

 Preparatory Works (design, tender, institutional set up etc.)
 Construction
 Operation

Fig. V-29 Implementation Schedule of Priority Development Projects

ANNEX VI
RURAL INFRASTRUCTURE

ANNEX VI

RURAL INFRASTRUCTURE

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1. INTRODUCTION

The Study aims to prepare the Master Plan for integrated agricultural and rural development project in the Study Area of 16,000 ha consisting of the Kandal Stung Study Area of 10,000 ha and Tonle Bati Study Area of 6,000 ha and to select priority development project for the Feasibility Study.

As a result of the Master Plan, the areas of about 1,950 ha delineated under the existing irrigation scheme in the Kandal Stung Study area and about 1,600 ha located in the upper reach of the existing Tonle Bati irrigation scheme were selected as a priority development area.

The study mainly includes the improvement and development of rural road networks and domestic water supply facilities. Although these infrastructures are essential for the farmers' welfare as well as successful agricultural development, their realization will take a large amount of investment. Therefore, the development plan is formulated so as to satisfy the minimum requirements to sustain the project activities and certain living standards in the short term and to gradually reinforce the facilities in the long term.

Rural infrastructure development should be based on the needs of the people in the Study Area. Thus, those facilities of which importance and necessity are agreed by both residents and the Government authorities will be given higher priority. Rural road networks and domestic water supply facilities are the main items to be developed.

To support agricultural development and rural economic activities as well as to improve socio-economic conditions in the Study Area, development of rural road network will be also accorded with a high priority development scheme. The provincial and village road networks will be consolidated.

To improve rural life, domestic water supply facilities will be also given a high priority development. In order to develop and improve the water supply system, the rural water supply facilities are provided to the following areas ;

- poor water quality
- water shortage in the dry season
- long distance from water source or well

The social infrastructure and public service facilities so far set up in the Study Area are all subject to upgrading and/or reinforcement so as to improve livelihood of local people satisfactorily. These infrastructure and public facilities to be developed are ;

- a. Establishment of community hall,
- b. Improvement of Khum (Commune) clinic, and
- c. Improvement of educational facilities.

Based on the formulation of Master Plan, a definite development plan on the Priority Development Area will be formulated and presented in this chapter.

2. RURAL ROAD NETWORKS

2.1 Present Conditions

2.1.1 Transportation Systems

Transportation of farm products from farms to residences is made by various means; human labor, ox and ox-cart, motorcycle and motorcycle drawn cart. Most of farmers depends on ox and ox-cart to transport paddy from fields to their farm yards. The transportation of goods to market in the Study Area is usually made by motorcycle or bicycle because almost farmers have them and road condition is not well. The transportation systems of Priority Development Area are same condition of the Study Area.

2.1.2 Road Networks

The access to Cang Dan, capital city of Kandal Province, is facilitated by a national road No.2, which leads to Phnom Penh with about 8 km long. The access to Takeo, capital city of Takeo Province, is also facilitated by this road No.2. Another direct access to Phnom Penh is a national road No. 3, which is about 27 km far from Kompong Toul located at Northwest of Kandal Stung Study Area. Provincial road No.105 connects the national road No.3 to the national road No.2. Although the road condition of the No.105 is not well, this route is all weather and much better than other local routes.

In the Study Area, there exist about 14.3 km of national roads and about 16.4 km of provincial road in Kandal Province. The national road No.3 located at the western extremity of the Kandal Stung Study Area is paved with asphalt. The national road No.2 located at the western extremity of the Tonle Bati Study Area is mostly paved with asphalt. The No.2 between Samrong Yong and Haknuman in the Tonle Bati Study Area is still unpaved, but the road is under rehabilitation. The provincial road No.27 in the Kandal Stung Study Area has been asphalt-paved, but severely damaged, so that only passable by four wheel drive car in the rainy season.

District roads are still unpaved, and more or less affected by erosion hazard at present. The district road of Kandal Stung is impassable due to breakage of bridge on irrigation canal. Village road (farm road) network are insufficiently provided for an efficient operation of crop cultivation. In the rainy season, those roads are hardly passable by car due to muddy or serious erosion.

The present road system in Kandal Stung Study Area and Tonle Bati Study Area are as shown in Fig. VI-1 and Fig. VI-2, and the existing conditions of road in the Study Area are as shown in Table VI-1.

The present road system in Kandal Stung Priority Development Area and Tonle Bati Priority Development Area are as shown in Fig. VI-3 and Fig. VI-4. The existing conditions of road in Priority Development Area are as shown in Table VI-1.

In Priority Development Area, there exist about 6.5 km of national roads and about 16.4 km of provincial road in Kandal Province respectively. Provincial roads of No.104 and No.105 connect the road No.3 and the No.2. Both these provincial roads, were substantially inundated by the flood of the Prek Thnot in August 1994. Although passable by car, the surface was severely damaged and bumpy. No district road is available in Priority Development Area. There exist about 8.0 km of village roads in the Kandal Stung Priority Development Area and about 14.6 km in the Tonle Bati Priority Development Area respectively. Those roads are hardly passable by car due to muddy or serious erosion in the rainy season.

2.2 Basic Development Plan

2.2.1 General

Rural people is forced with inconvenience of traffic especially in the rainy season due to poor road networks as well as severe conditions of road. The road networks in the Study Area provide for the following major services for the villagers concerned:

- i) marketing for daily necessities,
- ii) transporting crop products, commodities and materials between farm and market, and
- iii) communications in every aspects among the communities.

The main purpose of road network development is to establish sufficient transportation routes to improve daily transportation conditions and to promote regional and agricultural development in the Study Area.

The road network consists of the provincial road, the district road and village roads. The road condition will be upgraded from present condition with either asphalt pavement or gravel metalling, and construction of related structure where necessary.

Based on the inventory survey of the district road and village road, the improvement plan is set up to ensure smooth connection of villages with the trunk road and farmland. The improvement works of the roads consist of gravel metalling and widening, and construction of related structures.

2.2.2 Improvement Plan

(1) Trunk Road

The existing provincial roads of No.104 and No.105 will be rehabilitated and improved. The village trunk roads will be upgraded. The standard Gross section is shown in Fig.VI-5. The following table shows major improvement works for the existing roads. The location of trunk road to be improved in the Study Area are shown in Table VI-2 and Fig. VI-6.

Road Name	Length (km)	Pavement	Width (m)
Road No.104 & No.105	14.9	Asphalt	5.0
Village Trunk	15.9	Gravel Metalling	4.0

(2) Village Roads

The improvement works of the village roads consist of gravel metalling, widening, banking and construction of related structures. The total length of 62.3 km in 21 numbers will be improved. The standard Gross section is shown in Fig.VI-5. The location of the feeder roads to be improved are shown in Table VI-2 and Fig. VI-6.

The general features of improvement works of the feeder road are as summarized below:

Area	Nos of Roads	Length of Road to be Improved (km)	
		Type A	Type B
Kandal Stung	15	-	45.6
Tonle Bati	6	5.7	11.0
Total	21	5.7	56.6

Note: Type A; gravel metalling, t = 20 cm, to existing width of 5 m
Type B; gravel metalling, t = 20 cm, and widening to 5 m of width

2.3 Preliminary Design

2.3.1 Basic Design Consideration

Since both Provincial roads No 104 and 105 were substantially flooded by the Prek Thnot in August 1994, the entire reaches will be heightened for about 0.5 m and the village roads will also be upgraded with gravel pavement and widening. The following are design criteria of road improvement.

(1) Trunk Road

- Designed speed 50 km/hr
- Total width 7.0 m
- Pavement Asphalt
- Net width 5.0 m
- Thickness 5 cm
- Shoulder width 1.0 m

(2) Village Roads

- Designed speed 40 km/hr
- Total width 5.0 m
- Pavement Gravel metalling with laterite soil
- Net width 4.0 m
- Thickness 20 cm
- Shoulder width 0.5 m
- Height of road More than 30 cm from a level of paddy field surface

(3) Related Structures

i) Drainage Cross Culvert

Drainage system will be substantially improved. The existing drainage canals and ditches will be upgraded to have sufficient capacity to drain water. Additional drains as well as structures will be provided, where necessary.

ii) Bridge

Bridges which are deteriorated or superannuated, will be replaced with bridge or box culvert.

iii) Side Ditch

Where road passes through village, the side ditch will be provided. At the entrance of resident house a concrete pipe culvert with 30 cm diameter will be provided for proper functioning.

2.3.2 Improvement Plan

(1) Provincial Road

The provincial roads of No.104 and No.105 will be rehabilitated and improved. The following table shows major improvement works for the provincial roads. The location of provincial road to be improved in the Priority Development Area are shown in Fig. VI-7.

Road Name	Length	Pavement (km)
Route No.104	9.1	Asphalt
Route No.105	6.8	Asphalt

(2) Village Roads

The improvement works of the village roads consist of gravel metalling, widening, banking and construction of related structures. The total length of 22.6 km in 9 numbers will be improved. The location of the village roads to be improved are shown in Fig.VI-7 and Fig.VI-8.

The general features of improvement works of the village road are as summarized below:

Area	Nos. of Roads	Length of Road to be Improved (km)
Kandal Stung	4	8.0
Tonle Bati	5	14.6
Total	9	22.6

3. RURAL WATER SUPPLY FACILITY

3.1 Present Conditions

3.1.1 Present Water Use

In the Study Area, ground water is the main source of the drinking and other domestic use. At present, total 149 nos. of dug wells and 97 nos. of tubewells have been installed under the UNICEF and two foreign NGOs in the Kandal Stung Study Area, and total 17 nos. of dug wells and 35 nos. of tubewells in the Tonle Bati Study area under UNICEF respectively. Dug wells have a depth ranging from around 5 to 10 m, while tubewells range at around 30 to 40 m. Most of those dug wells are drawn water by bucket. Those tubewells are equipped with manual operating pumps.

Both Table VI-3 and Table VI-4 show the number of drinking water facility by village in the Study Area based on the interview survey of rural water facility respectively.

The above facilities in the Study Area is summarized below :

	Tubewell	Dug well
Kandal Stung Study Area*1		
- functioning well	90	145
- not functioning well	7	4
Sub Total	97	149
Tonle Bati Study Area*2		
- functioning well	35	17
- not functioning well	0	0
Sub Total	35	17
Both Priority Area		
- functioning well	125	162
- not functioning well	7	4
Total	132	166

*1 No well was provided for 9 villages out of 78 villages in total

*2 No well was provided for 7 villages out of 33 villages in total.

The density of user by village is shown in Table VI-5 and Table VI-6 in the Study Area.

In the dry season, many numbers of well are dried up. In such villages, a large number of water users depend water on other water sources, such as lake, canals or ponds, and are facing with severe short of domestic water supply facilities. The following table shows the number of functioning well in each commune and average of number of person commanded by each well in the dry season and rainy season respectively.

Name of Khum	Number of functioning well		Density of user per well	
	Rain season	Dry season	Rain season	Dry season
Kandal Stung Study Area			Persons	Persons
Tra Peang Veng	21	11	94	179
Thmei	14	13	91	98
Trea	15	7	262	562
Spean Thmo	2	2	987	987
Roluos	15	8	92	173
Preah Puth	10	6	160	267
Tien	10	10	144	144
Bakou	16	16	193	193
Kok Trap	51	51	59	59
Korng Nory	10	10	101	101
Anlung Romeat	35	34	61	63
Prek Roka	22	19	131	152
Tbeng	14	8	219	383
Tonle Bati Study Area				
Kreing Thnoug	4	3	919	1,225
Champey	8	7	542	620
Kandang	6	5	488	586
Put Sar	29	27	271	291
Trapeang Sap	5	3	454	757

The Tonle Bati Study Area is severely lacking water supply facilities in number as a whole. On the other hand, the central part of Kandal Stung is comparatively well served and less dried up. It is desirable that a number of water user per well is approximately 40 families (40x5=200 persons). In this context, the number of the well in the Study Area is extremely short particularly in Tonle Bati Study Area.

In the Priority Development Area, ground water is the main source of the drinking and other domestic use as same as the condition of the Study Area. At present, total 56 nos. of dug wells and 29 nos. of tubewells have been installed in the Kandal Stung Priority Development Area, and 9 nos. of tubewells in the Tonle Bati Priority Development Area.

Table VI-7 shows the number of drinking water facility by village in the Priority Development Area based on the inventory survey of rural water facility, and summarized below:

Facility	Priority Development Area	
	Kandal Stung	Tonle Bati
Tubewell	29	9
Dug well	56	0
Artificial pond	2	10
Lake	0	1

The following table shows the number of functioning well in each commune and average of number of person commanded by each well in the dry season and rainy season respectively (refer to Table VI-8).

Name of Khum	Number of functioning well		Density of user per well	
	Rain season	Dry season	Rain season	Dry season
Kandal Stung Priority Development Area			Persons	Persons
Roluos	15	8	92	173
Preah Puth	10	6	160	267
Tien	7	7	105	105
Bakou	15	15	178	178
Korng Nory	10	10	79	79
Anlung Romeat	28	28	62	62
Tonle Bati Priority Development Area				
Kreing Thnoug	4	3	919	1,225
Champey	3	3	462	462
Kandang	1	0	280	no well
Put Sar	1	1	472	472

3.1.2 Water Quality

To identify the quality of drinking water supply source such as dug well, tubewell and pond, some data of water quality test were collected from the Water Quality Laboratory, Department of Hydrology. In total, 27 data were obtained. The water quality tests including detailed chemical analysis and biological analysis were conducted in 1993 and 1994 by the above Laboratory. The result is as shown in Table VI-9.

As for the pH value of water, the sampling water ranges within the permissible limit of 6.5 to 8.5. According to the result of the chemical the quality of surface water and ground water is satisfactory, except for some ground water where a high iron content makes to unfit for human use. tubewell is better for protection from contamination by seepage water and for yielding excellent water.

3.1.3 Present Condition of Tubewell

There are several data of geological profiles and yield tests conducted by UNICEF and NGO. The location and representative geological profiles are as shown in Fig. VI-9, and Fig. VI-10. The Study Area is divided into four areas from the hydro-morphological view point as follows:

- i) Northern Kandal Stung
Northern area of provincial road Route No.105.
- ii) Central Kandal Stung
Central area along the Stung Toach river extending to the Tonle Bati lake.
- iii) Southern Kandal Stung
Theng area located at south-west part of the Kandal Stung Study Area.
- iv) All Tonle Bati
Whole area of the Tonle Bati Study Area.

The existing tubewells depth ranges from 30 to 40 m in the Northern Kandal Stung, the Southern Kandal Stung and the All Tonle Bati, but about 70 m in the Central Kandal Stung.

In the Northern Kandal Stung and Central Kandal Stung, the geological formations are comparatively sandy, and the ground water is sufficient to yield. However, the geological formations in the Southern Kandal Stung are clay with thick layer, and quantity of groundwater is not sufficient. In the all Tonle Bati, the geological formations are sandy and gravel, but the groundwater is not satisfactory in the dry season.

Table VI-10 show the condition of existing tubewell in the Priority Development Area based on the inventory survey and the location of tubewell in the Priority Development Area are shown in Fig.VI-11 and Fig.VI-12 respectively.

The tubewell is basically provided for a tubewell per village. The existing tubewells depth ranges mostly from 30 to 40 m in the Kandal Stung Priority Development Area, and from 20 to 30 m in the Tonle Bati Priority Development Area. Each tubewell is equipped with cylinder-type manual hand pump of Indian made. Though the maintenance of tubewell is to be conducted by village people, they don't know how to repair the pump facility due to lack of spare parts and cost.

In the Kandal Stung Priority Development Area, the geological formations are comparatively sandy, and the ground water is sufficient to yield, while in the Tonle Bati Priority Development Area, the geological formations are sandy and gravel, but the groundwater is not satisfactory in the dry season.

The iron content of ground water is high particularly in western part of the Kandal Stung area. These ground water show red-brown color after airing. Those water of tubewell are not used for drinking and cooking by village people, because less tasty. If they don't have the dug well during the dry season, they use the water after aeration and filtered.

In the rainy season, village people mostly use the rain water kept into the large jar for domestic water in the entire area. In the dry season, they use the tubewell water, the dug well water and artificial pond water where available.

3.1.4 Pumping Test

A pumping test was carried out to determine the characteristics of the aquifers and to get information on the yield and draw down of the well. The pumping test was executed at the following four tubewells as shown in Fig. VI-11 and Fig.VI-12.

No. 1 Test Well	(TW-B01)	Phum Krang Russey, Khum Put Sar
No. 2 Test Well	(TW-B14)	Phum Trokeit, Khum Champey
No. 3 Test Well	(TW-K05)	Phum Krang Sbauv, Khum Preah Puth
No. 4 Test Well	(TW-K24)	Phum Andong, Khum Bakou

The modified non-equilibrium formula as derived by Jacob was used in the analysis of the pumping test results. The time-draw down relation is shown in Fig.VI-13. The coefficient of the transmissibility is calculated by the following formula;

$$T = 0.183 \times \frac{Q}{\Delta S}$$

where, T = Coefficient of transmissibility (m²/day)
 Q = Average pumping rate (m³/day)
 ΔS = Drawdown per log cycle (m)

The aquifer characteristics are analyzed, using T-value obtained from the pumping tests. The result is as shown below;

Results of Pumping Test Analysis

Test well No.	Water level (m)	Yield (l/min)	Transmissi- bility (m ² /day)	Effective aquifer depth (m)	Permeability (m/day)
1	8.61	43	18	7	2.6
2	5.60	46	48	15	3.2
3	2.76	47	24	15	1.6
4	4.13	43	6	8	0.7

3.2 Basic Development Plan

3.2.1 General

The present water supply conditions in the Study Area are confronted with water shortage, poor water quality, and long distance from the water source or well. In order to improve these conditions, additional rural water supply facilities will be provided for the following areas where;

- a. water quality obtained is very poor and not potable.
- b. water pumped up is short for domestic use particularly in the dry season.
- c. density of dugwell is scarce resulting in very far from dugwell to residence.

The proposed water supply facilities are considered to be constructed in the following two categories:

i) Type I

- a. To dig tubewell more than depth of 30 m,
- b. To provide manual pump,
- c. To make the filter to remove oxidized iron if the iron content is high in the ground water,
- d. To carry the well water by bucket to the residence, and
- e. To stock the water in the large jar.

ii) Type II

- a. To dig tubewell more than depth of 50 m,
- b. To provide submergible motor pump,
- c. To make the filter to remove oxidized iron if the iron content is high in the ground water,
- d. To pump up to overhead tank, and
- e. To distribute water to faucet which command residence households of four to six.

Type I is rather simple and less construction and maintenance costs needed. Type II has the following problems and disadvantage:

- No electric power supply system for the operation of submergible motor pump is available,
- Lack of technical operator,
- Increase in operation and maintenance costs, and
- Collection of water charge for O & M is needed.

However, Type II system are much useful for the life improvement and the effect of demonstration of rural water supply system is significant from the following view points:

- much better clean water is obtainable than the Type I water,
- less manpower required for taking domestic water, and
- promotion of improvement of community life.

Therefore, Type II system is provided for the proposed community hall for both Khum Bakou and Kreing Thnoug, because power generator will be provided for community hall and the both places are rather crowded with rural people.

The water supply facilities are designed to accommodate the water requirements in 2004 . Increase rate of population is estimated at 2.8 % per year. Rural water supply system to be supplied in the Study Area is Type I or Type II depending on the following population density:

- Type I : About 25 to 50 beneficiary households should be located within 250 m from a well or within about 6 ha
- Type II : Number of beneficiaries should be about 50 to 100 households located within about 6 ha. One faucet should serve about 4-6 households within a distance of approximately 25 m.

3.2.2 Improvement Plan

Typical plan of rural water supply facilities is shown in Fig.14. The following rural water supply facilities are proposed to be constructed, as summarized below. The locations and number of the proposed rural water supply facilities are shown in Table VI-11, Table VI12 and Fig. VI-15.

		Kandal Stung Study Area	Tonle Bati Study Area
Type I			
(Tubewell with manual pump)	more than 50 m	67	0
	less than 50 m	72	124
	Total	139	124
Type II			
(Tubewell with submerged pump and pipeline)		1	1

3.3 Preliminary Design

3.3.1 Basic Design Consideration

The basic design criteria of the respective Types are as follows:

(1) Type I

Type I facilities consist of tubewell with cylinder-type manual pump. The facilities of Type I are designed on the following basis:

i) Water Supply Per Day

- Daily average water supply, q : 40 l/day/person
- Average daily water supply, $Q1$: $q \times$ population designed
- Maximum daily water supply, $Q2$: $1.3 \times Q1$
- Maximum hourly water supply, $Q3$: $2.5 \times Q1/24$

(2) Type II

Type II facilities consist of a tubewell, pumping equipment, water tank, main pipeline, distribution pipeline and communal faucets. The design criteria of Type II are as follows:

i) Water Supply Per Day

- Daily average water supply, q : 80 l/day/person
- Average daily water supply, $Q1$: $q \times$ population designed
- Maximum daily water supply, $Q2$: $1.3 \times Q1$
- Maximum hourly water supply, $Q3$: $2.5 \times Q1/24$

ii) Faucet : 3.5 m in Head

- Minimum diameter : 13 mm
- Water head at the end : 3.5 m

iii) Storage Tank

- Structure : overhead tank, reinforced concrete structure
- Storage volume : 0.20 to $0.25 \times Q2$

iv) Distribution Pipeline

: PVC pipe

v) Pump Operation Hour Per Day

- Pump operation : 12 hr per day
- Pump capacity : $Q2$

3.3.2 Improvement Plan

The following rural water supply facilities are proposed to be constructed as summarized below. The locations and number of the proposed rural water supply facilities are shown in Table VI-13, Fig.VI-16 and Fig.VI-17.

	Kandal Stung Priority Development Area	Tonle Bati Priority Development Area	Total
Type I (Tubewell with manual pump)	42	32	74
Type II (Tubewell with submerged pump and pipeline)	1	1	2

4. OTHER RURAL INFRASTRUCTURE FACILITIES

4.1 Present Conditions

4.1.1 Health Facility

Both the Study Areas, Kandal Stung and Tonle Bati, have a similar public health services facility. Table VI-14 and Table VI-15 show the existing conditions of Khum clinic in the Study Area. The Kandal Stung Study Area has 11 Khum clinics and a main hospital in the Khum Anlung Romeat. The Khum clinic is basically provided for each Khum except the Khum Preah Puth. The clinic of the Khum Preah Puth has been severely destroyed during Pol Pot regime. The existing condition of clinic buildings are 7 under a good condition, 1 fair and 3 bad respectively. The Tonle Bati Study Area has five Khum clinics of which one (1) is under a good condition and 4 really deteriorated. According to Director of District hospital, a minimum size required of Khum clinic is 8 m by 12 m house, and it needs three rooms, namely, dispensary, ward and medicine stock room.

