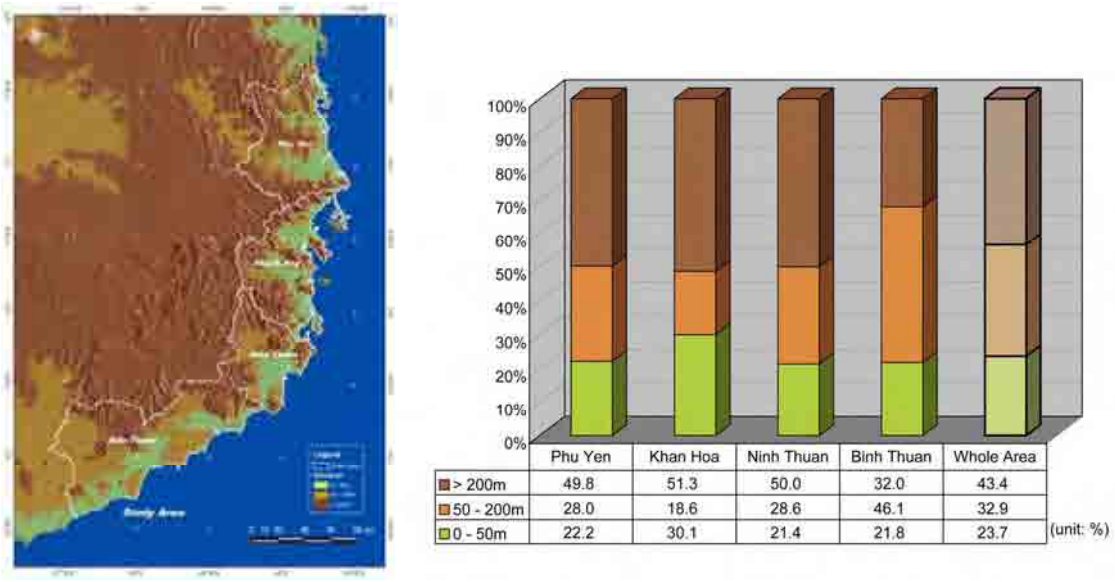
2.2 Geomorphology

2.2.1 Topology

The study area is located in the southern coastal zone of Vietnam and consists principally of lowlands, hills and densely vegetated mountains. Most of the study area is covered by the steep-sided mountainous area which makes up the edge of the Central Highland. The mountainous area runs from north to south along the western boundary of study area, and a part of steep-sided mountains reaches to the coastline bounding the eastern end of the study area. The lowlands and hills surrounded by the steep-sided mountains occur in the confined areas along the coastlines and rivers. The result of elevation classification from the SRTM data is shown in Figure 2.2.1 and the slope classification map is shown in Figure 2.2.2.

The elevation classification map (Figure 2.2.1) is color-coded. The mountainous area with elevations above 200m is shown in brown color, the hilly terrain between 50 to 200m in orange, and the lowland below 50m in green. According to the result of elevation classification, the mountainous area accounts for 43.4 % (approx. 9,100 sq. km) of the study area, likewise the hilly terrain is 32.9 % (approx. 6,900 sq. km) and the lowland is 23.7 % (approx. 5,000 sq. km). In Phu Yen, Khanh Hoa and Ninh Thuan Provinces, the mountainous area which mainly consists of the plutonic rocks occupies around 50 % of the area. However, in Binh Thuan Province, the mountainous area makes up 32.0 % and most of the area is the hilly terrain (46.1 %) which consists of Jurassic sediments rocks, Cenozoic basalts and dunes.



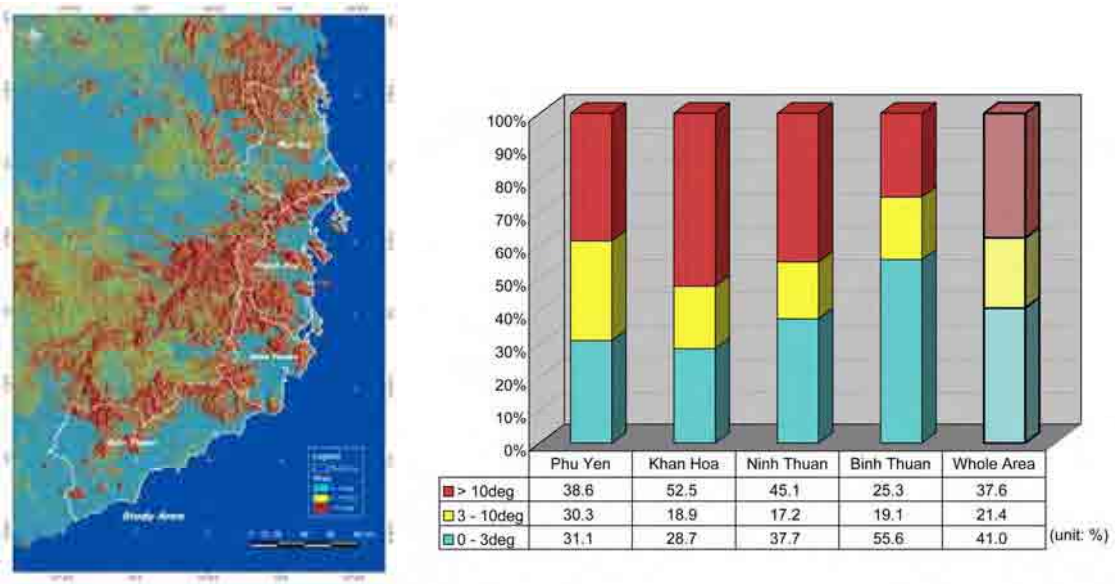
	Phu Yen	Khan Hoa	Ninh Thuan	Binh Thuan	Whole Area
> 200m	49.8	51.3	50.0	32.0	43.4
50 - 200m	28.0	18.6	28.6	46.1	32.9
0 - 50m	22.2	30.1	21.4	21.8	23.7

(unit: %)

Source: JICA Study Team

Figure 2.2.1 Elevation Classification of the Study Area

The slope classification map (Figure 2.2.2) is color-coded; the steep-sided area at slopes above 10 degrees is shown in red color, the gentle-sided area between 3 to 10 degrees in yellow, and the flat area below 3 degrees in light blue. From the result of slope classification, the steep-sided area accounts for 37.6 % (approx. 7,900 sq. km) of the study area, likewise the gentle-sided area is 21.4 % (approx. 4,500 sq. km) and the flat area is 41.0 % (approx. 8,600 sq. km). The portion of the steep-sided area of each province corresponds well to the portion of the mountainous area of elevation classification. This suggests that most of the mountainous area of the study area consist of steep-sided mountains which are made up of the plutonic rocks. In Phu Yen, Khanh Hoa and Ninh Thuan Provinces, the steep-sided area occupies around 30 to 50 % of the area; particularly the portion of it in Khanh Hoa Province makes up 52.5%. The steep-sided area of Binh Thuan Province is only 25 % and instead the flat area occupied above 50 %. The topographic features of Binh Thuan, which include the high portion of hilly area (46 %) in the elevation classification and the high potion of the flat area (55.6 %), indicate the widespread occurrence of plateaus of basaltic lava and tablelands of dune.



	Phu Yen	Khan Hoa	Ninh Thuan	Binh Thuan	Whole Area
> 10deg	38.6	52.5	45.1	25.3	37.6
3 - 10deg	30.3	18.9	17.2	19.1	21.4
0 - 3deg	31.1	28.7	37.7	55.6	41.0

(unit: %)

Source: JICA Study Team

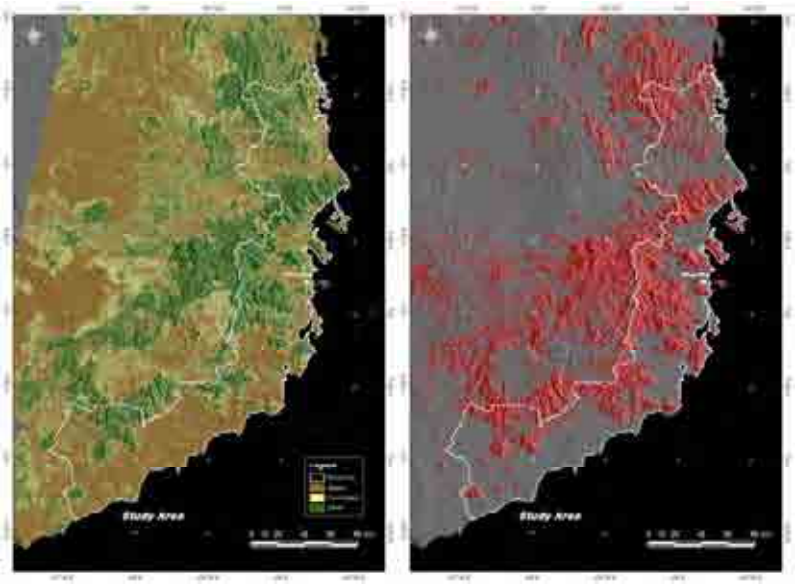
Figure 2.2.2 Slope Classification of the Study Area

2.2.2 Nature and Land Use

The nature and land use of the study area are closely correlated with the topographic features.

The high vegetation areas in the NDVI and VSW index images correspond exactly to the steep-sided mountainous area. The comparison between the high vegetation areas and steep-sided mountainous area is shown in Figure 2.2.3. The left image of Figure 2.2.3 shows the classification of NDVI color-coded with the dense area of vegetation shown in green color, the sparse area shown in brown and the intermediate area shown in yellow, and the right one shows the distribution of steep-sided mountainous area which is shown in red color. The steep-sided mountainous areas were

extracted as the pixels indicating “mountainous area” and “hilly terrain” in the elevation classification and “steep-sided area” in the slope classification. As the result of field survey, it became evident that the steep-sided mountainous area is covered by pine trees which flourish densely along the fractures (joints) of plutonic rocks.



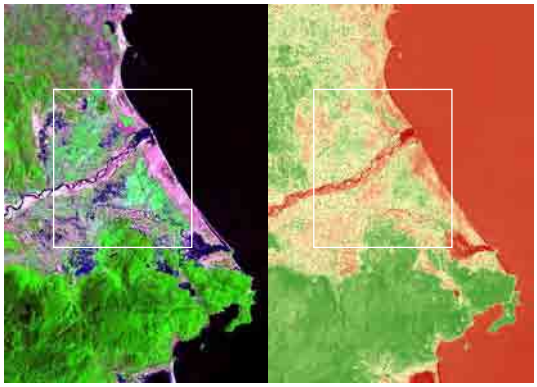
Source: JICA Study Team

Figure 2.2.3 Comparison between High Vegetation Areas and Steep-Sided Mountainous Areas

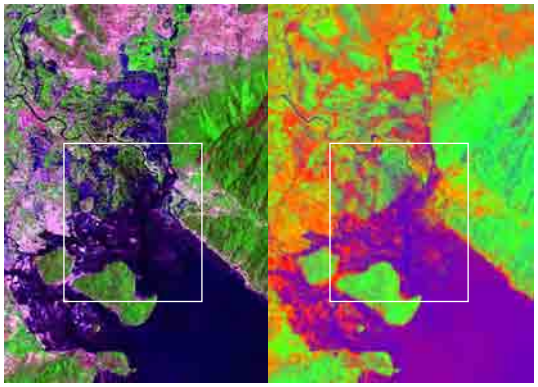
The lowland and hilly terrain, mainly used as paddy field and cultivated land, represents low vegetation values and high soil values in the VSW index image, since used remote sensing data were acquired during the dry season of the study area. However, in bank or delta of river, some high vegetation areas of NDVI image are observed, e.g. the delta of Da Rang River in Phu Yen Province (Figure 2.2.4). These indicate the irrigated areas, mainly paddy fields, in which water is supplied by irrigation canal or shallow groundwater reservoir.

Moreover, some high water values of VSW index were observed in the flat area near coastlines, e.g. the northern part of Khanh Hoa Province (Figure 2.2.5). These are ponds for the agriculture of shrimp and fish.

The present situations of land use will be described in 2.4 “Field Survey”.



ETM+ image NDVI image
Source: JICA Study Team



ETM+ image NDVI image
Source: JICA Study Team

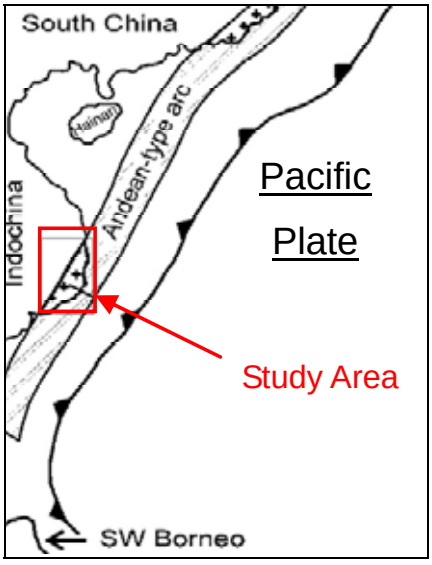
Figure 2.2.4 Irrigated Paddy Fields in the Delta of Da Rang River (left)
Figure 2.2.5 Ponds for Cultivation in the Northern Part of Khanh Hoa (right)

2.3 Geology

2.3.1 General Geology

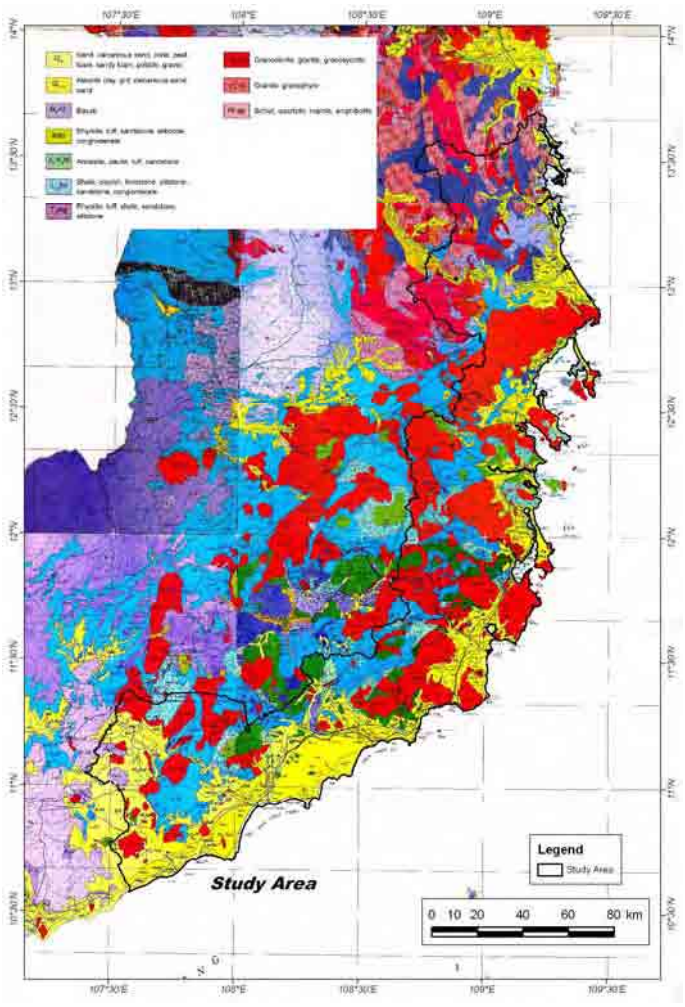
The study area is located in the late Mesozoic Andean-type magmatic arc which consists of voluminous granitic, andesitic and rhyolitic rocks (Figure 2.3.1). These calc-alkaline rocks are interpreted as a resulting of NW trending subduction of the western Pacific plate under the southeastern Asian continental margin (Taylor and Hayes 1983). The magmatic arc was initially formed in the south-east China during the mid Jurassic to early Cretaceous, then migrated south to westward to Vietnam during the mid Cretaceous, and it continued to the southwestern Borneo in the late Cretaceous and early Tertiary (Hamilton 1979).

The study area is made up of Proterozoic basement rocks, Mesozoic sediments and volcanic rocks, Tertiary and Quaternary sediments and volcanic rocks, and voluminous Paleozoic and Mesozoic granitic rock emplaced widely in the study area. The descriptions of each lithological unit are shown in the next chapter. The published geological maps at a scale of 1:500,000 are shown in Figure 2.3.2.



Source: Nguyen et al. (2004)

Figure 2.3.1 Location of the Late Mesozoic Andean-type Magmatic Arc



Source: Geological Survey of Vietnam

Figure 2.3.2 Existent Geological Map of the Study Area

2.3.2 Geological Description

(1) Dakmi Formation (PR1dm, early Proterozoic)

The Dakmi Formation is the oldest unit in the study area. It is 3,000 to 7,000m thick and consists of gneiss, crystalline schist, marble and migmatite. Its distribution is restricted in the northern part of the study area.

(2) Bengiang – Queson Complex (δ -γ bq, late Permian to early Triassic)

The Bengiang – Queson Complex is the late Permian to early Triassic plutonic rocks and consists of gabbro, diorite, granodiorite and granite. This unit is distributed widely in the northern part.

(3) Manggiang Formation (T2mg, early to mid Triassic)

The Manggiang Formation is the early to mid Triassic volcano – sedimentary formation of acidic composition and its total thickness is about 500 to 600m. This unit consists of basal conglomerate, sandstone, siltstone, and in the upper horizon passing upwards rhyolite or dacite and tuff intercalated

with lenses of marl occur. It is distributed in the northern part.

(4) Vancanh Complex (γ vc, early to mid Triassic)

The Vancanh Complex is the early to mid Triassic plutonic rocks and consists of granite and granophyre. This unit is distributed widely in the northern part.

(5) Bandon Formation (J1-2bd, early to mid Jurassic)

The Bandon Formation is the early to mid Jurassic sequence of mainly marine facies, and it is 1,200 to 1,300 thick. This unit consists of calcareous sandstone and siltstone, marl grading up to clayish shale, siltstone and sandstone. It is distributed widely in the central to southern part.

(6) Baoloc Formation (J3-K1bl, late Jurassic to Cretaceous)

The Baoloc Formation is the late Jurassic to Cretaceous volcano – sedimentary formation and the volcanic part is very thick, reaching to about 1,000m thick. This unit consists of basal conglomerate, red colored sandstone grading upwards to andesite, tuff and interbed of dacite. It is distributed widely in the central to southern part.

(7) Ankroet – Dinhquan Complex (δγ -γ ad, late Jurassic to early Cretaceous)

The Ankroet – Dinhquan Complex is the late Jurassic to early Cretaceous plutonic rocks and consists of quartz diorite, granodiorite and granite. It is distributed widely in the whole area

(8) Donduong Formation (Kdd, late Cretaceous)

The Donduong Formation is the late Cretaceous volcano – sedimentary formation and consists of rhyolite, dacite, their tuff and interbeds of red continental sediments. It is distributed widely in the central to the southern part.

(9) Deoca Complex (γ dc, late Cretaceous to Paleogene Rhythm)

The Deoca Complex is the late Cretaceous to Paleogene plutonic rock and consists of granodiorite, granite and granosyenite. It is distributed widely in the central to southern part.

(10) Kontum, Songba and Dilinh Formation (N2kt, Nsb, Ndl, Paleogene)

These formations are the Paleogene continental volcano − sedimentary facies and composed of siltstone, sandstone, diatomite, bentonite, lignite and intercalated basaltic layers. These formations are of narrow distribution along rivers in the mountainous area.

(11) Pliocene to Pleistocene Basalts (βN2-Q1)

The Pliocene to Pleistocene Basalts consists of tholeiitic basalt, plagio-basalt, hypersthene – bearing tholeiite, basalt – dolerite, alkaline basalt, high – alumina basalt with thin opal, chalcedony or sand, grit, coaly clay layer at the bottom. Total thickness is 90 to 140m. It is distributed widely in the

southwestern part.

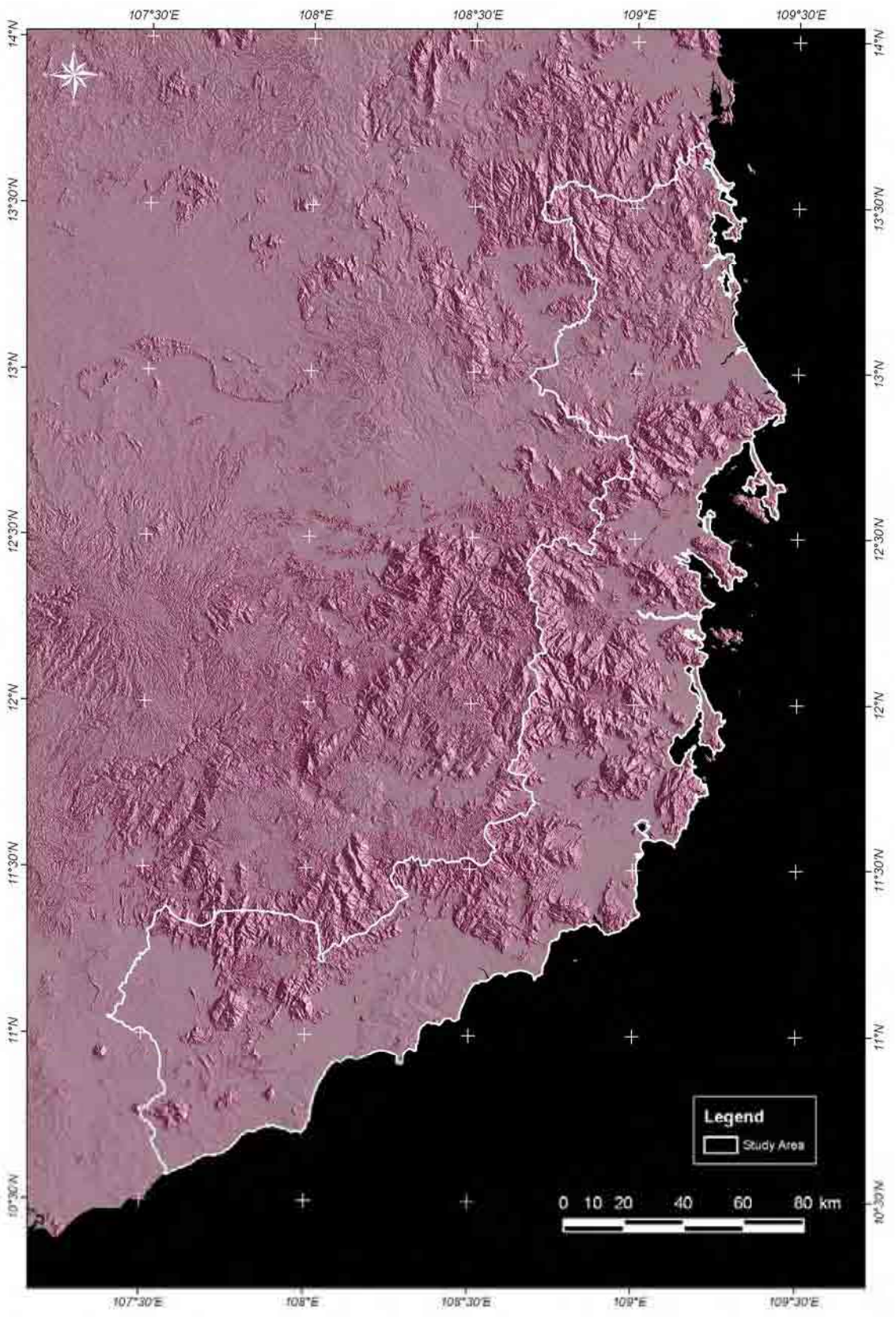
(12) Mid to Late Pleistocene Basalts (βQII-III)

The Middle to Upper Pleistocene Basalts is 40 to 13m thickness and consists of alkali olivine dolerite, trachybasalt, mafic phonolite and alkaline ultramafic extrusions including tefrite, basanite, limburgite, yielding mantle xenolith and megacryst. It is distributed widely in the northern to central part.

