
RỪNG
BAO PHÙ
H.XI XÔ PHÔN
Ph. Ma các
Ph. Dơ ma
Ph. Chúc
Ph. Koük Prich
Ph. Sot Mön
Ph. Kôk Tûm
Ph. Xê phi (2)
Ph. Srop
Ph. Xvay
Ph. Xà Xên
Ph. Khơ năng
Ph. Cro xăng
Ph. An lung Kiếp
Ph. Tum pup Sray
Ph. Prêc Sóc
Ph. Bàt Trăng Tốc
Thmei Khum
Ph. Luông
Ph. Ancheng
MONGOL
BOREY Reception Center
Ph. Rüssei Kraök



Battambang Reception Centre
Sangkar Reception Centre
BATDÂMBANG
(BATTAMBANG)
13°00'
Ph Os Tuk
Ph Rûmchek
Ph Prey Dâmrei
Ph Krâkaôh
Ph Boêng Chăk
Ph Kântnot Bânân
Ph Bânân
Ph Kantor
Ph Changho/Thmâr
Ph Snoêng
Ph Sâmraông
Ph Krâla Peâh
Reang Kesei
Ph Reâng Kraôl
Boêng Chăk
Ph Prey Tôtœng
Ph Svay Cheat
Ph Phnum Thippădei
Ph Koŭk Trôm
Ph Prey Phanhoâs
Ph Koâs Krâlâ
Ph Pŭm Pên
Ph Ânlŭng Kop
Ph Kuoy Chik Dei
Ph Preăh Pŏnley
Ph Ânlŭng Miăn
Ph Khlêng Kŭng
Ph Chhnal Moăn
Ph Krang Svay
PHNUM SOA NOM
PHNUM SAK NIM
PHNUM THNGEAS
PHNUM DON MAY
PHNUM ÂNLŬNG KHLA
H. MONG
Ph Kâmpông Âmpil
Ph Kâmpông Preăh
Ph Phnum Sâmpŏu
Ph Vatt Soph
Boêng Trâp
Stoêng Trâp
Stoêng Phăs
Boêng Sâmnap
Boêng Chŏng
Boêng Pêak Khêl
TV UV



PURSAT RECEPTION CENTER
PÔ XAT
Kh. To Xhoc
Kh. Dang Lang
Kh. Phxa Cramy
Kh. Bac Num
Kh. Phxa Lu
Kh. Lô loc Xa
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ANNEX 14.

RAW WATER QUALITY TESTS FOR RIVERS IN WESTERN PROVINCES OF CAMBODIA

SAMPLE LOCATION	ORIGINAL TUBIDITY (NTU)	OPTIMUM ALUM DOSAGE (MG/L)	SEDIMENTATION TIME (HOUR)	TURBIDITY AFTER SEDIMENTATION (NTU) *	E-COLI COUNT RAWWATER PER 10 ML *	E-COLI COUNT AFTER 24 HOU PER 10ML
SANGKE RIVER	120	40	5	5	+500	25
O TAKI	45	50	10	10	+500	60
O SANDASH	160	70	8	5	30	---
MAUNG RIVER	75	60	6	5	+500	---

ANNEX 15.

OXFAM EMERGENCY WATER PACKS

Oxfam Emergency Water Packs are equipment developed by Oxfam and well tried-out in various parts of the world. They are primarily designed to help provide a reliable and safe water supply in emergency situations. Each pack comes complete with all the necessary components, including tools required for quick assembly.

At the intake two pumps are installed in parrallel (one duty and one stand-by) on firm bases which should be elevated to above flood level but also as close to the water level as possible to minimize suction loss. The suction hose is connected to a special footvalve/ strainer/ drum unit which helps to avoid sucking-in river mud and floating debris. Through a length of delivery hose/pipe, the water is pumped to fill a rawwater/ sedimentation tank where a prepared volume of liquid aluminum sulfate (alum) solution of know concentration is added to the incoming column of raw water to maximize thorough mixing. Enhanced by the alum, larger and denser floc begins to settle at the bottom of the tank to forma blanket of sludge. This 'cleared' water is then emptied by pumping into a storage tank or a series of tanks where chlorine solution of know concentration and quantity is added for disinfection. This 'batch by batch' treatment approach is preferred because exact dosage of alum and chlorine and sedimentation / contact time can be controlled to give optimum results.

After a minimum of one hour contact time after chlorine solution is added, the clean water is ready for distribution through the network of distribution mains and tapstands. On level grounds the storage tank should be installed on an elevated base of approximately 0.8 meters to increase gravity flow in the distribution mains.

A group of six workers, under experienced supervision, can erect a large tank within 5 hours. Forming an elevated base for storage tank involves gathering and heaping 40 cubic meters of earth which can be a daunting task and must not be underestimated. Digging trenches for the distribution mains is another fifficult task where rapid installation is required.