The following show more detailed conditions of clinics in Priority Development Area;

(1) Kandal Stung Priority Development Area

i) Bakou Clinic

The Bakou Clinic constructed in 1982 by the donation of village people, is located to face the Provincial road No.105 at Phum Bakou of Khum Bakou. There are three buildings connecting with gallery. The total floor space of building is 165 m². The building built of wood. The condition of center building is severely damaged and the both side buildings are almost destroyed. The clinic facilities are not functioning for activities for public health services.

ii) Korng Nory Clinic

The Korng Nory Clinic constructed in 1983 by the assistance of Prasat temple and the donation of village people, is located on facing the Provincial road No.104 at Phum Velturan of Khum Korng Nory. The building with three rooms is as built of brick. The total floor space of building is 114 m². The condition of building is generally good. The clinic facilities are used by the staff for public health service activities.

iii) Preah Puth Clinic

The Preah Puth clinic has been severely destroyed in Pol Pot regime. Reconstruction of building is needed entirely.

iv) Roluos Clinic

The Roluos Clinic constructed in 1980 by the assistance of Prah Theat temple and the donation of village people, is located at Phum Prash Theat of Khum Roluos. The building has two rooms built of brick. The total floor space of building is 54 m². The building is rather old, and slightly damaged on the wall. The clinic facilities are used by the staff for the public health service activities.

v) Tien Clinic

The Tien Clinic constructed in 1985 by the donation of village people, is located on facing the Provincial road No.104 at Phum Krang of Khum Tien. The building has three rooms built of brick. The total floor space of building is 81 m². The condition of building is generally good. The clinic facilities are used by the staff for the public

health service activities. The Tien Khum offices have taken a room of clinic as the office, because the khum office has been occupied as school house.

(2) Tonle Bati Priority Development Area

i) Champey Clinic

The Champey Clinic constructed in 1981 by the assistance of OXFAM and the donation of village peoples, is located outside the Tonle Bati Priority Development Area at Phum Tro Kiet of Khum Champey. The building which has two rooms built of wood. The total floor space of building is 96 m². The building is severely destroyed. No clinic facility is provided. At present, staff of clinic are working at the khum office in front of the clinic.

ii) Kandang Clinic

The Kandang Clinic constructed in 1982 by the donation of village peoples, is located outside the Tonle Bati Priority Development Area at Phum Kandang Toch of Khum Kandang. The building has two rooms built of wood. The total floor space of building is 54 m². The building is severely broken and not functioning for the activities of public health services. At present, the clinic staff are working at their home instead of clinic house.

iii) Kreang Thnung Clinic

The Krang Thnung Clinic constructed in 1981 by the assistance of OXFAM and the donation of village peoples, is located outside the Tonle Bati Priority Development Area at Phum Krang Thnung of Khum Krang Thnung. The building which has three rooms built of brick. The total floor space of building is 96 m². The building is severely broken and not functioning for the activities of public health services. At present, the clinic staff are working at their home instead of the clinic house. The village peoples expect to construct the new clinic at the other place nearby Phum Tonle Bati, because the present clinic is too close to Put Sar clinic.

iv) Put Sar Clinic

The Put Sar Clinic constructed in 1983 by the donation of village peoples, is located outside the Tonle Bati Priority Development Area at Phum Kreang Sambat of Khum Put Sar. The two stories building has 5 rooms built of brick. The total floor space of building is 79 m². But the building is severely broken. The clinic facilities is, however, not functioning for the activities of public health services. At present, the clinic staff are working at their home instead of the clinic house.

The location of above Khum clinics is shown in Fig.VI-18 and Fig.VI-19.

4.1.2 School Facility

Table VI-16 shows the existing conditions of schools in Kandal Stung Study Area and Tonle Bati Study Area respectively, according to the interview survey carried out in December 1993. School facilities such as building, books and science equipment are inadequate. In order to overcome shortage of class room for enrolling students, the schools are managed by the rotation system of changing the class by school hours. Some schools built of wood have been superannuated so that replacement with new building or additional building are indispensable for improvement of the quality of education.

The present condition of schools is as summarized below;

Item	Kandal Stung Study Area		Tonle Bati Study Area	
	Primary school	Middle school	Primary school	Middle school
Number of school	19	1	13	1
Number of class room	110	25	104	11
Number of student	6,329	1,120	4,365	353
Average area of class room (m ²)	46	56	57	75
Average area per student (m ²)	0.8	1.3	1.4	2.3

There are 19 primary schools and 1 middle school in the Kandal Stung Study Area and 13 primary schools and 1 middle school in the Tonle Bati Study Area respectively. A class room size ranges from mostly 45 m² to 55 m² for the primary school, and 55 m² to 75 m² for the middle school. Though it is generally shortage of school, the current status of school room and facilities in the Tonle Bati Study Area is better than that of the Kandal Stung Study Area.

There are eight (8) primary schools and one (1) middle school in the Kandal Stung Priority Development Area and four (4) primary schools and one (1) middle school in the Tonle Bati Priority Development Area. School facilities such as building, books and science equipment are inadequate and insufficient. In order to overcome shortage of class room for enrolling students, the schools are managed by the rotation system to change the class by school hours. Some wooden schools have been superannuated so that replacement with new building or additional building are indispensable for improvement of the quality of education.

The present condition of primary school in the Priority Development Area is respectively as follows;

(1) Kandal Stung Priority Development Area

i) Roluos Primary School (Khum Roluos)

The Roluos primary school constructed in 1979 by the donation of village people, has a school house and a school office. Since the existing wooden school house is superannuated, new brick building to be replaced is under construction by the assistance of WVI, which comprised four (4) class rooms with total floor space of 218 m². However the office is used as classroom because of shortage of classroom. It is only five (5) class rooms for 450 total students of 10 classes and 10 teachers. There is the total school land area of about 3,400 m² on the Khum's land.

ii) Preah Puth Primary School (Khum Preah Puth)

Preah Puth Primary School has two school houses and a office. One new school house built of brick with four (4) class rooms of 279 m² of floor space was constructed in 1993 by the assistance of WVI. The other old school house built of wood with three (3) class rooms of 157 m² was constructed in 1979 by the donation of village people. It is 340 total students and seven (7) teachers in seven (7) classes. There is the total school space of about 6,100 m² on the Khum's land. The condition of old school house is slightly damaged on the wall but deteriorated.

iii) Tien Primary School (Khum Tien)

Tien primary school has been broken a few years ago but not reconstructed yet because of lack of fund. The school has been obliged to remove to the Khum office, and occupies all six (6) rooms of the office. It is 320 total students and 11 teachers comprising nine (9) classes. The chief of Khum plans to reconstruct the new school in the Khum office space area of 8,500 m².

iv) Bakou Primary School (Khum Bakou)

Bakou primary school has two school houses and a office. One new school house built of wood was constructed in 1994 by the assistance of Holland, and the other old wooden house was constructed in 1977 by the donation of village people. The both school houses have five (5) class rooms with total floor space of 255 m² each. It is 560 total students and 17 teachers comprising 17 classes. There exists the total school space of about 5,300 m² on the Khum's land. The condition of old school house is still good because of good maintenance.

v) Korng Nory Primary School (Khum Korng Nory)

Kong Nory primary school has two school houses and a school office. The both school houses built of wood was constructed in 1982 by the assistance of Pra Sath Temple and the donation of village people. Those school houses have three (3) class rooms of total floor area of 189 m² and three (3) class rooms of 178 m² respectively, and hold 210 total students and eight (8) teachers for eight (8) classes. There is the total school space of about 9,000 m² on the Khum's land. The condition of old school houses has been damaged and superannuated. So, the Khum peoples started to construct the new school house of five (5) class rooms nearby old school house in 1993. However, the work has been suspended due to shortage of fund.

vi) Anlung Romeat Primary School (Khum Anlung Romeat)

Anlung Romeat primary school has two school houses and a school office. The school houses built of brick were constructed one in 1990 and the other in 1994 by the assistance of three temples of Anlung Romeat, Toul Sala and Ang Sery. The both school houses have five (5) class rooms of total floor space 400 m² each, and hold 810 total students and 20 teachers for 20 classes. There is the total school space of about 13,500 m² in the Khum's land. The condition of school houses is fairly good. At present, the new school house is under construction by the assistance of the Party of Funsin Pek.

vii) Toul Sala Primary School (Khum Anlung Romeat)

Toul Sala primary school has a school house constructed in 1993 by the assistance of PARM. The school house built of brick have three (3) class rooms of total floor space 288 m², and hold 120 total students and six (6) teachers with six (6) classes. The school is located in the Toul Sala temple's land. The condition of school house is fairly good.

viii) Ang Sery Primary School (Khum Anlung Romeat)

Ang Sery primary school has a school house constructed in 1993 by the assistance of Cambodian people in USA. The school house built of brick have three (3) class rooms of total floor space 240 m², and hold 240 total students and six (6) teachers for six (6) classes. The school is located in the Ang Sery temple's land. The condition of school house is good. According to the chief of Khum, the surplus number of students more than 240 students are planned to attend the Anlung Romeat primary school in future.

(2) Tonle Bati Priority Development Area

i) Ang Velovan Primary School (Khum Kreing Thnounge)

Ang Velovan primary school has four school houses which was constructed in 1980 by the donation of village people. The school houses built of wood have nine (9) class rooms of total floor space of 555 m², and hold 450 total students and nine (9) teachers for 18 classes. The total school area of about 5,700 m² is located in the Khum's land. The school houses are damaged on the wall and superannuated.

ii) Tonle Bati Primary School (Khum Kreing Thnoug)

Tonle Bati primary school has four school houses and a school office. Two new school houses built of wood were constructed in 1993 and one in 1994 by the assistance of Tonle Bati temple, and one old school house built of wood was constructed in 1957 by assistance of Tonle Bati temple also. The school houses have 13 class rooms of total floor space 942 m², and hold 669 total students and 16 teachers for 14 classes. The total school area of about 8,900 m² is on the Khum's land. The old school house is considerably damaged on the wall and roof and superannuated.

iii) Daeu Krohom Primary School (Khum Champey)

Daeu Krohom primary school has two school houses which was constructed one in 1986 and the other in 1993 by the assistance of the Daeu Krohom temple and the donation of village people. The school houses built of wood have four (4) and two (2) class rooms of total floor space 286 m², and hold 400 total students and 6 teachers for 11 classes. The condition of old school house is slightly damaged on the wall.

The locations of above schools are shown in Fig.VI-18 and Fig VI-19.

4.1.3 Community Center

At present, no community center is existent at each Khum in both the Kandal Stung and the Tonle Bati Study Area (refer to Table VI-14).

4.1.4 Market Facility

At present, there are three (3) market facilities nearby the national road No.3 and three (3) small markets along national road No.2 in the Kandal Stung Study Area. The Kompong Toul Market at Khum Anlung Romeat is the largest where daily necessities, foods and miscellaneous goods are sold for rural habitants in and around the Study Area. In the Tonle Bati Study Area, there is only one market facility at Samrong Yong, which is larger than the Kompong Toul market, and is crowded with rural habitants in and around the Study Area as well as passengers passing through the national road No.2. Although density of market in the Study Area is rather satisfactory but improvement of facilities and access to those market area are extremely needed.

4.1.5 Rice Mill Facility

At present, 60 rice mills are operating in the Kandal Stung Study area, and 67 mills in the Tonle Bati Study Area respectively (refer to Table VI-14 and Table VI-17). According to Statistics of Factory in the Kandal Stung 1992/1993, rice mill facility increased by more than double in 1992 as shown below.

Registered year	1980	1983	1986	1989	1990	1991	1992	1993
Number of facility	1	2	1	2	5	8	18	18

In the Study Area, two types of rice mill are operated, one with the about 400 kg/hour and the other about 150 kg/hour of processing capacity (out put) on an average. Total capacity of facilities are almost sufficient enough in quantity and quality at present. The following calculation shows the estimation of balance between the processing capacity and consumption of rice in the Study Area.

Calculation of Balance

Assumed parameter	Processing capacity	100 kg/hr
	Processing hour per day	6 hr
	Operating day in a year	250 day
	Consumption of rice per capita	340 kg/year(paddy)
	Rate of milling (paddy to rice)	0.65
Kandal Stung Study Area		
Processing capacity	100 kg/hr x 6 hr x 250 day x 60 rice mill	=9,000 ton/year
Consumption	340 kg/year x 0.65 x 29,000 person	= 6,410 ton/year
Tonle Bati Study Area		
Processing capacity	100 kg/hr x 6 hr x 250 day x 67 rice mill	= 10,050 ton/year
Consumption	340 kg/year x 0.65 x 34,700 person	= 7,670 ton/year

4.1.6 Communication Facility

At present, there is one tele-communication facility at the Kandal Stung District Office as official communication with the Kandal Province office in the Study Area. No telephone system is available for residents in the Study Area. Receiving and delivery of messages between villages are communicated by a messenger. In Cambodia, telephone system is only available at limited cities such as Phnom Penh, Sihanouk Ville and Kep.

Communication media to inform residents in the Study Area include transistor radios and television sets. According to the interview survey, however, ownership ratio of communication media apparatus is about 30 % of residents in the Study Area .

4.1.7 Electricity Power Supply Facility

At present, no electricity power supply system is available in the Study Area. There are two small generators at Kompong Toul market area and Samrong Yong market area. Those small electricity powers are distributed to some customers who engage in business of market.

4.2 Basic Development Plan

4.2.1 Improvement of Khum Clinic

(1) General

The Khum Clinic is managed by the District Hospital. Operation efficiency of some Khum Clinic is substantially low due to superannuating of medical equipment and its function lowered. It is needed to improve the Khum Clinic for appropriate level as similar level as the Khum Clinic recently constructed at the Themey in the Kandal Stung Study Area.

(2) Improvement Plan

The following clinics are proposed to be improved in both Kandal Stung and Tonle Bati areas. The general feature of construction works of the Khum clinic facilities are summarized below.

Study Area	Building Area	Related Facility
Kandal Stung (Trea, Preah Puth, Bakou, Tbeng)	384 m ²	4 set
Tonle Bati (Kreing Thnoung, Cham Pei, Kandoeung, Puth Sar)	384 m ²	4 set
Total (8 places)	768 m ²	8 set

The locations of proposed Khum clinic facilities are shown in Fig. VI-20.

4.2.2 Supplement of Classroom

(1) General

The present condition of primary schools facilities in the Study Area are very poor. Some primary schools are confronted with severe lack of class rooms for primary education where the rotation classroom system are applied. Those schools extremely need the supplement of classroom. In the near future, a number of enrolling pupils will increase substantially.

(2) Improvement Plan

The locations and number of the required classroom are shown in Table VI-18 and Fig. VI-20. The class room facilities proposed are 58 in total in the Study Area.

4.2.3 Construction of Community Facilities

(1) General

At present, no community facilities of Khum is available in the Study Area. The community facilities are useful for communication and socio-economic activities of the village people and are expected to be utilized further for the farmers training, establishment of farmers organization, agricultural extension services, as well as for vocational training of rural people and women concerned.

(2) Improvement Plan

The locations of the proposed community facilities are shown in Fig. VI-20. The following community facilities are proposed to be constructed.

Facilities	Kandal Stung Study Area	Tonle Bati Study Area
Community Hall	13 places	5 places
Staff Quarter	25 houses	16 houses

4.3 Preliminary Design

4.3.1 Improvement of Khum Clinic

(1) Basic Design Consideration

Khum clinic is designed to facilitate the following:

- a. Three rooms as dispensary, ward and medicine stock room with brick construction, and
- b. The size of a room is 4 m long and 6 m wide.

Regarding the related facility, a new water supply facility of tubewell with manual pump is constructed near by building, and a outside toilet is provided. Typical layout plan of akhum clinic building is shown in Fig.VI-21.

(2) Improvement Plan

Since the most of Khum clinics are severely damaged, the priority of improvement to be taken is as follows:

- a. The Khum clinic building is broken and not function.
- b. In spite of poor facilities, the staff of clinic are conducting their tasks eagerly.

To improve the Khum clinic facilities, the following clinics are proposed to be constructed on the Priority Development Area. The general feature of construction works of the Khum clinic facilities are summarized below.

Name of Khum	Building Area	Related Facility
Bakou	96 m ²	1 set
Preah Puth	96 m ²	1 set
Kreing Thnoug	96 m ²	1 set
Total	384 m ²	3 set

The locations of proposed Khum clinic facilities are shown in Fig.VI-24 and Fig.VI25.

4.3.2 Supplement of Classroom

(1) Basic Design Consideration

Class room is designed to facilitate the following:

- a. The dimension of a classroom is 8 m long and 7 m wide.
- b. The front of classroom is attached with 2 m verandah.
- c. The building is made with brick.
- d. The related furniture such as benches, tables and chairs, and blackboard be provided.

Typical layout plan of school building is shown in Fig.VI-22.

(2) Improvement Plan

The required classroom is estimated by the as following criteria:

- a. Average number fo student in a classroom is 40 for the size of 8 m long and 7 m wide.
- b. A rotation classroom system is applied in two shifts per day at most.
- c. The rate of population increase is estimated at 2.8 % per year.

- d. The rate of enrolling student increase is estimated at 1 % per year.

The estimation of required classroom are shown in Table VI-19 and the locations are shown in Fig.VI-24 and Fig.VI-25. The classroom facilities are proposed to be 39 in Priority Development Area.

4.3.3 Construction of Community Facilities

(1) Basic Design Consideration

The facilities of community hall are designed to accommodate the following aspects and functions:

- a. Main building consists of three rooms as community hall, office and store room.
- b. Dimension of a community hall is 15 m long and 8 m wide.
- c. The front of hall is attached with 2 m verandah.
- d. The office space is 12 m² for a field worker, 16 m² for two field workers and 20 m² for three field workers.
- e. 100 m² of a staff quarter for a field worker is provided.
- f. The building is constructed with brick.
- g. The related furniture such as tables, chairs, and blackboard will be provided.
- h. The model cooking facilities, hygiene and health management room, a day care room, etc. are also accommodated

As the related facility, a new water supply facility of tubewell with manual pump is constructed near by the cookhouse or room, and latrine is provided. Typical layout plan of community hall building is shown in Fig.VI-23.

(2) Improvement Plan

The criteria to select for the improvement work of Khum community hall is as follows:

- a. A land for construction site should be offered Khum's public land by Khum office.
- b. The accessibility of proposed site should be at least jeepable.

The locations of the proposed community facilities are shown in Fig.VI-24 and Fig.VI25. The following community facilities are proposed to be constructed, as summarized below.

Facility	Kandal Stung Priority Development Area	Tonle Bati Priority Development Area
Community Hall	5 places	2 places
Staff Quarter	10 houses	5 houses

Tables

**Table VI-1 Existing Conditions of Road in the Study Area
and Priority Development Area**

Name of Road	Classification	Length (km)	Wide (m)	Kind of Road	Condition	Remarks
A. Kandal Stung Study Area						
1 No. 2	National Road	10.7	7.0	Asphalt pave.	smooth	
2 No. 3	National Road	3.6	12.0	Asphalt pave.	smooth	
3 No. 104	Provincial Road	9.6	7.0	Asphalt pave.	very rough	
4 No. 105	Provincial Road	6.8	6.0	Asphalt pave.	rough	
5 KS-D-1	District	9.3	4.0	Earth	rough	required one new bridge
6 KS-K-1	Khum	3.5	3.0	Earth	rough & narrow	
7 KS-K-2	Khum	2.9	2.5	Earth	rough & narrow	
8 KS-K-14	Khum	0.9	2.5	Earth	rough & narrow	
9 KS-K-3	Khum	1.5	3.0	Earth	rough & narrow	
10 KS-K-4	Khum	2.8	3.0	Earth	a little rough	
11 KS-K-5	Khum	2.8	4.0	Earth	smooth	1.1km of total length is asphalt pavement.
12 KS-K-7	Khum	2.7	2.5	Earth	very rough & narrow	
13 KS-K-6	Khum	4.0	2.5	Earth	very rough & narrow	
14 KS-K-10	Khum	3.2	2.5	Earth	rough & narrow	
15 KS-K-15	Khum	3.7	3.0	Earth	rough & narrow	
16 KS-K-9	Khum	1.4	3.0	Earth	rough	
17 KS-K-8	Khum	3.9	3.0	Earth	rough & narrow	
18 KS-K-13	Khum	1.8	2.5	Earth	rough & narrow	
19 KS-K-11	Khum	4.7	4.0	Gravel metalling	a little rough	
20 KS-K-12	Khum	1.4	3.0	Earth	a little rough	
21 KS-K-16	Khum	0.9	3.0	Earth	a little smooth	
B. Tonle Bati Study Area						
1 TB-D-1	District Road	5.4	4.0	Earth	Rough	including 1.5 km gravel metalling
2 TB-D-1	District Road	3.8	6.0	Earth	Rough	
3 TB-K-4	Khum Road	2.1	3.0	Earth	Rough	
4 TB-K-5	Khum Road	3.4	5.0	Earth	a little smooth	
5 TB-K-3	Khum Road	5.8	3.0	Earth	Rough & narrow	
6 TB-K-2	Khum Road	1.9	3.0	Earth	smooth	
7 TB-K-1	Khum Road	6.7	5.0	Gravel Metaling	smooth	
8 TB-K-6	Khum Road	2.3	5.0	Gravel Metaling	a little smooth	
9 TB-K-8	Khum Road	2.9	3.5	Earth	Rough	
10 TB-K-10	Khum Road	9.7	4.0	Earth	Rough	
11 TB-K-7	Khum Road	1.8	4.0	Earth	a little smooth	
12 TB-K-9	Khum Road	0.3	4.0	Earth	Rough	
13 TB-K-11	Khum Road	1.5	2.5	Earth	Rough	
14 TB-K-12	Khum Road	1.2	2.5	Earth	Rough & narrow	
15 Route 2	National Road	10.7	7.0	Asphalt pave.	a little smooth	6.6 km of total length is non-pavement.

Remark : in the Priority Development Area

Source : JICA Study team inventory survey

Notes : Provincial road number is revised to new number by the declaration No.2566/69 of Ministry of Public Works and Transportations in March 1994.