2.3.3 Photogeological Interpretation

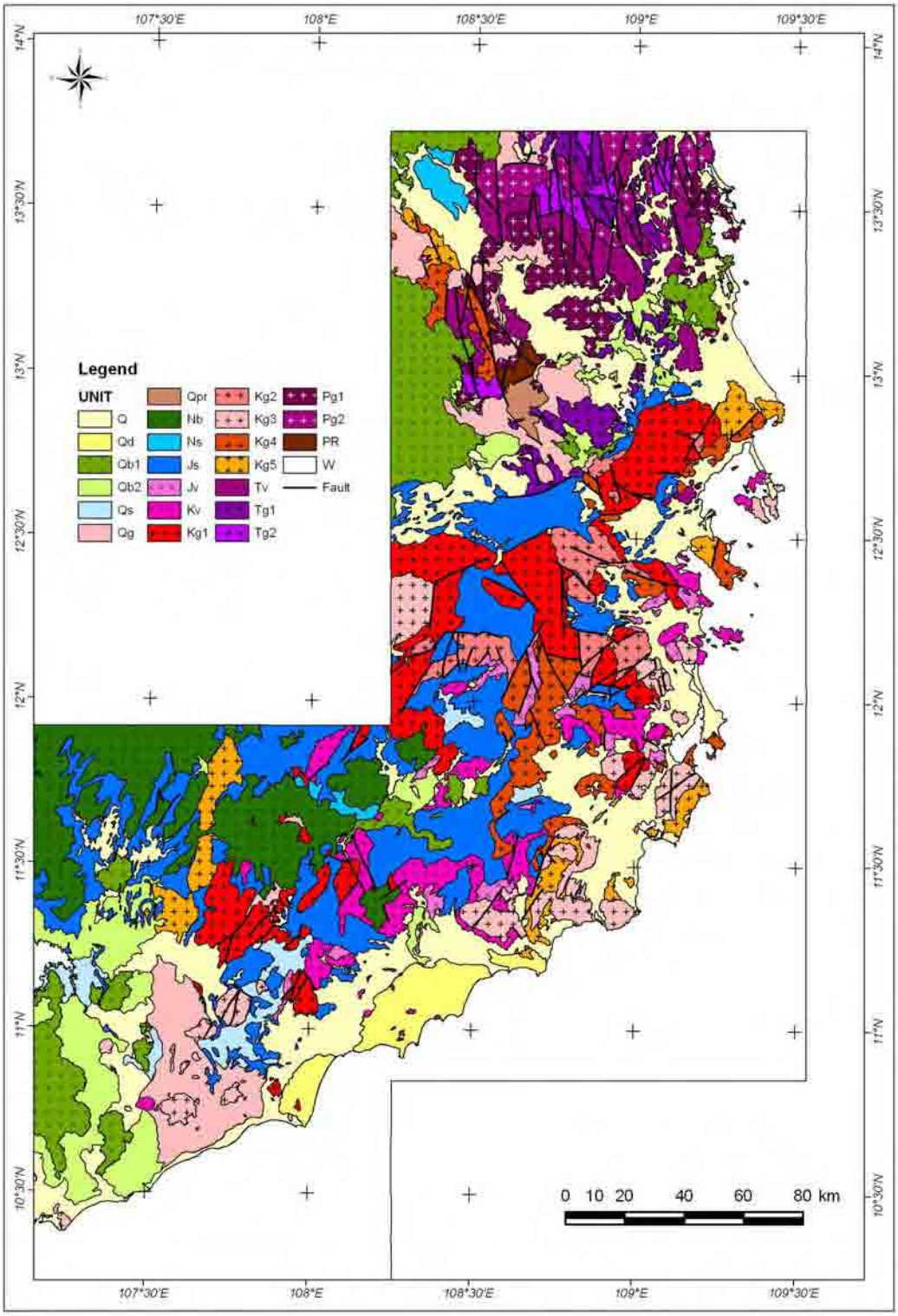
Photogeological Interpretation was carried out to understand the features of geology and geological structure in the study area. LANDSAT/ETM+ color composite images (Figure 2.3.2), TERRA/ASTER color composite images and shade/overground openness composite images of SRTM data (Figure 2.3.3) printed out at a scale of 1:250,000 were mainly used for the interpretation. In addition to them, NDVI image, VSW index image, processed image of SRTM data and the published geological map were used. The result of interpretation was validated by the field survey and converted to vector data for the construction of GIS database.

As the result of interpretation, the study area is divided into 23 geological units by their photogeological features (color, texture, rock resistance, drainage pattern, vegetation coverage, and so on) and many lineaments were extracted. The interpretation map of lithology is shown in Figure 2.3.4 and the lineament map is shown in Figure 2.3.5. These extracted geological units were compared with the published geological map, and the identification of geological units, their distribution, and stratigraphical sequences were determined (Table 2.3.1 and Table 2.3.2).



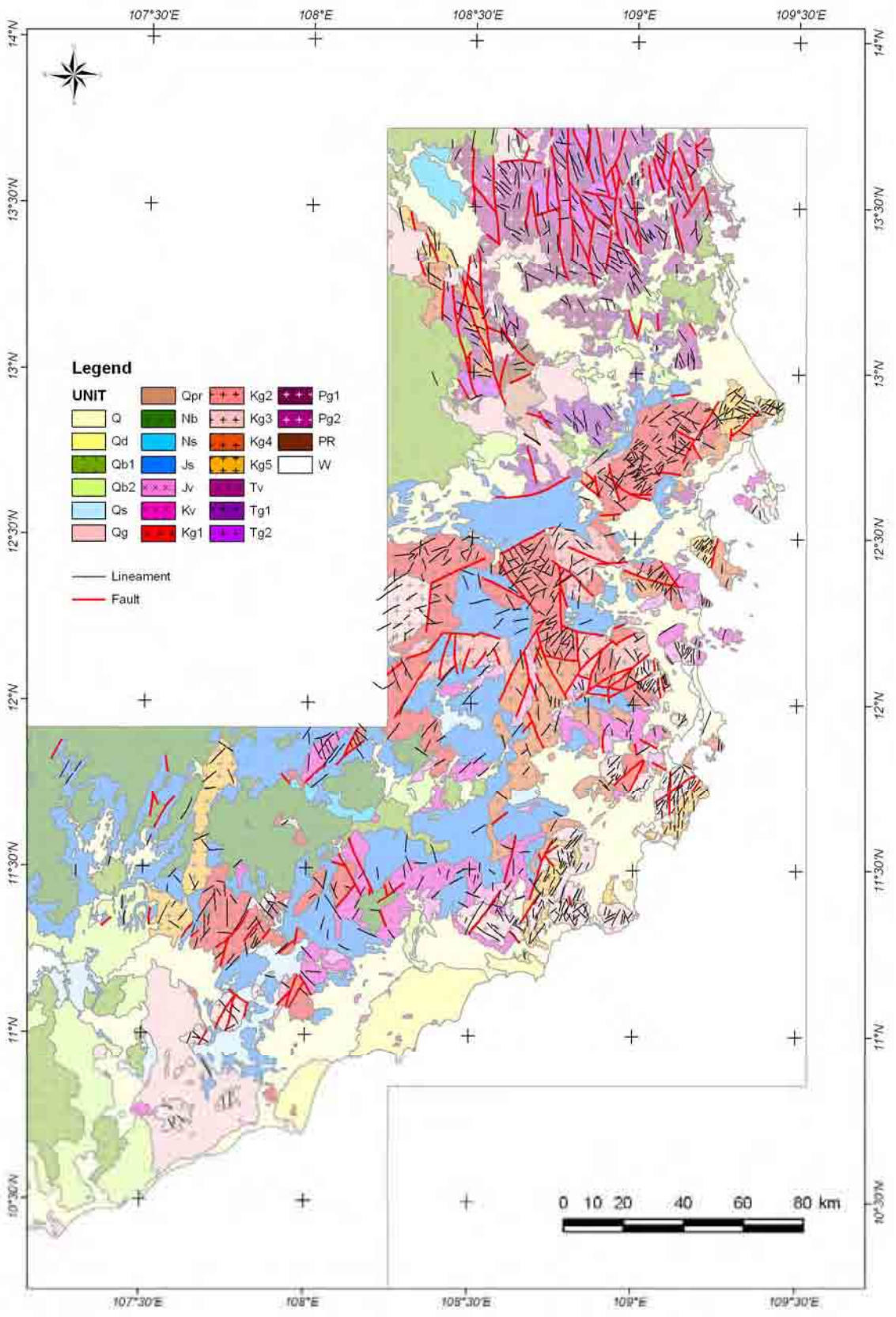
Source: JICA Study Team

Figure 2.3.3 Shade/Overground Openness Image of the Study Area



Source: JICA Study Team

Figure 2.3.4 Interpretation Map (Lithology) of the study area



Source: JICA Study Team

Figure 2.3.5 Interpretation Map (Lineament) of the study area

Table 2.3.1 Photogeological Interpretation Chart (1)

Unit Name	Tone	Texture	Drainage			Rock Properties			Cover		Comparison of geological map
			Pattern	density	Vally or gully cross section	Resistance	Bedding	Jointing	Vegetation	Landcover Landuse	
Q	pink-white-dark blue	smooth	dendritic	low	shallow	very low	none	none	sparse - moderate	paddy field, cultivation	Q
Qd	white - light purple	smooth	dendritic	low	shallow	very low	none	none	sparse	cultivation, desert	Q
Qb1	purple - brown	smooth	dendritic	low	shallow	low	none	none	moderate	grassland, cultivation	$\beta Q_{II\text{-}III}$
Qb2	dark purple	smooth	dendritic	low	shallow	very low	none	none	sparse	grassland, cultivation	Q, $\beta Q_{II\text{-}III}$
Qs	dark purple	granular	dendritic	medium - high	shallow	low	well bedded	none	sparse - moderate	-	Q, $J_{1\text{-}2}bd$
Qg	brown - dark green	coarse	dendritic	low	shallow	low	none	none	sparse - moderate	-	Q, granitic rock
Qpr	reddish purple	coarse	dendritic	low	shallow	low	none	none	sparse	-	Q, PR_1dm
Nb	dark purple	smooth	dendritic	low	shallow	low	none	none	sparse	grassland, cultivation	$\beta N_2\text{-}Q_1$
Ns	dark purple - green	smooth	dendritic	low	shallow	low	none	none	sparse	-	Ndl, Nsb, Nkb
Kv	green	blocky - granular	dendritic	medium	deep	medium	massive	none	moderate - dense	forest, cultivation	Kdd
Kg1	dark green	blocky	parallel	medium - high	sharp V-form	very high	massive	several direct. m - h density	very dense	forest	γ^2_5dc, $\gamma\delta^1_5\text{-}\gamma^1_5ad$
Kg2	dark - light green	granular	parallel - dendritic	medium	gentle V-form	medium	massive	one direct. low density	dense - very dense	grassland, forest	γ^2_5dc, $\gamma\delta^1_5\text{-}\gamma^1_5ad$
Kg3	green - partly reddish purple	blocky - granular	parallel	medium - high	sharp V-form	high	massive	one direct. m - h density	dense - very dense	forest	γ^2_5dc, $\gamma\delta^1_5\text{-}\gamma^1_5ad$
Kg4	green	blocky	parallel	medium	gentle V-form	medium - high	massive	several direct. low density	dense	forest	γ^2_5dc, $\gamma\delta^1_5\text{-}\gamma^1_5ad$
Kg5	dark green	linear	parallel	medium - high	sharp V-form	medium - high	massive	one direct. high density	dense	forest	γ^2_5dc, $\gamma\delta^1_5\text{-}\gamma^1_5ad$
Js	green - dark green	granular	trellis - dendritic	high	shallow - deep	low - medium	well bedded	none	moderate - dense	forest, cultivation	$J_{1\text{-}2}bd$
Jv	green - brown	smoothe	dendritic	low	shallow	low - medium	massive	none	moderate	-	$J_3\text{-}K_1bl$
Tv	green - dark green	blocky - granular	parallel	medium - high	sharp V-form	high	massive	several direct. m density	moderate - dense	forest	T_2mg

Table 2.3.2 Photogeological Interpretation Chart (2)

Unit Name	Tone	Texture	Drainage			Rock Properties			Cover		Comparison of geological map
			Pattern	density	Vally or gully cross section	Resistance	Bedding	Jointing	Vegetation	Landcover Landuse	
Tg1	green - dark green	blocky	parallel - dendritic	medium	deep	high	massive	several direct. m density	dense - very dense	forest	Y^2_4vc
Tg2	dark green	blocky - granular	parallel - dendritic	medium	sharp V-form	high	massive	several direct. m density	dense	forest	Y^2_4vc
Pg1	green - dark green	granular	dendritic - parallel	medium - high	deep	medium - high	massive	several direct. low density	dense	forest	$\delta^1_4 - Y^1_4bq$
Pg2	green - dark green	blocky	parallel	medium	gentle V-form	high	massive	several direct. m density	moderate - dense	forest	$\delta^1_4 - Y^1_4bq$
PR	green - dark green	smooth	-	low	shallow	low	none	none	sparse - moderate	-	PR_1dm

(1) Proterozoic

The unit PR is distributed in the narrow area of the northern part and corresponds to the early Proterozoic Dakmi Formation. This unit can be distinguished easily from the neighboring plutonic rocks by its smooth texture (Figure 2.3.6) .

Source: JICA Study Team

Figure 2.3.6 ETM+ Image of unit PR

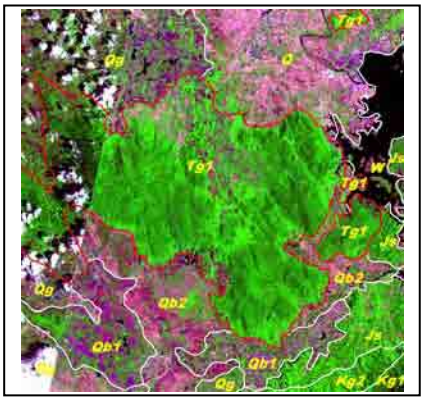
(2) Permian

The unit Pg1 and Pg2 are distributed widely in the northern part and correspond to the late Permian and early Triassic plutonic rocks, the Bengiang – Queson Complex. Its texture is massive and many lineaments which reflect joints in the plutonic rocks are observed. Pg1 and Pg2 are similar to Triassic plutonic rocks, but these units can be distinguished from the Triassics by the difference of rock resistance.

(3) Triassic

The unit Tv corresponds to the early to mid Triassic Manggiang Formation and its photogeological feature is characterized by the distribution of parallel drainage.

The units Tg1 and Tg2 corresponds to the early to mid Triassic Vancanh Complex and are distributed widely in the northern part. The rock resistance of Tg1 and Tg2 is very high and many lineaments and sharp V-form valleys reflecting joints are distributed in these units (Figure 2.3.7).



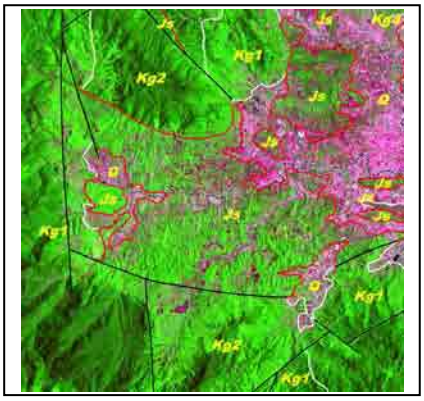
Source: JICA Study Team

Figure 2.3.7 ETM+ Image of unit Tg1

(4) Jurassic

The unit Js corresponds to the early to mid Jurassic sediments sequence, the Bandon Formation and is distributed widely in the central to southern part. The photogeological features of this unit are characterized by drainage system with trellis to angular pattern and well distinguished bedding (Figure 2.3.8).

The unit Jv which is distributed in the narrow area of the central to southern part, corresponds to the late Jurassic to Cretaceous volcano – sediments sequence, the Baoloc Formation. This unit has similar features to the Cretaceous volcano – sediments units, but it can be distinguished from the Cretaceous units by the differences of rock resistance and valley shape.



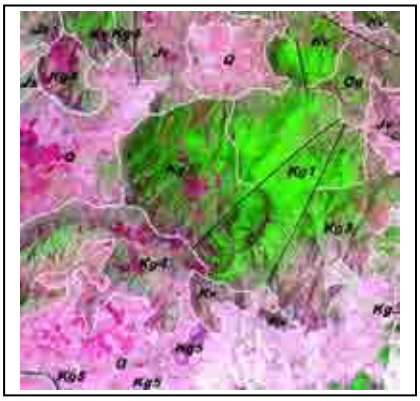
Source: JICA Study Team

Figure 2.3.8 ETM+ Image of unit Js

(5) Cretaceous

The unit Kg is distributed widely in the whole area and corresponds to the late Jurassic to early Cretaceous plutonic rocks, the Ankroet – Dinhquan Complex and the late Cretaceous to Paleogene Deoca Complex. This unit can be divided into 5 sub units (Kg1 to Kg5) by the difference of its rock resistance and lineament patterns (Figure 2.3.9).

The unit Kv corresponds to the late Cretaceous volcano – sediments sequence, the Donduong Formation. This unit is distributed widely in the central to southern part, and its photogeological feature is characterized by massive textures and drainage systems with dendritic pattern.

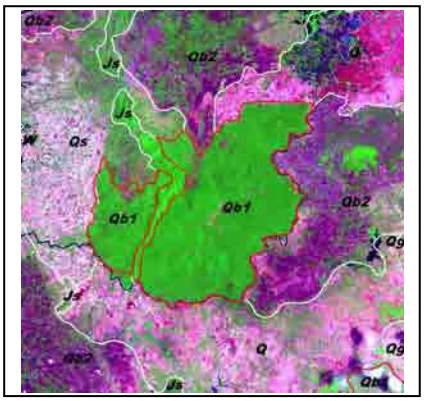


Source: JICA Study Team

Figure 2.3.9 ETM+ Image of unit Kg

(6) Cenozoic

The Cenozoic are distributed widely in the planes of the whole area and can be divided into 9 units, Q, Qd, Qb1, Qb2, Qs, Qg, Qpr, Nb and Ns by its photogeological feature. Especially, Nb, Qb1 and Qb2, which are distributed widely in the northern and southwestern part, correspond to Pliocene to Pleistocene basalts. Its texture is smooth and the rock resistance is rather higher than other Cenozoic units. In addition, these units represent topographic features of hill and tableland in the shade image of the SRTM data. From the above features, these units can be easily distinguished from other Cenozoic units (Figure 2.3.10).



Source: JICA Study Team

Figure 2.3.10 ETM+ Image of unit Qb1

(7) Geological structures

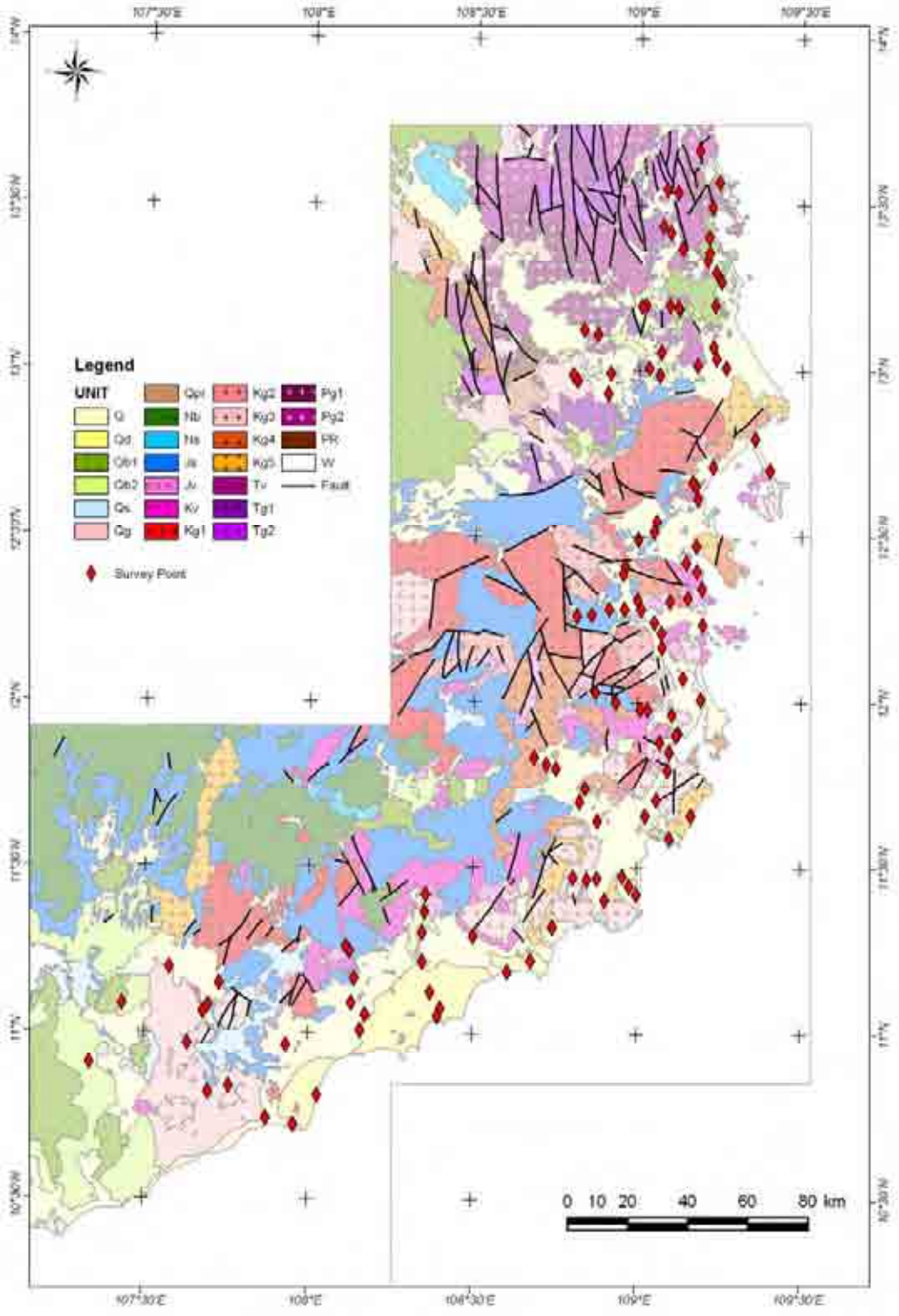
A lineament is defined by “straight and/or semi-curve linear features on the surface, which seems to reflect subsurface geological structures such as fracture”, and moreover a fault is defined briefly by “lineaments accompanied by topographical fluctuations and discontinuity of the geological unit”.
Most lineaments are distinguished in the units of the Permian, Triassic and Cretaceous plutonic rocks (Figure 2.4.1). The feature of lineaments (direction and density) varies among geological units and its differences are attributed to their geological features, such as mineral assemblage, rock resistance and jointing.

2.4 Field Survey

Based on the results of preliminary remote sensing data processing and analyses, the field survey was carried out for 10 days, between 25th June and 10th July 2007. The main purpose of survey is to check and validate the results of remote sensing data analyses and photogeological interpretations. The activities of the field survey were as follows:

- To check and validate the results of remote sensing data processing.
- To check and validate the results of photogeological interpretations.
- To define the distribution and classification of the plutonic and basaltic rocks.
- To check the surface condition (land cover, land use, vegetation coverage, etc.).
- To collect the information regarding hydrogeology and water usage.

The locations of survey points are shown in Figure 2.4.1 and the survey results at the representative points are shown bellow:



Source: JICA Study Team

Figure 2.4.1 Location map of the Survey Points

CHAPTER 3

SOCIO-ECONOMIC CONDITIONS

CHAPTER 3 SOCIO-ECONOMIC CONDITIONS

3.1 Outline of the Socio-Economic Survey

3.1.1 Objective

The survey aims at clarifying present socio-economic conditions and demands of local people regarding water supply as well as sanitary condition at the M/P's targeted study area. In this line the survey also covers topics on rural economy, household income/expenditure in order to grasp broader pictures from the economical viewpoint, comprising crucial information for the Master plan.