Under normal circumstances, the Oxfam Emergency Store in the United Kingdom keeps a good level of stocks of its normal emergency equipment. Provided the request for major items such as storage tanks and pumps are kept to a minimum, say below 5, they can normally be drawn from stocks. A large order may have to be filled by the manufacturer whcih can take up to 12 weeks to deliver to Oxfam in the United Kingdom.

Seafreighting from the U.K. to Cambodia via Singapore normally takes 2-2-1/2 months. Custom clearance in Cambodia can be a lengthyprocess. Airfreighting of large consignments have not been attempted recently. For smaller consignmets of under 200 kiograms, airfreighting from the U.K. via Bangkok and Laos can take up to 3 weeks to arrive in Phnom Penh.

ANNEX 16.

COST ESTIMATES FOR WATER SUPPLY SYSTEMS AT RECEPTION CENTRES

Mongol Borey Reception Centre (3000 person capacity)

		Capital Cost Estimate
1)	Install two ET75 Raw Water Pumps at intake (one duty, one standby)	2,400
2)	Erect one 95 cubic meter Raw Water sedimentation tank	2,300
3)	Install one ET75 transfer pumps	1,200
4)	Erect two 45 cubic metre storage tanks	3,000
5)	Provide necessary fittings	1,000
6)	Lay maximum 600 metre 3 inch PVC Distribution mains	1,000
7)	Lay 200 metre 3 inch PVC Pumping Main	350
8)	Install 8 tapstands and ferrules	700
9)	Tool Kits	150
10)	Consummable Engine Spares	800
	Sterling Pounds	12,900

Battambang Reception Centre (2000 person capacity)

		Capital Cost Estimate
1)	Install two PL4 Raw Water pumps at intake (one duty, one standby)	3,600
2)	Lay 1.4 Km of 3 inch PVC pumping main	2,300
3)	Erect one 70 cubic metre raw Water sedimentation tank	1,600
4)	Install two ET75 transfer pumps	2,400
5)	Erect two 45 cubic metre storage tanks	3,000
6)	Provide necessary fittings	1,000
7)	Lay 600 metre 3 inch PVC Distribution Mains	1,000
8)	Install 6 tapstands and ferrules	510
9)	Tool Kits	150
10)	Consummable Engine Spares	1,400
	Sterling Pounds	16,960

Sangker Reception Centre (1,500 persons capacity)

		Capital Cost Estimate
1)	Install two ET75 Raw Water pumps (one duty, one standby)	2,400
2)	Erect one 45 cubic metre Raw Water sedimentation tank	1,500
3)	Install one ET75 transfer pump	1,200
4)	Erect two 45 cubic metre storage tanks	3,000
5)	Provide necessary fittings	1,000
6)	Lay 600 metre 3 inch PVC Distribution mains	1,000
7)	Install 4 tapstand and ferrules	350
8)	Tool kit	150
9)	Consummable Engine Spares	800
	Sterling Pounds	11,400

Maung Russey Reception Centre (1,500 persons capacity)

Trucking from River		Capital Cost Estimate
1)	Install two ET75 along the bank of the River Maung	2,400
2)	Install ten 1 cubic metre portable bulk containers c/w fittings and strappings	7,000
3)	Erect one 45 cubic metre Raw Water/ sedimentation tank	1,500
4)	Install one ET75 transfer pump	1,200
5)	Fittings	1,000
6)	Lay maximum 600 metre 3 inch PVC Distribution Main	1,000
7)	Install 4 tapstands and ferrules	350
8)	Consummable Engine Spares	800
	Sterling Pounds	15,400

Piping from River		Capital Cost Estimate
1)	Install two PL4 intake pumps (one duty, one standby)	3,600
2)	Lay 6 kilometres 3 inch PVC Main	9,800
3)	Erect one 45 cubic metre Raw Water/ sedimentation tank	1,500
4)	Install two ET75 transfer pumps	1,200
5)	Fittings	1,000
6)	Lay maximum 600 metre 3 inch PVC Distribution mains	1,000
7)	Install 4 tapstands and ferrules	350
8)	Tool Kits	150
9)	Consummable Engine Spares	1,400
	Sterling Pounds	20,000

Pursat Reception Centre (1,000 persons capacity)

		Capital Cost Estimate
1)	Install appropriate size turbine pump with spare engine	9,000
2)	Lay 1.2 kilometres of 3 inch PVC main	2,600
3)	Install one 45 cubic metre storage tank	1,500
4)	Lay maximum of 600 metres of 3 inch PVC Distribution	350
5)	Install 4 tapstands and ferrules	340
6)	Tools KIts	150
7)	Consummable Engine Spares	1,000
	Sterling Pounds	15,240

Phnom Penh Reception Centre (4,000 persons capacity)

		Capital Cost Estimate
1)	Provide two ET75 transfer pumps (one duty and one standby)	2,400
2)	Install two 70 cubic metre storage tanks on elevated base	3,200
3)	Lay maximum 600 metre of 3 inch PVC Distribution Main	1,000
4)	Install 14 tapstands and ferrules	1,190
5)	Tools Kits	150
6)	Consummable Engine Spares	600
	Sterling Pounds	8,500