Table VI-2 Improvement Plan of Rural Road Network in the Study Area

Name of Road	Classification	Improvement Plan				Remarks
		Length (km)	Wide (m)	Kind of Pavement	Wide of Pavement	
A. Kandal Stung Study Area						
Stage I						
No. 104	Provincial Road	9.1	7.0	Asphalt	5.0	
No. 105	Provincial Road	6.8	7.0	Asphalt	5.0	
Sub-total		15.9				
KS-K-3	Khum Road	1.5	5.0	Gravel metalling	4.0	Type B
KS-K-4	Khum Road	2.8	5.0	Gravel metalling	4.0	Type B
KS-K-5	Khum Road	1.7	5.0	Gravel metalling	4.0	Type B
KS-K-5	Khum Road	1.1	5.0	Asphalt	4.0	Type B
KS-K-16	Khum Road	0.9	5.0	Gravel metalling	4.0	Type B
Sub-total		8.0				
Stage II						
KS-D-1	District Road	9.3	5.0	Gravel metalling	4.0	Type B
KS-K-1	Khum Road	3.5	5.0	Gravel metalling	4.0	Type B
KS-K-2	Khum Road	2.9	5.0	Gravel metalling	4.0	Type B
KS-K-6	Khum Road	4.0	5.0	Gravel metalling	4.0	Type B
KS-K-7	Khum Road	2.7	5.0	Gravel metalling	4.0	Type B
KS-K-8	Khum Road	3.9	5.0	Gravel metalling	4.0	Type B
KS-K-10	Khum Road	3.2	5.0	Gravel metalling	4.0	Type B
KS-K-11	Khum Road	4.7	5.0	Gravel metalling	4.0	Type B
KS-K-12	Khum Road	1.4	5.0	Gravel metalling	4.0	Type B
KS-K-15	Khum Road	2.0	5.0	Gravel metalling	4.0	Type B
Sub-total		37.6				
B. Tonle Bati Study Area						
Stage I						
TB-K-2	Khum	1.9	5.0	Gravel metalling	4.0	Type B
TB-K-3	Khum	5.8	5.0	Gravel metalling	4.0	Type B
TB-K-5	Khum	3.4	5.0	Gravel metalling	4.0	Type A
TB-K-6	Khum	2.3	5.0	Gravel metalling	4.0	Type A
TB-K-12	Khum	1.2	5.0	Gravel metalling	4.0	Type B
Sub-total		14.6				
Stage II						
TB-D-1	District Road	9.2	6.0	Gravel metalling	5.0	
TB-K-1	Khum Road	6.7	6.0	Gravel metalling	5.0	
Sub-total		15.9				
TB-K-4	Khum Road	2.1	5.0	Gravel metalling	4.0	Type B
Sub-total		2.1				
Stage I						
	Provincial Road	15.9	7.0	Asphalt	5.0	
	Khum Road	22.6	5.0	Gravel metalling	4.0	
Stage II						
	District Road	15.9	6.0	Gravel metalling	5.0	
	Khum Road	39.7	5.0	Gravel metalling	4.0	

Table VI-3 Number of Drinking Water Source Facility by Village in the Kandal Stung Study Area (1/2)

Commune/ Village	Tubewell				Dug Well				Other Source		
	Function		No function	Sub total	Function		No function	Sub total	Pond	River	Lake
	Good	(1*)			Good	(2*)					
Tra Peang Veng	12	4	0	12	9	8	0	9	0	0	0
1 Prey Totung	3	-	-	3	1	-	-	1	-	-	-
2 Dam Nak Trabek	2	-	-	2	-	-	-	0	-	-	-
3 Trapcins Bakou	3	2	-	3	2	2	-	2	-	-	-
4 Sleng	3	2	-	3	-	-	-	0	-	-	-
5 Taleuk	1	-	-	1	6	6	-	6	-	-	-
Thmei	9	0	0	9	5	1	0	5	0	0	0
1 Phum Thmei	4	-	-	4	-	-	-	0	-	-	-
2 Trapaing chak	3	-	-	3	-	-	-	0	-	-	-
3 Toul Kam Rieng	1	-	-	1	1	1	-	1	-	-	-
4 Krang Tei	-	-	-	0	1	-	-	1	-	-	-
5 Tonlea	1	-	-	1	3	-	-	3	-	-	-
Trea	5	2	0	5	10	6	2	12	0	2	0
1 Tras	-	-	-	0	1	1	-	1	-	-	-
2 Trea	-	-	-	0	-	-	-	0	-	1	-
3 Rong Kor	-	-	-	0	2	-	2	4	-	-	-
4 Moat Bang	1	-	-	1	-	-	-	0	-	-	-
5 Kaprao	1	-	-	1	-	-	-	0	-	-	-
6 Daun Vong	1	1	-	1	-	-	-	-	-	-	-
7 Traping Kak	-	-	-	0	-	-	-	0	-	1	-
8 Traping Bva	1	-	-	1	3	1	-	3	-	-	-
9 Damrei Slap	1	1	-	1	4	4	-	4	-	-	-
Spean Thmo	2	0	1	3	0	0	0	0	0	5	0
1 Kok Aulock	1	-	-	1	-	-	-	0	-	-	-
2 Anh Chanh	1	-	-	1	-	-	-	0	-	-	-
3 Mocun Tra	-	-	1	1	-	-	-	0	-	-	-
4 Spean Thmo	-	-	-	0	-	-	-	0	-	1	-
5 Svay Mean Lake	-	-	-	0	-	-	-	0	-	1	-
6 Ha	-	-	-	0	-	-	-	0	-	1	-
7 Daung	-	-	-	0	-	-	-	0	-	1	-
8 Prek Chrey	-	-	-	0	-	-	-	0	-	1	-
Roluos	3	0	0	3	12	7	0	12	0	0	0
1 Kandal	1	-	-	1	3	3	-	3	-	-	-
2 Prash Theat	1	-	-	1	3	2	-	3	-	-	-
3 Krapeu Troum	1	-	-	1	6	2	-	6	-	-	-
Preah Puth	5	0	0	5	5	4	0	5	2	0	0
1 Bor Na	1	-	-	1	1	1	-	1	1	-	-
2 Krang Sbauv	1	-	-	1	2	1	-	2	-	-	-
3 Krang Trea	1	-	-	1	1	1	-	1	-	-	-
4 Prah Puth	1	-	-	1	-	-	-	0	1	-	-
5 Ben Bauv	1	-	-	1	1	1	-	1	-	-	-
Tien	7	0	0	7	3	0	0	3	0	1	0
1 Kraing	1	-	-	1	-	-	-	0	-	-	-
2 Sala	-	-	-	0	-	-	-	0	-	1	-
3 Kantuy Tuk	1	-	-	1	-	-	-	0	-	-	-
4 Thmar	1	-	-	1	-	-	-	0	-	-	-
5 Krang Kroch	2	-	-	2	1	-	-	1	-	-	-
6 Thmey	2	-	-	2	2	-	-	2	-	-	-
Bakou	8	0	0	8	8	0	0	8	0	0	0
1 Khnout	1	-	-	1	1	-	-	1	-	-	-
2 Bakou	1	-	-	1	2	-	-	2	-	-	-
3 Veal Kandal	1	-	-	1	-	-	-	0	-	-	-
4 Pou Doss	1	-	-	1	1	-	-	1	-	-	-
5 Tbong Kdey	2	-	-	2	2	-	-	2	-	-	-
6 Aur Andong	1	-	-	1	-	-	-	0	-	-	-
7 Svay Minh	1	-	-	1	2	-	-	2	-	-	-

Notes: (1*) = Number of well reducing pump-up discharge in dry season (2*) = Number of well becoming empty in dry season

Table VI-3 Number of Drinking Water Source Facility by Village in the Kandal Stung Study Area (2/2)

Commune/ Village	Tubewell				Dug Well				Other Source		
	Function		No function	Sub total	Function		No function	Sub total	Pond	River	Lake
	Good	(1*)			Good	(2*)					
Kok Trap	4	0	1	5	47	0	2	49	0	0	0
1 Kraing Thmey	-	-	-	0	8	-	-	8	-	-	-
2 Svay Lich	-	-	-	0	11	-	-	11	-	-	-
3 Chhoeu Neang	1	-	1	2	3	-	-	3	-	-	-
4 Kok Trap	1	-	-	1	6	-	-	6	-	-	-
5 Kbal Sess	1	-	-	1	3	-	2	5	-	-	-
6 Char	1	-	-	1	1	-	-	1	-	-	-
7 Svay Koeut	-	-	-	0	7	-	-	7	-	-	-
8 Kok Pring	-	-	-	0	4	-	-	4	-	-	-
9 Lick	-	-	-	0	4	-	-	4	-	-	-
Korng Nory	4	0	4	8	6	0	0	6	0	0	0
1 korng Nory	1	-	2	3	3	-	-	3	-	-	-
2 Veal Thlan	-	-	1	1	-	-	-	0	-	-	-
3 Srey Sambath	1	-	-	1	-	-	-	0	-	-	-
4 Trapaing Somret	2	-	1	3	3	-	-	3	-	-	-
Anlung Romeat	7	4	0	7	28	3	0	28	0	0	0
1 Kang Cheung	1	-	-	1	10	-	-	10	-	-	-
2 Khang Tbond	1	-	-	1	3	-	-	3	-	-	-
3 Khang Lech	2	1	-	2	3	-	-	3	-	-	-
4 Sre Kok	1	2	-	1	6	3	-	6	-	-	-
5 Doeum Trang	1	1	-	1	6	-	-	6	-	-	-
6 Kampong Tourl	1	-	-	1	-	-	-	0	-	-	-
Prek Roka	11	1	1	12	11	2	0	11	0	0	0
1 Chambak Trap	2	-	-	2	3	2	-	3	-	-	-
2 Beng Kack	2	1	1	3	2	-	-	2	-	-	-
3 Koh Knot	7	-	-	7	1	-	-	1	-	-	-
4 Prek Roka	-	-	-	0	5	-	-	5	-	-	-
Tbeng	13	8	0	13	1	1	0	1	0	0	0
1 Ung Kloeu	2	2	-	2	-	-	-	0	-	-	-
2 Sror Lomag	2	1	-	2	-	-	-	0	-	-	-
3 Kok Till	2	2	-	2	-	-	-	0	-	-	-
4 Chi Mao	1	-	-	1	1	1	-	1	-	-	-
5 Krang Chhoeu N	2	2	-	2	-	-	-	0	-	-	-
6 Kam nap	1	-	-	1	-	-	-	0	-	-	-
7 Kraing Koam	3	1	-	3	-	-	-	0	-	-	-
Total	90	19	7	97	145	32	4	149	2	8	0

Notes : (1*) = Number of well reducing pump-up discharge in dry season (2*) = Number of well becoming empty in dry season
Source : Interview survey by JICA study team

Table VI-4 Number of Drinking Water Source Facility by Village in the Tonle Bati Study Area

Commune/ Village	Tubewell				Dug Well				Other Source		
	Function		No function	Sub total	Function		No function	Sub total	Pond	River	Lake
	Good	(1*)			Good	(2*)					
Kreing Thnoug	4	2	0	4	0	0	0	0	7	0	1
1. Kreing Thnoug	2	1	-	2	-	-	-	0	3	-	-
2. Haknouchman	-	-	-	0	-	-	-	0	1	-	-
3. Chroa Sdao	2	-	-	2	-	-	-	0	2	-	-
4. Tonle Bati	-	1	-	0	-	-	-	0	-	-	1
5. Tboung Damrey	-	-	-	0	-	-	-	0	1	-	-
Champey	8	1	0	8	0	0	0	0	4	0	0
1. Demdong	1	-	-	1	-	-	-	0	1	-	-
2. Mkak	2	-	-	2	-	-	-	0	1	-	-
3. Trar kiet	3	-	-	3	-	-	-	0	-	-	-
4. Prek	1	-	-	1	-	-	-	0	-	-	-
5. Moeung Krachey	1	1	-	1	-	-	-	0	-	-	-
6. Prek Mul	-	-	-	0	-	-	-	0	1	-	-
7. Choeng l	-	-	-	0	-	-	-	0	1	-	-
Kandang	6	1	0	6	0	0	0	0	2	0	0
1. Haknuman	1	1	-	1	-	-	-	0	1	-	-
2. Are Pealeang	1	-	-	1	-	-	-	0	-	-	-
3. Preas Mibu	1	-	-	1	-	-	-	0	-	-	-
4. Kas Doeng Thom	2	-	-	2	-	-	-	0	-	-	-
5. Krang Ampil	-	-	-	0	-	-	-	0	1	-	-
6. Krar Sang	1	-	-	1	-	-	-	0	-	-	-
Put Sar	12	2	0	12	17	0	0	17	0	0	0
1. Put Sar	1	1	-	1	1	-	-	1	-	-	-
2. Krang Russey	1	-	-	1	-	-	-	0	-	-	-
3. Cham Bak	1	1	-	1	-	-	-	0	-	-	-
4. Krang Pou	2	-	-	2	-	-	-	0	-	-	-
5. Kla Kon	1	-	-	1	-	-	-	0	-	-	-
6. Prey Sva	-	-	-	0	5	-	-	5	-	-	-
7. Kroch	-	-	-	0	4	-	-	4	-	-	-
8. Kan Dork	-	-	-	0	7	-	-	7	-	-	-
9. Trapeang Trav	2	-	-	2	-	-	-	0	-	-	-
10. Kreang Sambat	1	-	-	1	-	-	-	0	-	-	-
11. Kvan Neas	3	-	-	3	-	-	-	0	-	-	-
Trapeang Sap	5	2	0	5	0	0	0	0	1	0	0
1. Trakiet	1	-	-	1	-	-	-	0	-	-	-
2. Doeum Kray	1	-	-	1	-	-	-	0	-	-	-
3. Chak	1	1	-	1	-	-	-	0	1	-	-
4. Sman Khnhei	2	1	-	2	-	-	-	0	-	-	-
Total	35	8	0	35	17	0	0	17	14	0	1

Notes : (1*) = Number of well reducing pump-up discharge in dry season (2*) = Number of well becoming empty in dry season
Source : Interview survey by JICA study team

Table VI-5 Density of User per a Well by Village in the Kandal Stung Study Area (1/2)

Commune/ Village	Population	Tubewell		Dug well		Total number		Density of user		Remarks
		RS	* DS	RS	DS	RS	DS	Rainy season	Dry season	
Tra Peang Veng	1970	12	10	9	1	21	11	94	179	
1 Prey Totung	404	3	3	1	1	4	4	101	101	
2 Dam Nak Trabek	227	2	2	-	-	2	2	114	114	
3 Trapeins Bakou	550	3	2	2	0	5	2	110	275	
4 Sleng	490	3	2	-	-	3	2	163	245	
5 Taleuk	299	1	1	6	0	7	1	43	299	
Thmei	1268	9	9	5	4	14	13	91	98	
1 Phum Thmei	570	4	4	-	-	4	4	143	143	
2 Trapeing chak	281	3	3	-	-	3	3	94	94	
3 Toul Kam Rieng	141	1	1	1	0	2	1	71	141	
4 Krang Tei	111	-	-	1	1	1	1	111	111	
5 Tonlea	165	1	1	3	3	4	4	41	41	
Trea	3937	5	3	10	4	15	7	262	562	
1 Tras	615	-	-	1	0	1	0	615	no well	
2 Trea	397	-	-	-	-	0	0	no well	no well	
3 Rong Kor	559	-	-	2	2	2	2	280	280	
4 Moat Bang	334	1	1	-	-	1	1	334	334	
5 Kapreao	302	1	1	-	-	1	1	302	302	
6 Daun Vong	345	1	0	-	-	1	0	345	no well	
7 Traping Kak	473	-	-	-	-	0	0	no well	no well	
8 Traping Bva	558	1	1	3	2	4	3	140	186	
9 Damrei Slap	354	1	0	4	0	5	0	71	no well	
Spean Thmo	1973	2	2	0	0	2	2	987	987	
1 Kok Auloek	226	1	1	-	-	1	1	226	226	
2 Anh Chanh	337	1	1	-	-	1	1	337	337	
3 Moeun Tra	332	-	-	-	-	0	0	no well	no well	
4 Spean Thmo	328	-	-	-	-	0	0	no well	no well	
5 Svay Mean Lake	158	-	-	-	-	0	0	no well	no well	
6 Ha	258	-	-	-	-	0	0	no well	no well	
7 Daung	129	-	-	-	-	0	0	no well	no well	
8 Prek Chrey	205	-	-	-	-	0	0	no well	no well	
Roluos	1386	3	3	12	5	15	8	92	173	
1 Kandal	526	1	1	3	0	4	1	132	no well	
2 Prash Theat	334	1	1	3	1	4	2	84	167	
3 Krapeu Troum	526	1	1	6	4	7	5	75	105	
Preah Puth	1604	5	5	5	1	10	6	160	267	
1 Bor Na	366	1	1	1	0	2	1	183	no well	
2 Krang Sbauv	405	1	1	2	1	3	2	135	no well	
3 Krang Trea	291	1	1	1	0	2	1	146	291	
4 Prah Puth	307	1	1	-	-	1	1	no well	no well	
5 Ben Bauv	235	1	1	1	0	2	1	118	no well	
Tien	1438	7	7	3	3	10	10	144	144	
1 Kraing	183	1	1	-	-	1	1	183	183	
2 Sala	250	-	-	-	-	-	-	no well	no well	
3 Kantuy Tuk	120	1	1	-	-	1	1	120	120	
4 Thmar	147	1	1	-	-	1	1	147	147	
5 Krang Kroch	328	2	2	1	1	3	3	109	109	
6 Thmey	410	2	2	2	2	4	4	103	103	
Bakou	3092	8	8	8	8	16	16	193	193	
1 Khmout	342	1	1	1	1	2	2	171	171	
2 Bakou	469	1	1	2	2	3	3	156	156	
3 Veal Kandal	309	1	1	-	-	1	1	309	309	
4 Pou Doss	324	1	1	1	1	2	2	162	162	
5 Tbong Kdey	558	2	2	2	2	4	4	140	140	
6 Aur Andong	416	1	1	-	-	1	1	416	416	
7 Svay Minh	674	1	1	2	2	3	3	225	225	

Notes : * It is assumed that the deep well yield become one thirds, if it reduces in the dry season.

Table VI-5 Density of User per a Well by Village in the Kandal Stung Study Area (2/2)

Commune/ Village	Population	Tubewell		Dug well		Total number		Density of user		Remarks
		RS	* DS	RS	DS	RS	DS	Rainy season	Dry season	
Kok Trap	3017	4	4	47	47	51	51	59	59	
1 Kraing Thmey	269	-	0	8	8	8	8	34	34	
2 Svay Lich	477	-	0	11	11	11	11	43	43	
3 Chhoeu Neang	295	1	1	3	3	4	4	74	74	
4 Kok Trap	374	1	1	6	6	7	7	53	53	
5 Kbal Sess	328	1	1	3	3	4	4	82	82	
6 Char	396	1	1	1	1	2	2	198	198	
7 Svay Kocut	283	-	0	7	7	7	7	40	40	
8 Kok Pring	297	-	0	4	4	4	4	74	74	
9 Lick	298	-	0	4	4	4	4	75	75	
Korong Nory	1008	4	4	6	6	10	10	101	101	
1 kong Noy	402	1	1	3	3	4	4	101	101	
2 Veal Thlan	222	-	-	-	-	-	-	no well	no well	
3 Serey Sambath	203	1	1	-	-	1	1	203	203	
4 Trapeang Somret	181	2	2	3	3	5	5	36	36	
Anlung Romeat	2152	7	6	28	28	35	34	61	63	
1 Kang Cheung	347	1	1	10	10	11	11	32	32	
2 Khang Tbong	352	1	1	3	3	4	4	88	88	
3 Khang Lech	278	2	2	3	3	5	5	56	56	
4 Sre Kok	369	1	1	6	6	7	7	53	53	
5 Docum Trang	418	1	0	6	6	7	6	60	70	
6 Kampong Tourl	388	1	1	-	-	1	1	388	388	
Prek Roka	2886	11	10	11	9	22	19	131	152	
1 Chambak Trap	726	2	2	3	1	5	3	145	242	
2 Beng Kack	495	2	1	2	2	4	3	124	165	
3 Koh Knot	610	7	7	1	1	8	8	76	76	
4 Prek Roka	1055	-	0	5	5	5	5	211	211	
Tbeng	3063	13	8	1	0	14	8	219	383	
1 Ung Kloeu	585	2	1	-	-	2	1	293	585	
2 Srer Lomag	446	2	1	-	-	2	1	223	446	
3 Kok Till	280	2	1	-	-	2	1	140	280	
4 Chi Mao	205	1	1	1	0	2	1	103	205	
5 Krang Chhocu N	460	2	1	-	-	2	1	230	460	
6 Kam nap	578	1	1	-	-	1	1	578	578	
7 Kraing Koam	509	3	2	-	-	3	2	170	255	
Total	28794	90	79	145	116	235	195			

Remarks : RS = Rainy Season DS = Dry Season

Notes : * It is assumed that the deep well yield become one thirds.

Source : Calculated by JICA Study team based on the result of Interview survey

Table VI-6 Density of User per a Well by Village in the Tonle Bati Study Area

Communc/ Village	Population	Tubewell		Dug well		Total number		Density of user		Remarks
		RS	*DS	RS	DS	RS	DS	Rainy season	Dry season	
Kreing Thnoung	3675	4	3	0	0	4	3	919	1225	
1. Krang Thnoung	747	2	2	-	-	2	2	374	no well	
2. Haknouckman	601	-	-	-	-	0	0	no well	no well	
3. Chroa Sdao	704	2	1	-	-	2	1	no well	no well	
4. Tonle Bati	1007	-	-	-	-	0	0	no well	no well	
5. Tboung Damrey	616	-	-	-	-	0	0	no well	no well	
Champey	4338	8	7	0	0	8	7	542	620	
1. Demdong	648	1	1	-	-	1	1	no well	no well	
2. Mkak	739	2	2	-	-	2	2	370	370	
3. Trar kiet	826	3	3	-	0	3	3	275	275	
4. Prek	539	1	1	-	0	1	1	539	539	
5. Mocung Krachey	745	1	0	-	0	1	0	745	no well	
6. Prek Mul	610	-	0	-	0	0	0	no well	no well	
7. Choeung I	231	-	0	-	0	0	0	no well	no well	
Kandang	2928	6	5	0	0	6	5	488	586	
1. Haknuman	280	1	0	-	-	1	0	280	no well	
2. Are Pealcang	698	1	1	-	0	1	1	698	698	
3. Preas Mibu	299	1	1	-	0	1	1	299	299	
4. Kas Doeng Thom	791	2	2	-	0	2	2	396	396	
5. Krang Ampil	392	-	0	-	0	0	0	no well	no well	
6. Krar Sang	468	1	1	-	0	1	1	468	468	
Put Sar	7856	12	10	17	17	29	27	271	291	
1. Put Sar	1400	1	0	1	1	2	1	700	1400	
2. Krang Russey	472	1	1	-	-	1	1	472	472	
3. Cham Bak	798	1	0	-	0	1	0	798	no well	
4. Krang Pou	1023	2	2	-	0	2	2	512	512	
5. Kla Kon	450	1	1	-	0	1	1	450	450	
6. Prey Sva	595	-	0	5	5	5	5	119	119	
7. Kroeh	519	-	0	4	4	4	4	130	130	
8. Kan Dork	580	-	0	7	7	7	7	83	83	
9. Trapeang Trav	986	2	2	-	0	2	2	493	493	
10. Kreang Sambat	574	1	1	-	0	1	1	574	574	
11. Kvan Neas	459	3	3	-	0	3	3	153	153	
Trapeang Sap	2271	5	3	0	0	5	3	454	757	
1. Trakiet	486	1	1	-	0	1	1	486	486	
2. Docum Kray	328	1	1	-	0	1	1	328	328	
3. Chak	504	1	0	-	0	1	0	504	no well	
4. Sman Khnhci	953	2	1	-	0	2	1	477	953	
Total	21068	35	28	17	17	52	45			

Remarks : RS = Rainy Season DS = Dry Season

Notes : * It is assumed that the deep well yield become one thirds.