3.1.2 Survey Area and Target

The survey area covers 24 communes in 4 provinces that are requiring urgent improvement of water supply and sanitary condition. Targets of the survey are the local residents in those 24 communes, and are husband or wife who can see their own households' general picture. The number of interviews in total amounts to about 10% of all the households, 3,875 households. The targeted communes are as follows:

Table 3.1.1 Distribution of Interviewees (figures are the number of interviewees in each commune)

Province	Phu Yen Province	Khanh Hoa Province	Ninh Thuan Province	Binh Thuan Province
Commune	1) Xuan Phuoc, (180) 2) An Dinh, (155) 3) An Tho, (74) 4) An My, (282) 5) Son Phuoc, (69) 6) Ea Cha Rang, (59) 7) Suoi Bac, (145) 8) Son Thanh Dong (189)	1) Cam An Bac, (117) 2) Cam Hiep Nam, (130) 3) Cam Hai Tay (233)	1) Nhon Hai, (240) 2) Cong Hai, (149) 3) Bac Son, (130) 4) Phuoc Minh, (89) 5) Phuoc Hai, (230) 6) Phuoc Dinh (158)	1) Muong Man, (140) 2) Gia Huynh, (118) 3) Nghi Duc, (203) 4) Tan Duc, (116) 5) Me Pu, (270) 6) Sung Nhon , (165) 7) Da Kai (234)
Sub-Total	1,153	480	996	1,246
TOTAL	**3,875**			

Among all the 3,875 interviewees, 398 people, 10 % in total are categorized as "minority ethnic group", of which 142 are Cham (many in N-3: Bac Son and N-5: Phuoc Hai); and 118 are Raclay (many of them are N-2: Cong Hai and N-3: Bac Son as well).

3.1.3 Survey Period

The survey was conducted from July 2007 to October 2007 by Nha Trang University under supervision of the JICA study team.

3.1.4 Methodology

The survey introduced questionnaires to collect information, which were proceeded by face to face style through enumerators.

3.2 Result of the Socio-Economic Survey

3.2.1 Water Source and Use (Dry season)

(Water source)

In the survey area, many of local people obtain water from their own dug wells and/or neighborhoods' as primary water source (67% of interviewees among total), though, there are some areas where local people have to rely on purchasing water because of depletion of water in dug wells and other alternative sources. Among all, N-4: Phuoc Hai, N-1: Nhon Hai and K-3: Cam Hai Tay are under particularly severe condition.

Table 3.2.1 Primary Water Source in Dry Season

			Piped water	Dug well		Tube well		Spring	River/stream	Rain water	Purchase		Other	TOTAL
				my own	not my own	my own	not my own				bottled	not bottled		
Phu Yen	P-1	Xuan Phuoc	1	143	22	1	0	1	0	0	0	0	12	180
			0.6%	79.4%	12.2%	0.6%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	6.7%	100.0%
	P-2	An Dinh	1	97	28	16	10	3	0	0	0	0	0	155
			0.6%	62.6%	18.1%	10.3%	6.5%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	P-3	An Tho	0	24	19	2	0	0	0	0	0	1	28	74
			0.0%	32.4%	25.7%	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	37.8%	100.0%
	P-4	An My	0	110	36	127	2	0	0	0	0	0	7	282
			0.0%	39.0%	12.8%	45.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	2.5%	100.0%
	P-5	Son Phuoc	4	26	32	0	0	7	0	0	0	0	0	69
			5.8%	37.7%	46.4%	0.0%	0.0%	10.1%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	P-6	Ea Cha Rang	0	18	18	0	0	23	0	0	0	0	0	59
			0.0%	30.5%	30.5%	0.0%	0.0%	39.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	P-7	Suoi Bac	30	47	64	0	0	4	0	0	0	0	0	145
			20.7%	32.4%	44.1%	0.0%	0.0%	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	P-8	Son Thanh Dong	0	47	19	111	8	1	3	0	0	0	0	189
			0.0%	24.9%	10.1%	58.7%	4.2%	0.5%	1.6%	0.0%	0.0%	0.0%	0.0%	100.0%
Subtotal			**36**	**512**	**238**	**257**	**20**	**39**	**3**	**0**	**0**	**1**	**47**	**1153**
			3.1%	**44.4%**	**20.6%**	**22.3%**	**1.7%**	**3.4%**	**0.3%**	**0.0%**	**0.0%**	**0.1%**	**4.1%**	**100.0%**
Khanh Hoa	K-1	Cam An Bac	0	104	2	0	0	0	0	0	0	0	11	117
			0.0%	88.9%	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.4%	100.0%
	K-2	Cam Hiep Nam	0	99	22	3	1	1	0	0	0	3	1	130
			0.0%	76.2%	16.9%	2.3%	0.8%	0.8%	0.0%	0.0%	0.0%	2.3%	0.8%	100.0%
	K-3	Cam Hai Tay	0	94	20	0	0	0	0	1	0	118	0	233
			0.0%	40.3%	8.6%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	50.6%	0.0%	100.0%
Subtotal			**0**	**297**	**44**	**3**	**1**	**1**	**0**	**1**	**0**	**121**	**12**	**480**
			0.0%	**61.9%**	**9.2%**	**0.6%**	**0.2%**	**0.2%**	**0.0%**	**0.2%**	**0.0%**	**25.2%**	**2.5%**	**100.0%**
Ninh Thuan	N-1	Nhon Hai	0	102	5	0	0	0	0	0	0	133	0	240
			0.0%	42.5%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	55.4%	0.0%	100.0%
	N-2	Cong Hai	0	51	68	0	0	20	0	1	0	9	0	149
			0.0%	34.2%	45.6%	0.0%	0.0%	13.4%	0.0%	0.7%	0.0%	6.0%	0.0%	100.0%
	N-3	Bac Son	55	10	16	0	0	32	0	0	0	5	12	130
			42.3%	7.7%	12.3%	0.0%	0.0%	24.6%	0.0%	0.0%	0.0%	3.8%	9.2%	100.0%
	N-4	Phuoc Minh	2	14	4	0	0	0	0	1	0	68	0	89
			2.2%	15.7%	4.5%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	76.4%	0.0%	100.0%
	N-5	Phuoc Hai	0	131	35	0	0	4	0	0	0	0	60	230
			0.0%	57.0%	15.2%	0.0%	0.0%	1.7%	0.0%	0.0%	0.0%	0.0%	26.1%	100.0%
	N-6	Phuoc Dinh	15	52	25	13	0	0	0	0	0	46	7	158
			9.5%	32.9%	15.8%	8.2%	0.0%	0.0%	0.0%	0.0%	0.0%	29.1%	4.4%	100.0%
Subtotal			**72**	**360**	**153**	**13**	**0**	**56**	**0**	**2**	**0**	**261**	**79**	**996**
			7.2%	**36.1%**	**15.4%**	**1.3%**	**0.0%**	**5.6%**	**0.0%**	**0.2%**	**0.0%**	**26.2%**	**7.9%**	**100.0%**
Binh Thuan	B-1	Muong Man	0	60	13	8	2	2	9	7	0	10	29	140
			0.0%	42.9%	9.3%	5.7%	1.4%	1.4%	6.4%	5.0%	0.0%	7.1%	20.7%	100.0%
	B-2	Gia Huynh	0	101	16	0	0	1	0					118
			0.0%	85.6%	13.6%	0.0%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	B-3	Nghi Duc	0	200	0	3	0	0	0	0	0	0	0	203
			0.0%	98.5%	0.0%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	B-4	Tan Duc	2	82	18	4	3	3	0	0	0	4	0	116
			1.7%	70.7%	15.5%	3.4%	2.6%	2.6%	0.0%	0.0%	0.0%	3.4%	0.0%	100.0%
	B-5	Me Pu	0	188	3	64	1	0	0	0	0	0	14	270
			0.0%	69.6%	1.1%	23.7%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	5.2%	100.0%
	B-6	Sung Nhon	0	161	4	0	0	0	0	0	0	0	0	165
			0.0%	97.6%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	B-7	Da Kai	0	194	6	10	0	0	0	0	0	4	20	234
			0.0%	82.9%	2.6%	4.3%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%	8.5%	100.0%
Subtotal			**2**	**986**	**60**	**89**	**6**	**6**	**9**	**7**	**0**	**18**	**63**	**1,246**
			0.2%	**79.1%**	**4.8%**	**7.1%**	**0.5%**	**0.5%**	**0.7%**	**0.6%**	**0.0%**	**1.4%**	**5.1%**	**100.0%**
TOTAL			**110**	**2,155**	**495**	**362**	**27**	**102**	**12**	**10**	**0**	**401**	**201**	**3,875**
			2.8%	**55.6%**	**12.8%**	**9.3%**	**0.7%**	**2.6%**	**0.3%**	**0.3%**	**0.0%**	**10.3%**	**5.2%**	**100.0%**

Other: Those who didn't give any answers

(Water source in rainy season)

The volume of water obtained through dug well increases in comparison with dry season, and then automatically, less number of people relies on purchasing water.

Only 6% of total chose "purchasing water" as primary water source in rainy season, and the communes corresponding to such condition are the same in dry season.

Table 3.2.2 Primary Water Source in Rainy Season

			Piped water	Dug well		Tube well		Spring	River/stream	Rain water	Purchase		Other	TOTAL
				my own	not my own	my own	not my own				bottled	not bottled		
Phu Yen	P-1	Xuan Phuoc	1	153	21	0	0	1	0	0	0	0	4	180
			0.6%	85.0%	11.7%	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	2.2%	100.0%
	P-2	An Dinh	0	106	22	16	8	3	0	0	0	0	0	155
			0.0%	68.4%	14.2%	10.3%	5.2%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	P-3	An Tho	0	34	15	2	0	0	0	0	0	0	23	74
			0.0%	45.9%	20.3%	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	31.1%	100.0%
	P-4	An My	0	124	33	117	2	0	0	0	0	0	6	282
			0.0%	44.0%	11.7%	41.5%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	100.0%
	P-5	Son Phuoc	4	26	35	0	0	2	0	2	0	0	0	69
			5.8%	37.7%	50.7%	0.0%	0.0%	2.9%	0.0%	2.9%	0.0%	0.0%	0.0%	100.0%
	P-6	Ea Cha Rang	0	10	21	0	0	17	0	4	0	0	7	59
			0.0%	16.9%	35.6%	0.0%	0.0%	28.8%	0.0%	6.8%	0.0%	0.0%	11.9%	100.0%
	P-7	Suoi Bac	31	50	63	0	0	1	0	0	0	0	0	145
			21.4%	34.5%	43.4%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	P-8	on Thanh Don	0	49	14	112	8	0	2	3	0	0	1	189
			0.0%	25.9%	7.4%	59.3%	4.2%	0.0%	1.1%	1.6%	0.0%	0.0%	0.5%	100.0%
Subtotal			**36**	**552**	**224**	**247**	**18**	**24**	**2**	**9**	**0**	**0**	**41**	**1153**
			3.1%	47.9%	19.4%	21.4%	1.6%	2.1%	0.2%	0.8%	0.0%	0.0%	3.6%	100.0%
Khanh Hoa	K-1	Cam An Bac	0	108	2	0	0	0	0	0	0	0	7	117
			0.0%	92.3%	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.0%	100.0%
	K-2	Cam Hiep Nan	0	103	20	2	1	0	0	4	0	0		130
			0.0%	79.2%	15.4%	1.5%	0.8%	0.0%	0.0%	3.1%	0.0%	0.0%	0.0%	100.0%
	K-3	Cam Hai Tay	0	139	21	0	0	0	0	15	0	58	0	233
			0.0%	59.7%	9.0%	0.0%	0.0%	0.0%	0.0%	6.4%	0.0%	24.9%	0.0%	100.0%
Subtotal			**0**	**350**	**43**	**2**	**1**	**0**	**0**	**19**	**0**	**58**	**7**	**480**
			0.0%	72.9%	9.0%	0.4%	0.2%	0.0%	0.0%	4.0%	0.0%	12.1%	1.5%	100.0%
Ninh Thuan	N-1	Nhon Hai	0	98	5	0	0	0	0	39	0	98	0	240
			0.0%	40.8%	2.1%	0.0%	0.0%	0.0%	0.0%	16.3%	0.0%	40.8%	0.0%	100.0%
	N-2	Cong Hai	0	51	74	0	0	14	0	9	0	1	0	149
			0.0%	34.2%	49.7%	0.0%	0.0%	9.4%	0.0%	6.0%	0.0%	0.7%	0.0%	100.0%
	N-3	Bac Son	48	10	22	0	0	25	0	19	0	4	2	130
			36.9%	7.7%	16.9%	0.0%	0.0%	19.2%	0.0%	14.6%	0.0%	3.1%	1.5%	100.0%
	N-4	Phuoc Minh	2	17	6	0	0	0	0	42	0	22	0	89
			2.2%	19.1%	6.7%	0.0%	0.0%	0.0%	0.0%	47.2%	0.0%	24.7%	0.0%	100.0%
	N-5	Phuoc Hai	1	134	31	0	0	3	0	0	0	0	61	230
			0.4%	58.3%	13.5%	0.0%	0.0%	1.3%	0.0%	0.0%	0.0%	0.0%	26.5%	100.0%
	N-6	Phuoc Dinh	14	53	26	13	0	0	0	2	0	44	6	158
			8.9%	33.5%	16.5%	8.2%	0.0%	0.0%	0.0%	1.3%	0.0%	27.8%	3.8%	100.0%
Subtotal			**65**	**363**	**164**	**13**	**0**	**42**	**0**	**111**	**0**	**169**	**69**	**996**
			6.5%	36.4%	16.5%	1.3%	0.0%	4.2%	0.0%	11.1%	0.0%	17.0%	6.9%	100.0%
Binh Thuan	B-1	Muong Man	0	49	6	5	1	0	5	48	0	5	21	140
			0.0%	35.0%	4.3%	3.6%	0.7%	0.0%	3.6%	34.3%	0.0%	3.6%	15.0%	100.0%
	B-2	Gia Huynh		102	13	0	0			3				118
			0.0%	86.4%	11.0%	0.0%	0.0%	0.0%	0.0%	2.5%	0.0%	0.0%	0.0%	100.0%
	B-3	Nghi Duc	0	200	3	0	0	0	0	0	0	0	0	203
			0.0%	98.5%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	B-4	Tan Duc	2	53	6	3	2	0	0	48	0	1	1	116
			1.7%	45.7%	5.2%	2.6%	1.7%	0.0%	0.0%	41.4%	0.0%	0.9%	0.9%	100.0%
	B-5	Me Pu	0	188	3	64	1	0	0	0	0	0	14	270
			0.0%	69.6%	1.1%	23.7%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	5.2%	100.0%
	B-6	Sung Nhon	0	161	4	0	0	0	0	0	0	0	0	165
			0.0%	97.6%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	B-7	Da Kai	0	196	2	16	0	0	0	12	0	0	8	234
			0.0%	83.8%	0.9%	6.8%	0.0%	0.0%	0.0%	5.1%	0.0%	0.0%	3.4%	100.0%
Subtotal			**2**	**949**	**37**	**88**	**4**	**0**	**5**	**111**	**0**	**6**	**44**	**1246**
			0.2%	**76.2%**	**3.0%**	**7.1%**	**0.3%**	**0.0%**	**0.4%**	**8.9%**	**0.0%**	**0.5%**	**3.5%**	**100.0%**
TOTAL			**103**	**2214**	**468**	**350**	**23**	**66**	**7**	**250**	**0**	**233**	**161**	**3875**
			2.7%	**57.1%**	**12.1%**	**9.0%**	**0.6%**	**1.7%**	**0.2%**	**6.5%**	**0.0%**	**6.0%**	**4.2%**	**100.0%**

Other: Those who didn't give any answers

(Volume of water use)

Information on volume of water use per person/day is distributed from 50 to 80 litters among communes, as long as limiting purposes to drink and cook. If including the all types of water use purpose such as bathing, toilet and others, the figure hikes to above 100 litter/person/day, as seen in B-5: Me Pu, B-7: Da Kai, etc.

Table 3.2.3 Water volume to Use Per Person in a Day

			Water volume (AVERAGE)	Water volume (MEDIAN)
Phu Yen	P-1	Xuan Phuoc	73.2	50.0
	P-2	An Dinh	121.0	83.3
	P-3	An Tho	72.0	50.0
	P-4	An My	69.8	50.0
	P-5	Son Phuoc	71.7	33.3
	P-6	Ea Cha Rang	77.2	64.3
	P-7	Suoi Bac	99.0	75.0
	P-8	Son Thanh Dong	74.4	50.0
Subtotal			**82.3**	**50.0**
Khanh Hoa	K-1	Cam An Bac	117.0	100.0
	K-2	Cam Hiep Nam	151.2	125.0
	K-3	Cam Hai Tay	108.3	62.5
Subtotal			**122.0**	**80.0**
Ninh Thuan	N-1	Nhon Hai	57.0	50.0
	N-2	Cong Hai	71.9	66.7
	N-3	Bac Son	91.1	50.0
	N-4	Phuoc Minh	62.5	50.0
	N-5	Phuoc Hai	64.6	54.4
	N-6	Phuoc Dinh	133.9	100.0
Subtotal			**78.1**	**60.0**
Binh Thuan	B-1	Muong Man	219.3	125.0
	B-2	Gia Huynh	149.0	95.0
	B-3	Nghi Duc	158.0	125.0
	B-4	Tan Duc	186.9	100.0
	B-5	Me Pu	241.2	200.0
	B-6	Sung Nhon	122.9	83.3
	B-7	Da Kai	197.7	166.7
Subtotal			**187.6**	**140.0**
TOTAL			**120.0**	**90.0**

Note: Colleting information on water use volume faced difficulty to receive precise answers from interviewees in spite of ways to ask questions with some devices. In this line, the answers contain possibilities to be deviated from their own reality. The figures in the table should be reconfirmed with field observation.

(Fetching water)

Owing to dug wells being primary sources, which are normally located in their own yard or at least neighborhood's, fetching water is not a heavy task for anyone in family.

However, there are 11 communes out of 24 communes where 10%-20% of answers spent 30 minute or more for fetching water.

Table 3.2.4 Time for Fetching Water in Dry Season

			Less than 5 min.	5-10 min.	10-30min.	30-60min.	More than 60min.	Total
Phu Yen	P-1	Xuan Phuoc	75	69	32	2	2	180
			41.7%	38.3%	17.8%	1.1%	1.1%	100.0%
	P-2	An Dinh	85	25	21	22	2	155
			54.8%	16.1%	13.5%	14.2%	1.3%	100.0%
	P-3	An Tho	27	15	16	15	1	74
			36.5%	20.3%	21.6%	20.3%	1.4%	100.0%
	P-4	An My	51	54	148	23	6	282
			18.1%	19.1%	52.5%	8.2%	2.1%	100.0%
	P-5	Son Phuoc	44	12	13	0	0	69
			63.8%	17.4%	18.8%	0.0%	0.0%	100.0%
	P-6	Ea Cha Rang	19	11	22	4	3	59
			32.2%	18.6%	37.3%	6.8%	5.1%	100.0%
	P-7	Suoi Bac	42	40	30	13	20	145
			29.0%	27.6%	20.7%	9.0%	13.8%	100.0%
	P-8	Son Thanh Dong	139	40	8	2	0	189
			73.5%	21.2%	4.2%	1.1%	0.0%	100.0%
Subtotal			**482**	**266**	**290**	**81**	**34**	**1153**
			41.8%	**23.1%**	**25.2%**	**7.0%**	**2.9%**	**100.0%**
Khanh Hoa	K-1	Cam An Bac	83	26	7	1	0	117
			70.9%	22.2%	6.0%	0.9%	0.0%	100.0%
	K-2	Cam Hiep Nam	24	54	42	7	3	130
			18.5%	41.5%	32.3%	5.4%	2.3%	100.0%
	K-3	Cam Hai Tay	35	99	39	32	28	233
			15.0%	42.5%	16.7%	13.7%	12.0%	100.0%
Subtotal			**142**	**179**	**88**	**40**	**31**	**480**
			29.6%	**37.3%**	**18.3%**	**8.3%**	**6.5%**	**100.0%**
Ninh Thuan	N-1	Nhon Hai	100	92	46	1	1	240
			41.7%	38.3%	19.2%	0.4%	0.4%	100.0%
	N-2	Cong Hai	50	29	49	20	1	149
			33.6%	19.5%	32.9%	13.4%	0.7%	100.0%
	N-3	Bac Son	71	7	30	15	7	130
			54.6%	5.4%	23.1%	11.5%	5.4%	100.0%
	N-4	Phuoc Minh	21	27	38	2	1	89
			23.6%	30.3%	42.7%	2.2%	1.1%	100.0%
	N-5	Phuoc Hai	180	19	29	0	2	230
			78.3%	8.3%	12.6%	0.0%	0.9%	100.0%
	N-6	Phuoc Dinh	71	52	26	6	3	158
			44.9%	32.9%	16.5%	3.8%	1.9%	100.0%
Subtotal			**422**	**174**	**192**	**38**	**12**	**996**
			42.4%	**17.5%**	**19.3%**	**3.8%**	**1.2%**	**100.0%**
Binh Thuan	B-1	Muong Man	70	24	24	13	9	140
			50.0%	17.1%	17.1%	9.3%	6.4%	100.0%
	B-2	Gia Huynh	91	20	6	1	0	118
			77.1%	16.9%	5.1%	0.8%	0.0%	100.0%
	B-3	Nghi Duc	50	123	28	1	1	203
			24.6%	60.6%	13.8%	0.5%	0.5%	100.0%
	B-4	Tan Duc	89	16	6	2	3	116
			76.7%	13.8%	5.2%	1.7%	2.6%	100.0%
	B-5	Me Pu	181	15	13	10	51	270
			67.0%	5.6%	4.8%	3.7%	18.9%	100.0%
	B-6	Sung Nhon	165	0	0	0	0	165
			100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	B-7	Da Kai	80	49	69	24	12	234
			34.2%	20.9%	29.5%	10.3%	5.1%	100.0%
Subtotal			**646**	**198**	**77**	**27**	**64**	**1246**
			51.8%	**15.9%**	**6.2%**	**2.2%**	**5.1%**	**100.0%**
TOTAL			**1,692**	**817**	**647**	**186**	**141**	**3,875**
			43.7%	**21.1%**	**16.7%**	**4.8%**	**3.6%**	**100.0%**

(Quality of water) [1]

Impressions on water quality that local people bear comprise their 70% by the level as "acceptable" or beyond "good". On the other hand, "not good" and "very bad" occupy the remained 30% of the total.

The answers as "very bad" are concentrated in some communes such as P-6: Ea Cha Rang and B-4: Tan Duc; more than 30% of them answered the water quality as "very bad".

Table 3.2.5 Local People's Impression on Water Quality

			Good quality	Acceptable	Not good	Very bad	Other	Total
Phu Yen	P-1	Xuan Phuoc	31	42	59	46	2	180
			17.2%	23.3%	32.8%	25.6%	1.1%	100.0%
	P-2	An Dinh	151	0	1	3		155
			97.4%	0.0%	0.6%	1.9%	0.0%	100.0%
	P-3	An Tho	4	24	39	7	0	74
			5.4%	32.4%	52.7%	9.5%	0.0%	100.0%
	P-4	An My	156	45	64	16	1	282
			55.3%	16.0%	22.7%	5.7%	0.4%	100.0%
	P-5	Son Phuoc	12	32	12	13	0	69
			17.4%	46.4%	17.4%	18.8%	0.0%	100.0%
	P-6	Ea Cha Rang	11	16	13	19	0	59
			18.6%	27.1%	22.0%	32.2%	0.0%	100.0%
	P-7	Suoi Bac	29	37	73	6	0	145
			20.0%	25.5%	50.3%	4.1%	0.0%	100.0%
	P-8	Son Thanh Dong	151	23	11	4	0	189
			79.9%	12.2%	5.8%	2.1%	0.0%	100.0%
Subtotal			**545**	**219**	**272**	**114**	**3**	**1153**
			47.3%	19.0%	23.6%	9.9%	0.3%	100.0%
Khanh Hoa	K-1	Cam An Bac	0	39	54	15	9	117
			0.0%	33.3%	46.2%	12.8%	7.7%	100.0%
	K-2	Cam Hiep Nam	16	47	58	8	1	130
			12.3%	36.2%	44.6%	6.2%	0.8%	100.0%
	K-3	Cam Hai Tay	71	152	10	0	0	233
			30.5%	65.2%	4.3%	0.0%	0.0%	100.0%
Subtotal			**87**	**238**	**122**	**23**	**10**	**480**
			18.1%	49.6%	25.4%	4.8%	2.1%	100.0%
Ninh Thuan	N-1	Nhon Hai	5	181	54	0		240
			2.1%	75.4%	22.5%	0.0%	0.0%	100.0%
	N-2	Cong Hai	5	69	64	11	0	149
			3.4%	46.3%	43.0%	7.4%	0.0%	100.0%
	N-3	Bac Son	43	16	42	29	0	130
			33.1%	12.3%	32.3%	22.3%	0.0%	100.0%
	N-4	Phuoc Minh	3	77	9	0	0	89
			3.4%	86.5%	10.1%	0.0%	0.0%	100.0%
	N-5	Phuoc Hai	36	89	98	5	2	230
			15.7%	38.7%	42.6%	2.2%	0.9%	100.0%
	N-6	Phuoc Dinh	33	105	20	0	0	158
			20.9%	66.5%	12.7%	0.0%	0.0%	100.0%
Subtotal			**125**	**537**	**287**	**45**	**2**	**996**
			12.6%	53.9%	28.8%	4.5%	0.2%	100.0%
Binh Thuan	B-1	Muong Man	46	38	55	1	0	140
			32.9%	27.1%	39.3%	0.7%	0.0%	100.0%
	B-2	Gia Huynh	22	49	45	2	0	118
			18.6%	41.5%	38.1%	1.7%	0.0%	100.0%
	B-3	Nghi Duc	6	69	91	33	4	203
			3.0%	34.0%	44.8%	16.3%	2.0%	100.0%
	B-4	Tan Duc	9	63	9	35	0	116
			7.8%	54.3%	7.8%	30.2%	0.0%	100.0%
	B-5	Me Pu	26	148	50	11	35	270
			9.6%	54.8%	18.5%	4.1%	13.0%	100.0%
	B-6	Sung Nhon	35	76	20	2	32	165
			21.2%	46.1%	12.1%	1.2%	19.4%	100.0%
	B-7	Da Kai	49	125	40	10	10	234
			20.9%	53.4%	17.1%	4.3%	4.3%	100.0%
Subtotal			**193**	**568**	**310**	**94**	**81**	**1246**
			15.5%	**45.6%**	**24.9%**	**7.5%**	**6.5%**	**100.0%**
TOTAL			**950**	**1562**	**991**	**276**	**96**	**3875**
			24.5%	**40.3%**	**25.6%**	**7.1%**	**2.5%**	**100.0%**

[1] Description on water quality here reflects only local people's impression, and does not necessarily accord with scientific data.