Source : Calculated by JICA Study team based on the result of Interview survey

**Table VI-7 Number of Drinking Water Source Facility by Village
in Priority Development Area**

Commune/ Village	Tubewell	Dug Well		Other Source			Remarks
		(1*)	(2*)	Pond	River	Lake	
Kandal Stung Priority Development Area							
Roluos							
1 Kandal	1	3	3	-	-	-	
2 Prash Theat	1	3	2	-	-	-	
3 Krapeu Troum	1	6	2	-	-	-	
Preah Puth							
1 Krang Trea	1	1	1	-	-	-	
2 Bcn Bauv	1	1	1	-	-	-	
3 Prah Puth	1	-	-	1	-	-	
4 Krang Sbauv	1	2	1	-	-	-	
5 Bor Na	1	1	1	1	-	-	
Tien							
1 Krang Kroch	2	1	-	-	-	-	
2 Thmey	2	2	-	-	-	-	
Bakou							
1 Bakou	1	2	-	-	-	-	
2 Khmout	1	1	-	-	-	-	
3 Veal Kandal	1	-	-	-	-	-	
4 Pou Doss	1	1	-	-	-	-	
5 Tbong Kdey	2	2	-	-	-	-	
6 Svay Minh	1	2	-	-	-	-	
Korng Nory							
1 Kong Noy	1	3	-	-	-	-	
2 Serey Sambath	1	-	-	-	-	-	
3 Trapaing Somret	2	3	-	-	-	-	
Anlung Romeat							
1 Kang Cheung	1	10	-	-	-	-	
2 Khang Tbong	1	3	-	-	-	-	
3 Khang Lech	2	3	-	-	-	-	
4 Sre Kok	1	6	3	-	-	-	
5 Kampong Tourl	1	-	-	-	-	-	
Total	29	56	14	2	0	0	
Tonle Bati Priority Development Area							
Kreing Thnoung							
1 Krang Thnoung	2	-	-	3	-	-	
2 Haknouckman	-	-	-	1	-	-	
3 Chroa Sdao	2	-	-	2	-	-	
4 Tonle Bati	-	-	-	-	-	1	
5 Tboung Damrey	-	-	-	1	-	-	
Champey							
1 Demdong	1	-	-	1	-	-	
2 Mkak	2	-	-	1	-	-	
Kandang							
1 Haknuman	1	-	-	1	-	-	
Put Sar							
1 Krang Russey	1	-	-	-	-	-	
Total	9	0	0	10	0	1	

Notes: (1*) = Number of well

(2*) = Number of well becoming empty or shortage in dry season

Source: Inventory survey by JICA study team

Table VI-8 Density of User per a Well by Village in Priority Development Area

Commune/ Village	Population	Tubewell		Dug well		Total number		Density of user	
		Rainy season	*Dry season	Rainy season	Dry season	Rainy season	Dry season	Rainy season	Dry season
Kandal Stung Priority Development Area									
Roluos	1,386					15	8	92	173
1 Kandal	526	1	1	3	0	4	1	132	526
2 Prash Theat	334	1	1	3	1	4	2	84	167
3 Krapeu Troum	526	1	1	6	4	7	5	75	105
Preah Puth	1,604					10	6	160	267
1 Krang Trea	291	1	1	1	0	2	1	146	291
2 Ben Bauv	235	1	1	1	0	2	1	118	235
3 Prah Puth	307	1	1	-	-	1	1	307	307
4 Krang Sbauv	405	1	1	2	1	3	2	135	203
5 Bor Na	366	1	1	1	0	2	1	183	366
Tien	738					7	7	105	105
1 Krang Kroch	328	2	2	1	1	3	3	109	109
2 Thmey	410	2	2	2	2	4	4	103	103
Bakou	2,676					15	15	178	178
1 Bakou	469	1	1	2	2	3	3	156	156
2 Khmout	342	1	1	1	1	2	2	171	171
3 Veal Kandal	309	1	1	-	-	1	1	309	309
4 Pou Doss	324	1	1	1	1	2	2	162	162
5 Tbong Kdey	558	2	2	2	2	4	4	140	140
6 Svay Minh	674	1	1	2	2	3	3	225	225
Kong Nory	786					10	10	79	79
1 Kong Noy	402	1	1	3	3	4	4	101	101
2 Serey Sambath	203	1	1	-	-	1	1	203	203
3 Trapaing Somret	181	2	2	3	3	5	5	36	36
Anlung Romeat	1,734					28	28	62	62
1 Kang Cheung	347	1	1	10	10	11	11	32	32
2 Khang Tbong	352	1	1	3	3	4	4	88	88
3 Khang Lech	278	2	2	3	3	5	5	56	56
4 Sre Kok	369	1	1	6	6	7	7	53	53
5 Kampong Tourl	388	1	1	-	-	1	1	388	388
Total	16,462	29	29	56	45	155	140	106	118
Tonle Bati Priority Development Area									
Kreing Thnoug	3,675					4	3	919	1,225
1 Krang Thnoug	747	2	2	-	-	2	2	374	374
2 Haknouckman	601	-	-	-	-	0	0	No Well	No Well
3 Chroa Sdao	704	2	1	-	-	2	1	352	704
4 Tonle Bati	1,007	-	-	-	-	0	0	No Well	No Well
5 Tboung Damrey	616	-	-	-	-	0	0	No Well	No Well
Champey	1,387					3	3	462	462
1 Demdong	648	1	1	-	-	1	1	648	648
2 Mkak	739	2	2	-	-	2	2	370	370
Kandang									
1 Haknuman	280	1	0	-	-	1	0	280	No Well
Put Sar									
1 Krang Russey	472	1	1	-	-	1	1	472	472
Total	7,201	9	7	0	0	12	10	600	720

Notes : * It is assumed that the deep well yield become half, if it reduces in the dry season.

Source : Calculated by JICA Study team base on the result of interview survey

Table VI-9 Analyses Results of Water Quality for Water Supply Facility (1/2)

Sample No.	KS-1	KS-2	KS-3	KS-4	KS-5	KS-6	KS-7	KS-8
Name of Khum	Roluos	Preah Puth	Preah Puth	Preah Puth	Bakou	Anlung Romeat	Anlung Romeat	Siam Reap
Name of Phum	Prash Theat	Bor Na	Krang Trea	Preah Puth	Bakou	Khang Tbong	District Hospital	Siam Reap
Kind of Facility	TW-K01	Pond	TW-K06	Pond	Dugwell	Dugwell	Tubewell	Tubewell
Temperature								
pH	7.14	7.03	6.93	6.3	6.86	6.47	7.41	7.62
EC	22.3	12.97	255	9.75	138.2	44.2	88.2	92.9
SS	1	6	6	60	3	2	4	0
DO	1.094	1.354	1.434	0	1.384	2.293	1.507	3.424
Total-CO2	15.663	9.112		43.776		162.64		
Cl	0.06	0.01	0.12	0.02	0.02	0.04	0.1	0.03
Fe	0.15	<0.001	<0.001	3.25	7.45	0.5	>10	4.7
NO3	0.053	0.062	3.467	5.346	6.204	6.398	0.515	0.246
SO4	0.11	0.216	13.684	0.079	5.986	1.405	0.895	1.538
Mn	0.017	0.01	<0.001	0.002	0.012	0.022	<0.001	0.006
Ca	0.357	0.304	7.353	0.303	2.018	0.871	0.154	2.327
Mg	0.305	0.292	6.008	0.25	3.092	0.49	0.704	2.838
Alk	2.184	0.971	7.131	0.829	5.077	1.258	7.954	7.757
Coliform	0	25	0	150	5	2	0	0

Source : Water Quality Laboratory, Department of Hydrology.

Table VI-9 Analyses Results of Water Quality for Water Supply Facility (2/2)

Sample No.	TB-1	TB-2	TB-3	TB-4	TB-5	TB-6	TB-7	TB-8
Name of Khum	Kreing Thnoug Kreing Thnoug	Chroa Sdao	Put Sar	Kreing Thnoug Kreing Thnoug	Kreing Thnoug	Champey	Champey	Put Sar
Name of Phum	Krang Russey	Orung	Tboug Damrey	Mkak	Trokeit	Khvann Meas		
N.L.	11° 20' 03"	11° ' "	11° ' "	11° 17' 20"	11° 17' 03"	11° 20' 14"		
E.L.	104° 52' 07"	104° ' "	104° ' "	104° 52' 49"	104° 52' 44"	104° 52' 44"		
Kind of Facility	Pond	Tubewell (TW-B04)	Tubewell (TW-B01)	Tubewell (TW-B02)	Pond	Pond	Tubewell	(TW-B11)
Temperature	27.8	30.2	30.2	30.4	27.2	27.8	30.8	30.3
pH	6.53	7.5	6.65	6.9	6.39	6.53	7.01	7.34
EC	6.68	234	34.3	121.7	8.54	10.01	148.7	104.7
SS	14	2	2	2	40	70	0	0
DO	1.122	1.715	1.753	2.419	0	0.412	2.093	2.086
Total-CO2	12.394		56.289		23.643			
Cl	0.02	0.19	0.13	0.12	0.04	0.08	0.04	0.06
Fe	0.2	4.95	9.6	10	6.25	0.4	30	4.15
NO3	0.026	0.889	0.119	0.119	0.026	0.012	0.937	0.128
SO4	0.193	14.368	0.946	5.618	0.248	0.238	2.724	1.374
Mn	0.016	0.006	0.018	0.016	0.014	0.019	0.006	0.007
Ca	0.148	4.561	0.374	2.035	0.149	0.223	1.072	0.689
Mg	0.12	4.203	0.692	1.625	0.181	0.26	2.279	0.298
Alk	0.412	9.652	2.577	4.376	0.583	0.627	11.558	9.162
Coliform	0	0	0	0	150	80	0	0

Source : Water Quality Laboratory, Department of Hydrology.

Table VI-10 Condition of Existing Tubewell in Priority Development Area (1/2)

No.	Name of Commune	Name of Village	Location		Depth (m)	Constructed by	Constructed Date	Condition of Water			Use for drinking	Remarks (Other Condition)
			N.L.	E.L.				Taste	Color	Smell		
TW-K01	Roblos	Prash Theat	11° 26' 10"	104° 52' 29"	34	24HRTV	11-Jun-94	no	transparent	no	yes	
TW-K02	Roblos	Krapeu Troum	11° 26' 7"	104° 52' 26"	34	24HRTV	15-Jun-94	no	transparent	no	yes	
TW-K03	Roblos	Kandal	11° 25' 57"	104° 52' 48"	37	24HRTV	31-May-94					Hand pump is not installed yet.
TW-K04	Preah Puth	Bor Na	11° 25' 13"	104° 52' 8"	37	24HRTV	21-May-94	no	transparent	no	yes	potable after 2 or 3 day
TW-K05	Preah Puth	Krang Chauv	11° 24' 59"	104° 51' 59"	34	24HRTV	14-May-94	no	red-brown	no	yes	Iron is contained ; potable after 3 or 4 day
TW-K06	Preah Puth	Krang Trea	11° 25' 17"	104° 51' 43"	37	24HRTV	16-May-94	no	transparent	no	yes	Shortage of pump yield
TW-K07	Preah Puth	Prah Puth	11° 25' 30"	104° 50' 57"	34	24HRTV	31-May-94	no	transparent	no	yes	
TW-K08	Preah Puth	Ben Bauv	11° 24' 55"	104° 51' 8"	36	24HRTV	11-May-94	no	transparent	no	yes	Hand pump has been broken.
TW-K09	Tien	Thmey	11° 26' 16"	104° 51' 15"	50	UNICEF	6-Jul-88	no	transparent	no	yes	Hand pump has been broken.
TW-K10	Tien	Thmey				24HRTV						under construction
TW-K11	Tien	Krang Kroch	11° 26' 3"	104° 51' 42"	50	UNICEF	22-Jul-88	no	transparent	no	yes	Hand pump has been broken.
TW-K12	Tien	Krang Kroch				24HRTV						under construction
TW-K13	Kong Nory	Kong Nory	11° 26' 19"	104° 50' 40"	34	UNICEF	28-Jul-88	no	red-brown	metallic	yes	Iron is contained ; potable after 3 or 4 day
TW-K14	Kong Nory	Veal Thlan	11° 26' 13"	104° 50' 18"	40	24HRTV	17-Sep-92	no	red-brown	metallic	no	Iron is contained ; dug well use
TW-K15	Kong Nory	Serey Sambath	11° 26' 3"	104° 49' 54"	40	24HRTV	20-Oct-92	no	transparent	no	yes	
TW-K16	Kong Nory	Trapaing Somret	11° 25' 53"	104° 50' 3"	40	UNICEF	8-Sep-88	no	red-brown	metallic	no	Iron is contained ; dug well use
TW-K17	Kong Nory	Trapaing Somret	11° 26' 6"	104° 50' 40"				no	red-brown	metallic	no	Iron is contained
TW-K18	Bakou	Veal Kandal	11° 24' 54"	104° 49' 49"	36	24HRTV	8-Oct-92	no	red-brown	metallic	yes	Iron is contained ; potable after a day
TW-K19	Bakou	Pou Doss	11° 25' 4"	104° 49' 38"	37	24HRTV	13-Oct-92	no	red-brown	metallic	no	Iron is contained ; dug well use
TW-K20	Bakou	Bakou	11° 24' 50"	104° 49' 27"	25	UNICEF	4-Jul-88	no	red-brown	metallic	yes	Iron is contained ; potable after 2 or 3 day
TW-K21	Bakou	Khmour	11° 24' 41"	104° 49' 6"	33	24HRTV	29-Sep-92	no	red-brown	metallic	yes	Iron is contained ; potable after a week
TW-K22	Bakou	Tbong Kdey	11° 25' 8"	104° 49' 22"	39	UNICEF	18-May-88	no	red-brown	metallic	yes	Iron is contained ; potable after 1 or 2 day
TW-K23	Bakou	Tbong Kdey	11° 25' 13"	104° 49' 17"	32	24HRTV	20-Oct-92	no	red-brown	metallic	yes	Iron is contained
TW-K24	Bakou	Andong	11° 25' 54"	104° 49' 27"	36	24HRTV	20-Oct-92	no	red-brown	metallic	yes	Iron is contained

Table VI-10 Condition of Existing Tubewell in Priority Development Area (2/2)

No.	Name of Commune	Name of Village	Location		Depth (m)	Constructed by	Constructed Date	Condition of Water			Use for drinking	Remarks (Other Condition)
			N.L.	E.L.				Taste	Color	Smell		
TW-K25	Bakou	Svay Minh	11° 25' 32"	104° 49' 9"	36	UNICEF	20-May-88	no	red-brown	metallic	no	Iron is contained; dug well use
TW-K26	Anlung Romeat	Kampong Tourl	11° 25' 37"	104° 48' 39"	42	24HRTV	14-Aug-92	no	red-brown	metallic	no	Iron is contained; dug well or river use
TW-K27	Anlung Romeat	Kampong Tourl	11° 25' 30"	104° 48' 42"	36	24HRTV	10-Aug-92	no	red-brown	metallic	yes	Iron is contained; potable after 2 day
TW-K28	Anlung Romeat	Kang Cheung	11° 25' 18"	104° 48' 17"	25	UNICEF	24-Jul-92	no	red-brown	metallic	no	Iron is contained; dug well use
TW-K29	Anlung Romeat	Deum Trang	11° 25' 23"	104° 47' 58"	39	24HRTV	18-Aug-92	no	red-brown	metallic	yes	Iron is contained; potable after 3 or 4 day
TW-K30	Anlung Romeat	SreKok	11° 24' 58"	104° 48' 5"	32	24HRTV	30-Jul-92	no	red-brown	metallic	yes	Iron is contained; potable after a day
TW-K31	Anlung Romeat	SreKok	11° 24' 58"	104° 48' 12"	30	24HRTV	26-Jul-92	no	red-brown	metallic	no	Iron is contained; dug well use
TW-K32	Anlung Romeat	Anlung Romeat	11° 25' 12"	104° 48' 26"	32	24HRTV	3-Aug-92	no	red-brown	metallic	no	Iron is contained; dug well use
TW-B01	Put Sar	Krang Russey	11° 19' 34"	104° 53' 4"	28	UNICEF	2-Apr-92	no	clear	no	yes	
TW-B10	Put Sar	Khleang Sambat	11° 20' 9"	104° 52' 20"	50	UNICEF	17-Mar-88	no	clear	no	yes	shortage in dry season
TW-B11	Put Sar	Khvann Meas	11° 20' 14"	104° 52' 44"	29	UNICEF	2-Apr-92	no	clear	no	yes	
TW-B02	Kreing Thnounge	Orung	11° 19' 47"	104° 51' 58"	36	OXFAM	2-Apr-85	no	red-brown	no	no	Iron is contained
TW-B03	Kreing Thnounge	Krang Thnounge	11° 19' 1"	104° 52' 10"	21	UNHCR	20-Jun-93	no	clear	no	yes	shortage in dry season
TW-B04	Kreing Thnounge	Chroa Sdao	11° 18' 46"	104° 52' 36"	21	UNHCR	16-Jun-93	no	clear	no	yes	shortage in dry season
TW-B05	Kreing Thnounge	Chroa Sdao	11° 18' 28"	104° 52' 37"	23	UNHCR	8-Jun-93	no	clear	no	yes	shortage in dry season
TW-B06	Kandang	Haknuman	11° 18' 34"	104° 51' 16"	50		1-Dec-88	lime	clear	lime	no	shortage in dry season
TW-B12	Kandang	Proh Miob	11° 17' 29"	104° 50' 55"	40	UNICEF	20-Sep-88	lime	clear	lime	yes	shortage in dry season
TW-B13	Kandang	Kandong Thom	11° 17' 22"	104° 50' 56"	34	OXFAM	20-Aug-85	no	clear	no	yes	
TW-B07	Champey	Demdong	11° 17' 52"	104° 52' 33"	30		14-Mar-92	no	clear	no	yes	shortage in dry season
TW-B08	Champey	Mkak	11° 17' 22"	104° 52' 41"	23	OXFAM	21-Dec-88	no	clear	no	yes	
TW-B09	Champey	Mkak	11° 17' 21"	104° 52' 36"	22	OXFAM	21-Dec-88	no	clear	no	yes	
TW-B14	Champey	Trokeit	11° 16' 48"	104° 52' 41"	43	OXFAM	1-Dec-85	no	clear	no	yes	

Remarks : N.L. = North latitude, E.L. = East longitude by GPS(Global Positioning System)

Source : Inventory survey by JICA Study team

Table VI-11 Number of Provided Well (Type I & Type II) by Village in the Kandal Stung Study Area (1/2)

	Population (1)	Projection Population (2)=1.32x(1)	Required Well (3)	Existing Well (4)	Provided Well (5)=(3)-(4)	Remarks
Tra Peang Veng	1970				5	Depth > 50 m
1 Prey Totung	404	533	3	3	0	
2 Dam Nak Trabek	227	300	2	2	0	
3 Trapeins Bakou	550	726	4	2	2	
4 Sleng	490	647	4	2	2	
5 Taleuk	299	395	2	1	1	
Thmei	1268				2	Depth > 50 m
1 Phum Thmei	570	752	4	4	0	
2 Trapaing chak	281	371	2	3	0	
3 Toul Kam Rieng	141	186	1	1	0	
4 Krang Tei	111	147	1	0	1	
5 Tonlea	165	218	2	1	1	
Trea	3937				28	Depth > 50 m
1 Tras	615	812	5	0	5	
2 Trea	397	524	3	0	3	
3 Rong Kor	559	738	4	0	4	
4 Moat Bang	334	441	3	1	2	
5 Kapreao	302	399	2	1	1	
6 Daun Vong	345	455	3	0	3	
7 Traping Kak	473	624	4	0	4	
8 Traping Bva	558	737	4	1	3	
9 Damrei Slap	354	467	3	0	3	
Spean Thmo	1973				16	Depth < 50 m
1 Kok Auloek	226	298	2	1	1	
2 Anh Chanh	337	445	3	1	2	
3 Moeun Tra	332	438	3	0	3	
4 Spean Thmo	328	433	3	0	3	
5 Svay Mean Lake	158	209	2	0	2	
6 Ha	258	341	2	0	2	
7 Daung	129	170	1	0	1	
8 Prek Chrey	205	271	2	0	2	
Roluos	1386				8	Depth < 50 m
1 Kandal	526	694	4	1	3	
2 Prash Theat	334	441	3	1	2	
3 Krapeu Troum	526	694	4	1	3	
Preah Puth	1604				8	Depth < 50 m
1 Bor Na	366	483	3	1	2	
2 Krang Sbauv	405	535	3	1	2	
3 Krang Trea	291	384	2	1	1	
4 Prah Puth	307	405	3	1	2	
5 Ben Bauv	235	310	2	1	1	
Tien	1438				5	Depth < 50 m
1 Kraing	183	242	2	1	1	
2 Sala	250	330	2	0	2	
3 Kantuy Tuk	120	158	1	1	0	
4 Thmar	147	194	1	1	0	
5 Krang Kroch	328	433	3	2	1	
6 Thmey	410	541	3	2	1	

Table VI-11 Number of Provided Well (Type I & Type II) by Village in the Kandal Stung Study Area (2/2)

	Population (1)	Projection Population (2)=1.32x(1)	Required Well (3)	Existing Well (4)	Provided Well (5)=(3)-(4)	Remarks
Bakou	3092				16	Depth < 50 m
1 Khmot	342	451	3	1	2	
2 Bakou	469	619	4	1	2	Type II...1 Set
3 Veal Kandal	309	408	3	1	2	
4 Pou Doss	324	428	3	1	2	
5 Tbong Kdey	558	737	4	2	2	
6 Aur Andong	416	549	3	1	2	
7 Svay Minh	674	890	5	1	4	
Kok Trap	3017				19	Depth > 50 m
1 Kraing Thmey	269	355	2	0	2	
2 Svay Lich	477	630	4	0	4	
3 Chhoeu Neang	295	389	2	1	1	
4 Kok Trap	374	494	3	1	2	
5 Kbal Sess	328	433	3	1	2	
6 Char	396	523	3	1	2	
7 Svay Koeut	283	374	2	0	2	
8 Kok Pring	297	392	2	0	2	
9 Lick	298	393	2	0	2	
Kong Nory	1008				5	Depth < 50 m
1 kong Noy	402	531	3	1	2	
2 Veal Thlan	222	293	2	0	2	
3 Serey Sambath	203	268	2	1	1	
4 Trapaing Somret	181	239	2	2	0	
Anlung Romeat	2152				9	Depth < 50 m
1 Kang Cheung	347	458	3	1	2	
2 Khang Tbong	352	465	3	3	0	
3 Khang Lech	278	367	2	2	0	
4 Sre Kok	369	487	3	1	2	
5 Doeum Trang	418	552	3	0	3	
6 Kampong Tourl	388	512	3	1	2	
Prek Roka	2886				13	Depth > 50 m
1 Chambak Trap	726	958	5	2	3	
2 Beng Kaek	495	653	4	1	3	
3 Koh Knot	610	805	5	7	0	
4 Prek Roka	1055	1,393	7	0	7	
Tbeng	1311				6	Depth < 50 m
1 Ung Kloeu	585	772	4	1	3	
2 Srer Lomag	446	589	3	1	2	
3 Kok Till	280	370	2	1	1	
Total	Type I				139	72 Nos. Depth < 50m 67 Nos. Depth < 50m
	Type II				1	