3.2.2 Monthly Expense in Use among Total Monthly Budget

(Monthly household expense in general)

Monthly household expense varies from about 1.5 million VND/month to beyond 4 million VND/month. The communes whose locations have advantage in terms of access to commercial/big cities and/or allow them to engage in rice farming, aquaculture, horticulture, which normally assure more preferable and stable income, show higher Median of income than communes in mountain area. The following table shows the monthly expense by "average" and "median".

Table 3.2.6 Monthly Household Expense

			Less than 490	500-990	1,000-1,490	1,500-1,990	2,000-2,490	More than 2,500	Average	Median
Phu Yen	P-1	Xuan Phuoc	7	28	76	35	17	17	1,572	1,405
			3.9%	15.6%	42.2%	19.4%	9.4%	9.4%	-	-
	P-2	An Dinh	4	30	51	42	15	13	1,527	1,450
			2.6%	19.4%	32.9%	27.1%	9.7%	8.4%	-	-
	P-3	An Tho	3	13	25	20	9	4	1,485	1,374
			4.1%	17.6%	33.8%	27.0%	12.2%	5.4%	-	-
	P-4	An My	2	26	95	79	40	40	1,951	1,585
			0.7%	9.2%	33.7%	28.0%	14.2%	14.2%	-	-
	P-5	Son Phuoc	2	5	6	5	6	45	3,519	3,175
			2.9%	7.2%	8.7%	7.2%	8.7%	65.2%		
	P-6	Ea Cha Rang	0	3	8	10	8	30	3,023	2,536
			0.0%	5.1%	13.6%	16.9%	13.6%	50.8%	-	-
	P-7	Suoi Bac	11	18	22	24	21	49	2,048	1,945
			7.6%	12.4%	15.2%	16.6%	14.5%	33.8%	-	-
	P-8	Son Thanh Dong	3	21	44	46	34	41	1,953	1,725
			1.6%	11.1%	23.3%	24.3%	18.0%	21.7%	-	-
Subtotal			**32**	**144**	**327**	**261**	**150**	**239**	**1,966**	**1,655**
			2.8%	12.5%	28.4%	22.6%	13.0%	20.7%		
Khanh Hoa	K-1	Cam An Bac	1	6	23	26	26	35	2,219	2,034
			0.9%	5.1%	19.7%	22.2%	22.2%	29.9%		
	K-2	Cam Hiep Nam	7	8	21	23	27	44	2,420	2,218
			5.4%	6.2%	16.2%	17.7%	20.8%	33.8%	-	-
	K-3	Cam Hai Tay	2	23	54	42	34	78	2,555	1,947
			0.9%	9.9%	23.2%	18.0%	14.6%	33.5%	-	-
Subtotal			**10**	**37**	**98**	**91**	**87**	**157**	**2,437**	**2,076**
			2.4%	8.7%	23.1%	21.5%	20.5%	37.0%		
Ninh Thuan	N-1	Nhon Hai	0	13	57	56	60	54	2,271	1,821
			0.0%	5.4%	23.8%	23.3%	25.0%	22.5%	-	-
	N-2	Cong Hai	1	30	39	39	19	21	1,728	1,560
			0.7%	20.1%	26.2%	26.2%	12.8%	14.1%	-	-
	N-3	Bac Son	5	30	30	29	13	23	1,778	1,498
			3.8%	23.1%	23.1%	22.3%	10.0%	17.7%	-	-
	N-4	Phuoc Minh	0	6	13	20	24	26	2,140	2,100
			0.0%	6.7%	14.6%	22.5%	27.0%	29.2%	-	-
	N-5	Phuoc Hai	2	26	65	62	39	36	1,794	1,645
			0.9%	11.3%	28.3%	27.0%	17.0%	15.7%	-	-
	N-6	Phuoc Dinh	1	0	27	22	29	79	3,252	2,508
			0.6%	0.0%	17.1%	13.9%	18.4%	50.0%	-	-
Subtotal			**9**	**105**	**231**	**228**	**184**	**239**	**2,159**	**1,733**
			0.9%	10.5%	23.2%	22.9%	18.5%	24.0%	-	-
Binh Thuan	B-1	Muong Man	0	8	7	6	7	112	6,003	4,691
			0.0%	5.7%	5.0%	4.3%	5.0%	80.0%	-	-
	B-2	Gia Huynh	1	1	5	16	13	82	3,884	3,127
			0.8%	0.8%	4.2%	13.6%	11.0%	69.5%	-	-
	B-3	Nghi Duc	0	6	19	30	26	122	3,589	2,754
			0.0%	3.0%	9.4%	14.8%	12.8%	60.1%	-	-
	B-4	Tan Duc	1	1	8	14	22	70	3,290	2,816
			2.5%	17.6%	33.8%	27.0%	12.2%	5.4%	-	-
	B-5	Me Pu	0	8	28	44	45	145	2,972	2,592
			0.0%	3.0%	10.4%	16.3%	16.7%	53.7%	-	-
	B-6	Sung Nhon	2	9	38	28	38	50	2,510	2,038
			1.2%	5.5%	23.0%	17.0%	23.0%	30.3%	-	-
	B-7	Da Kai	3	12	28	47	27	117	2,818	2,493
			1.3%	5.1%	12.0%	20.1%	11.5%	50.0%	-	-
Subtotal			**7**	**45**	**133**	**185**	**178**	**698**	**3,439**	**2,754**
			0.5%	3.4%	10.0%	14.0%	13.4%	52.7%	-	-
TOTAL			**58**	**331**	**789**	**765**	**599**	**1333**	**2,754**	**2,037**
			1.5%	**8.5%**	**20.4%**	**19.7%**	**15.5%**	**34.4%**		

Local people keep a variety of income sources such as not only main jobs as farming but also seasonal immigrant works and some of remittance. Moreover, thanks to the growth of chances to engage in retail side business for many of them, the basic trend of income is judged to have grown for the past years. **Income amount itself was not asked in the survey because it is difficult for interviewees to answer due to many/easily fluctuated varieties of the income sources as mentioned.

(Expense on water use)

Some of the communes where they have to purchase water need to allocate more budgets on water than others. More people spend money on water in such communes as K-3: Cam Hai Tay and N-4: Phuoc Minh

Table 3.2.7 Percentage of Expense on Water among Monthly Budget in Dry Season

			Zero	Less than 1%	1-5%	5-10%	More than 10%
Phu Yen	P-1	Xuan Phuoc	178	1	1	0	0
			98.9%	0.6%	0.6%	0.0%	0.0%
	P-2	An Dinh	20	6	84	45	3
			12.9%	3.9%	54.2%	29.0%	1.9%
	P-3	An Tho	63	2	7	2	0
			85.1%	2.7%	9.5%	2.7%	0.0%
	P-4	An My	250	17	14	1	0
			88.7%	6.0%	5.0%	0.4%	0.0%
	P-5	Son Phuoc	58	8	3	0	0
			84.1%	11.6%	4.3%	0.0%	0.0%
	P-6	Ea Cha Rang	47	3	8	1	0
			79.7%	5.1%	13.6%	1.7%	0.0%
	P-7	Suoi Bac	98	21	25	1	0
			67.6%	14.5%	17.2%	0.7%	0.0%
	P-8	Son Thanh Dong	186	2	1	0	0
			98.4%	1.1%	0.5%	0.0%	0.0%
Subtotal			**900**	**60**	**143**	**50**	**3**
			78.1%	**5.2%**	**12.4%**	**4.3%**	**0.3%**
Khanh Hoa	K-1	Cam An Bac	77	2	35	3	0
			65.8%	1.7%	29.9%	2.6%	0.0%
	K-2	Cam Hiep Nam	119	2	7	2	0
			91.5%	1.5%	5.4%	1.5%	0.0%
	K-3	Cam Hai Tay	91	9	62	71	35
			39.1%	3.9%	26.6%	30.5%	15.0%
Subtotal			**287**	**13**	**104**	**76**	**35**
			59.8%	**2.7%**	**21.7%**	**15.8%**	**7.3%**
Ninh Thuan	N-1	Nhon Hai	21	7	167	45	11
			8.8%	2.9%	69.6%	18.8%	4.6%
	N-2	Cong Hai	126	4	16	3	2
			84.6%	2.7%	10.7%	2.0%	1.3%
	N-3	Bac Son	54	20	52	4	0
			41.5%	15.4%	40.0%	3.1%	0.0%
	N-4	Phuoc Minh	12	2	32	43	6
			13.5%	2.2%	36.0%	48.3%	6.7%
	N-5	Phuoc Hai	129	39	61	1	0
			56.1%	17.0%	26.5%	0.4%	0.0%
	N-6	Phuoc Dinh	46	65	45	2	0
			29.1%	41.1%	28.5%	1.3%	0.0%
Subtotal			**388**	**137**	**373**	**98**	**19**
			39.0%	**13.8%**	**37.4%**	**9.8%**	**1.9%**
Binh Thuan	B-1	Muong Man	43	11	59	27	13
			30.7%	7.9%	42.1%	19.3%	9.3%
	B-2	Gia Huynh	107	2	7	2	0
			90.7%	1.7%	5.9%	1.7%	0.0%
	B-3	Nghi Duc	121	33	46	3	2
			59.6%	16.3%	22.7%	1.5%	1.0%
	B-4	Tan Duc	105	2	7	2	0
			90.5%	1.7%	6.0%	1.7%	0.0%
	B-5	Me Pu	83	136	50	1	0
			30.7%	50.4%	18.5%	0.4%	0.0%
	B-6	Sung Nhon	165	0	0	0	0
			100.0%	0.0%	0.0%	0.0%	0.0%
	B-7	Da Kai	142	69	21	2	0
			60.7%	29.5%	9.0%	0.9%	0.0%
Subtotal			**766**	**253**	**190**	**37**	**15**
			61.5%	**20.3%**	**15.2%**	**3.0%**	**1.2%**
TOTAL			**2,341**	**463**	**810**	**261**	**72**
			60.4%	**11.9%**	**20.9%**	**6.7%**	**1.9%**

As reference, the following table shows the percentage of expense on electricity in the same manner. In general more people spend on electricity than water use, as the Mode falls on 1-5% of total expense. **Electricity has already been installed in most of locations in the survey area.

Table 3.2.8 Percentage of Expense on Electricity among Monthly Budget

			Zero	Less than 1%	1-5%	5-10%	More than 10%
Phu Yen	P-1	Xuan Phuoc	0	8	144	25	3
			0.0%	4.4%	80.0%	13.9%	1.7%
	P-2	An Dinh	0	6	117	26	6
			0.0%	3.9%	75.5%	16.8%	3.9%
	P-3	An Tho	0	4	65	4	1
			0.0%	5.4%	87.8%	5.4%	1.4%
	P-4	An My	4	11	241	26	0
			1.4%	3.9%	85.5%	9.2%	0.0%
	P-5	Son Phuoc	0	0	8	23	38
			0.0%	0.0%	10.8%	31.1%	51.4%
	P-6	Ea Cha Rang	4	21	31	3	0
			6.8%	35.6%	52.5%	5.1%	0.0%
	P-7	Suoi Bac	3	11	122	8	1
			2.1%	7.6%	84.1%	5.5%	0.7%
	P-8	Son Thanh Dong	5	13	160	10	1
			2.6%	6.9%	84.7%	5.3%	0.5%
Subtotal			**16**	**74**	**888**	**125**	**50**
			1.4%	**6.4%**	**77.0%**	**10.8%**	**4.3%**
Khanh Hoa	K-1	Cam An Bac	0	5	100	12	0
			0.0%	4.3%	85.5%	10.3%	0.0%
	K-2	Cam Hiep Nam	56	4	65	4	1
			43.1%	3.1%	50.0%	3.1%	0.8%
	K-3	Cam Hai Tay	1	7	157	53	15
			0.4%	3.0%	67.4%	22.7%	6.4%
Subtotal			**57**	**16**	**322**	**69**	**16**
			13.4%	**3.8%**	**75.9%**	**16.3%**	**3.8%**
Ninh Thuan	N-1	Nhon Hai	0	13	195	21	11
			0.0%	5.4%	81.3%	8.8%	4.6%
	N-2	Cong Hai	1	5	120	22	1
			0.7%	3.4%	80.5%	14.8%	0.7%
	N-3	Bac Son	4	14	107	5	0
			3.1%	10.8%	82.3%	3.8%	0.0%
	N-4	Phuoc Minh	0	2	79	8	0
			0.0%	2.2%	88.8%	9.0%	0.0%
	N-5	Phuoc Hai	0	23	188	15	4
			0.0%	10.0%	81.7%	6.5%	1.7%
	N-6	Phuoc Dinh	1	17	122	16	2
			0.6%	10.8%	77.2%	10.1%	1.3%
Subtotal			**6**	**74**	**811**	**87**	**18**
			0.6%	**7.4%**	**81.4%**	**8.7%**	**1.8%**
Binh Thuan	B-1	Muong Man	14	9	90	19	8
			10.0%	6.4%	64.3%	13.6%	5.7%
	B-2	Gia Huynh	3	19	92	2	2
			2.5%	16.1%	78.0%	1.7%	1.7%
	B-3	Nghi Duc	26	167	10	0	0
			12.8%	82.3%	4.9%	0.0%	0.0%
	B-4	Tan Duc	7	22	75	10	2
			6.0%	19.0%	64.7%	8.6%	1.7%
	B-5	Me Pu	1	55	199	10	5
			0.4%	20.4%	73.7%	3.7%	1.9%
	B-6	Sung Nhon	1	28	127	9	0
			0.6%	17.0%	77.0%	5.5%	0.0%
	B-7	Da Kai	1	30	178	17	8
			0.4%	12.8%	76.1%	7.3%	3.4%
Subtotal			**53**	**163**	**761**	**67**	**25**
			18.5%	**13.1%**	**61.1%**	**5.4%**	**2.0%**
TOTAL			**132**	**327**	**2782**	**348**	**109**
			3.4%	**8.4%**	**71.8%**	**9.0%**	**2.8%**

3.2.3 Sanitary Condition

(Toilet)

Pervasion of toilet installation varies among communes, however, as the basic trend Phu Yen province has smaller pervasion rate and Khanh Hoa has larger to the contrary. The government has been promoting toilet installation nationwide through governmental project and/or some loan/grant program, but local people's acceptance as well as continuous use of toilet after their installation is influenced by types of toilets along with their own culture.

Table 3.2.9 Types of Toilet

			Have toilet				Not have toilet			Have toilet Sub-total (1-4)	No toilet Sub-total (5-7)
			Septic tank-1	DVCL-2	Ventilated-3	Pour flush-4	Dug hole-5	Temporary-6	Open air-7		
Phu Yen	P-1	Xuan Phuoc	0	29	0	2	1	5	143	31	149
			0.0%	16.1%	0.0%	1.1%	0.6%	2.8%	79.4%	17.2%	82.8%
	P-2	An Dinh	26	0	2	20	7	9	91	48	107
			16.8%	0.0%	1.3%	12.9%	4.5%	5.8%	58.7%	31.0%	69.0%
	P-3	An Tho	0	0	0	7	2	4	61	7	67
			0.0%	0.0%	0.0%	9.5%	2.7%	5.4%	82.4%	9.5%	90.5%
	P-4	An My	20	24	1	64	13	22	138	109	173
			7.1%	8.5%	0.4%	22.7%	4.6%	7.8%	48.9%	38.7%	61.3%
	P-5	Son Phuoc	2	0	0	1	5	0	61	3	66
			2.9%	0.0%	0.0%	1.4%	7.2%	0.0%	88.4%	4.3%	95.7%
	P-6	Ea Cha Rang	1	2		0	3	0	53	3	56
			1.7%	3.4%	0.0%	0.0%	5.1%	0.0%	89.8%	5.1%	94.9%
	P-7	Suoi Bac	0	46	0	19	2	2	76	65	80
			0.0%	31.7%	0.0%	13.1%	1.4%	1.4%	52.4%	44.8%	55.2%
	P-8	Son Thanh Dong	16	6	2	0	101	21	43	24	165
			8.5%	3.2%	1.1%	0.0%	53.4%	11.1%	22.8%	12.7%	87.3%
Subtotal			**65**	**107**	**5**	**113**	**134**	**63**	**666**	**290**	**863**
			5.6%	9.3%	0.4%	9.8%	11.6%	5.5%	57.8%	25.2%	74.8%
Khanh Hoa	K-1	Cam An Bac	5	0	39	3	54	14	2	47	70
			4.3%	0.0%	33.3%	2.6%	46.2%	12.0%	1.7%	40.2%	59.8%
	K-2	Cam Hiep Nam	32	10	1	40	5	27	15	83	47
			24.6%	7.7%	0.8%	30.8%	3.8%	20.8%	11.5%	63.8%	36.2%
	K-3	Cam Hai Tay	5	0	0	160	6	4	58	165	68
			2.1%	0.0%	0.0%	68.7%	2.6%	1.7%	24.9%	70.8%	29.2%
Subtotal			**42**	**10**	**40**	**203**	**65**	**45**	**75**	**295**	**185**
			8.8%	2.1%	8.3%	42.3%	13.5%	9.4%	15.6%	61.5%	38.5%
Ninh Thuan	N-1	Nhon Hai	7	3	1	124	8	17	80	135	105
			2.9%	1.3%	0.4%	51.7%	3.3%	7.1%	33.3%	56.3%	43.8%
	N-2	Cong Hai	4	0	0	7	0	0	138	11	138
			2.7%	0.0%	0.0%	4.7%	0.0%	0.0%	92.6%	7.4%	92.6%
	N-3	Bac Son	2	0	0	5	0	1	122	7	123
			1.5%	0.0%	0.0%	3.8%	0.0%	0.8%	93.8%	5.4%	94.6%
	N-4	Phuoc Minh	0	2	0	44	6	2	35	46	43
			0.0%	2.2%	0.0%	49.4%	6.7%	2.2%	39.3%	51.7%	48.3%
	N-5	Phuoc Hai	1	0	0	132	7	1	89	133	97
			0.4%	0.0%	0.0%	57.4%	3.0%	0.4%	38.7%	57.8%	42.2%
	N-6	Phuoc Dinh	3	0	81	0	3	6	65	84	74
			1.9%	0.0%	51.3%	0.0%	1.9%	3.8%	41.1%	53.2%	46.8%
Subtotal			**17**	**5**	**82**	**312**	**24**	**27**	**529**	**416**	**580**
			1.7%	0.5%	8.2%	31.3%	2.4%	2.7%	53.1%	41.8%	58.2%
Binh Thuan	B-1	Muong Man	48	4	4	20	30	6	28	76	64
			34.3%	2.9%	2.9%	14.3%	21.4%	4.3%	20.0%	54.3%	45.7%
	B-2	Gia Huynh	1	11	6	22	48	7	23	40	78
			0.8%	9.3%	5.1%	18.6%	40.7%	5.9%	19.5%	33.9%	66.1%
	B-3	Nghi Duc	0	0	0	57	89	57	0	57	146
			0.0%	0.0%	0.0%	28.1%	43.8%	28.1%	0.0%	28.1%	71.9%
	B-4	Tan Duc	3	2	4	39	8	7	53	48	68
			2.6%	1.7%	3.4%	33.6%	6.9%	6.0%	45.7%	41.4%	58.6%
	B-5	Me Pu	8	28	1	98	122	9	5	134	136
			3.0%	10.4%	0.4%	36.3%	45.2%	3.3%	1.9%	49.6%	50.4%
	B-6	Sung Nhon	1	33	1	39	7	83	1	74	91
			0.6%	20.0%	0.6%	23.6%	4.2%	50.3%	0.6%	44.8%	55.2%
	B-7	Da Kai	12	26	0	83	24	73	16	121	113
			5.1%	11.1%	0.0%	35.5%	10.3%	31.2%	6.8%	51.7%	48.3%
Subtotal			**73**	**104**	**16**	**358**	**328**	**242**	**126**	**550**	**696**
			5.9%	8.3%	1.3%	28.7%	26.3%	19.4%	10.1%	44.1%	55.9%
TOTAL			**197**	**226**	**143**	**986**	**551**	**377**	**1,396**	**1,551**	**2,324**
			5.1%	**5.8%**	**3.7%**	**25.4%**	**14.2%**	**9.7%**	**36.0%**	**40.0%**	**60.0%**

Among persons who do not have installed toilet, who answered "open air-7" for the question on

toilet types they have, only quite limited number of people, about 3%, answered they use the residue/excremental matters as fertilizer.

(Water related disease)

Although nearly half of them rarely contract water related diseases, the remaining half in the survey area expressed diarrhea, skin disease as well as Trachoma as major diseases they contract, and those as still one of their concerns on their daily lives.