Source : JICA Study team calculation based on the result of Interview survey

Table VI-12 Number of Provided Well (Type I & Type II) by Village in the Tonle Bati Study Area

	Population (1)	Projection Population (2)=1.32x(1)	Required Well (3)	Existing Well (4)	Provided Well (5)=(3)-(4)	Remarks
Kreing Thnoug	3675				22	Depth < 50 m
1. Krang Thnoug	747	986	5	2	3	
2. Haknouckman	601	793	4	0	4	
3. Chroa Sdao	704	929	5	1	4	
4. Tonle Bati	1007	1,329	7	0	6	Type II...1 Set
5. Tboung Damrey	616	813	5	0	5	
Champey	4338				25	Depth < 50 m
1. Demdong	648	855	5	1	4	
2. Mkak	739	975	5	2	3	
3. Trar kiet	826	1,090	6	3	3	
4. Prek	539	711	4	1	3	
5. Moeung Krachey	745	983	5	0	5	
6. Prek Mul	610	805	5	0	5	
7. Choeung l	231	305	2	0	2	
Kandang	2928				16	Depth < 50 m
1. Haknuman	280	370	2	1	1	
2. Are Pealeang	698	921	5	1	4	
3. Preas Mibu	299	395	2	1	1	
4. Kas Doeng Thom	791	1,044	6	2	4	
5. Krang Ampil	392	517	3	0	3	
6. Krar Sang	468	618	4	1	3	
Put Sar	7856				47	Depth < 50 m
1. Put Sar	1400	1,848	10	0	10	
2. Krang Russey	472	623	4	1	3	
3. Cham Bak	798	1,053	6	0	6	
4. Krang Pou	1023	1,350	7	2	5	
5. Kla Kon	450	594	3	1	2	
6. Prey Sva	595	785	4	0	4	
7. Kroeh	519	685	4	0	4	
8. Kan Dork	580	766	4	0	4	
9. Trapeang Trav	986	1,302	7	2	5	
10. Kreang Sambat	574	758	4	1	3	
11. Kvan Neas	459	606	4	3	1	
Trapeang Sap	2271				15	Depth < 50 m
1. Trakiet	486	642	4	1	3	
2. Doeum Kray	328	433	3	1	2	
3. Chak	504	665	4	0	4	
4. Sman Khnhei	953	1,258	7	1	6	
Total					124	
	Type I					
	Type II				1	

Source : JICA Study team calculation based on the result of Interview survey

Table VI-13 Number of Provided Well (Type I & Type II) by Village in Priority Development Area

Name of Village	Population (1)	Projection Population (2)=1.32x(1)	Required Well (3)	Existing Well (4)	Provided Well (5)=(3)-(4)	Remarks
Kandal Stung Priority Development Area						
Roluos						
1 Kandal	526	694	4	1	3	
2 Prash Theat	334	441	3	1	2	
3 Krapeu Troum	526	694	4	1	3	
Preah Puth						
1 Krang Trea	291	384	2	1	1	
2 Ben Bauv	235	310	2	1	1	
3 Prah Puth	307	405	3	1	2	
4 Krang Sbauv	405	535	3	1	2	
5 Bor Na	366	483	3	1	2	
Tien						
1 Krang Kroch	328	433	3	2	1	
2 Thmey	410	541	3	2	1	
Bakou						
1 Bakou	469	619	4	1	1	Type II --1
2 Khmout	342	451	3	1	2	
3 Veal Kandal	309	408	3	1	2	
4 Pou Doss	324	428	3	1	2	
5 Tbong Kdey	558	737	4	2	2	
6 Svay Minh	674	890	5	1	4	
Kong Nory						
1 Kong Noy	402	531	3	1	2	
2 Serey Sambath	203	268	2	1	1	
3 Trapaing Somret	181	239	2	2	0	
Anlung Romeat						
1 Kang Cheung	347	458	3	1	2	
2 Khang Tbong	352	465	3	1	2	
3 Khang Lech	278	367	2	2	0	
4 Sre Kok	369	487	3	1	2	
5 Kampong Tourl	388	512	3	1	2	
			Total	Type I	42	
				Type II	1	
Tonle Bati Priority Development Area						
Kreing Thnoung						
1 Krang Thnoung	747	986	5	2	3	
2 Haknouckman	601	793	4	0	4	
3 Chroa Sdao	704	929	5	1	4	
4 Tonle Bati	1,007	1,329	7	0	5	Type II --1
5 Tboung Damrey	616	813	5	0	5	
Champey						
1 Demdong	648	855	5	1	4	
2 Mkak	739	975	5	2	3	
Kandang						
1 Haknuman	280	370	2	1	1	
Put Sar						
1 Krang Russey	472	623	4	1	3	
			Total	Type I	32	
				Type II	1	

Source : JICA Study team calculation based on the result of Inventory survey

Table VI-14 Number of Center/Facility by Khum and by Type in the Study Area

Name of Khum	Market	School	Community Center	Khum Clinic	Agricultural Center	Rice mill Facility	Post-harvest Center
Kandal Stung Study Area							
1 Tra Peang Veng	1	2	-	1	**	5	-
2 Thmei	-	1	-	1	**	6	-
3 Trea	-	3	-	1	**	10	-
4 Spean Thmo	-	1	-	1	-	5	-
5 Roleous	-	1	-	1	-	2	-
6 Preah Puth	-	1	-	-	-	2	-
7 Tien	-	1	-	1	-	5	-
8 Ba Ku	1	2	-	1	-	3	-
9 Kok Trap	-	1	-	1	-	5	-
10 Kung Noy	-	1	-	1	-	2	-
11 Anlong Remeath	1	3	-	*1	-	3	-
12 Prek Roka	-	1	-	1	-	7	-
13 Tbeng	-	2	-	1	-	5	-
Total	3	20	0	11	1	60	0
Tonle Bati Study Area							
1 Krang Thnung	-	4	-	1	***	10	-
2 Cham Pei	-	2	-	1	***	15	-
3 Kandoeung	-	3	-	1	***	11	-
4 Puth Sar	-	4	-	1	***	17	-
5 Trapeang Sap	1	6	1	1	***	14	-
Total	1	19	1	5	1	67	0

Notes : *1 = District Hospital, ** = to be covered by Kandal Stung Rural Development Center, *** = to be covered by Tonle Bati Agriculture Development Center, Capacity of rice mill is approximately 150 kg / hour to 400 kg / hour.

Source : Interview survey by JICA study team

Table VI-15 Existing Conditions of Khum Clinic in the Study Area & Priority Development Area

Name of Khum	Constructed in	Built of	Plot Space (m ²)	Total Floor Space (m ²)	Total Room Floor Space (m ²)	Condition of Building	Related Facilities		Remarks
							Tubewell	Toilet	
Kandal Suong Study Area									
1 Bakou	1982	Wooden	2,400	165	128	Heavy damaged	Nothing	Nothing	Nothing of building
2 Krong Nory	1983	Brick	1,400	114	77	Good	1	Broken	
3 Preah Puth	-	-	-	-	-	-	-	-	
4 Roluos	1980	Brick	1,200	54	30	Good	1	Nothing	
5 Tien	1985	Brick	**	81	54	Good	Nothing	Nothing	
Anlung Romeat									
6 Anlung Romeat	-	-	-	-	-	-	-	-	Covered by District Hospital
7 Thmei	-	Brick	-	-	-	Good	-	-	New building
8 Trea	-	Wooden	-	-	-	Heavy damaged	-	-	Old building
9 Spean Thmo	-	Brick	-	-	-	Fair	-	-	
10 Kok Trap	-	Brick	-	-	-	Good	-	-	
11 Tra Peang Veng	-	Brick	-	-	-	Good	-	-	
12 Prek Roka	-	Brick & Wooden	-	-	-	Good	-	-	
13 Tbeng	-	Wooden	-	-	-	Heavy damaged	-	-	
Tonle Bati Study Area									
1 Champey *	1981	Wooden	1,200	96	96	Heavy damaged	1	Nothing	Nothing
2 Kandang *	1981	Wooden	900	54	45	Heavy damaged	1	Nothing	
3 Kreing Thnoung	1982	Wooden	900	96	96	Heavy damaged	1	Nothing	
4 Put Sar *	1983	Brick	1,600	80	114	Heavy damaged	Nothing	Nothing	
5 Trapeang Sap	-	-	-	-	-	Fair	-	-	

Remarks : [] in Priority Development Area

Note : * Facility site is out of the priority development boundary ; ** Khum clinic is built in the plot of Khum office.

Source : Inventory survey by JICA Study team

Table VI-16 Existing Conditions of School in the Study Area & Priority Development Area (1/2)

Name of Commune	Name of village	Name of school	Kind of school	Built of	Number of student nos.	Number of class nos.	Number of Teacher teachers	School Space (m ²)	Total Floor Space (m ²)	Total Classroom Space (m ²)	Average Classroom Space (m ²)	Remarks
Kandal Stung Study Area												
1. Roluos	Prash Theat	Roluos	Primary	Wood	450	4	10	3,400	238	177	44	
2. Preah Puth	Prash Theat	Preah Puth	Primary	Wood	340	7	7	6,100	279	343	49	
3. Tien	Krang	Tien	Primary	Wood	320	6	11	Office	Office	Office	41	
4. Bakou	Tbong Kdey	Bakou	Primary	Wood	560	10	17	5,300	255	410	41	
	Svay Minh	Kampong Kantout	Middle & High		1,120	25	40		2,128	1,400	56	
5. Korng Nory	Trapaing Somrei	Korng Nory	Primary	Wood	210	6	8	9,000	178	294	49	
6. Anlung Romeat	Kampong Touri	Anlung Romeat	Primary	Brick	810	10	20	13,500	800	560	56	
	Deoum Frang	Toul Sala	Primary	Wood	120	3	6	Temple	288	168	56	
	Sre Kok	Ang Sery	Primary	Brick	240	3	6	Temple	240	168	56	
7. Tra Peang Veng	Ta Lek	Por Sat	Primary	Brick	290	6			386	322	54	
	Prey Totung	Trapeang Veng	Primary	Wood	330	7			504	392	56	
8. Thmei	Thmei	Thmei	Primary	Wood/Brick	385	11			792	792	72	
9. Trea	Traping Bva	Trea	Primary	Brick	165	2			128	128	64	
	Rong Kor	Trea	Primary	Wood	129	3			168	168	56	
	Tras	Trea	Primary	Wood	321	8			484	420	53	
10. Spean Thmo	Moeun Tra	Jomka Kesai	Primary	Wood	570	9			220	220	24	
11. Kok Trap	Kok Trap	Kok Trap	Primary	Wood	580	9			225	225	25	
12. Prek Roka	Koh Knot	Prek Roka	Primary	Brick	509	6			395	315	53	
13. Tbeng	Ung Kloeou	Ung Krooch*	Primary	Wood	300	6			216	216	36	
	Krang Koam	Krang Koam*	Primary	Brick	150	3			108	108	36	
Total of primary school in the Study Area					6,329	110			5,560	5,102	46	
Total of middle school in the Study Area					1,120	25			2,128	1,400	56	
Total of primary school in Priority Development Area					3,050	49			2,258	2,120	43	
Total of middle school in Priority Development Area					1,120	25			2,128	1,400	56	

Remarks : [shaded box] in Priority Development Area

Note : * = out of the Study area

Source : Inventory survey by JICA study team

Table VI-16 Existing Conditions of School in the Study Area & Priority Development Area (2/2)

Name of Commune	Name of village	Name of school	Kind of school	Built of	Number of Student	Number of class room	Number of Class	Number of Teacher	School Space (m ²)	Total Floor Space (m ²)	Total Classroom Space (m ²)	Average Classroom Space (m ²)	Remarks
Tonle Bati Study Area													
7. Kreang Thnong	Chrea Sdao	Ang Volevan	Primary	Wood	450	9	18	9	5,700	555	431	48	
	Tonle Bati	Tonle Bati	Primary	Brick	670	13	14	13	8,900	942	745	57	
	Tonle Bati	Tonle Bati	Middle	Wood/Brick	353	11	14	33	-	1,008	824	75	
	Khna	Tap Bory	Primary	Brick	300	9				704	704	78	
8. Cham Pei	Mkak	Daeukrohan	Primary	Wood	400	6	11	6	Temple	286	254	42	
	Trer Kiet	Trer Kiet	Primary	Wood/Brick	150	6				432	432	72	
16. Kandoeung	Krar Sang	Kalang Sem	Primary	Wood/Brick	225	5				280	280	56	
	Kandoeung Thor	So Puy	Primary	Wood/Brick	405	9				504	504	56	
	Are Pealeng	Bontei Trav	Primary	Wood/Brick	540	12				672	672	56	
17. Puth Sar	Prey Sva	Prey Cher	Primary	Wood/Brick	560	14				784	784	56	
	Krorh	Wat Botomsorya	Primary	Wood	90	3				168	168	56	
	Cham Bak	Wat Cham Bak Betmeus	Primary	Wood	500	15				840	840	56	
18. Trapeang Sap	Kreang Sambat	Wat Khlang Moeming	Primary	Brick	75	3				147	147	49	
	Prech	Sery Chou To Van*	Primary	Wood/Brick	360	6				270	270	45	
	Traktiet	Trop Kos*	Primary	Wood	180	3				120	120	40	
	Sdok Prei	Sam Poutingen*	Primary	Wood/Brick	700	10				602	602	60	
	Sang Ke	Ding Keomini*	Primary	Wood/Brick	600	9				390	390	43	
	Sman Khnhei	Sman Kehei*	Primary	Wood/Brick	700	20				640	640	32	
	Pun Phnom	Pun Phnom*	Primary	Wood	600	8				350	350	44	
Total of primary school in the Study Area					4,365	104				6,314	5,961	57	
Total of middle school in the Study Area					353	11				1,008	824	75	
Total of primary school in Priority Development Area					1,520	28				1,783	1,430	51	
Total of middle school in Priority Development Area					353	11				1,008	824	75	

Remarks: [] in Priority Development Area

Note: * = out of the Study area

Source: Inventory survey by JICA study team

Table VI-17 Number of Rice Mill by Khum in the Kandal Stung Study Area

Name of Khum	Name of Village	Year of Registration	Name of Khum	Name of Village	Year of Registration	
Tien (5 rice mill)	Thmey	1991	Tbeng (5 rice mill)	Krang Chhoeu N	**	
	Thmey	1991		Chi Mao	1991	
	Kraing	**		Kraing Koam	1992	
	Kantuy Tuk	**		Ung Kloe	1986	
	Krang Krauch	1992		Sror Lomag	1991	
Roleous (2 rice mill)	Pes Theat	1992	Kok Trap (5 rice mill)	Char	1993	
	Krapeu Trom	1992		Svay Koout	1993	
Kung Noy (2 rice mill)	Kung Noy	1989			chhoeu Neang	1993
	Kung Noy	1992			Kok Trap	1993
				Svay Lich	1991	
Ba Ku (3 rice mill)	Thbong Kdey	1990	Trea (10 rice mill)	Tras	1991	
	Bakou	1992		Tras	1992	
	Aur Andong	1992		Tras	1990	
Preah Puth (2 rice mill)	Banna	1992			Trea	1993
	Kraing Trea	1991		Rong Kor	1993	
Prek Roka (7 rice mill)	Prek Roka	1990		Rong Kor	1993	
	Chambak Trap	1983		Moat Bang	1992	
	Beng Kaek	1992		Daun Vong	1993	
	Chambak Trap	1992		Traping Bva	1989	
	Prek Roka	1993		Damrei Slap	1992	
	Beng Kaek	1993				
Spean Thmo (5 rice mill)	Prek Roka	1990	Tra Peang Veng (5 rice mill)	Prey Totung	1983	
	Anh Chanh	1980		Taleuk	1992	
	Anh Chanh	1993		Taleuk	1992	
	Spean Thmo	1992		Trapeins Bakou	1991	
	Ha	1990	Cham Boak Slathor	1993		
	Daung	1993	Thmei (6 rice mill)	Trapaing chak	1992	
Anlong Remeath (3 rice mill)	Anlong Remeath	1992			Trapaing chak	1993
	Anlong Remeath	1993			Toul Kam Rieng	1993
	Sre Kauk	**			Thmei	1993
					Thmei	**
				Tonlea	1993	
Total number of rice mill =					60	

Source : Statistics of factory in the Kandal Stung 1992/1993

Note : ** No available data for year of registration

Table VI-18 Estimation of Required Classroom in the Study Area

Name of Commune	Name of village	Name of school	Kind of school	Number of class room	Number of Student	Existing Area (m ²)	Available Area (m ²)	Number of Target students	Existing Unit Area (m ² /student)	Required Area (m ²)	Balance Area (m ²)	Required Classroom nos.	Remarks	
Kandal Stung Study Area														
1. Tra Peang Veng 2. Thmei 3. Trea 4. Spean Thmo 5. Roluos 6. Preah Puth 7. Tien 8. Bakou 9. Kok Trap 10. Komg Nory 11. Anlung Romeat 12. Prek Roka	Ta Lek	Por Sat	Primary	6	290	322	322	421	1.11	295	27			
	Prey Toung	Trapeang Veng	Primary	7	330	392	392	479	1.19	335	57			
	Thmei	Thmei	Primary	11	385	792	792	559	2.06	391	401			
	Traping Bva	Trea	Primary	2	165	128	128	240	0.78	168	-40		Stage II	
	Rong Kor	Trea	Primary	3	129	168	168	187	1.30	131	37			
	Tras	Trea	Primary	8	321	420	420	466	1.31	326	94			
	Moeun Tra	Jomka Kesai	Primary	9	570	220	220	828	0.39	579	-359		7	Stage II
	Prash Theat	Roluos	Primary	4	450	177	177	653	0.39	457	-280		6	Stage I
	Preah Puth	Preah Puth	Primary	7	340	343	217	494	1.01	346	-129		3	Stage I
	Krang	Tien	Primary	6	320	0	0	465		325	-325		6	Stage I
	Tbong Kdey	Bakou	Primary	10	560	410	410	813	0.73	569	-159		3	Stage I
	Kok Trap	Kok Trap	Primary	9	580	225	225	842	0.39	590	-365		7	Stage II
Komg Nory	Komg Nory	Primary	6	210	294	0	305	1.40	213	-213		4	Stage I	
Traping Somret	Anlung Romeat	Primary	10	810	560	819	1,176	0.69	823	-4		1	Stage I	
Kampong Toul	Toul Sala	Primary	3	120	168	168	174	1.40	122	46				
Docum Trang	Ang Sery	Primary	3	240	168	168	348	0.70	244	-76		2	Stage I	
Sre Kok	Prek Roka	Primary	6	509	315	315	739	0.62	517	-202		4	Stage II	
Koh Knot												25		
										Sub-total(Stage I)		19		
										Sub-total(Stage II)		44		
Tonle Bati Study Area														
13. Krang Thnung 14. Champey 15. Kandocung 16. Puth Sar	Chrong Sdau	Ang Velovan	Primary	9	450	431	147	653	0.96	457	-310		6	Stage I
	Khna	Tap Bory	Primary	9	300	704	704	436	2.35	305	399			
	Tonle Bati	Tonle Bati	Primary	12	670	745	448	973	1.11	681	-233		5	Stage I
	Nkak	Daeukrohon	Primary	6	400	254	254	581	0.64	407	-153		3	Stage I
	Trar Kiet	Trar Kiet	Primary	6	150	432	432	218	2.88	152	280			
	Krar Sang	Kalang Sem	Primary	5	225	280	280	327	1.24	229	51			
	Kandocung Thom	So Puy	Primary	9	405	504	504	588	1.24	412	92			
	Are Pealeng	Bontei Trav	Primary	12	540	672	672	784	1.24	549	123			
	Prey Sva	Prey Cher	Primary	14	560	784	784	813	1.40	569	215			
	Krorh	Wat Botomsorya	Primary	3	90	168	168	131	1.87	91	77			
	Cham Bak	Wat Cham Bak Beumus	Primary	15	500	840	840	726	1.68	508	332		14	Stage I
	Kreang Sambat	Wat Kiang Moeting	Primary	3	75	147	147	109	1.96	76	71		0	Stage II
										Sub-total(Stage I)		14		
										Sub-total(Stage II)		0		
										Total		14		

Source : JICA study team estimation based on interview survey

Table VI-19 Estimation of Required Classroom in Priority Development Area

Name of Commune	Name of village	Name of school	Existing		Projection			Number of Proposed Classroom nos.		
			Number of Student students	Number of Classroom nos.	Classroom Space (m ²)	Number of Student students	Required Space (m ²)		Reduced Space (m ²)	Balance Space (m ²)
Kandal Stung Priority Development Area										
1. Roluos	Prash Theat	Roluos	450	4	177	653	457	-280	6	6
2. Preah Puth	Preah Puth	Preah Puth	340	7	343	494	346	-129	3	3
3. Tien	Krang	Tien	320	6	Office	465	325	-325	6	6
4. Bakou	Tbong Kdey	Bakou	560	10	410	813	569	-159	3	3
5. Komng Nory	Trapaing Somret	Komng Nory	210	6	294	305	213	-294	4	4
6. Anlung Romeat	Kampong Tourl	Anlung Romeat	810	10	560	1,176	823	-4	1	3
	Doem Trang	Toul Sala	120	3	168	174	122	46	2	0*
	Sre Kok	Ang Sery	240	3	168	348	244	-76	2	0*
								Sub-total	25	25
Tonle Bati Priority Development Area										
7. Kreing Thnoung	Chroa Sdao	Ang Velovan	450	9	431	653	457	-284	6	6
	Tonle Bati	Tonle Bati	670	13	745	973	681	-297	5	5
8. Champey	Mkak	Daekrohon	400	6	254	581	407	-153	3	3
								Sub-total	14	14
								Total	39	39

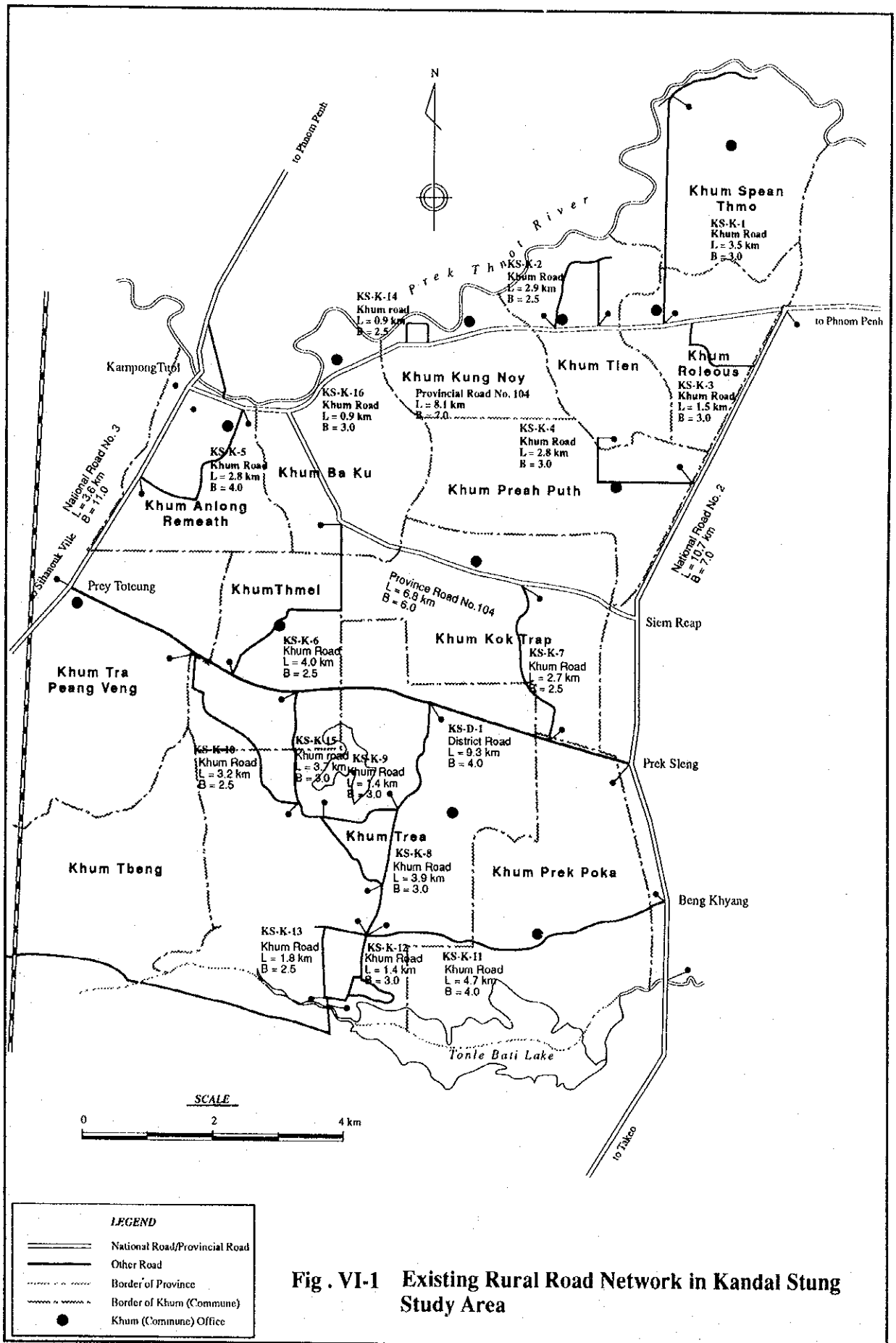
* Surplus students of Ang Sery School go to Anlung Romeat School.

Note : Reduced Space = - Space of classroom to become no function in projection year.