Table 3.2.10 Water related Diseases

			Diarrhea	Cholera	Dysentery	Hepatitis	Malaria	Schistsome	Trachoma	Skin diseases	Other	No contracts
Phu Yen	P-1	Xuan Phuoc	46	12	0	2	32	24	23	58	36	75
			25.6%	6.7%	0.0%	1.1%	17.8%	13.3%	12.8%	32.2%	20.0%	41.7%
	P-2	An Dinh	18	6	0	3	5	3	13	6	13	107
			11.6%	3.9%	0.0%	1.9%	3.2%	1.9%	8.4%	3.9%	8.4%	69.0%
	P-3	An Tho	10	3	3	1	19	1	6	15	17	35
			13.5%	4.1%	4.1%	1.4%	25.7%	1.4%	8.1%	20.3%	23.0%	47.3%
	P-4	An My	2	4	0	4	2	3	1	6	5	260
			0.7%	1.4%	0.0%	1.4%	0.7%	1.1%	0.4%	2.1%	1.8%	92.2%
	P-5	Son Phuoc	54	1	0	1	38	21	7	14	2	8
			78.3%	1.4%	0.0%	1.4%	55.1%	30.4%	10.1%	20.3%	2.9%	11.6%
	P-6	Ea Cha Rang	47	1	0	1	24	32	9	23	3	4
			79.7%	1.7%	0.0%	1.7%	40.7%	54.2%	15.3%	39.0%	5.1%	6.8%
	P-7	Suoi Bac	0	0	0	0	0	0	0	0	0	145
			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	P-8	Son Thanh Dong	30	3	2	4	28	2	6	25	0	127
			15.9%	1.6%	1.1%	2.1%	14.8%	1.1%	3.2%	13.2%	0.0%	67.2%
Subtotal			**207**	**30**	**5**	**16**	**148**	**86**	**65**	**147**	**76**	**761**
			18.0%	2.6%	0.4%	1.4%	12.8%	7.5%	5.6%	12.7%	6.6%	66.0%
Khanh Hoa	K-1	Cam An Bac	26	2	0	5	6	27	16	44	26	32
			22.2%	1.7%	0.0%	4.3%	5.1%	23.1%	13.7%	37.6%	22.2%	27.4%
	K-2	Cam Hiep Nam	2	0	0	0	0	0	0	8	13	111
			1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.2%	10.0%	85.4%
	K-3	Cam Hai Tay	0	0	0	0	0	0	0	0	0	233
			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Subtotal			**28**	**2**	**0**	**5**	**6**	**27**	**16**	**52**	**39**	**376**
			6%	0%	0%	1%	1%	6%	3%	11%	8%	78%
Ninh Thuan	N-1	Nhon Hai	20	2	0	0	4	22	6	18	1	202
			8.3%	0.8%	0.0%	0.0%	1.7%	9.2%	2.5%	7.5%	0.4%	84.2%
	N-2	Cong Hai	82	42	0	5	44	15	79	1	31	0
			55.0%	28.2%	0.0%	3.4%	29.5%	10.1%	53.0%	0.7%	20.8%	0.0%
	N-3	Bac Son	64	17	0	6	64	23	62	50	8	26
			49.2%	13.1%	0.0%	4.6%	49.2%	17.7%	47.7%	38.5%	6.2%	20.0%
	N-4	Phuoc Minh	6	0	1	0	2	8	21	27	7	46
			6.7%	0.0%	1.1%	0.0%	2.2%	9.0%	23.6%	30.3%	7.9%	51.7%
	N-5	Phuoc Hai	21	2	0	0	1	0	7	14	50	152
			9.1%	0.9%	0.0%	0.0%	0.4%	0.0%	3.0%	6.1%	21.7%	66.1%
	N-6	Phuoc Dinh	3	0	0	0	2	0	3	2	45	115
			1.9%	0.0%	0.0%	0.0%	1.3%	0.0%	1.9%	1.3%	28.5%	72.8%
Subtotal			**196**	**63**	**1**	**11**	**117**	**68**	**178**	**112**	**142**	**541**
			19.7%	6.3%	0.1%	1.1%	11.7%	6.8%	17.9%	11.2%	14.3%	54.3%
Binh Thuan	B-1	Muong Man	38	8	6	4	11	24	35	42	17	73
			27.1%	5.7%	4.3%	2.9%	7.9%	17.1%	25.0%	30.0%	12.1%	52.1%
	B-2	Gia Huynh	5	20	0	2	42	25	12	19	80	14
			4.2%	16.9%	0.0%	1.7%	35.6%	21.2%	10.2%	16.1%	67.8%	11.9%
	B-3	Nghi Duc	88	6	0	11	43	115	72	89	62	38
			43.3%	3.0%	0.0%	5.4%	21.2%	56.7%	35.5%	43.8%	30.5%	18.7%
	B-4	Tan Duc	14	1	0	4	9	2	2	5	35	63
			12.1%	0.9%	0.0%	3.4%	7.8%	1.7%	1.7%	4.3%	30.2%	54.3%
	B-5	Me Pu	29	5	0	5	20	5	2	11	33	157
			10.7%	1.9%	0.0%	1.9%	7.4%	1.9%	0.7%	4.1%	12.2%	58.1%
	B-6	Sung Nhon	35	2	1	16	4	10	28	28	38	77
			21.2%	1.2%	0.6%	9.7%	2.4%	6.1%	17.0%	17.0%	23.0%	46.7%
	B-7	Da Kai	24	0	2	0	1	13	10	16	11	187
			10.3%	0.0%	0.9%	0.0%	0.4%	5.6%	4.3%	6.8%	4.7%	79.9%
Subtotal			**233**	**42**	**9**	**42**	**130**	**194**	**161**	**210**	**276**	**609**
			18.7%	3.4%	0.7%	3.4%	10.4%	15.6%	12.9%	16.9%	22.2%	48.9%
TOTAL			**459**	**111**	**10**	**62**	**255**	**292**	**356**	**380**	**462**	**1,786**
			11.8%	**2.9%**	**0.3%**	**1.6%**	**6.6%**	**7.5%**	**9.2%**	**9.8%**	**11.9%**	**46.1%**

Other:
Gynaecological:
Teeth: discolour, lose early
Stomachache, Large intestine
Marsh fever
Bronchocele
Kidney stone

3.2.4 Demands on Water Supply on Water Supply and Sanitary Condition

(1) Water supply

(Demands on water supply)

The degree of demands on additional water supply differs by communes, according with the currently available water in each commune. The following table shows the details of those demands on how much they need more water, comparing with the present volume:

Table 3.2.11 Demands on Water Supply

			Much more	Slightly more	If possible	Currently enough	Other
Phu Yen	P-1	Xuan Phuoc	79	13	19	69	0
			43.9%	7.2%	10.6%	38.3%	0.0%
	P-2	An Dinh	32	8	2	112	1
			20.6%	5.2%	1.3%	72.3%	0.6%
	P-3	An Tho	51	9	8	6	0
			68.9%	12.2%	10.8%	8.1%	0.0%
	P-4	An My	53	28	9	192	0
			18.8%	9.9%	3.2%	68.1%	0.0%
	P-5	Son Phuoc	37	12	3	17	0
			53.6%	17.4%	4.3%	24.6%	0.0%
	P-6	Ea Cha Rang	39	17	1	2	0
			66.1%	28.8%	1.7%	3.4%	0.0%
	P-7	Suoi Bac	72	9	24	40	0
			49.7%	6.2%	16.6%	27.6%	0.0%
	P-8	Son Thanh Dong	55	17	18	99	0
			29.1%	9.0%	9.5%	52.4%	0.0%
Subtotal			**418**	**113**	**84**	**537**	**1**
			36.3%	**9.8%**	**7.3%**	**46.6%**	**0.1%**
Khanh Hoa	K-1	Cam An Bac	50	41	24	2	0
			42.7%	35.0%	20.5%	1.7%	0.0%
	K-2	Cam Hiep Nam	60	27	3	40	0
			46.2%	20.8%	2.3%	30.8%	0.0%
	K-3	Cam Hai Tay	150	17	37	29	0
			64.4%	7.3%	15.9%	12.4%	0.0%
Subtotal			**260**	**85**	**64**	**71**	**0**
			31.0%	**10.1%**	**7.6%**	**8.5%**	**0.0%**
Ninh Thuan	N-1	Nhon Hai	176	19	40	3	2
			73.3%	7.9%	16.7%	1.3%	0.8%
	N-2	Cong Hai	108	31	4	6	0
			72.5%	20.8%	2.7%	4.0%	0.0%
	N-3	Bac Son	117	6	0	7	0
			90.0%	4.6%	0.0%	5.4%	0.0%
	N-4	Phuoc Minh	81	6	0	2	0
			91.0%	6.7%	0.0%	2.2%	0.0%
	N-5	Phuoc Hai	109	39	14	68	0
			47.4%	17.0%	6.1%	29.6%	0.0%
	N-6	Phuoc Dinh	59	30	20	48	1
			37.3%	19.0%	12.7%	30.4%	0.6%
Subtotal			**650**	**131**	**78**	**134**	**3**
			65.3%	**13.2%**	**7.8%**	**13.5%**	**0.3%**
Binh Thuan	B-1	Muong Man	81	31	8	20	0
			57.9%	22.1%	5.7%	14.3%	0.0%
	B-2	Gia Huynh	85	16	16	1	0
			72.0%	13.6%	13.6%	0.8%	0.0%
	B-3	Nghi Duc	101	44	12	46	0
			49.8%	21.7%	5.9%	22.7%	0.0%
	B-4	Tan Duc	84	11	8	12	1
			72.4%	9.5%	6.9%	10.3%	0.9%
	B-5	Me Pu	73	57	2	138	0
			27.0%	21.1%	0.7%	51.1%	0.0%
	B-6	Sung Nhon	38	45	32	50	0
			23.0%	27.3%	19.4%	30.3%	0.0%
	B-7	Da Kai	91	42	15	85	1
			38.5%	17.9%	6.4%	36.3%	0.4%
Subtotal			**553**	**246**	**93**	**352**	**2**
			44.4%	**19.8%**	**7.5%**	**28.3%**	**0.2%**
TOTAL			**1,881**	**575**	**319**	**1,094**	**6**
			48.5%	**14.8%**	**8.2%**	**28.2%**	**0.2%**

(Demands on allocation of water use)

The survey also clarifies demands of water allocation from the viewpoint of usage purpose. Drinking use drew more answers among all, and then, cooking, and bathing along with the order. The table shows the results responding to the question: on what usage purpose you would like to increase the volume of water, by multiple answers allowing 3 items at max.

Table 3.2.12 Demands on Water Use Allocation

			Drinking	Cooking	Washing	Bathing	Toliet	Kitchen garden	Animal	Farming	Total
Phu Yen	P-1	Xuan Phuoc	109	97	16	62	0	0	0	3	287
			60.6%	53.9%	8.9%	34.4%	0.0%	0.0%	0.0%	1.7%	
	P-2	An Dinh	29	21	28	28	1	1	11	1	191
			18.7%	13.5%	18.1%	18.1%	0.6%	0.6%	7.1%	0.6%	
	P-3	An Tho	42	21	32	42	8	11	31	4	191
			56.8%	28.4%	43.2%	56.8%	10.8%	14.9%	41.9%	5.4%	
	P-4	An My	56	32	33	34	3	15	21	12	206
			19.9%	11.3%	11.7%	12.1%	1.1%	5.3%	7.4%	4.3%	
	P-5	Son Phuoc	52	41	5	25	4	0	0	1	128
			75.4%	59.4%	7.2%	36.2%	5.8%	0.0%	0.0%	1.4%	
	P-6	Ea Cha Rang	57	56	1	19	0	0	0	0	133
			96.6%	94.9%	1.7%	32.2%	0.0%	0.0%	0.0%	0.0%	
	P-7	Suoi Bac	85	79	48	69	0	0	0	6	287
			58.6%	54.5%	33.1%	47.6%	0.0%	0.0%	0.0%	4.1%	
	P-8	on Thanh Dor	16	43	58	63	1	17	11	14	223
			8.5%	22.8%	30.7%	33.3%	0.5%	9.0%	5.8%	7.4%	
Subtotal			**446**	**390**	**221**	**342**	**17**	**44**	**74**	**41**	**1,646**
			38.7%	**33.8%**	**19.2%**	**29.7%**	**1.5%**	**3.8%**	**6.4%**	**3.6%**	
Khanh Hoa	K-1	Cam An Bac	106	110	12	67	1	0	1	3	300
			90.6%	94.0%	10.3%	57.3%	0.9%	0.0%	0.9%	2.6%	
	K-2	Cam Hiep Nar	87	87	3	81	1	0	0	0	259
			66.9%	66.9%	2.3%	62.3%	0.8%	0.0%	0.0%	0.0%	
	K-3	Cam Hai Tay	205	198	32	186	1	5	0	1	628
			88.0%	85.0%	13.7%	79.8%	0.4%	2.1%	0.0%	0.4%	
Subtotal			**398**	**395**	**47**	**334**	**3**	**5**	**1**	**4**	**1,187**
			82.9%	**82.3%**	**9.8%**	**69.6%**	**0.6%**	**1.0%**	**0.2%**	**0.8%**	
Ninh Thuan	N-1	Nhon Hai	225	216	85	170	0	0	2	6	704
			93.8%	90.0%	35.4%	70.8%	0.0%	0.0%	0.8%	2.5%	
	N-2	Cong Hai	142	111	48	86	2	4	3	3	399
			95.3%	74.5%	32.2%	57.7%	1.3%	2.7%	2.0%	2.0%	
	N-3	Bac Son	70	89	70	108	0	2	9	16	364
			53.8%	68.5%	53.8%	83.1%	0.0%	1.5%	6.9%	12.3%	
	N-4	Phuoc Minh	87	87	0	68	0	1	0	0	243
			97.8%	97.8%	0.0%	76.4%	0.0%	1.1%	0.0%	0.0%	
	N-5	Phuoc Hai	179	171	6	126	0	0	8	2	492
			77.8%	74.3%	2.6%	54.8%	0.0%	0.0%	3.5%	0.9%	
	N-6	Phuoc Dinh	79	98	47	82	4	3	4	4	321
			50.0%	62.0%	29.7%	51.9%	2.5%	1.9%	2.5%	2.5%	
Subtotal			**782**	**772**	**256**	**640**	**6**	**10**	**26**	**31**	**2,523**
			78.5%	**77.5%**	**25.7%**	**64.3%**	**0.6%**	**1.0%**	**2.6%**	**3.1%**	
Binh Thuan	B-1	Muong Man	108	111	11	81	4	1	0	26	342
			77.1%	79.3%	7.9%	57.9%	2.9%	0.7%	0.0%	18.6%	
	B-2	Gia Huynh	115	100	11	60	0	2	3	0	291
			97.5%	84.7%	9.3%	50.8%	0.0%	1.7%	2.5%	0.0%	
	B-3	Nghi Duc	155	145	8	115	0	0	5	9	437
			76.4%	71.4%	3.9%	56.7%	0.0%	0.0%	2.5%	4.4%	
	B-4	Tan Duc	99	90	22	46	1	1	2	2	263
			85.3%	77.6%	19.0%	39.7%	0.9%	0.9%	1.7%	1.7%	
	B-5	Me Pu	112	110	38	71	3	4	16	3	357
			41.5%	40.7%	14.1%	26.3%	1.1%	1.5%	5.9%	1.1%	
	B-6	Sung Nhon	111	111	101	6	0	7	3	4	343
			67.3%	67.3%	61.2%	3.6%	0.0%	4.2%	1.8%	2.4%	
	B-7	Da Kai	70	70	5	31	5	1	3	6	191
			29.9%	29.9%	2.1%	13.2%	2.1%	0.4%	1.3%	2.6%	
Subtotal			**770**	**737**	**196**	**410**	**13**	**16**	**32**	**50**	**2,224**
			61.8%	**59.1%**	**15.7%**	**32.9%**	**1.0%**	**1.3%**	**2.6%**	**4.0%**	
TOTAL			**2,396**	**2,294**	**720**	**1,726**	**39**	**75**	**133**	**126**	**7,580**
			61.8%	**59.2%**	**18.6%**	**44.5%**	**1.0%**	**1.9%**	**3.4%**	**3.3%**	

(Willingness/affordability of payment for water supply)

Under the assumption that they would gain water in more stable mode with assured quality, they expressed their own affordable payment ceilings as follows. The questions divide initial installation cost as well as their running cost monthly.

Willingness/affordability of payment for the initial cost on water supply

Table 3.2.13 Willingness/Affordability to Pay for Installation Cost (house connection) of Water Supply (000VND)

			Less than 300	300-500	500-800	800-1,000	More than 1,000
Phu Yen	P-1	Xuan Phuoc	107	45	9	13	6
			59.4%	25.0%	5.0%	7.2%	3.3%
	P-2	An Dinh	77	31	21	14	12
			49.7%	20.0%	13.5%	9.0%	7.7%
	P-3	An Tho	18	35	7	9	5
			24.3%	47.3%	9.5%	12.2%	6.8%
	P-4	An My	146	67	41	14	14
			51.8%	23.8%	14.5%	5.0%	5.0%
	P-5	Son Phuoc	36	8	7	7	11
			52.2%	11.6%	10.1%	10.1%	15.9%
	P-6	Ea Cha Rang	32	11	9	3	4
			54.2%	18.6%	15.3%	5.1%	6.8%
	P-7	Suoi Bac	62	38	25	8	12
			42.8%	26.2%	17.2%	5.5%	8.3%
	P-8	Son Thanh Dong	93	44	14	17	21
			49.2%	23.3%	7.4%	9.0%	11.1%
Subtotal			**571**	**279**	**133**	**85**	**85**
			49.5%	**24.2%**	**11.5%**	**7.4%**	**7.4%**
Khanh Hoa	K-1	Cam An Bac	69	31	10	6	1
			59.0%	26.5%	8.5%	5.1%	0.9%
	K-2	Cam Hiep Nam	64	52	7	1	6
			49.2%	40.0%	5.4%	0.8%	4.6%
	K-3	Cam Hai Tay	82	88	44	7	12
			35.2%	37.8%	18.9%	3.0%	5.2%
Subtotal			**215**	**171**	**61**	**14**	**19**
			44.8%	**35.6%**	**12.7%**	**2.9%**	**4.0%**
Ninh Thuan	N-1	Nhon Hai	13	100	86	35	6
			5.4%	41.7%	35.8%	14.6%	2.5%
	N-2	Cong Hai	70	56	14	7	2
			47.0%	37.6%	9.4%	4.7%	1.3%
	N-3	Bac Son	90	27	5	6	2
			69.2%	20.8%	3.8%	4.6%	1.5%
	N-4	Phuoc Minh	6	41	34	4	4
			6.7%	46.1%	38.2%	4.5%	4.5%
	N-5	Phuoc Hai	79	108	29	8	6
			34.3%	47.0%	12.6%	3.5%	2.6%
	N-6	Phuoc Dinh	96	57	3	0	2
			60.8%	36.1%	1.9%	0.0%	1.3%
Subtotal			**354**	**389**	**171**	**60**	**22**
			35.5%	**39.1%**	**17.2%**	**6.0%**	**2.2%**
Binh Thuan	B-1	Muong Man	45	62	10	11	12
			32.1%	44.3%	7.1%	7.9%	8.6%
	B-2	Gia Huynh	43	59	8	6	2
			36.4%	50.0%	6.8%	5.1%	1.7%
	B-3	Nghi Duc	94	92	14	1	2
			46.3%	45.3%	6.9%	0.5%	1.0%
	B-4	Tan Duc	46	27	19	18	6
			39.7%	23.3%	16.4%	15.5%	5.2%
	B-5	Me Pu	102	101	21	29	17
			37.8%	37.4%	7.8%	10.7%	6.3%
	B-6	Sung Nhon	103	54	3	3	2
			62.4%	32.7%	1.8%	1.8%	1.2%
	B-7	Da Kai	112	81	15	20	6
			47.9%	34.6%	6.4%	8.5%	2.6%
Subtotal			**545**	**476**	**90**	**88**	**47**
			43.7%	**38.2%**	**7.2%**	**7.1%**	**3.8%**
TOTAL			**1,685**	**1,315**	**455**	**247**	**173**
			43.5%	**33.9%**	**11.7%**	**6.4%**	**4.5%**

Willingness/affordability of payment for the running cost on water supply

Table 3.2.14 Willingness/Affordability of Payment for Monthly Usage Cost (water tariff) of Water Supply (000VND)

			Less than 30	30-50	50-80	80-100	More than 100
Phu Yen	P-1	Xuan Phuoc	120	45	12	3	0
			66.7%	25.0%	6.7%	1.7%	0.0%
	P-2	An Dinh	95	14	16	18	12
			61.3%	9.0%	10.3%	11.6%	7.7%
	P-3	An Tho	62	7	3	2	0
			83.8%	9.5%	4.1%	2.7%	0.0%
	P-4	An My	212	63	6	0	1
			75.2%	22.3%	2.1%	0.0%	0.4%
	P-5	Son Phuoc	42	16	4	4	3
			60.9%	23.2%	5.8%	5.8%	4.3%
	P-6	Ea Cha Rang	37	14	1	3	4
			62.7%	23.7%	1.7%	5.1%	6.8%
	P-7	Suoi Bac	96	34	15	0	0
			84.0%	15.1%	0.9%	0.0%	0.0%
	P-8	Son Thanh Dong	110	59	11	4	5
			58.2%	31.2%	5.8%	2.1%	2.6%
Subtotal			**774**	**252**	**68**	**34**	**25**
			67.1%	**21.9%**	**5.9%**	**2.9%**	**2.2%**
Khanh Hoa	K-1	Cam An Bac	100	13	4	0	0
			85.5%	11.1%	3.4%	0.0%	0.0%
	K-2	Cam Hiep Nam	81	44	4	1	0
			62.3%	33.8%	3.1%	0.8%	0.0%
	K-3	Cam Hai Tay	85	101	34	5	8
			36.5%	43.3%	14.6%	2.1%	3.4%
Subtotal			**266**	**158**	**42**	**6**	**8**
			55.4%	**32.9%**	**8.8%**	**1.3%**	**1.7%**
Ninh Thuan	N-1	Nhon Hai	31	88	81	29	11
			12.9%	36.7%	33.8%	12.1%	4.6%
	N-2	Cong Hai	81	55	13	0	0
			54.4%	36.9%	8.7%	0.0%	0.0%
	N-3	Bac Son	106	20	4	0	0
			81.5%	15.4%	3.1%	0.0%	0.0%
	N-4	Phuoc Minh	31	54	4	0	0
			34.8%	60.7%	4.5%	0.0%	0.0%
	N-5	Phuoc Hai	169	56	4	0	1
			73.5%	24.3%	1.7%	0.0%	0.4%
	N-6	Phuoc Dinh	81	64	9	2	2
			51.3%	40.5%	5.7%	1.3%	1.3%
Subtotal			**499**	**337**	**115**	**31**	**14**
			50.1%	**33.8%**	**11.5%**	**3.1%**	**1.4%**
Binh Thuan	B-1	Muong Man	43	76	13	3	5
			30.7%	54.3%	9.3%	2.1%	3.6%
	B-2	Gia Huynh	61	25	10	11	11
			51.7%	21.2%	8.5%	9.3%	9.3%
	B-3	Nghi Duc	135	62	6	0	0
			66.5%	30.5%	3.0%	0.0%	0.0%
	B-4	Tan Duc	50	42	14	4	6
			43.1%	36.2%	12.1%	3.4%	5.2%
	B-5	Me Pu	172	81	10	5	2
			63.7%	30.0%	3.7%	1.9%	0.7%
	B-6	Sung Nhon	158	6	1	0	0
			95.8%	3.6%	0.6%	0.0%	0.0%
	B-7	Da Kai	162	51	10	5	6
			69.2%	21.8%	4.3%	2.1%	2.6%
Subtotal			**781**	**343**	**64**	**28**	**30**
			62.7%	**27.5%**	**5.1%**	**2.2%**	**2.4%**
TOTAL			**2,320**	**1,090**	**289**	**99**	**77**
			59.9%	**28.1%**	**7.5%**	**2.6%**	**2.0%**

(2) Sanitary Condition

(Demands on toilet installation)

Among the households who do not have toilet at present, about 60% of them showed strong necessity to install toilet. On the other hand, half of remained 40% of them put less priority to install as “if possible, would like to install” and the rest half showed least interests as “do not feel the

necessity so much", even though they do not have toilet.

Table 3.2.15 Necessity of Toilet Installation

			Strongly	If possible	Not so much
Phu Yen	P-1	Xuan Phuoc	87	17	53
			55.4%	10.8%	33.8%
	P-2	An Dinh	99	5	51
			63.9%	3.2%	32.9%
	P-3	An Tho	36	20	5
			59.0%	32.8%	8.2%
	P-4	An My	81	37	19
			59.1%	27.0%	13.9%
	P-5	Son Phuoc	28	30	3
			45.9%	49.2%	4.9%
	P-6	Ea Cha Rang	28	24	1
			52.8%	45.3%	1.9%
	P-7	Suoi Bac	33	22	19
			44.6%	29.7%	25.7%
	P-8	Son Thanh Dong	25	8	10
			58.1%	18.6%	23.3%
Subtotal			**417**	**163**	**161**
			56.3%	22.0%	21.7%
Khanh Hoa	K-1	Cam An Bac	2	0	0
			100.0%	0.0%	0.0%
	K-2	Cam Hiep Nam	14	1	0
			93.3%	6.7%	0.0%
	K-3	Cam Hai Tay	43	27	111
			23.8%	14.9%	61.3%
Subtotal			**59**	**28**	**111**
			29.8%	14.1%	56.1%
Ninh Thuan	N-1	Nhon Hai	69	11	0
			86.3%	13.8%	0.0%
	N-2	Cong Hai	77	22	5
			74.0%	21.2%	4.8%
	N-3	Bac Son	73	46	3
			59.8%	37.7%	2.5%
	N-4	Phuoc Minh	35	0	0
			39.3%	0.0%	0.0%
	N-5	Phuoc Hai	83	4	2
			93.3%	4.5%	2.2%
	N-6	Phuoc Dinh	63	2	0
			96.9%	3.1%	0.0%
Subtotal			**400**	**85**	**10**
			80.8%	17.2%	2.0%
Binh Thuan	B-1	Muong Man	18	7	3
			64.3%	25.0%	10.7%
	B-2	Gia Huynh	21	2	0
			91.3%	8.7%	0.0%
	B-3	Nghi Duc	0	0	0
			0.0%	0.0%	0.0%
	B-4	Tan Duc	47	5	1
			88.7%	9.4%	1.9%
	B-5	Me Pu	4	0	0
			100.0%	0.0%	0.0%
	B-6	Sung Nhon	1	0	0
			100.0%	0.0%	0.0%
	B-7	Da Kai	28	31	29
			31.8%	35.2%	33.0%
Subtotal			**119**	**45**	**33**
			60.4%	22.8%	16.8%
TOTAL			**995**	**321**	**315**
			61.0%	**19.7%**	**19.3%**

(Willingness/affordability of payment for toilet installation)

Including answer options to improve the toilets they have at present, all the interviewees expressed

how much they afford to pay for installation of toilet. The table shows the basic trend that more than half concentrate to less than 1 million VND as affordable amount to install, which is actually less than necessary cost, approximately estimated about 2 million VND.

To the contrary to the basic trend, some examples show stronger willingness to pay for toilet installation such as P-4: An My where nearly half of them chose 3 million to 5 million VND to afford under the relatively lower pervasion rate of toilet, 38%, in the An My commune.

Table 3.2.16 Willingness/Affordability to Pay for Installation Cost of Toilet (000VND)

			Less than 500	500-1,000	1,000-3,000	3,000-5,000	More than 5,000
Phu Yen	P-1	Xuan Phuoc	111	15	33	15	6
			61.7%	8.3%	18.3%	8.3%	3.3%
	P-2	An Dinh	64	31	54	5	1
			41.3%	20.0%	34.8%	3.2%	0.6%
	P-3	An Tho	17	12	26	15	4
			23.0%	16.2%	35.1%	20.3%	5.4%
	P-4	An My	52	27	37	140	26
			18.4%	9.6%	13.1%	49.6%	9.2%
	P-5	Son Phuoc	25	7	19	10	8
			34.3%	10.4%	28.4%	14.9%	11.9%
	P-6	Ea Cha Rang	32	11	9	3	4
			54.2%	18.6%	15.3%	5.1%	6.8%
	P-7	Suoi Bac	50	42	37	5	11
			34.0%	29.2%	25.7%	3.5%	7.6%
	P-8	Son Thanh Dong	80	35	47	17	10
			42.3%	18.5%	24.9%	9.0%	5.3%
Subtotal			**431**	**180**	**262**	**210**	**70**
			37.4%	15.6%	22.7%	18.2%	6.1%
Khanh Hoa	K-1	Cam An Bac	34	43	36	4	0
			29.1%	36.8%	30.8%	3.4%	0.0%
	K-2	Cam Hiep Nam	56	32	38	4	0
			43.1%	24.6%	29.2%	3.1%	0.0%
	K-3	Cam Hai Tay	87	69	47	18	12
			37.3%	29.6%	20.2%	7.7%	5.2%
Subtotal			**177**	**144**	**121**	**26**	**12**
			36.9%	30.0%	25.2%	5.4%	2.5%
Ninh Thuan	N-1	Nhon Hai	73	117	43	7	0
			30.4%	48.8%	17.9%	2.9%	0.0%
	N-2	Cong Hai	37	34	41	30	7
			24.8%	22.8%	27.5%	20.1%	4.7%
	N-3	Bac Son	60	6	35	24	5
			46.2%	4.6%	26.9%	18.5%	3.8%
	N-4	Phuoc Minh	16	39	27	5	2
			18.0%	43.8%	30.3%	5.6%	2.2%
	N-5	Phuoc Hai	56	82	82	9	1
			24.3%	35.7%	35.7%	3.9%	0.4%
	N-6	Phuoc Dinh	15	31	50	36	26
			9.5%	19.6%	31.6%	22.8%	16.5%
Subtotal			**257**	**309**	**278**	**111**	**41**
			25.8%	31.0%	27.9%	11.1%	4.1%
Binh Thuan	B-1	Muong Man	48	57	24	5	6
			34.3%	40.7%	17.1%	3.6%	4.3%
	B-2	Gia Huynh	50	52	16	0	0
			42.4%	44.1%	13.6%	0.0%	0.0%
	B-3	Nghi Duc	103	45	33	20	2
			50.7%	22.2%	16.3%	9.9%	1.0%
	B-4	Tan Duc	72	20	20	4	0
			62.1%	17.2%	17.2%	3.4%	0.0%
	B-5	Me Pu	84	70	47	30	39
			31.1%	25.9%	17.4%	11.1%	14.4%
	B-6	Sung Nhon	89	7	15	37	17
			53.9%	4.2%	9.1%	22.4%	10.3%
	B-7	Da Kai	188	16	22	8	0
			80.3%	6.8%	9.4%	3.4%	0.0%
Subtotal			**634**	**267**	**177**	**104**	**64**
			50.9%	21.4%	14.2%	8.3%	5.1%
TOTAL			**1,499**	**900**	**838**	**451**	**187**
			38.7%	**23.2%**	**21.6%**	**11.6%**	**4.8%**

The following information gives a view how much they put importance on the improvement of water supply and sanitary condition among all their possible concerns in their daily lives.

Among all the 16 issues in the question, “improvement of domestic water supply” gained the next

place to the most as their needs/concerns, following “health”. As to “toilet”, it also gained fifth placement among all, about 30% of their multiple answers.

The details are as follows: **The question allows 3 multiple answers at maximum.

Table 3.2.17 Concerns/Demands of Daily Lives (multiple answers: max 3 items)

			Food	Income	Fuelwood	Domestic wate	Crop	Road	Irrigation	Electricity	Education	Health	Toilet	Forest	Landslide	Land tenure	Transp mode	Other
Phu Yen	P-1	Xuan Phuoc	130	91	1	50	41	28	0	9	104	122	25	16	0	6	1	1
			72.2%	50.6%	0.6%	27.8%	22.8%	15.6%	0.0%	5.0%	57.8%	67.8%	13.9%	8.9%	0.0%	3.3%	0.6%	0.6%
	P-2	An Dinh	33	45	13	48	54	49	18	20	42	0	73	60	7	14	0	0
			21.3%	29.0%	8.4%	31.0%	34.8%	31.6%	11.6%	12.9%	27.1%	0.0%	47.1%	38.7%	4.5%	9.0%	0.0%	0.0%
	P-3	An Tho	5	9	1	54	12	54	2	2	39	65	29	0	0	0	0	0
			6.8%	12.2%	1.4%	73.0%	16.2%	73.0%	2.7%	2.7%	52.7%	87.8%	39.2%	0.0%	0.0%	0.0%	0.0%	0.0%
	P-4	An My	188	97	21	73	57	94	19	28	102	202	138	1	1	1	0	0
			66.7%	34.4%	7.4%	25.9%	20.2%	33.3%	6.7%	9.9%	36.2%	71.6%	48.9%	0.4%	0.4%	0.4%	0.0%	0.0%
	P-5	Son Phuoc	21	21	0	48	6	22	2	5	22	45	42	1	0	3	4	0
			30.4%	30.4%	0.0%	69.6%	8.7%	31.9%	2.9%	7.2%	31.9%	65.2%	60.9%	1.4%	0.0%	4.3%	5.8%	0.0%
	P-6	Ea Cha Rang	17	23	0	54	6	3	2	10	21	38	36	2	1	9		2
			28.8%	39.0%	0.0%	91.5%	10.2%	5.1%	3.4%	16.9%	35.6%	64.4%	61.0%	3.4%	1.7%	15.3%	0.0%	3.4%
	P-7	Suoi Bac	124	77	1	105	76	2	23	2	28	78	36	1	0	0	0	0
			85.5%	53.1%	0.7%	72.4%	52.4%	1.4%	15.9%	1.4%	19.3%	53.8%	24.8%	0.7%	0.0%	0.0%	0.0%	0.0%
	P-8	Son Thanh Dong	11	101	6	49	21	67	17	23	27	106	47	2	4	14	0	0
			5.8%	53.4%	3.2%	25.9%	11.1%	35.4%	9.0%	12.2%	14.3%	56.1%	24.9%	1.1%	2.1%	7.4%	0.0%	0.0%
Subtotal			**529**	**464**	**43**	**481**	**273**	**319**	**83**	**99**	**385**	**656**	**426**	**83**	**13**	**47**	**5**	**3**
			45.9%	**40.2%**	**3.7%**	**41.7%**	**23.7%**	**27.7%**	**7.2%**	**8.6%**	**33.4%**	**56.9%**	**36.9%**	**7.2%**	**1.1%**	**4.1%**	**0.4%**	**0.3%**
Khanh Hoa	K-1	Cam An Bac	25	58	5	90	66	6	9	2	68	83	67	1	3	3	0	1
			21.4%	49.6%	4.3%	76.9%	56.4%	5.1%	7.7%	1.7%	58.1%	70.9%	57.3%	0.9%	2.6%	2.6%	0.0%	0.9%
	K-2	Cam Hiep Nam	47	73	2	85	25	32	10	26	59	100	49	0	17	4	0	0
			36.2%	56.2%	1.5%	65.4%	19.2%	24.6%	7.7%	20.0%	45.4%	76.9%	37.7%	0.0%	13.1%	3.1%	0.0%	0.0%
	K-3	Cam Hai Tay	86	114	16	169	52	140	44	18	126	197	112	0	2	4	5	0
			36.9%	48.9%	6.9%	72.5%	22.3%	60.1%	18.9%	7.7%	54.1%	84.5%	48.1%	0.0%	0.9%	1.7%	2.1%	0.0%
Subtotal			**158**	**245**	**23**	**344**	**143**	**178**	**63**	**46**	**253**	**380**	**228**	**1**	**22**	**11**	**5**	**1**
			32.9%	**51.0%**	**4.8%**	**71.7%**	**29.8%**	**37.1%**	**13.1%**	**9.6%**	**52.7%**	**79.2%**	**47.5%**	**0.2%**	**4.6%**	**2.3%**	**1.0%**	**0.2%**
Ninh Thuan	N-1	Nhon Hai	233	220	35	212	17	18	27	2	119	161	64	2	1	0	0	5
			97.1%	91.7%	14.6%	88.3%	7.1%	7.5%	11.3%	0.8%	49.6%	67.1%	26.7%	0.8%	0.4%	0.0%	0.0%	2.1%
	N-2	Cong Hai	119	64	23	86	52	11	42	11	15	62	23	0	0	0	0	0
			79.9%	43.0%	15.4%	57.7%	34.9%	7.4%	28.2%	7.4%	10.1%	41.6%	15.4%	0.0%	0.0%	0.0%	0.0%	0.0%
	N-3	Bac Son	75	93	0	122	28	12	12	6	55	95	104	0	1	2	0	9
			57.7%	71.5%	0.0%	93.8%	21.5%	9.2%	9.2%	4.6%	42.3%	73.1%	80.0%	0.0%	0.8%	1.5%	0.0%	6.9%
	N-4	Phuoc Minh	33	42	10	83	2	6	8	31	21	30	42	0	0	3	0	0
			37.1%	47.2%	11.2%	93.3%	2.2%	6.7%	9.0%	34.8%	23.6%	33.7%	47.2%	0.0%	0.0%	3.4%	0.0%	0.0%
	N-5	Phuoc Hai	28	113	7	148	29	33	2	14	58	109	81	5	0	0	7	1
			12.2%	49.1%	3.0%	64.3%	12.6%	14.3%	0.9%	6.1%	25.2%	47.4%	35.2%	2.2%	0.0%	0.0%	3.0%	0.4%
	N-6	Phuoc Dinh	101	138	36	97	51	20	13	27	89	104	72	0	11	17	14	0
			63.9%	87.3%	22.8%	61.4%	32.3%	12.7%	8.2%	17.1%	56.3%	65.8%	45.6%	0.0%	7.0%	10.8%	8.9%	0.0%
Subtotal			**589**	**670**	**111**	**748**	**179**	**100**	**104**	**91**	**357**	**561**	**386**	**7**	**13**	**22**	**21**	**15**
			59.1%	**67.3%**	**11.1%**	**75.1%**	**18.0%**	**10.0%**	**10.4%**	**9.1%**	**35.8%**	**56.3%**	**38.8%**	**0.7%**	**1.3%**	**2.2%**	**2.1%**	**1.5%**
Binh Thuan	B-1	Muong Man	36	57	7	97	12	62	50	35	74	79	31	0	0	2	13	0
			25.7%	40.7%	5.0%	69.3%	8.6%	44.3%	35.7%	25.0%	52.9%	56.4%	22.1%	0.0%	0.0%	1.4%	9.3%	0.0%
	B-2	Gia Huynh	25	63	1	96	16	13	13	13	33	60	52	0	0	26	0	8
			21.2%	53.4%	0.8%	81.4%	13.6%	11.0%	11.0%	11.0%	28.0%	50.8%	44.1%	0.0%	0.0%	22.0%	0.0%	6.8%
	B-3	Nghi Duc	118	109	2	131	162	86	17	6	147	198	15	4	3	1	4	0
			58.1%	53.7%	1.0%	64.5%	79.8%	42.4%	8.4%	3.0%	72.4%	97.5%	7.4%	2.0%	1.5%	0.5%	2.0%	0.0%
	B-4	Tan Duc	30	85	2	85	39	1	1	27	80	110	39	0	3	3	0	0
			25.9%	73.3%	1.7%	73.3%	33.6%	0.9%	0.9%	23.3%	69.0%	94.8%	33.6%	0.0%	2.6%	2.6%	0.0%	0.0%
	B-5	Me Pu	120	76	3	141	78	65	5	2000.0%	111	223	37	12	0	2	22	0
			44.4%	28.1%	1.1%	52.2%	28.9%	24.1%	1.9%	7.4%	41.1%	82.6%	13.7%	4.4%	0.0%	0.7%	8.1%	0.0%
	B-6	Sung Nhon	49	80	0	49	87	39	5	3	89	136	30	0	0	6	0	32
			29.7%	48.5%	0.0%	29.7%	52.7%	23.6%	3.0%	1.8%	53.9%	82.4%	18.2%	0.0%	0.0%	3.6%	0.0%	19.4%
	B-7	Da Kai	79	94	6	114	64	147	31	39	89	173	52	8	8	21	8	0
			33.8%	40.2%	2.6%	48.7%	27.4%	62.8%	13.2%	16.7%	38.0%	73.9%	22.2%	3.4%	3.4%	9.0%	3.4%	0.0%
Subtotal			**457**	**564**	**21**	**713**	**458**	**413**	**122**	**143**	**623**	**979**	**256**	**24**	**14**	**61**	**47**	**40**
			36.7%	**45.3%**	**1.7%**	**57.2%**	**36.8%**	**33.1%**	**9.8%**	**11.5%**	**50.0%**	**78.6%**	**20.5%**	**1.9%**	**1.1%**	**4.9%**	**3.8%**	**3.2%**
TOTAL			**1,733**	**1,943**	**198**	**2,286**	**1,053**	**1,010**	**372**	**379**	**1,618**	**2,576**	**1,296**	**115**	**62**	**141**	**78**	**59**
			44.7%	**50.1%**	**5.1%**	**59.0%**	**27.2%**	**26.1%**	**9.6%**	**9.8%**	**41.8%**	**66.5%**	**33.4%**	**3.0%**	**1.6%**	**3.6%**	**2.0%**	**1.5%**

3.2.5 Survey for Existing Wells

The Table 3.2.18 shows the result of survey for existing wells from the view of water supply. The JICA Study Team also conducted inventory survey for existing wells from the view of groundwater. (Refer to Table 3.2.19) The Table 3.2.20 summarizes both of results.

Table 3.2.18 Result of Survey for Existing Wells from the View of Water Supply

Province	Code	Commune	Problems of water quality			
			Turbidity & Color*1	Fluoride	Salinity	Others
Phu Yen	P-1	Xuan Phuoc	X			
	P-2	An Dinh	X	X		Iron
	P-3	An Tho	X			
	P-4	An My	X	X	X	
	P-5	Son Phuoc	X			
	P-6	Ea Cha Rang	X	X		Calcium
	P-7	Suoi Bac	X			
	P-8	Son Thanh Dong	X			
Khanh Hoa	K-1	Cam An Bac	X	X	X	
	K-2	Cam Hiep Nam	X	X		
	K-3	Cam Hai Tay	X	X	X	Pesticide, fertilizer
Ninh Thuan	N-1	Nhon Hai	X		X	
	N-2	Cong Hai	X	X	X	
	N-3	Bac Son	X		X	
	N-4	Phuoc Minh	X		X	
	N-5	Phuoc Hai	X		X	
	N-6	Phuoc Dinh	X		X	
Binh Thuan	B-1	Muong Man	X	X	X	Calcium
	B-2	Gia Huynh	X	X		
	B-3	Nghi Duc	X	X		
	B-4	Tan Duc	X	X		Calcium
	B-5	Me Pu	X	X		
	B-6	Sung Nhon	X	X		
	B-7	Da Kai	X	X		Smell

Note: *1: Turbidity is indicated in rainy season.

This result is observed from the representatives of communes, based on water quality test by DOH. DOH conducted water quality test in 24 communes and pointed out problems for turbidity, fluoride and salinity.

Table 3.2.19 Result of Survey for Existing Wells from the View of Groundwater

Province	No.	Commune	Water Quality of Existing Wells						
			Sali-nity	Fluoride	Calcium	High pH	Metallic taste	Tur-bidity	Odor
Phu Yen	P-1	Xuan Phuoc		X	X		X		
	P-2	An Dinh		X			X		
	P-3	An Tho	X	X		X	X		
	P-4	An My	X	X					
	P-5	Son Phuoc							X
	P-6	Ea Cha Rang		X	X	X			
	P-7	Suoi Bac			X				
	P-8	Son Thanh Dong							
Khanh Hoa	K-1	Cam An Bac	X	X					
	K-2	Cam Hiep Nam		X				X	
	K-3	Cam Hai Tay	X	X					
Ninh Thuan	N-1	Nhon Hai	X						
	N-2	Cong Hai	X				X		
	N-3	Bac Son	X						
	N-4	Phuoc Minh	X						
	N-5	Phuoc Hai	X				X		
	N-6	Phuoc Dinh	X						
Binh Thuan	B-1	Muong Man	X				X		
	B-2	Gia Huynh					X		
	B-3	Nghi Duc						X	
	B-4	Tan Duc		X			X		
	B-5	Me Pu					X		
	B-6	Sung Nhon					X		
	B-7	Da Kai					X		

This result is observed by interview to representatives of communes, owner of wells and result of simple water quality test.

Table 3.2.20 Summary of Problems of Water Quality in Existing Wells

Province	Code	Commune	Problems of water quality						
			Turbidity[*1]	Fluoride	Salinity	Ca	High pH	Metallic Taste	Odor
Phu Yen	P-1	Xuan Phuoc	X	X		X		X	
	P-2	An Dinh	X	X				X	
	P-3	An Tho	X	X	X		X	X	
	P-4	An My	X	X	X				
	P-5	Son Phuoc	X						X
	P-6	Ea Cha Rang	X	X		X	X		
	P-7	Suoi Bac	X			X			
	P-8	Son Thanh Dong	X						
Khanh Hoa	K-1	Cam An Bac	X	X	X				
	K-2	Cam Hiep Nam	X	X					
	K-3	Cam Hai Tay	X	X	X				
Ninh Thuan	N-1	Nhon Hai	X		X				
	N-2	Cong Hai	X	X	X			X	
	N-3	Bac Son	X		X				
	N-4	Phuoc Minh	X		X				
	N-5	Phuoc Hai	X		X			X	
	N-6	Phuoc Dinh	X		X				
Binh Thuan	B-1	Muong Man	X	X	X	X		X	
	B-2	Gia Huynh	X	X				X	
	B-3	Nghi Duc	X	X					
	B-4	Tan Duc	X	X		X		X	
	B-5	Me Pu	X	X				X	
	B-6	Sung Nhon	X	X				X	
	B-7	Da Kai	X	X				X	

According to the result of survey for existing wells from the view of water supply, CPC pointed out problems regarding water quality of primary water source, which people are currently using in their daily life. The summary of this result is shown in below.

- Contaminated water due to high turbidity in rainy season and turbidity is indicated in dug wells in all communes.
- High salinity and this has compelled users to purchase water in spite of water availability in dug wells.
- Presence of fluoride in water of dug well, which, people believe, is one of the reasons causing dental fluorosis.
- Presence of calcium in water, which, people believe, is one of the reasons for kidney stone formation.

3.2.6 Other (Additional Information on the Framework of Survey: Social Issue in General)

As reference to grasp general view of the survey area, “ethnics”, “number of family members” and “living years” are additionally presented hereto. **Attention should be paid on the following data such as the percentage of ethnic groups, which reflects only answers from interviewees.

(Ethnics)

Minority ethnic groups are concentrated in some communes, or, at village levels if looking in detail. Cham and Raclay are the principal groups among minorities in the survey area.

Table 3.2.21 Ethnics

			Kinh	Minority					Total
				Cham	Ede	Raclay	Hroi	Other	
Phu Yen	P-1	Xuan Phuoc	168	0	0	0	0	12	180
			93.3%	0.0%	0.0%	0.0%	0.0%	6.7%	100.0%
	P-2	An Dinh	155	0	0	0	0	0	155
			100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	P-3	An Tho	74	0	0	0	0	0	74
			100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	P-4	An My	282	0	0	0	0	0	282
			100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	P-5	Son Phuoc	29	2	0	0	24	14	69
			42.0%	2.9%	0.0%	0.0%	34.8%	20.3%	100.0%
	P-6	Ea Cha Rang	26	0	30	0	3	0	59
			44.1%	0.0%	50.8%	0.0%	5.1%	0.0%	100.0%
	P-7	Suoi Bac	101	1	2	0	40	1	145
			69.7%	0.7%	1.4%	0.0%	27.6%	0.7%	100.0%
	P-8	Son Thanh Dong	189	0	0	0	0	0	189
			100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Subtotal			**1,024**	**3**	**32**	**0**	**67**	**27**	**1,153**
			88.8%	0.3%	2.8%	0.0%	5.8%	2.3%	100.0%
Khanh Hoa	K-1	Cam An Bac	117	0	0	0	0	0	117
			100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	K-2	Cam Hiep Nam	130	0	0	0	0	0	130
			100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	K-3	Cam Hai Tay	233	0	0	0	0	0	233
			100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Subtotal			**480**	**0**	**0**	**0**	**0**	**0**	**480**
			100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Ninh Thuan	N-1	Nhon Hai	240	0	0	0	0	0	240
			100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	N-2	Cong Hai	77	0	0	72	0	0	149
			51.7%	0.0%	0.0%	48.3%	0.0%	0.0%	100.0%
	N-3	Bac Son	30	54	0	46	0	0	130
			23.1%	41.5%	0.0%	35.4%	0.0%	0.0%	100.0%
	N-4	Phuoc Minh	88	1	0	0	0	0	89
			98.9%	1.1%	0.0%	0.0%	0.0%	0.0%	100.0%
	N-5	Phuoc Hai	160	70	0	0	0	0	230
			69.6%	30.4%	0.0%	0.0%	0.0%	0.0%	100.0%
	N-6	Phuoc Dinh	156	2	0	0	0	0	158
			98.7%	1.3%	0.0%	0.0%	0.0%	0.0%	100.0%
Subtotal			**751**	**127**	**0**	**118**	**0**	**0**	**996**
			75.4%	12.8%	0.0%	11.8%	0.0%	0.0%	100.0%
Binh Thuan	B-1	Muong Man	140	0	0	0	0	0	140
			100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	B-2	Gia Huynh	108	0	0	0	0	10	118
			91.5%	0.0%	0.0%	0.0%	0.0%	8.5%	100.0%
	B-3	Nghi Duc	203	0	0	0	0	0	203
			100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	B-4	Tan Duc	111	4	1	0	0	1	116
			95.7%	3.4%	0.9%	0.0%	0.0%	0.0%	100.0%
	B-5	Me Pu	262	8	0	0	0	0	270
			97.0%	3.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	B-6	Sung Nhon	165	0	0	0	0	0	165
			100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	B-7	Da Kai	234	0	0	0		0	234
			100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Subtotal			**1,223**	**12**	**1**	**0**	**0**	**11**	**1,246**
			98.2%	**1.0%**	**0.1%**	**0.0%**	**0.0%**	**0.9%**	**100.0%**
TOTAL			**3,478**	**142**	**33**	**118**	**67**	**38**	**3,875**
			89.8%	**3.7%**	**0.9%**	**3.0%**	**1.7%**	**1.0%**	**100.0%**

Other:
Bana
Nung
Chauro

(Number of family members)

The following table shows the number of family members excluding ones living outside the commune for any purposes such as going to school and work.