+ under construction space in 1994 year

Source : JICA Study team estimation based on inventory survey

Figures



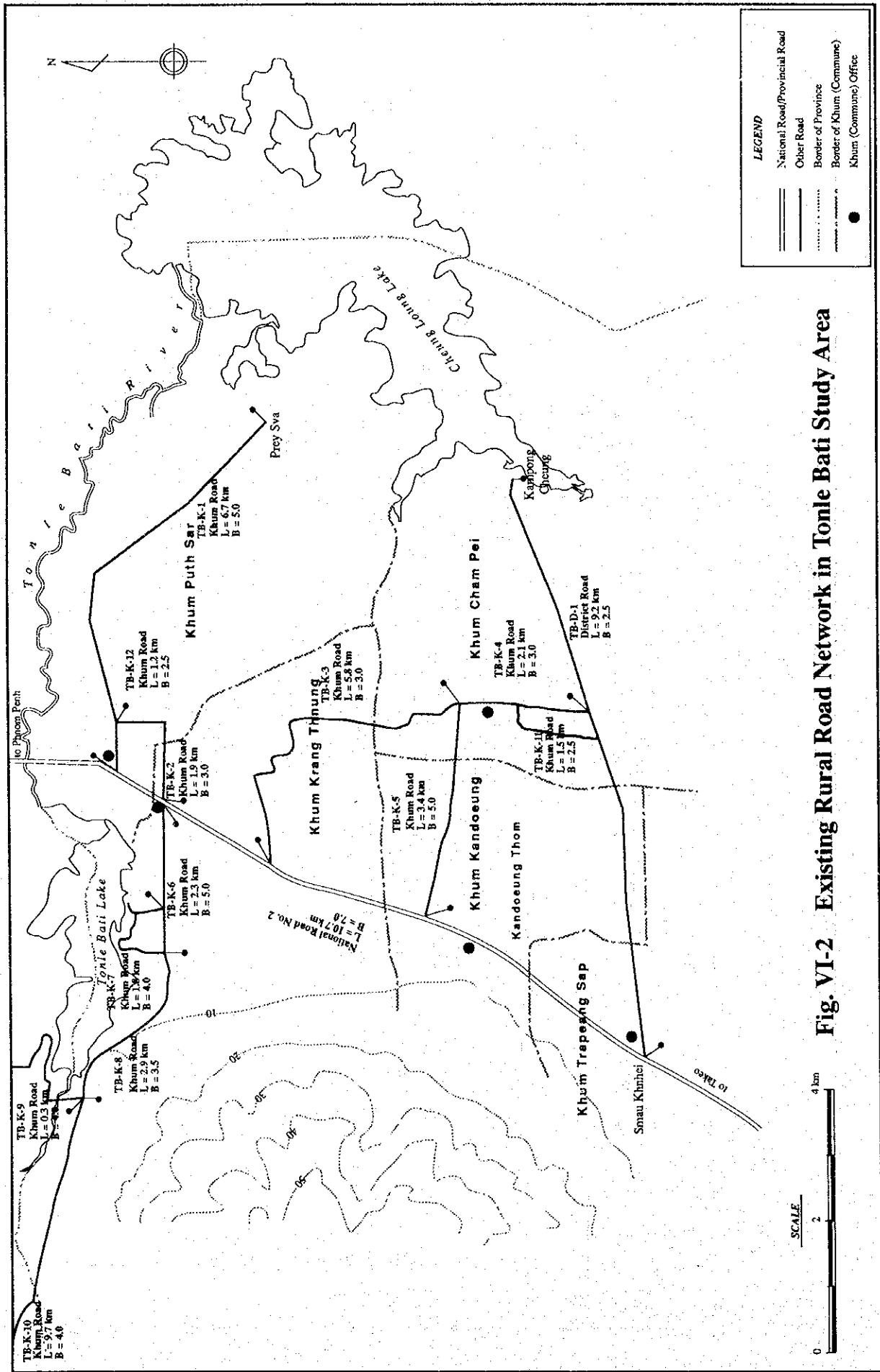


Fig. VI-2 Existing Rural Road Network in Tonle Bati Study Area

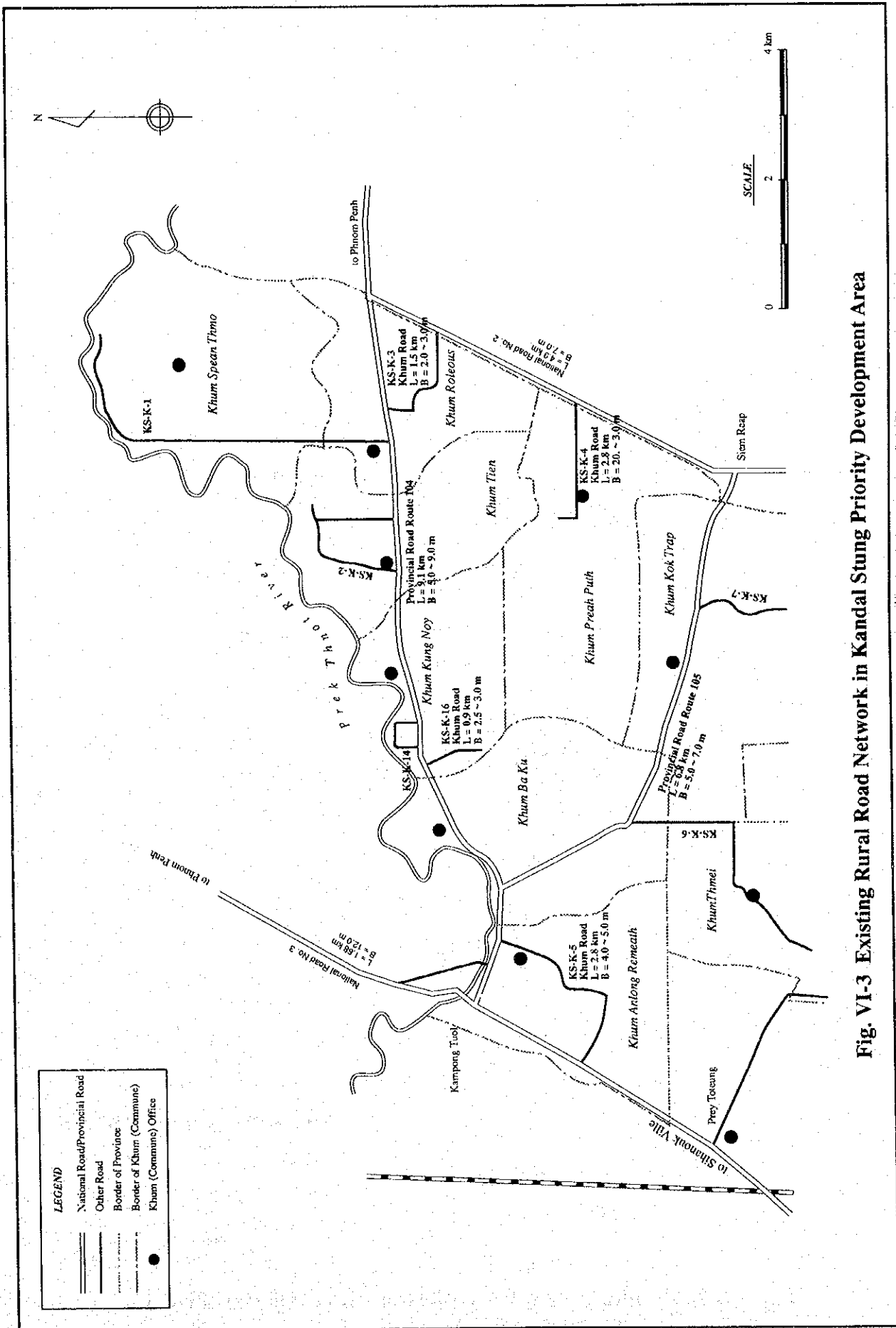


Fig. VI-3 Existing Rural Road Network in Kandal Stung Priority Development Area

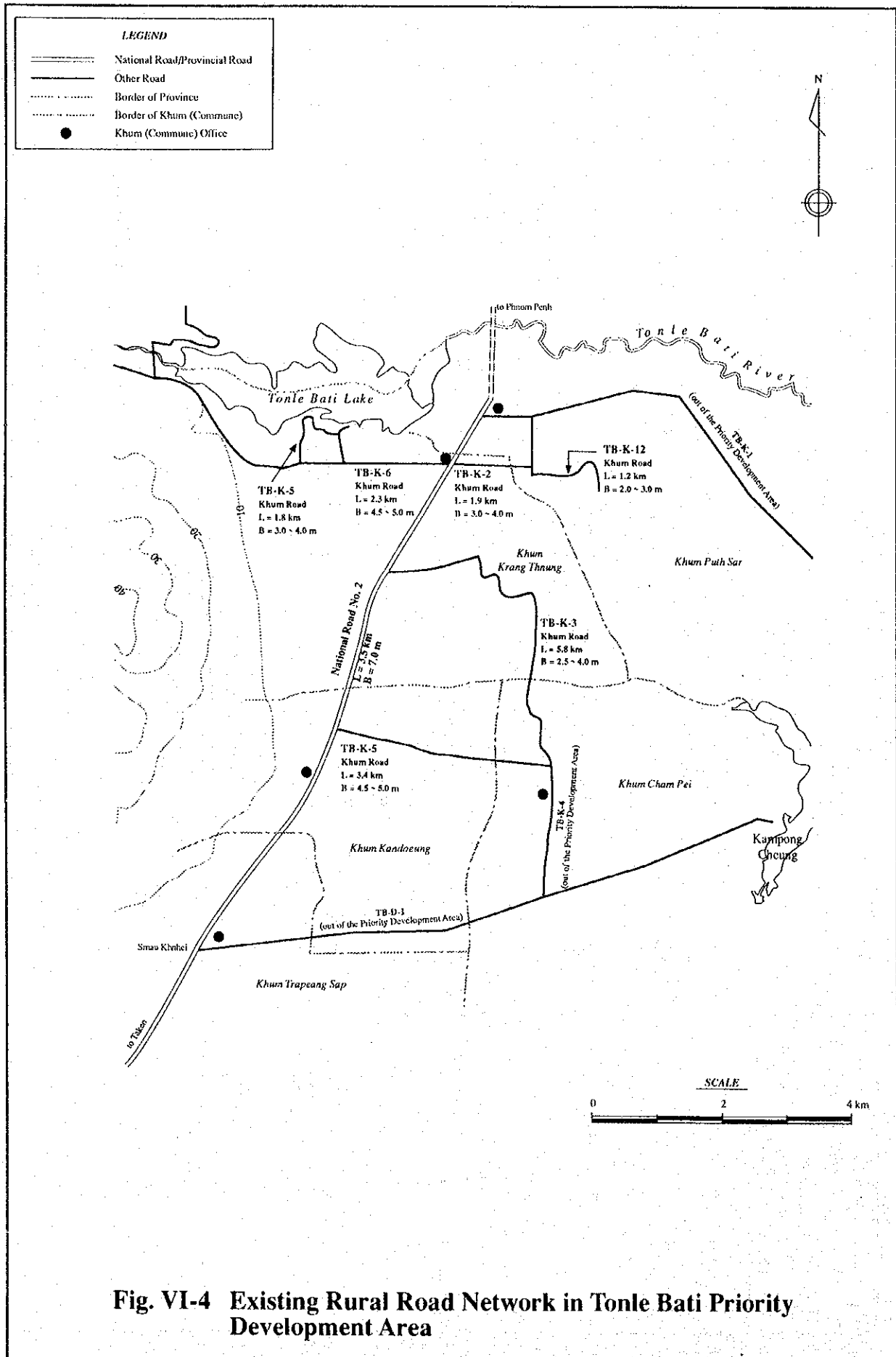


Fig. VI-4 Existing Rural Road Network in Tonle Bati Priority Development Area

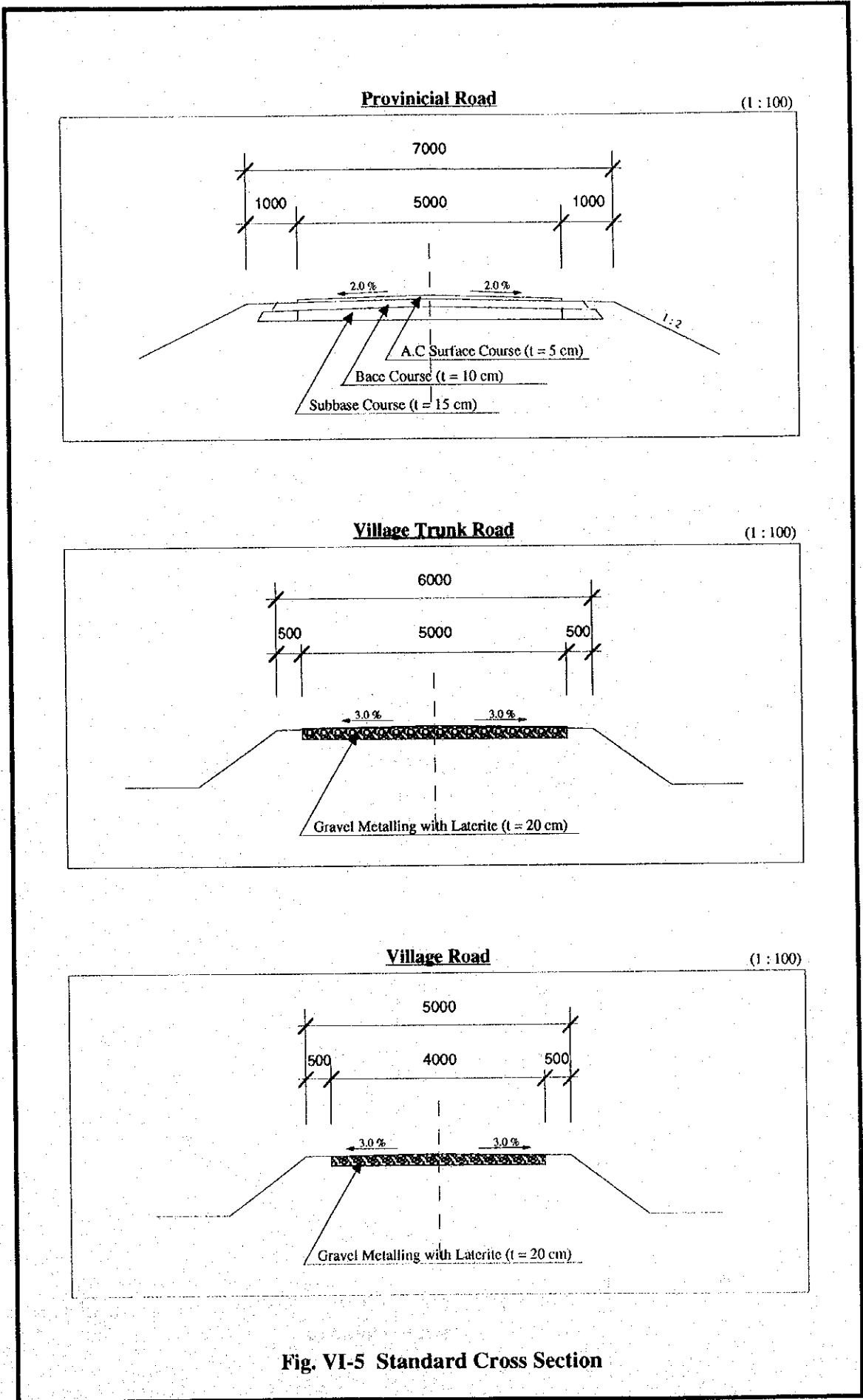


Fig. VI-5 Standard Cross Section

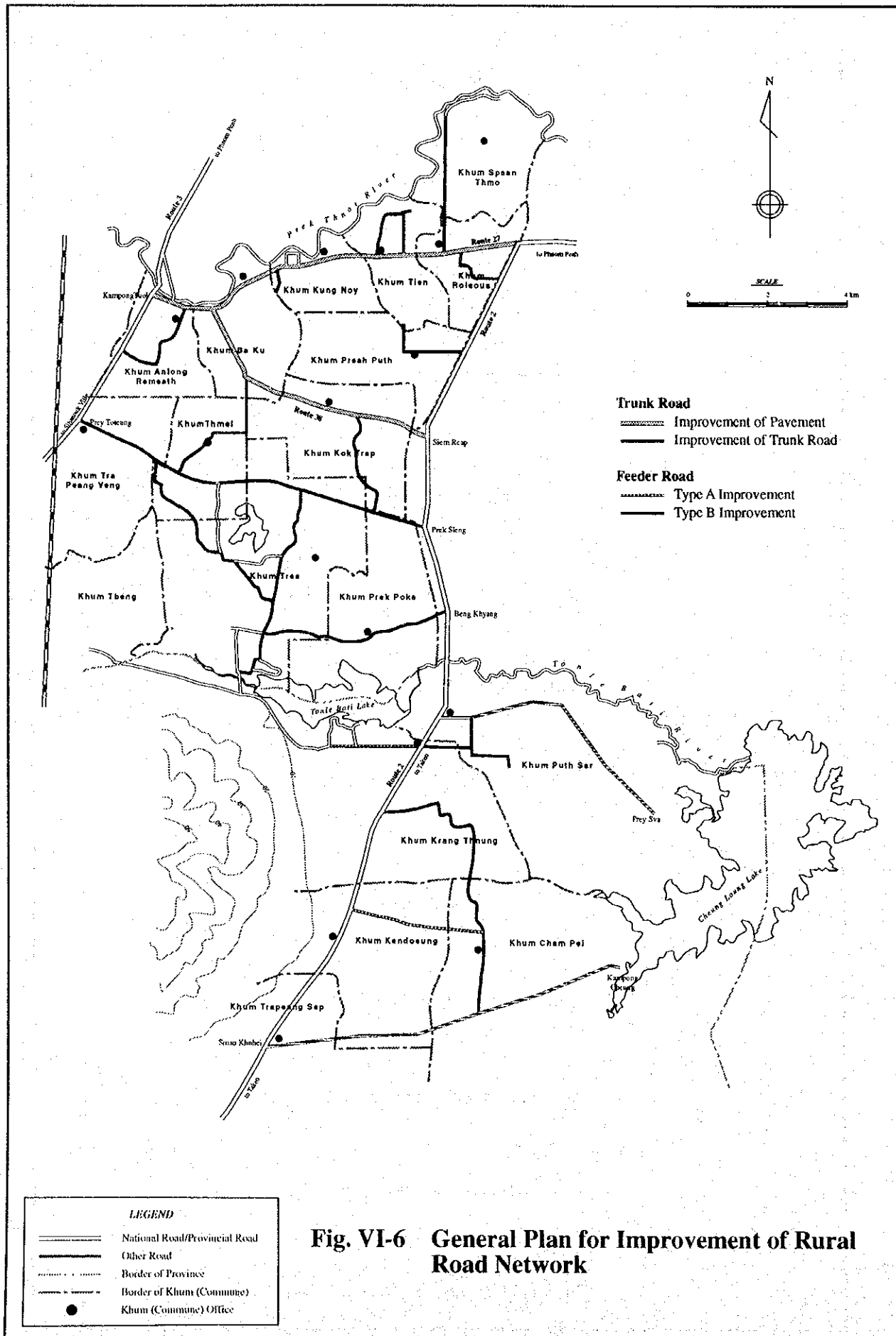


Fig. VI-6 General Plan for Improvement of Rural Road Network

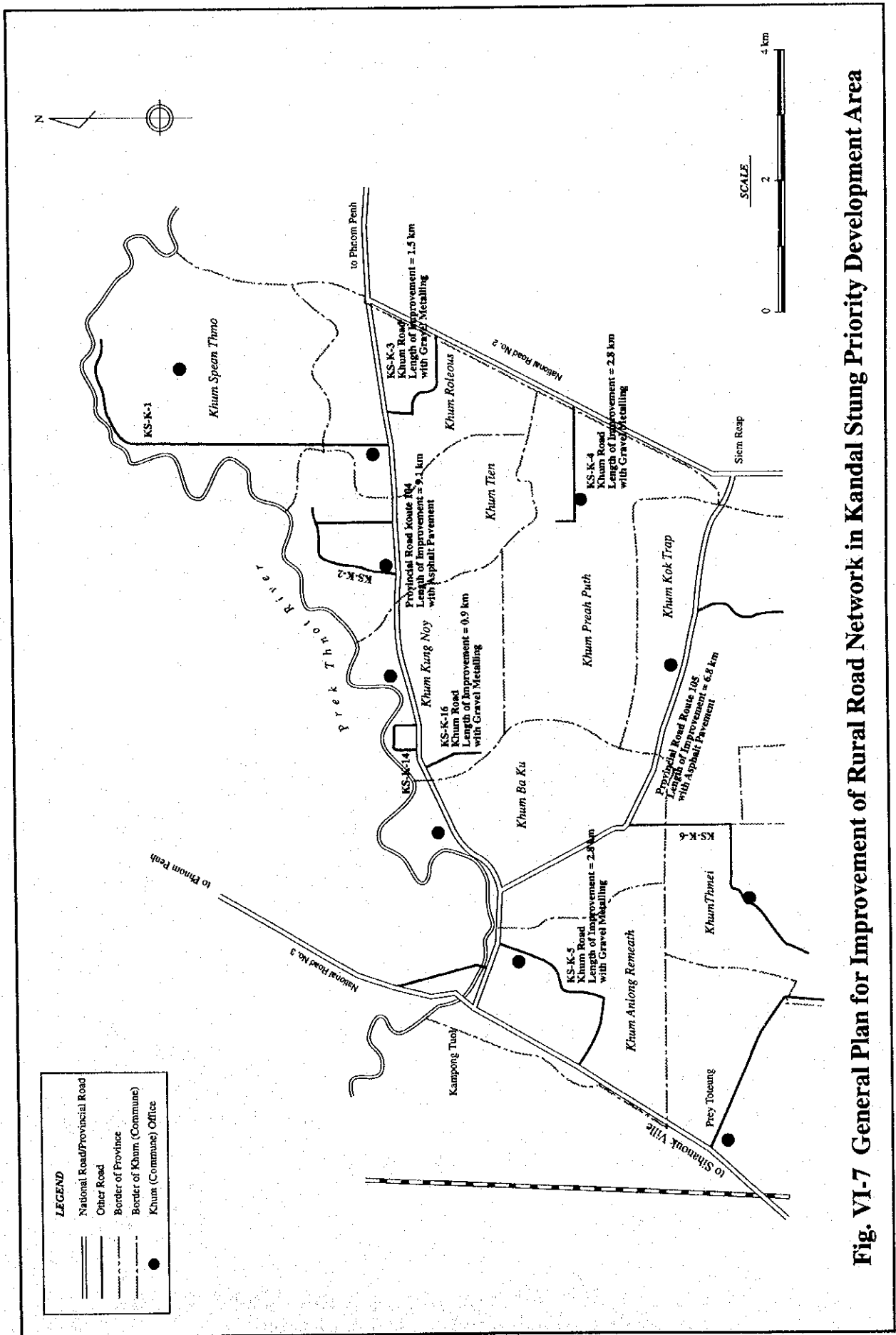


Fig. VI-7 General Plan for Improvement of Rural Road Network in Kandal Stung Priority Development Area

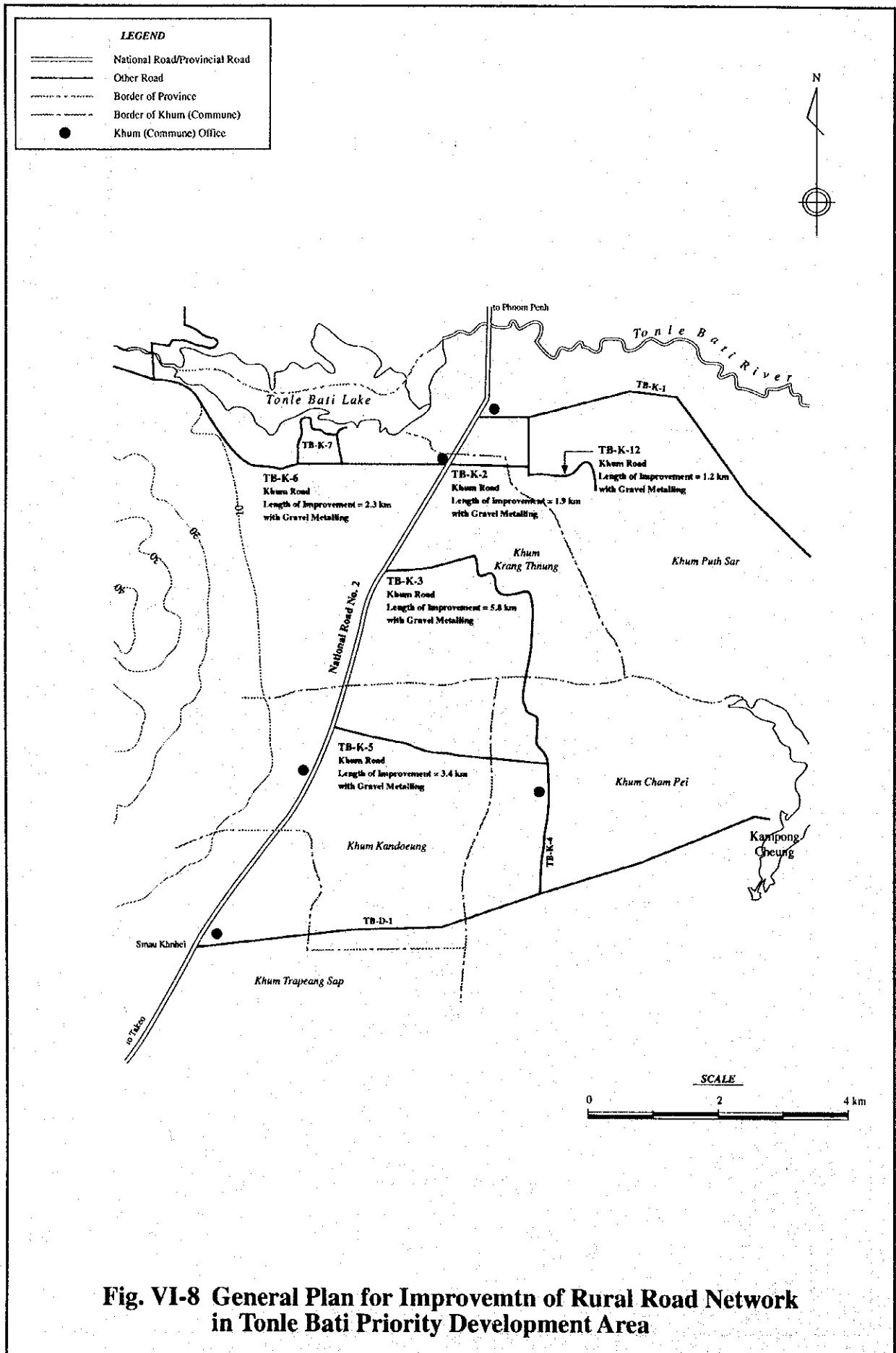
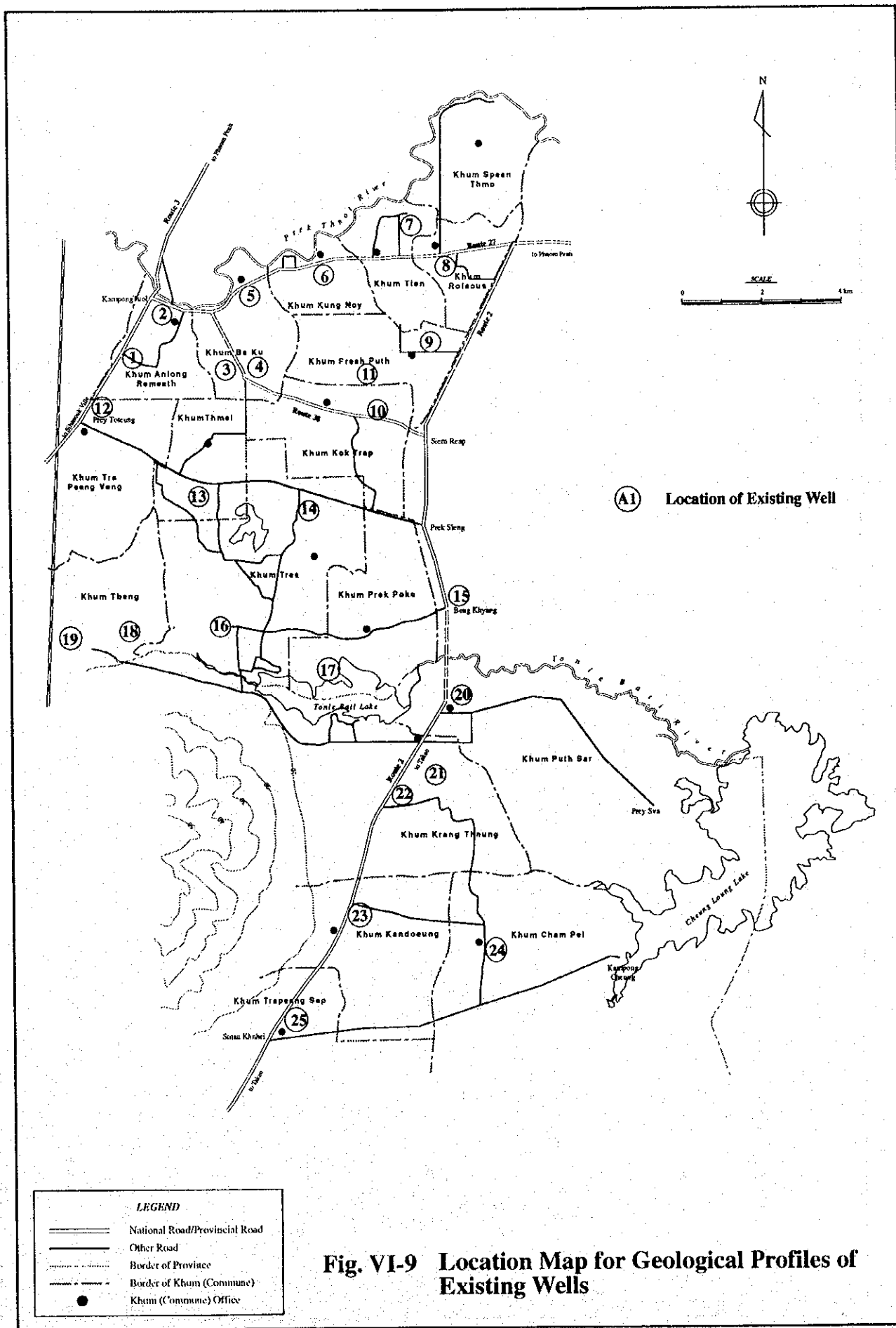


Fig. VI-8 General Plan for Improvemtn of Rural Road Network in Tonle Bati Priority Development Area



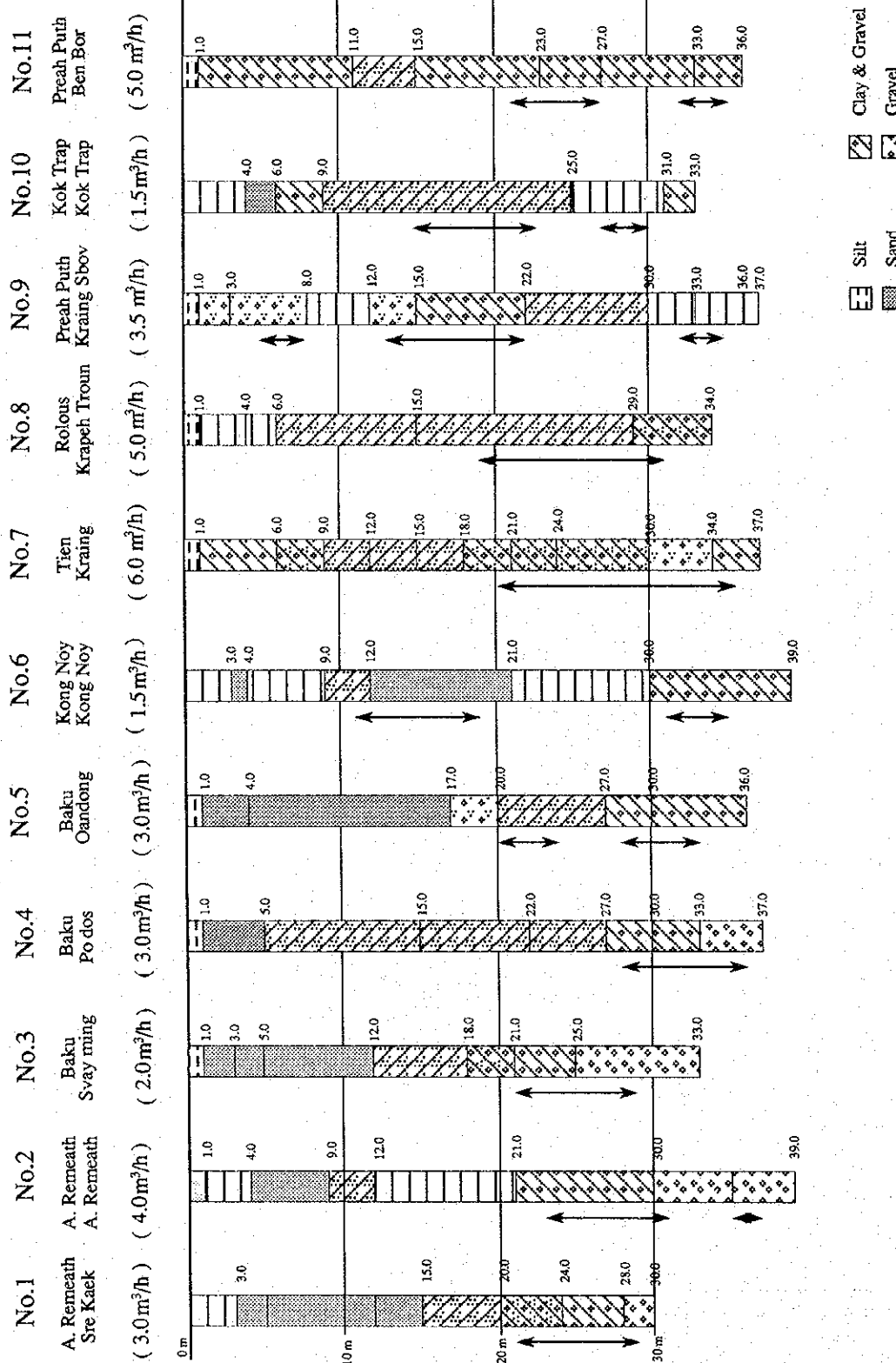


Fig. VI-10 Geological Profiles of Existing Tubewells in the Study Area (1/3)

- EE Silt
- Gravel
- Clay
- Sand & Clay
- Strainer
- Clay & Gravel
- Gravel
- Sand & Gravel
- Sand & Gravel & Clay
- Pumping yield immediately after boring

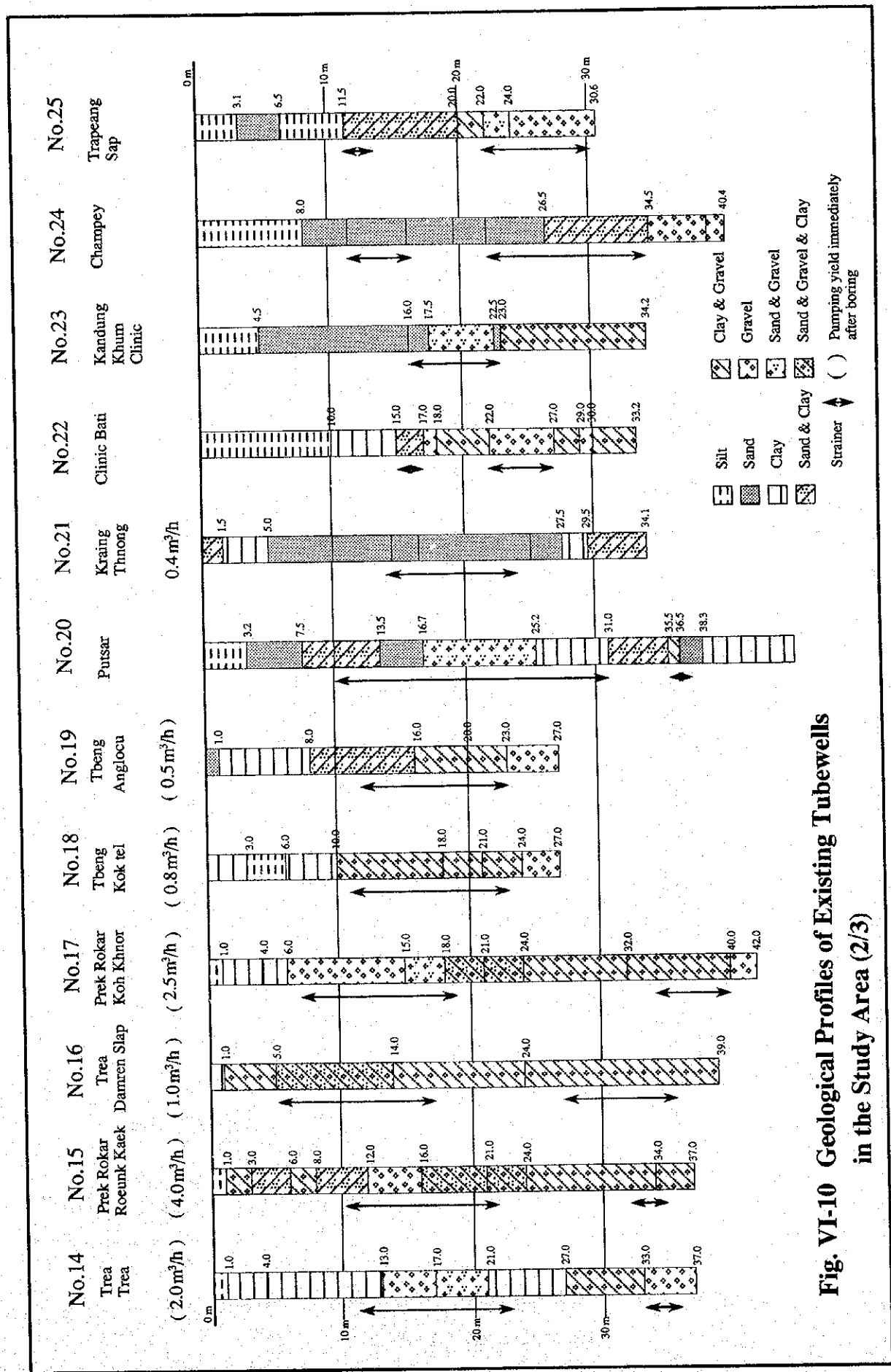


Fig. VI-10 Geological Profiles of Existing Tubewells in the Study Area (2/3)

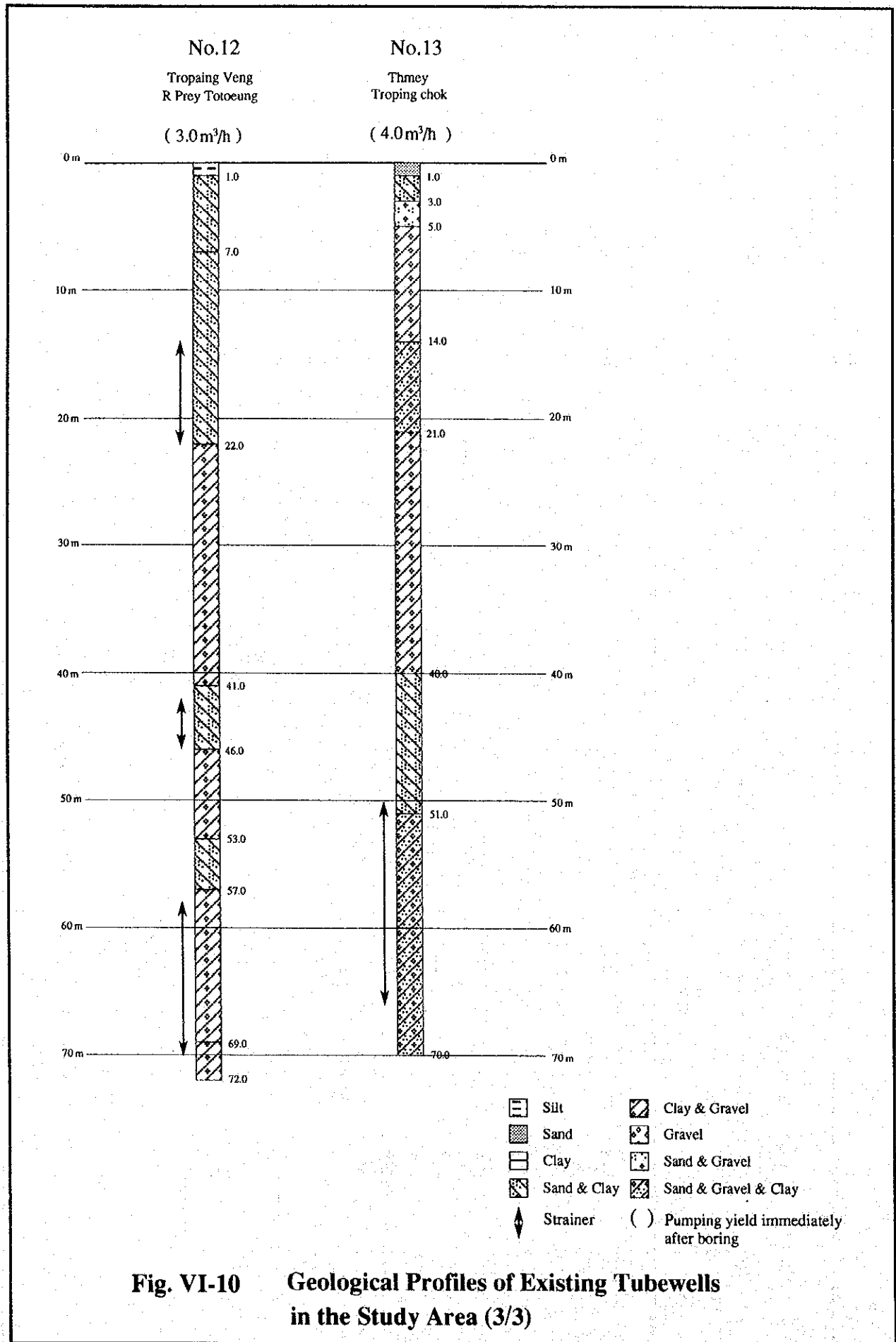


Fig. VI-10 Geological Profiles of Existing Tubewells in the Study Area (3/3)