Table 3.2.22 Number of Household Members

			Below 3	4	5	6	7	More than 8	Average
Phu Yen	P-1	Xuan Phuoc	38	60	37	27	11	9	4.0
			20.9%	33.0%	20.3%	14.8%	6.0%	4.9%	
	P-2	An Dinh	39	38	44	23	6	5	4.5
			25.2%	24.5%	28.4%	14.8%	3.9%	3.2%	
	P-3	An Tho	17	25	19	10	1	1	4.4
			23.3%	34.2%	26.0%	13.7%	1.4%	1.4%	
	P-4	An My	57	96	63	35	15	16	4.7
			20.2%	34.0%	22.3%	12.4%	5.3%	5.7%	
	P-5	Son Phuoc	14	16	21	9	4	5	4.8
			20.3%	23.2%	30.4%	13.0%	5.8%	7.2%	
	P-6	Ea Cha Rang	13	13	13	8	7	5	5.1
			22.0%	22.0%	22.0%	13.6%	11.9%	8.5%	
	P-7	Suoi Bac	35	30	39	27	8	6	4.6
			24.1%	20.7%	26.9%	18.6%	5.5%	4.1%	
	P-8	Son Thanh Dong	36	46	50	31	14	12	5.0
			19.0%	24.3%	26.5%	16.4%	7.4%	6.3%	
Subtotal			**249**	**324**	**286**	**170**	**66**	**59**	**4.6**
			21.6%	**28.1%**	**24.8%**	**14.7%**	**5.7%**	**5.1%**	
Khanh Hoa	K-1	Cam An Bac	23	23	28	24	11	8	5.0
			19.7%	19.7%	23.9%	20.5%	9.4%	6.8%	
	K-2	Cam Hiep Nam	23	31	28	17	12	19	4.7
			17.7%	23.8%	21.5%	13.1%	9.2%	14.6%	
	K-3	Cam Hai Tay	32	60	55	49	23	14	5.0
			13.7%	25.8%	23.6%	21.0%	9.9%	6.0%	
Subtotal			**78**	**114**	**111**	**90**	**46**	**41**	**4.9**
			16.3%	**23.8%**	**23.1%**	**18.8%**	**9.6%**	**8.5%**	
Ninh Thuan	N-1	Nhon Hai	36	66	70	37	15	16	4.9
			15.0%	27.5%	29.2%	15.4%	6.3%	6.7%	
	N-2	Cong Hai	90	188	80	150	49	184	5.0
			12.1%	25.4%	10.8%	20.2%	6.6%	24.8%	
	N-3	Bac Son	18	18	15	20	23	36	6.4
			13.8%	13.8%	11.5%	15.4%	17.7%	27.7%	
	N-4	Phuoc Minh	8	33	20	15	3	10	5.0
			9.0%	37.1%	22.5%	16.9%	3.4%	11.2%	
	N-5	Phuoc Hai	26	43	43	45	39	34	5.7
			11.3%	18.7%	18.7%	19.6%	17.0%	14.8%	
	N-6	Phuoc Dinh	25	24	18	31	24	36	5.8
			15.8%	15.2%	11.4%	19.6%	15.2%	22.8%	
Subtotal			**203**	**372**	**246**	**298**	**153**	**316**	**5.4**
			20.4%	**37.3%**	**24.7%**	**29.9%**	**15.4%**	**31.7%**	
Binh Thuan	B-1	Muong Man	35	40	27	12	12	14	4.7
			25.0%	28.6%	19.3%	8.6%	8.6%	10.0%	
	B-2	Gia Huynh	30	27	23	18	15	5	4.8
			25.4%	22.9%	19.5%	15.3%	12.7%	4.2%	
	B-3	Nghi Duc	22	50	49	39	28	15	5.3
			10.8%	24.6%	24.1%	19.2%	13.8%	7.4%	
	B-4	Tan Duc	19	32	31	18	10	6	4.8
			16.4%	27.6%	26.7%	15.5%	8.6%	5.2%	
	B-5	Me Pu	43	79	60	49	20	19	5.0
			15.9%	29.3%	22.2%	18.1%	7.4%	7.0%	
	B-6	Sung Nhon	38	47	43	21	8	8	4.5
			23.0%	28.5%	26.1%	12.7%	4.8%	4.8%	
	B-7	Da Kai	32	48	62	41	25	26	5.0
			13.7%	20.5%	26.5%	17.5%	10.7%	11.1%	
Subtotal			**219**	**323**	**295**	**198**	**118**	**93**	**4.9**
			17.6%	**25.9%**	**23.7%**	**15.9%**	**9.5%**	**7.5%**	
TOTAL			**749**	**1,133**	**938**	**756**	**383**	**509**	**4.9**
			19.3%	**29.2%**	**24.2%**	**19.5%**	**9.9%**	**13.1%**	

(Living years)

Information collected confirms that the majority of population in the survey area has lived in the same location more than 20 years, and the population incoming probably is limited. **Due to merger and separation of villages/communes, number of population has been fluctuated from the viewpoint of administration boundaries.

Table 3.2.23 Number of Years to Live in those Communities

			5 years below	5-10 years	11-20 years	20 years more	Total
Phu Yen	P-1	Xuan Phuoc	9	11	23	137	180
			5.0%	6.1%	12.8%	76.1%	100.0%
	P-2	An Dinh	2	2	17	134	155
			1.3%	1.3%	11.0%	86.5%	100.0%
	P-3	An Tho	4	4	12	54	74
			5.4%	5.4%	16.2%	73.0%	100.0%
	P-4	An My	6	9	15	252	282
			2.1%	3.2%	5.3%	89.4%	100.0%
	P-5	Son Phuoc	4	5	10	50	69
			5.8%	7.2%	14.5%	72.5%	100.0%
	P-6	Ea Cha Rang	4	20	8	27	59
			6.8%	33.9%	13.6%	45.8%	100.0%
	P-7	Suoi Bac	17	13	65	50	145
			11.7%	9.0%	44.8%	34.5%	100.0%
	P-8	Son Thanh Dong	13	12	13	151	189
			6.9%	6.3%	6.9%	79.9%	100.0%
Subtotal			**59**	**76**	**163**	**855**	**1,153**
			5.1%	**6.6%**	**14.1%**	**74.2%**	**100.0%**
Khanh Hoa	K-1	Cam An Bac	0	1	3	113	117
			0.0%	0.9%	2.6%	96.6%	100.0%
	K-2	Cam Hiep Nam	7	10	3	110	130
			5.4%	7.7%	2.3%	84.6%	100.0%
	K-3	Cam Hai Tay	14	9	22	188	233
			6.0%	3.9%	9.4%	80.7%	100.0%
Subtotal			**21**	**20**	**28**	**411**	**480**
			4.4%	**4.2%**	**5.8%**	**85.6%**	**100.0%**
Ninh Thuan	N-1	Nhon Hai	1	4	1	234	240
			0.4%	1.7%	0.4%	97.5%	100.0%
	N-2	Cong Hai	8	14	9	118	149
			5.4%	9.4%	6.0%	79.2%	100.0%
	N-3	Bac Son	13	14	26	77	130
			10.0%	10.8%	20.0%	59.2%	100.0%
	N-4	Phuoc Minh	6	8	17	58	89
			6.7%	9.0%	19.1%	65.2%	100.0%
	N-5	Phuoc Hai	7	11	26	186	230
			3.0%	4.8%	11.3%	80.9%	100.0%
	N-6	Phuoc Dinh	9	11	10	128	158
			5.7%	7.0%	6.3%	81.0%	100.0%
Subtotal			**44**	**62**	**89**	**801**	**996**
			4.4%	**6.2%**	**8.9%**	**80.4%**	**100.0%**
Binh Thuan	B-1	Muong Man	2	4	7	127	140
			1.4%	2.9%	5.0%	90.7%	100.0%
	B-2	Gia Huynh	10	12	31	65	118
			8.5%	10.2%	26.3%	55.1%	100.0%
	B-3	Nghi Duc	0	3	10	190	203
			0.0%	1.5%	4.9%	93.6%	100.0%
	B-4	Tan Duc	5	21	37	53	116
			4.3%	18.1%	31.9%	45.7%	100.0%
	B-5	Me Pu	1	11	30	228	270
			0.4%	4.1%	11.1%	84.4%	100.0%
	B-6	Sung Nhon	5	8	28	124	165
			3.0%	4.8%	17.0%	75.2%	100.0%
	B-7	Da Kai	4	9	123	98	234
			1.7%	3.8%	52.6%	41.9%	100.0%
Subtotal			**27**	**68**	**266**	**885**	**1,246**
			2.2%	**5.5%**	**21.3%**	**71.0%**	**100.0%**
TOTAL			**151**	**226**	**546**	**2,952**	**3,875**
			3.9%	**5.8%**	**14.1%**	**76.2%**	**100.0%**

3.2.7 Issues of Existing Water Source and Water Use

Based on the result of socio-economic survey and survey for existing wells, some issues of existing water source and water use is identified in the targeted 24 communes. Table 3.2.24 shows issues of existing water source.

Table 3.2.24 Issues of Existing Water Source and Water Use

Code	Commune	[1] Table3.2.1	[2] Table3.2.5		[3] Table3.2.4	[4] Table3.2.6	[5] Table3.2.7	[6] Table3.2.10	[7] Table3.2.11	[8] Table3.2.12	[9] Table3.2.17	[10] Table3.2.9		[11] Table3.2.18	Necessity of water supply
		Primary water source (Dry season)	Local people's Impression on water quality		Fetching water (Dry season)	Monthly household expense (Average, 000VND)	Percentage of expense on water among monthly budget in dry season	Water related diseases	Demands on water use supply	Demands on water use allocation	Concerns/Demands of daily lives	Types of toilet		Problems of water quality	
			Good quality/ Acceptable	Not good/ Very bad								Have toilet	No toilet		
P-1	Xuan Phuoc	Dug well: 91.7%	41%	58%	Less than 5min: 41.7% 5-10min:38.3%	1,572	Zero: 98.9%	Skin disease: 32.2%	Much more: 43.9% Currently enough: 38.3%	Drinking: 60.0% Cooking: 53.9% Bathing: 34.4%	Food: 72.2% Health: 67.8% Education: 57.8% Income: 50.6%	17.2%	82.8%	Turbidity Fluoride Calcium Metallic taste	44% of respondents answered that they need much more water than water volume available through primary water source. (51%, including “Slightly more”, [7]) 58% of respondents feel unsatisfied with water quality in primary water source. ([2]) Furthermore, people have concerns on frequent occurrence of skin diseases. ([6]) According to the result of inventory survey of existing wells, presence of turbidity, fluoride, calcium and metallic taste are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 83% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 60% of respondents need additional water volume for drinking purposes. ([7]) 68% of respondents have concerns on water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated to be key issues considering the results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.
P-2	An Dinh	Dug well: 80.6%	97%	3%	Less than 5min: 54.8%	1,527	1-5%: 54.2% 5-10%:29.0%	No: 69.0%	Currently enough: 72.3%	Drinking: 18.7%	Toilet: 47.1% Forest: 38.7% Crop: 34.8% Domestic water: 31.0%	31.0%	69.0%	Turbidity Fluoride Metallic taste	72% of respondents feel satisfied with current water volume in primary water source. ([7]) 97% of respondents feel satisfied with water quality in primary water source. ([2]) Furthermore, there is no report regarding water born disease. ([6]) Although, the monthly household expense is lower than average of all target communes (2,037), 83% of respondents purchase water for drinking. ([4] and [5]) According to the result of inventory survey of existing well, presence of turbidity, fluoride and metallic taste are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 69% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. Demand of drinking water and domestic water is not so high. ([8] and [9]) However, it is assumed that most of users purchase water for drinking because people have concern of water quality. Furthermore, the problem of water quality still remains in accordance with the result of inventory survey of existing wells. Therefore, **water quality** is evaluated to be major issue considering the results of survey as mentioned above and water supply, which can supply stable and safe water, is required.
P-3	An Tho	Dug well: 58.1%	38%	62%	Less than 5min: 36.5%	1,485	Zero: 85.1%	No: 47.3%	Much more: 68.9%	Drinking: 56.8% Bathing: 56.8% Washing: 43.2% Animal: 41.9%	Health: 87.8% Domestic water: 73.0% Road: 73.0% Education: 52.7% Toilet: 39.2%	9.5%	90.5%	Turbidity Fluoride Salinity High pH Metallic taste	69% of respondents need much more water than water volume available in primary water source. (71%, including “Slightly more”, [7]) 62% respondents feel unsatisfied with water quality in primary water source. ([2]) There is no report regarding water borne diseases. ([6]) According to the result of inventory survey of existing well, presence of turbidity, fluoride, salinity, high pH and metallic taste are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 91% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, influences water quality in dug wells. 57% of respondents need additional amount of water for drinking purposes. ([7]) 73% of respondents have concerns on water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.

Code	Commune	[1] Table3.2.1 Primary water source (Dry season)	[2] Table3.2.5 Local people's Impression on water quality: Good quality/ Acceptable	[2] Table3.2.5 Local people's Impression on water quality: Not good/ Very bad	[3] Table3.2.4 Fetching water (Dry season)	[4] Table3.2.6 Monthly household expense (Average, 000VND)	[5] Table3.2.7 Percentage of expense on water among monthly budget in dry season	[6] Table3.2.10 Water related diseases	[7] Table3.2.11 Demands on water use supply	[8] Table3.2.12 Demands on water use allocation	[9] Table3.2.17 Concerns/Demands of daily lives	[10] Table3.2.9 Types of toilet: Have toilet	[10] Table3.2.9 Types of toilet: No toilet	[11] Table3.2.18 Problems of water quality	Necessity of water supply
P-4	An My	Dug well: 51.8% Tube well: 45.7%	71%	28%	10-30min: 52.5%	1,951	Zero: 88.7%	No: 92.2%	Currently enough: 68.1%	Drinking: 19.9%	Health: 71.6% Food: 66.7% Toilet: 48.9% Education: 36.2% Income: 34.4% Road: 33.3%	38.7%	61.3%	Turbidity Fluoride Salinity	68% of respondents feel satisfied with current water volume in primary water source. ([7]) 71% of respondents feel satisfied with water quality in primary water source. ([2]) Furthermore, there is no report regarding water borne disease. ([6]) However, according to the result of inventory survey for existing wells, presence of turbidity, fluoride and sanitary is reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 61% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 53% of respondents spend 10-30min for fetching water, and it is deplorable condition to get water. Demand of drinking water and domestic water is not high. However, the problem of water quality still remains in accordance with the result of inventory survey of existing wells. Therefore, **water quality** and **exertions for fetching water** are evaluated to be major issues considering results of survey as mentioned above and water supply, which can supply stable and safe water, is required.
P-5	Son Phuoc	Dug well: 84.1%	64%	36%	Less than 5min: 63.8%	3,519	Zero: 84.1%	Diarrhea: 78.3% Malaria: 55.1% Schistsome: 30.4%	Much more:53.6%	Drinking: 75.4% Cooking: 59.4% Bathing: 36.2%	Domestic water: 69.6% Health: 65.2% Toilet: 60.9% Education: 31.9% Road: 31.9% Food: 30.4% Income: 30.4%	4.3%	95.7%	Turbidity Odor	54% of respondents need much more water than water volume available through primary water source. (71%, including “Slightly more”, [7]) 64% of respondents feel satisfied with water quality in primary water source. ([2]) However, 78% of respondents have concern on frequent occurrence of diarrhea. ([6]) According to the result of inventory survey of existing wells, presence of turbidity and odor are reported by representative of commune. ([11]) In rainy season, turbidity is indicated in all dug wells. Since 96% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 75% of respondents need additional amount of water for drinking purposes. ([7]) 70% of respondents have concerns on water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated as major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.
P-6	Ea Cha Rang	Dug well: 61.0% Spring: 39.0%	46%	54%	10-30min: 37.3% Less than 5min: 32.2%	3,023	Zero: 79.7%	Diarrhea: 79.7% Schistsome: 54.2% Skin desease:39.0%	Much more:66.1%	Drinking: 96.6% Cooking: 94.9% Bathing: 32.2%	Domestic water: 91.5% Health: 64.4% Toilet: 61.0% Income: 39.0% Education: 35.6%	5.1%	94.9%	Turbidity Fluoride Calcium High pH	66% of respondents need much more water than water volume available at present through primary water source. (85%, including “Slightly more”, [7]) 54% of respondents feel unsatisfied with water quality in primary water source. ([2]) Furthermore, 80% of respondents have concern on frequent occurrence of diarrhea. ([6]) According to the result of inventory survey of existing wells, presence of turbidity, fluoride, calcium and high pH are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 95% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 37% of respondents spend about 10-30min for fetching water, it could be said that access to water is in deplorable condition.([3]) 97% of respondents need additional amount of water for drinking purposes. ([7]) 92% of respondents have concern on water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume**, **water quality** and **work for fetching water** are evaluated as major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is necessary.

Code	Commune	[1] Table3.2.1 Primary water source (Dry season)	[2] Table3.2.5 Local people's Impression on water quality: Good quality/ Acceptable	[2] Table3.2.5 Local people's Impression on water quality: Not good/ Very bad	[3] Table3.2.4 Fetching water (Dry season)	[4] Table3.2.6 Monthly household expense (Average, 000VND)	[5] Table3.2.7 Percentage of expense on water among monthly budget in dry season	[6] Table3.2.10 Water related diseases	[7] Table3.2.11 Demands on water use supply	[8] Table3.2.12 Demands on water use allocation	[9] Table3.2.17 Concerns/Demands of daily lives	[10] Table3.2.9 Types of toilet: Have toilet	[10] Table3.2.9 Types of toilet: No toilet	[11] Table3.2.18 Problems of water quality	Necessity of water supply
P-7	Suoi Bac	Dug well: 76.6%	46%	54%	Less than 5min: 29.0% 5-10min: 27.6%	2,048	Zero: 67.6%	No: 100.0%	Much more: 49.7%	Drinking: 58.6% Cooking: 54.5% Bathing: 47.6% Washing: 33.1%	Food: 85.5% Domestic water: 72.4% Health: 53.8% Income: 53.1% Crop: 52.4%	44.8%	55.2%	Turbidity Calcium	50% of respondents need much more water than water volume available at present through primary water source. (56%, including “Slightly more”, [7]) 54% of respondents answered that they feel unsatisfied with water quality in primary water source. ([2]) According to the result of inventory survey of existing wells, presence of turbidity and calcium are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 55% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 59% of respondents need additional water volume for drinking purposes. ([7]) 72% of respondents have concern on water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.
P-8	Son Thanh Dong	Tube well: 63.0% Dug well: 34.9%	92%	8%	Less than 5min: 73.5%	1,953	Zero: 98.4%	No: 67.2%	Currently enough: 52.4%	Bathing: 33.3% Washing: 30.7%	Health: 56.1% Income: 53.4% Road: 35.4%	12.7%	87.3%	Turbidity	52% of respondents feel satisfied with current water volume in primary water source. ([7]) 92% of respondents feel satisfied with water quality in primary water source. ([2]) Furthermore, there is no report regarding water borne disease. ([6]) According to the result of inventory survey of existing wells, presence of turbidity is reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 87% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. Demand of drinking water and domestic water is not high. However, the problem of water quality still remains in accordance with the result of inventory survey of existing wells. Therefore, **water quality** is evaluated to be major issue considering results of survey as mentioned above and water supply, which can supply stable and safe water, is required.
K-1	Cam An Bac	Dug well: 90.6%	33%	59%	Less than 5min: 70.9%	2,219	Zero: 65.8% 1-5%: 29.9%	Skin disease: 37.6%	Much more: 42.7% Slightly more: 35.5%	Cooking: 94.0% Drinking: 90.6% Bathing: 57.3%	Domestic water: 76.9% Health: 70.9% Education: 58.1% Toilet: 57.3% Crop: 56.4% Income: 49.6%	40.2%	59.8%	Turbidity Fluoride Salinity	43% of respondents need much more water than water volume available at present through primary water source. (81%, including “Slightly more”, [7]) 59% of respondents feel unsatisfied with water quality in primary water source. ([2]) According to the result of inventory survey of existing wells, presence of turbidity, fluoride and salinity are reported by representative of commune. ([11]) In rainy season, turbidity is indicated in all dug wells. Since 60% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 91% of respondents need additional water volume for drinking purposes. ([7]) 77% of respondents have concern on water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.

Code	Commune	[1] Table3.2.1 Primary water source (Dry season)	[2] Table3.2.5 Local people's Impression on water quality: Good quality/ Acceptable	[2] Table3.2.5 Local people's Impression on water quality: Not good/ Very bad	[3] Table3.2.4 Fetching water (Dry season)	[4] Table3.2.6 Monthly household expense (Average, 000VND)	[5] Table3.2.7 Percentage of expense on water among monthly budget in dry season	[6] Table3.2.10 Water related diseases	[7] Table3.2.11 Demands on water use supply	[8] Table3.2.12 Demands on water use allocation	[9] Table3.2.17 Concerns/Demands of daily lives	[10] Table3.2.9 Types of toilet: Have toilet	[10] Table3.2.9 Types of toilet: No toilet	[11] Table3.2.18 Problems of water quality	Necessity of water supply
K-2	Cam Hiep Nam	Dug well: 93.1%	48%	51%	5-10min: 41.5% 10-30min:32.3%	2,420	Zero: 91.5%	No: 85.4%	Much more: 46.2% Currently enough: 30.8%	Drinking: 66.9% Cooking: 66.9% Bathing: 62.3%	Health: 76.9% Domestic water: 65.4% Income: 56.2% Education: 45.4% Toilet: 37.7% Food: 36.2%	63.8%	36.2%	Turbidity Fluoride	46% of respondents need much more water than water volume available at present through primary water source. (67%, including “Slightly more”, [7]) 51% of respondents feel unsatisfied with water quality in primary water source. ([2]) Furthermore, 38% expressed concern on frequent occurrence of skin disease. ([6]) According to the result of inventory survey of existing wells, presence of turbidity and fluoride are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 32% of respondents spend 10-30min for fetching water, therefore it may be said that access to water is in deplorable condition. 67% of respondents need additional water volume for drinking purposes. ([7]) 65% of respondents concern on water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume**, **water quality** and **work for fetching water** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.
K-3	Cam Hai Tay	Purchase: 50.6% Dug well: 48.9%	96%	4%	5-10min: 42.5%	2,555	Zero: 39.1% 5-10%: 30.5%	No: 100.0%	Much more: 64.4%	Drinking: 88.0% Cooking: 85.0% Bathing: 79.8%	Health: 84.5% Domestic water: 72.5% Road: 60.1% Education: 54.1% Income: 48.9% Toilet: 48.1% Food: 36.9%	70.8%	29.2%	Turbidity Fluoride Salinity	64% of respondents need much more water than water volume available at present through primary water source. (72%, including “Slightly more”, [7]) 51% of respondents purchase drinking water at present, since water volume of primary water source is not enough. ([1]) 96% of respondents feel satisfied with water quality in primary water source. ([2]) According to the result of inventory survey of existing wells, presence of turbidity, fluoride and salinity are reported by representative of commune. ([11]) 88% of respondents need additional water volume for drinking purposes. ([7]) 73% of respondents concern on water volume and water quality of domestic water in daily lives. ([8]) Despite the fact that 96% of respondents feel satisfied with water quality, the problem of water quality still remains in accordance with the result of inventory survey of existing wells. Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.
N-1	Nhon Hai	Purchase: 55.4% Dug well: 44.6%	78%	23%	Less than 5min: 41.7% 5-10min: 38.3%	2,271	1-5%: 69.6%	No: 84.2%	Much more: 73.3%	Drinking: 93.8% Cooking: 90.0% Bathing: 70.8%	Food: 97.1% Income: 91.7% Domestic water: 88.3% Health: 67.1%	56.3%	43.8%	Turbidity Salinity	73% of respondents need much more water than water volume available at present through primary water source. (81%, including “Slightly more”, [7]) 55% of respondents purchase drinking water at present. ([1]) 78% of respondents feel satisfied with water quality in primary water source. ([2]) According to the result of inventory survey for existing wells, presence of turbidity and salinity are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 44% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 94% of respondents need additional water volume for drinking purposes. ([7]) 88% of respondents concern on water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.