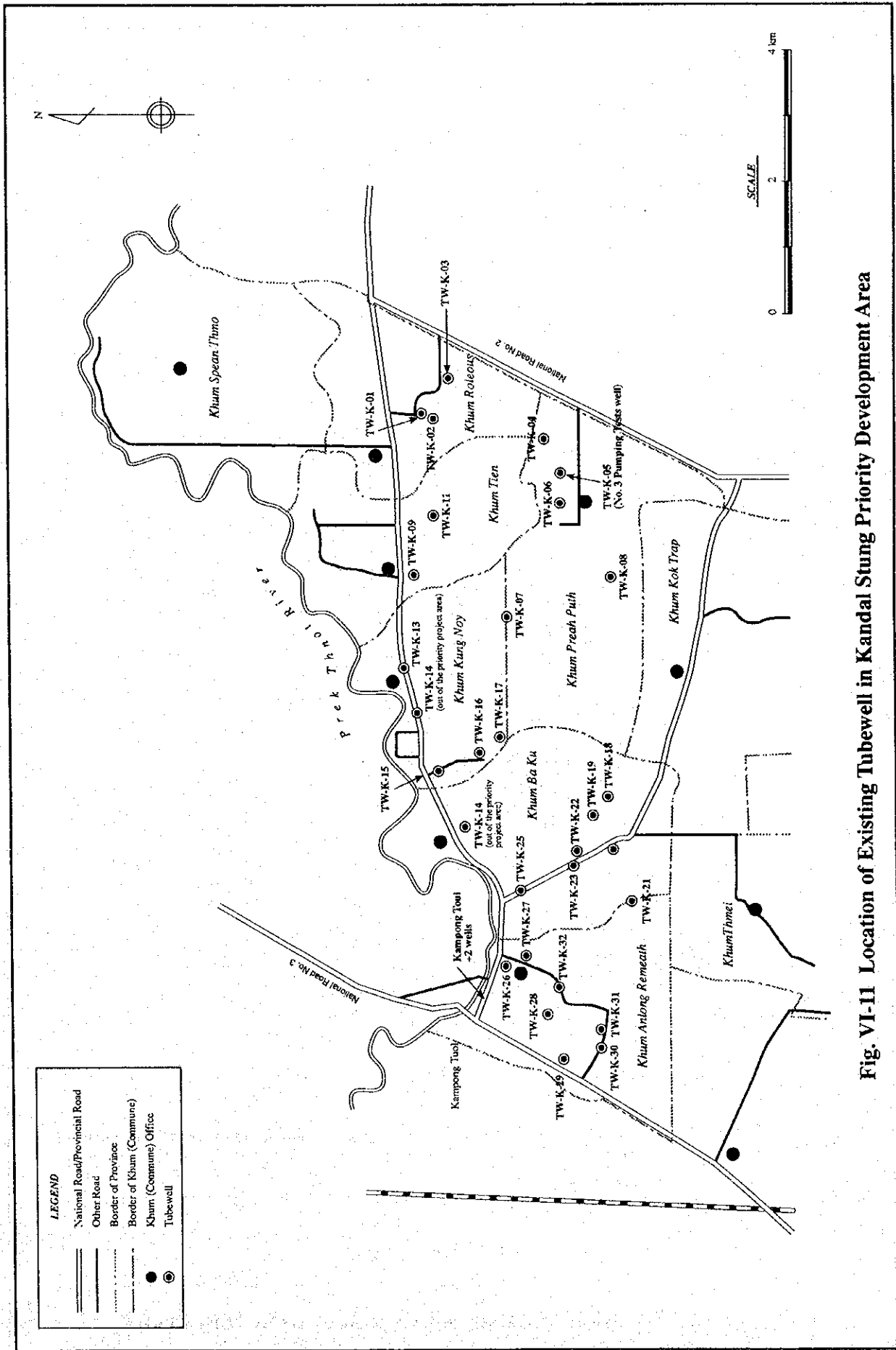
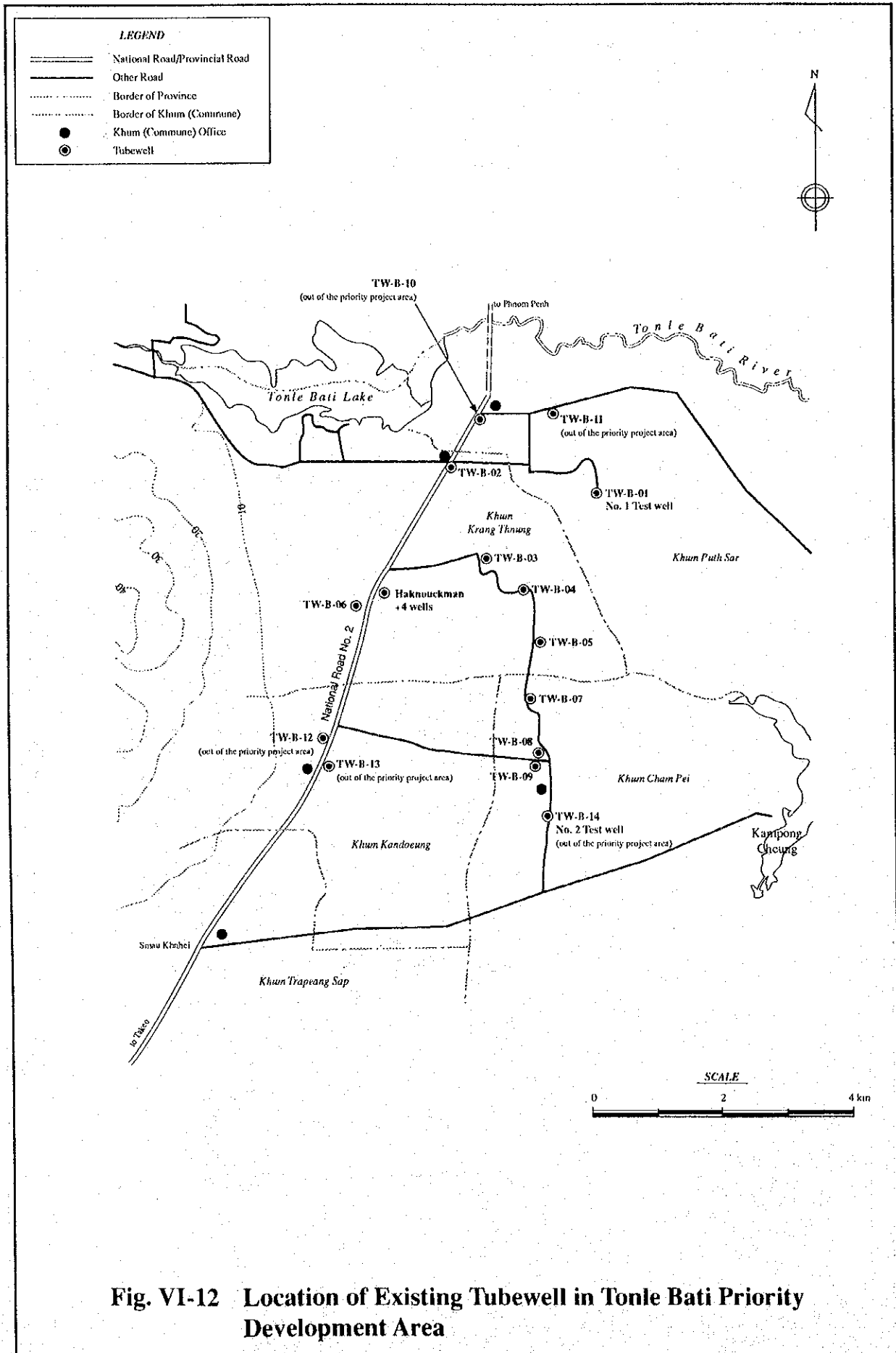
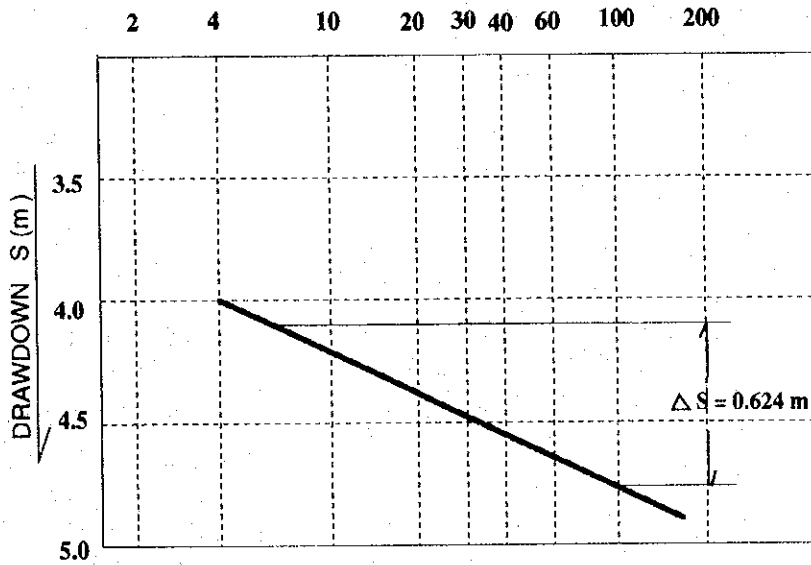


Fig. VI-11 Location of Existing Tubewell in Kandal Stung Priority Development Area



HOLE NO. 1 AQUIFER TEST (JACOB'S METHOD)
 DATE : 22, 7, 94' DRAWDOWN TEST (LOG T ~ CURVE)

TIME DURATION (LOG Tmin)



S.W.L = 8.608 m
 Q = 43.33 l/min

SCREEN = 7 m

$$T = \frac{0.183 Q}{A S}$$

$$= \frac{0.183 \times 0.0433}{0.824}$$

$$= 1.269 \times 10^{-2} \text{ m}^2/\text{min}$$

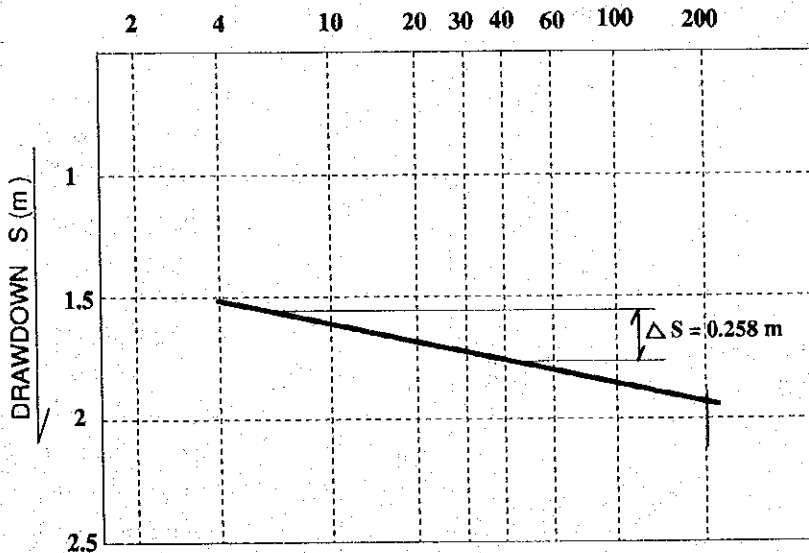
$$K = \frac{M}{T} \cdot \frac{1.289 \times 10^{-2}}{7}$$

$$= 1.814 \times 10^{-3} \text{ m/min}$$

$$= 3.023 \times 10^3 \text{ cm/sec}$$

HOLE NO. 2 AQUIFER TEST (JACOB'S METHOD)
 DATE : 22, 7, 94' DRAWDOWN TEST (LOG T ~ CURVE)

TIME DURATION (LOG Tmin)



S.W.L = 5.596 m
 Q = 46.93 l/min

SCREEN = 15m

$$T = \frac{0.183 Q}{A S}$$

$$= \frac{0.183 \times 0.04693}{0.258}$$

$$= 3.33 \times 10^{-2} \text{ m}^2/\text{min}$$

$$K = \frac{M}{T} \cdot \frac{3.33 \times 10^{-2}}{15}$$

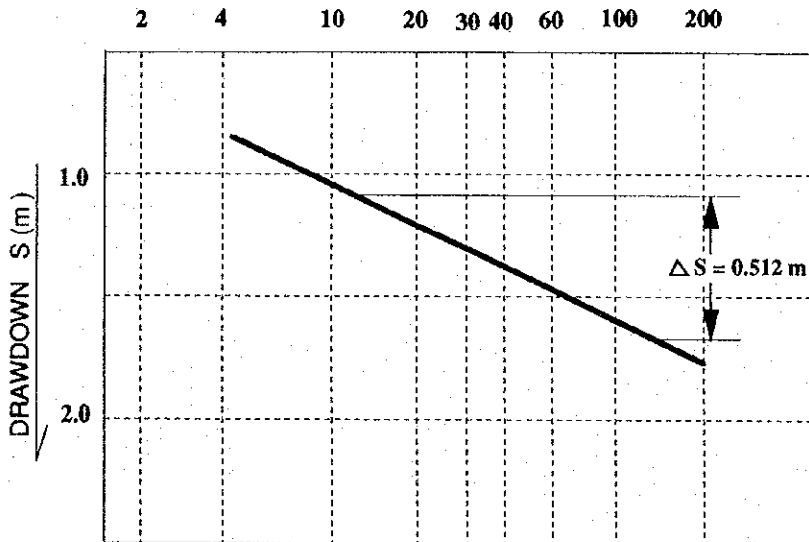
$$K = 2.22 \times 10^{-3} \text{ m/min}$$

$$K = 3.69 \times 10^{-3} \text{ cm/sec}$$

Fig. VI-13 Relation of Time-drawdown (1/2)

HOLE NO.3 AQUIFER TEST (JACOB'S METHOD)
 DATE : 22. 7, 94' DRAWDOWN TEST (LOG T ~ GURVE)

TIME DURATION (LOG Tmin)



S.W.L = 2.762 m
 Q = 47.63 l/min

SCREEN = 15m

$$T = \frac{0.183 Q}{A S}$$

$$= \frac{0.183 \times 0.04763}{0.512}$$

$$= 1.7 \times 10^{-2} \text{ m}^2/\text{min}$$

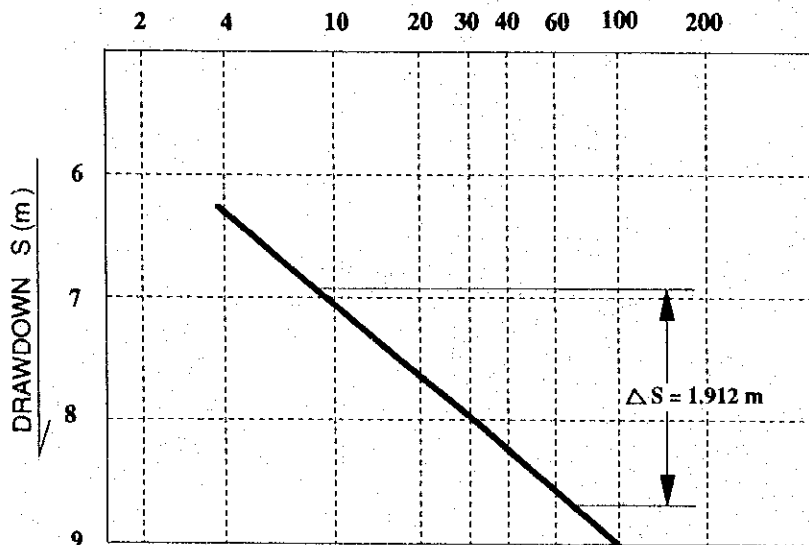
$$K = \frac{M}{T} \cdot \frac{1.7 \times 10^{-2}}{15}$$

$$= 1.138 \times 10^{-3} \text{ m/min}$$

$$= 1.892 \times 10^{-3} \text{ cm/sec}$$

HOLE NO.4 AQUIFER TEST (JACOB'S METHOD)
 DATE : 22. 7, 94' DRAWDOWN TEST (LOG T ~ GURVE)

TIME DURATION (LOG Tmin)



S.W.L = 4.130 m
 Q = 43.19 l/min

SCREEN = 8 m

$$T = \frac{0.183 Q}{A S}$$

$$= \frac{0.183 \times 0.04319}{1.192}$$

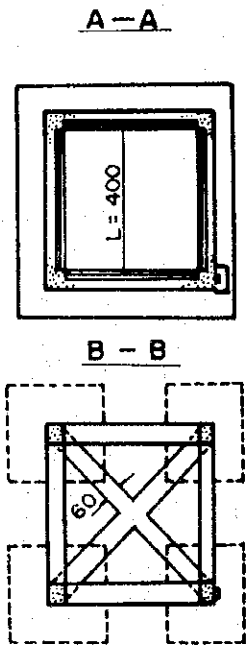
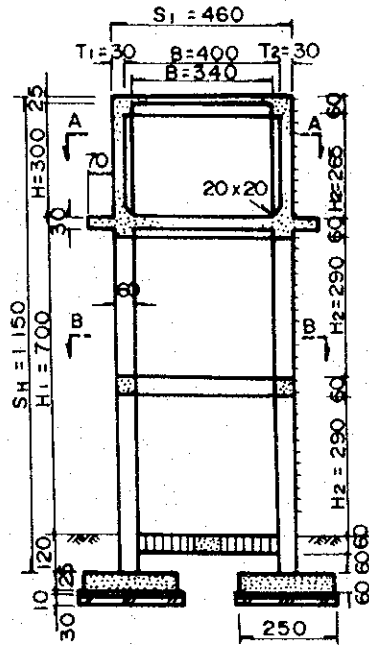
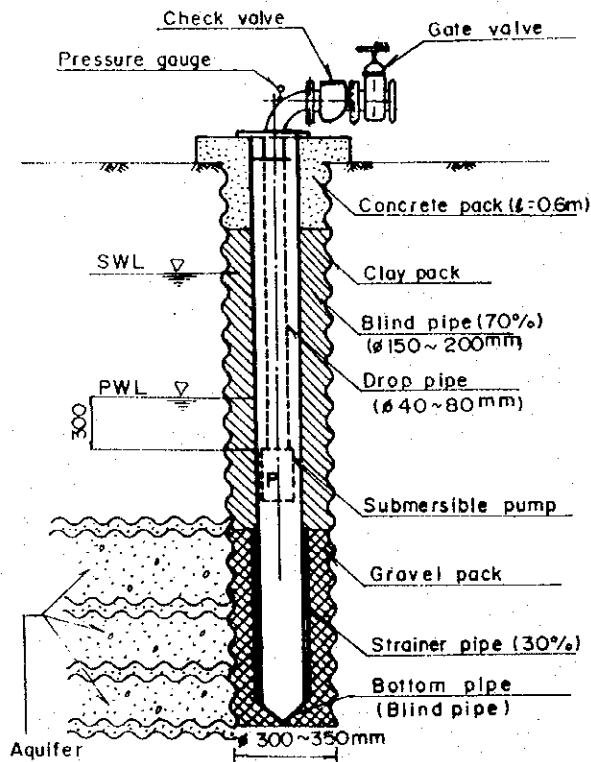
$$= 4.13 \times 10^{-3} \text{ m}^2/\text{min}$$

$$K = \frac{M}{T} \cdot \frac{4.13 \times 10^{-3}}{8}$$

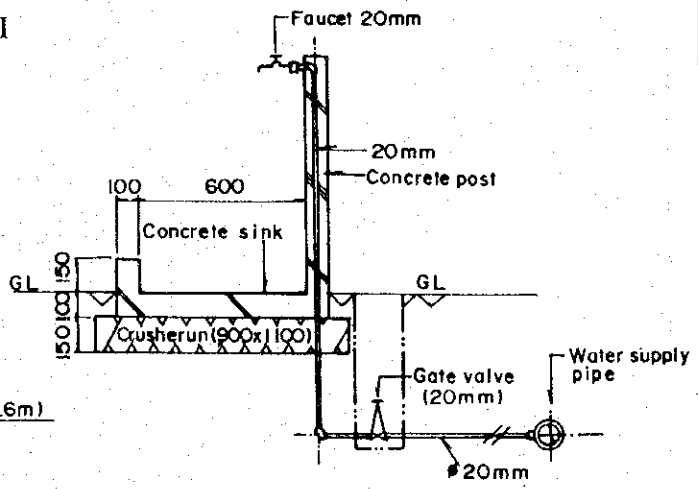
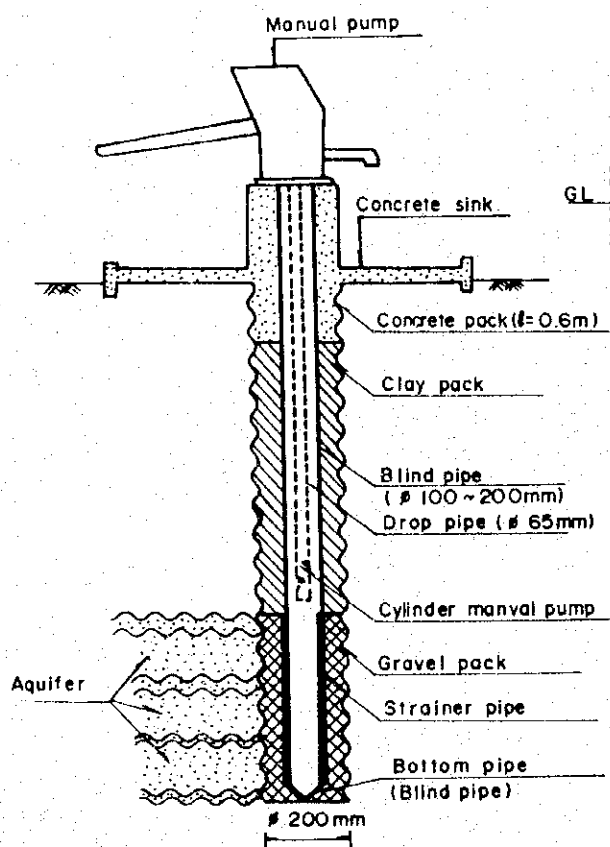
$$K = 5.16 \times 10^{-4} \text{ m/min}$$

$$K = 8.61 \times 10^{-4} \text{ cm/sec}$$

Fig. VI-13 Relation of Time-drawdown (2/2)



TYPICAL SECTION OF WELL TYPE II



TYPICAL SECTION OF WELL TYPE I

Fig. VI-14 Typical Plan of Rural Water Supply Facilities