Code	Commune	[1] Table3.2.1 Primary water source (Dry season)	[2] Table3.2.5 Local people's Impression on water quality: Good quality/ Acceptable	[2] Table3.2.5 Local people's Impression on water quality: Not good/ Very bad	[3] Table3.2.4 Fetching water (Dry season)	[4] Table3.2.6 Monthly household expense (Average, 000VND)	[5] Table3.2.7 Percentage of expense on water among monthly budget in dry season	[6] Table3.2.10 Water related diseases	[7] Table3.2.11 Demands on water use supply	[8] Table3.2.12 Demands on water use allocation	[9] Table3.2.17 Concerns/Demands of daily lives	[10] Table3.2.9 Types of toilet: Have toilet	[10] Table3.2.9 Types of toilet: No toilet	[11] Table3.2.18 Problems of water quality	Necessity of water supply
N-2	Cong Hai	Dug well: 79.9%	50%	50%	Less than 5min: 33.6% 5-10min: 32.9%	1,728	Zero: 84.6%	Diarrhea: 55.0% Trachoma: 53.0%	Much more: 72.5%	Drinking: 95.3% Cooking: 74.5% Bathing: 57.7% Washing: 32.2%	Food: 79.9% Domestic water: 57.7% Income: 43.0% Health: 41.6% Crop: 34.9%	7.4%	92.6%	Turbidity Fluoride Salinity Metallic taste	73% of respondents need much more water than water volume available at present through primary water source. (93%, including “Slightly more”, [7]) 50% of respondents feel unsatisfied with water quality in primary water source. ([2]) Furthermore, 55% of respondents concern on frequent occurrence of diarrhea. ([6]) According to the result of inventory survey of existing wells, presence of turbidity, fluoride, salinity and metallic taste are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 93% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 95% of respondents need additional water volume for drinking purposes. ([7]) 58% of respondents concern over water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.
N-3	Bac Son	Piped water: 42.3%	45%	55%	Less than 5min: 54.6%	1,778	Zero: 41.5% 1-5%: 40.0%	Diarrhea: 49.2% Malaria: 49.2% Trachoma:47.7% Skin desease:38.5%	Much more: 90.0%	Bathing: 83.1% Cooking: 68.5% Drinking: 53.8% Washing: 53.8%	Domestic water: 93.8% Toilet: 80.0% Health: 73.1% Income: 71.5% Food: 57.7% Education: 42.3%	5.4%	94.6%	Turbidity Salinity	90% of respondents need much more water than water volume available at present through primary water source. (95%, including “Slightly more”, [7]) 55% of respondents feel unsatisfied with water quality in primary water source. ([2]) Furthermore, 49% of respondents concern on frequent occurrence of diarrhea. ([6]) According to the result of inventory survey of existing wells, presence of turbidity and salinity are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 95% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. Despite the fact that commune has existing water supply system, available water volume is limited. ([1]) 54% of respondents need additional water volume for drinking purposes. ([7]) 94% of respondents concern over water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey, and water supply, which can supply stable and safe water, is required.
N-4	Phuoc Minh	Purchase: 76.4%	90%	10%	10-30min: 42.7% 5-10min: 30.3%	2,140	5-10%: 48.3% 1-5%: 36.0%	No: 51.7% Skin disease: 30.3%	Much more: 91.0%	Drinking: 97.8% Cooking: 97.8% Bathing: 76.4%	Domestic water: 93.3% Toilet: 47.2% Income: 47.2% Food: 37.1% Electricity: 34.8%	51.7%	48.3%	Turbidity Salinity	91% of respondents need much more water than water volume available at present through primary water source. (98%, including “Slightly more”, [7]) 90% of respondents feel satisfied with water quality in primary water source. ([2]) However, according to the result of inventory survey of existing wells, presence of turbidity and salinity are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 48% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 43% of respondents spend 10-30min for fetching water and it may be said that the access to water is in deplorable condition.([3]) 98% of respondents need additional water volume for drinking purposes. ([7]) 93% of respondents concern over water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume**, **water quality** and **work for fetching water** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.

Code	Commune	[1] Table3.2.1 Primary water source (Dry season)	[2] Table3.2.5 Local people's Impression on water quality: Good quality/ Acceptable	[2] Table3.2.5 Local people's Impression on water quality: Not good/ Very bad	[3] Table3.2.4 Fetching water (Dry season)	[4] Table3.2.6 Monthly household expense (Average, 000VND)	[5] Table3.2.7 Percentage of expense on water among monthly budget in dry season	[6] Table3.2.10 Water related diseases	[7] Table3.2.11 Demands on water use supply	[8] Table3.2.12 Demands on water use allocation	[9] Table3.2.17 Concerns/Demands of daily lives	[10] Table3.2.9 Types of toilet: Have toilet	[10] Table3.2.9 Types of toilet: No toilet	[11] Table3.2.18 Problems of water quality	Necessity of water supply
N-5	Phuoc Hai	Dug well: 72.2%	54%	45%	Less than 5min: 78.3%	1,794	Zero: 56.1%	No: 66.1%	Much more: 47.4%	Drinking: 77.8% Cooking: 74.3% Bathing: 54.8%	Domestic water: 64.3% Income: 49.1% Health: 47.4% Toilet: 35.2%	57.8%	42.2%	Turbidity Salinity Metallic taste	47% of respondents need much more water than water volume available at present through primary water source. (64%, including “Slightly more”, [7]) 54% of respondents feel satisfied with water quality in primary water source. ([2]) However, according to the result of inventory survey of existing wells, presence of turbidity, salinity and metallic taste are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. 42% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 78% of respondents need additional water volume for drinking purposes. ([7]) 64% of respondents concern over water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.
N-6	Phuoc Dinh	Dug well: 48.7%	87%	13%	Less than 5min: 44.9% 5-10min:32.9%	3,252	Less than 1%: 41.1%	No: 72.8%	Much more: 37.3% Currently enough: 30.4%	Cooking: 62.0% Bathing: 51.9% Drinking: 50.0%	Income: 87.3% Health: 65.8% Food: 63.9% Domestic water: 61.4% Education: 56.3% Toilet: 45.6% Crop: 32.3%	53.2%	46.8%	Turbidity Salinity	37% of respondents need much more water than water volume available at present through primary water source. (56%, including “Slightly more”, [7]) 87% of respondents feel satisfied with water quality in primary water source. ([2]) However, according to the result of inventory survey of existing wells, presence of turbidity and salinity are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 47% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 50% of respondents need additional water volume for drinking purposes. ([7]) 61% of respondents concern over water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.
B-1	Muong Man	Dug well: 52.1%	60%	40%	Less than 5min: 50.0%	6,003	1-5%: 42.1% Zero: 30.7%	No: 52.1% Skin disease: 30.0%	Much more: 57.9%	Cooking: 32.5% Drinking: 31.6%	Domestic water: 69.3% Health: 56.4% Education: 52.9% Road: 44.3% Income: 40.7% Irrigation: 35.7%	54.3%	45.7%	Turbidity Fluoride Salinity Calcium Metallic taste	58% of respondents need much more water than water volume available at present in primary water source. (80%, including “Slightly more”, [7]) 60% of respondents feel satisfied with water quality in primary water source. ([2]) However, according to the result of inventory survey of existing wells, presence of turbidity, fluoride, salinity, calcium and metallic taste are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 46% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 32% of respondents need additional water volume for drinking purposes. ([7]) 69% of respondents concern over water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.

Code	Commune	[1] Table3.2.1 Primary water source (Dry season)	[2] Table3.2.5 Local people's Impression on water quality: Good quality/ Acceptable	[2] Table3.2.5 Local people's Impression on water quality: Not good/ Very bad	[3] Table3.2.4 Fetching water (Dry season)	[4] Table3.2.6 Monthly household expense (Average, 000VND)	[5] Table3.2.7 Percentage of expense on water among monthly budget in dry season	[6] Table3.2.10 Water related diseases	[7] Table3.2.11 Demands on water use supply	[8] Table3.2.12 Demands on water use allocation	[9] Table3.2.17 Concerns/Demands of daily lives	[10] Table3.2.9 Types of toilet: Have toilet	[10] Table3.2.9 Types of toilet: No toilet	[11] Table3.2.18 Problems of water quality	Necessity of water supply
B-2	Gia Huynh	Dug well: 99.2%	60%	40%	Less than 5min: 77.1%	3,884	Zero: 90.7%	Malaria: 35.6%	Much more: 72.0%	Drinking: 97.5% Cooking: 84.7% Bathing: 50.8%	Domestic water: 81.4% Income: 53.4% Health: 50.8% Toilet: 44.1%	33.9%	66.1%	Turbidity Fluoride Metallic taste	72% of respondents need much more water than water volume available at present through primary water source. (86%, including “Slightly more”, [7]) 60% of respondents feel satisfied with water quality in primary water source. ([2]) However, according to the result of inventory survey of existing wells, presence of turbidity, fluoride and metallic taste are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 66% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 98% of respondents need additional water volume for drinking purposes. ([7]) 81% of respondents concern over water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.
B-3	Nghi Duc	Dug well: 98.5%	37%	61%	5-10min:60.6%	3,589	Zero: 59.6%	Schistsome: 56.7% Skin disease: 43.8% Diarrhea: 43.3% Trachoma: 35.5%	Much more: 49.8%	Drinking: 76.4% Cooking: 71.4% Bathing: 56.7%	Health: 97.5% Crop: 79.8% Education: 72.4% Food: 58.1% Income: 53.7% Road: 42.4%	28.1%	71.9%	Turbidity Fluoride	50% of respondents need much more water than water volume available at present through primary water source. (71%, including “Slightly more”, [7]) 61% of respondents feel unsatisfied with water quality in primary water source. ([2]) According to the result of inventory survey of existing wells, presence of turbidity and fluoride are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since, 72% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 76% of respondents need additional water volume for drinking purposes. Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.
B-4	Tan Duc	Dug well: 86.2%	62%	38%	Less than 5min: 76.7%	3,290	Zero: 90.5%	No: 54.3%	Much more: 72.4%	Drinking: 85.3% Cooking: 77.6% Bathing: 19.0%	Health: 94.8% Domestic water: 73.3% Income: 73.3% Education: 69.0% Toilet: 33.6% Crop: 33.6%	41.4%	58.6%	Turbidity Fluoride Calcium Metallic taste	72% of respondents need much more water than water volume available at present through primary water source. (82%, including “Slightly more”, [7]) 62% of respondents feel satisfied with water quality in primary water source. ([2]) However, according to the result of inventory survey of existing wells, presence of turbidity, fluoride, calcium and metallic taste are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 59% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 85% of respondents need additional water volume for drinking purposes. ([7]) 73% of respondents concern over water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.

Code	Commune	[1] Table3.2.1 Primary water source (Dry season)	[2] Table3.2.5 Local people's Impression on water quality: Good quality/ Acceptable	[2] Table3.2.5 Local people's Impression on water quality: Not good/ Very bad	[3] Table3.2.4 Fetching water (Dry season)	[4] Table3.2.6 Monthly household expense (Average, 000VND)	[5] Table3.2.7 Percentage of expense on water among monthly budget in dry season	[6] Table3.2.10 Water related diseases	[7] Table3.2.11 Demands on water use supply	[8] Table3.2.12 Demands on water use allocation	[9] Table3.2.17 Concerns/Demands of daily lives	[10] Table3.2.9 Types of toilet: Have toilet	[10] Table3.2.9 Types of toilet: No toilet	[11] Table3.2.18 Problems of water quality	Necessity of water supply
B-5	Me Pu	Dug well: 70.7%	64%	23%	Less than 5min: 67.0%	2,972	Less than 1%: 50.4% Zero: 30.7%	No: 58.1%	Currently enough: 51.1%	Drinking: 41.5% Cooking: 40.7%	Health: 82.6% Domestic water: 52.2% Food: 44.4% Education: 41.1%	49.6%	50.4%	Turbidity Fluoride Metallic taste	51% of respondents feel satisfied with current water volume through primary water source. ([7]) 64% of respondents feel satisfied with water quality in primary water source. ([2]) Furthermore, there is no report regarding water borne disease. ([6]) However, according to the result of inventory survey of existing wells, presence of turbidity, fluoride and metallic taste is reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 50% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 42% of respondents need additional water for drinking purposes. ([7]) 52% of respondents concern over water volume and water quality of domestic water in daily lives. ([8]) Therefore, especially, **water quality** is evaluated to be prime issue considering results of survey as mentioned above and water supply, which can supply stable and safe water, is required.
B-6	Sung Nhon	Dug well: 100.0%	67%	13%	Less than 5min: 100.0%	2,510	Zero: 100.0%	No: 46.7%	Currently enough: 30.3%	Drinking: 67.3% Cooking: 67.3% Bathing: 61.2%	Health: 82.4% Education: 53.9% Crop: 52.7% Income: 48.5%	44.8%	55.2%	Turbidity Fluoride Metallic taste	30% of respondents feel satisfied with current water volume through primary water source. ([7]) 67% of respondents feel satisfied with water quality in primary water source. ([2]) Furthermore, there is no report regarding water borne disease. ([6]) However, according to the result of inventory survey of existing wells, presence of turbidity, fluoride and metallic taste is reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 55% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 67% of respondents need additional water volume for drinking purposes. Therefore, especially, **water quality** is evaluated to be prime issue considering results of survey as mentioned above and water supply, which can supply stable and safe water, is required.
B-7	Da Kai	Dug well: 85.5%	74%	21%	Less than 5min: 34.2%	2,818	Zero: 60.7%	No: 79.9%	Much more: 38.5% Currently enough: 36.3%	Drinking: 29.9% Cooking: 29.9%	Health: 73.9% Road: 62.8% Domestic water: 48.7% Income: 40.2% Education: 38.0% Food: 33.8%	51.7%	48.3%	Turbidity Fluoride Metallic taste	39% of respondents need much more water than water volume available at present through primary water source. (56%, including “Slightly more”, [7]) 74% of respondents feel satisfied with water quality in primary water source. ([2]) However, according to the result of inventory survey of existing wells, presence of turbidity, fluoride, salinity and metallic taste are reported by representative of commune. ([11]) In rainy season, turbidity is observed in all dug wells. Since 48% of respondents don't have toilet ([10]) and they defecate outside, it is assumed that E coli, one of the reason for diarrhea, affects water quality in dug wells. 30% of respondents need additional water volume for drinking purposes. ([7]) 49% of respondents concern over water volume and water quality of domestic water in daily lives. ([8]) Therefore, **water volume** and **water quality** are evaluated to be major issues considering results of survey as mentioned above, and water supply, which can supply stable and safe water, is required.

3.3 Analysis of the Result by Cross Tabulation

In addition to the aforementioned results, analysis of correlation between some of the crucial aspects gives another view on water supply/use and sanitary condition in the survey area. Analysis of correlation is presented here by cross tabulation, covering those following items:

Analysis	Correlation	
Water related aspects	Water expense (%) among monthly household budget	Necessity of water supply
	Affordability/willingness of installation cost for water supply	
	Affordability/willingness of usage monthly cost for water supply	
Sanitary related aspects	Affordability/willingness of installation cost for toilet	Necessity of toilet
	Households (%) who have both toilet and dug well	Contract water related diseases
Other (ethnic aspect)	Rate of minority people's households in villages	Necessity of water supply

3.3.1 Analysis of Water Related Aspects

(Correlation between "water expense" and "necessity of water supply")

(How to see and to determine the location of communes in the Table)

1. **How to see**: Both axis of water expense and necessity of water extend their degrees: from top to bottom as for water expense and from left to right as for necessity of water. Therefore, the closer to lower-right column communes are located, signifying, the more they spend on water as % of their monthly budget and also have necessity of water supply as well.
2. **Water expense**: Determined the position by the "Mode" in the questionnaire asking how much they spend on water in their monthly budget. For example, if the "Mode" of all the answers from P2: An Dinh falls into "1-5%", Anh Dinh is positioned at "1-5%" in the table.
3. **Necessity of water**: Calculated the average point of each commune as follows on the question asking how much they need water, comparing with the current volume.

Points	Options of question (questionnaire 6-1)
3 points	option 1: Yes. Much more water is necessary
2 points	option 2: Slight addition can satisfy
1 point	option 3: If possible, but not so much
0 point	option 4: No need, the current volume is enough

Looking at the correlation between "water expenses" on household budget and people's recognition of "needs on water supply", it gives clear picture which communes are suffering from water expense more than others as well as are holding stronger desires to improve water supply at the same time. According to the table below, N-4: Phuoc Minh is fallen to such a commune, as located in the lower-right column, suggesting more people suffer from heavier financial burden on water use because they have to purchase water from vendors basically and (therefore), they expressed their higher needs on improvement of water supply. Following N-4 Phuoc Minh commune, N-1: Nhon Hai and N3: Bac Son are also categorized as such communes with similar circumstances in accordance with their locations in the table.

Table 3.3.1 Correlation between "Water Expense" and "Necessity of Water Supply"

Water expense/ necessity	Necessity points 0.0-0.74	0.75-1.49	1.50-2.24	2.25-3.0
0-1%		P4: An Mỹ (0.79) P8: Sơn Thành Đông(1.15) B5: Mepu(1.24) B6: Sung nhon(1,35)	P1: Xuân Phước (1.57) P5: Sơn Phước(2,0) P7: Suối Bạc(1.78) K1: Cam An Bắc(2.19) K2:Cam Hiep Nam(1.89) N5: Phước Hải(1.82) N5: Phước Dinh(1.63) B3: Nghị Đức(1.98) B7: Đa kai (1.59)	P3: An Thọ (2.42) P6: Ea cha rang (2.58) N2: Công Hải (2.62) B2: Gia Huynh(2.57) B4: Tân Đức (2,43)
1-5%	P2: An Định(0.74)		K3: Cam Hải Tây (2.24) B1: Mương mán (2.24)	N1: Nhơn Hải(2.53) N3: Bắc Sơn(2.79)
5-10%				N4: Phước Minh(2.87)
10%-				

(Correlation between "installation cost (house connection) " and "necessity of water supply")

The following table shows the correlation between the aspect "how much they afford as well as are willing to pay for installation cost of water supply", and "the necessity of water". In the same manner as explained in the above box, the location of communes in the table is determined by Mode on the basis of the questionnaire results as for installation cost, and the necessity of water is taken by their average points as before.

Although no communes are placed in the lower-right column, there are some communes in a relatively closer column which signifies stronger needs of water supply and higher affordability/willingness to pay for water supply installation.

Table 3.3.2 Correlation between "Installation Cost (house connection)" and "Necessity of Water Supply"

Installation cost (000VND)/ necessity	Necessity points 0.0-0.74	0.75-1.49	1.50-2.24	2.25-3.0
below 300	P2: An Định(0.74)	P4: An Mỹ (0.79) P8: Sơn Thành Đông(1.15) B5: Mepu(1.24) B6: Sung nhon(1,35)	P1: Xuân Phước (1.57) P5: Sơn Phước(2,0) P7: Suối Bạc(1.78) K1: Cam An Bắc(2.19) K2:Cam Hiep Nam(1.89) N5: Phước Dinh(1.63) B7: Đa kai (1.59)	P6: Ea cha rang (2.58) N2: Công Hải (2.62) N3: Bắc Sơn(2.79) B4: Tân Đức (2,43)
300-500			K3: Cam Hải Tây (2.24) N5: Phước Hải(1.82) B1: Mương mán (2.24) B3: Nghị Đức(1.98)	P3: An Thọ (2.42) N4: Phước Minh(2.87) N1: Nhơn Hải(2.53) B2: Gia Huynh(2.57)
500-800				
800 over				

(Correlation between "usage monthly cost (water tariff) " and "necessity of water supply")

In the same manner, correlation of affordability/willingness to pay for usage monthly cost instead of installation cost, with their recognition on the necessity of water is shown in the following table.

Table 3.3.3 Correlation between "Usage Monthly Cost (water tariff) " and "Necessity of Water Supply"

Usage cost (000VND)/ necessity	Necessity points 0.0-0.74	0.75-1.49	1.50-2.24	2.25-3.0
below 30	P2: An Định(0.74)	P4: An Mỹ (0.79) P8: Sơn Thành Đông(1.15) B5: Mepu(1.24) B6: Sung nhon(1,35)	P1: Xuân Phước (1.57) P5: Sơn Phước(2,0) P7: Suối Bạc(1.78) K1: Cam An Bắc(2.19) K2:Cam Hiep Nam(1.89) N5: Phước Hải(1.82) N5: Phước Dinh(1.63) B1: Mương mán (2.24) B7: Đa kai (1.59)	P6: Ea cha rang (2.58) N2: Công Hải (2.62) B2: Gia Huynh(2.57) B4: Tân Đức (2,43)
30-50			K3: Cam Hải Tây (2.24) B3: Nghị Đức(1.98)	P3: An Thọ (2.42) N1: Nhơn Hải(2.53) N4: Phước Minh(2.87)
50-80				
80 over				

Looking through both cost aspects of installation and monthly usage, it is judged that P3: An Thọ, N1: Nhơn Hải and N4: Phước Minh in particular have stronger affordability/willingness to shoulder costs and needs of water supply as well, comparing with other communes.

3.3.2 Analysis of Sanitary Related Aspects

(Correlation between "installation cost" and "concerns on toilet")

The following table shows the correlation between "affordability/willingness to pay for installation of toilet" and the degree of their "concerns on toilet". The figure of affordability/willingness in the table is determined by Mode of all the answers for the questionnaire, and the concern on toilet is judged by the percentage of interviewees who answered toilet as one of their concerns among all the 16 alternative issues in the question (see 2.6 Local needs in general).

Table 3.3.4 Correlation between "Installation Cost" and "Concerns on Toilet"

Installation cost (000VND)/ necessity	Concern (necessity) on toilet 0-24%	25-49%	50-74%	75-100%
below 500	P1: Xuân Phước (14%) P7: Suối Bạc(25%) P8: Sơn T. Đông (25%) B6: Sung nhon(18%) B7: Đa kai (22%)	P2: An Định(47%) K2:Cam Hiep Nam(38%) K3: Cam Hải Tây (48%) N4: Phước Minh(47%) B4: Tân Đức (34%)	P5: Sơn Phước(61%) P6: Ea cha rang (61%) K1: Cam An Bắc (57%)	N3: Bắc Sơn(80%)
500-1,000	B1: Mương mán (22%) B5: Mepu(14%)	N1: Nhơn Hải(27%) N5: Phước Hải(35%) B2: Gia Huynh (44%)		
1,000-3,000	N2: Công Hải (15%) B5: Nghi Đức(7%)	P3: An Thọ (39%) N6: Phước Dinh (46%)		
3,000 over		P4: An Mỹ (49%)		

According to the results shown, both P4: An My and N6: Phuoc Dinh are located very closely to the lower-right column in the table, indicating that both communes have relatively higher necessity of toilet as well as affordability to pay for its installation.

(Correlation between "households who have both toilet and dug well" and "contract diseases")

The following chart shows the correlation of "households who have both toilet facility and dug well" and "contract diseases". The survey pre-assumed that groundwater at shallow level could be contaminated by human excremental matters, if residents do not have toilet facilities within the yard. Therefore, households without toilet facility cum dug well users may face larger potential to get contracted with water related diseases more than toilet holders.

Following such pre-assumption, analysis was conducted by use of the chart below. The X axis shows the rate of households to have toilet as well as dug well, and Y axis indicates the rate of households who answered that they sometimes contract water related diseases.

Thus, it indicates that the communes located at upper left column have smaller number (rate) of toilet holders cum dug well users, and also higher rate of contracting diseases, which are P-5: Son Phuoc, P-6: Ea Cha Rang, and N-3: Bac Son fallen in this category. To the contrary, the communes which show higher rate of toilet holders and dug well users are relatively away from potentials to get contracted diseases, as shown in K-3: Cam Hai Tay and K-2 Cam Hiep Nam, which are located in lower right column. In addition, the fact that there are less communes located in columns of upper right and lower left supports the reliability of the pre-assumption of these two correlations.

In conclusion, the pre-assumption of high correlation between toilet facility-dug well and contracting water related diseases is generally affirmed.

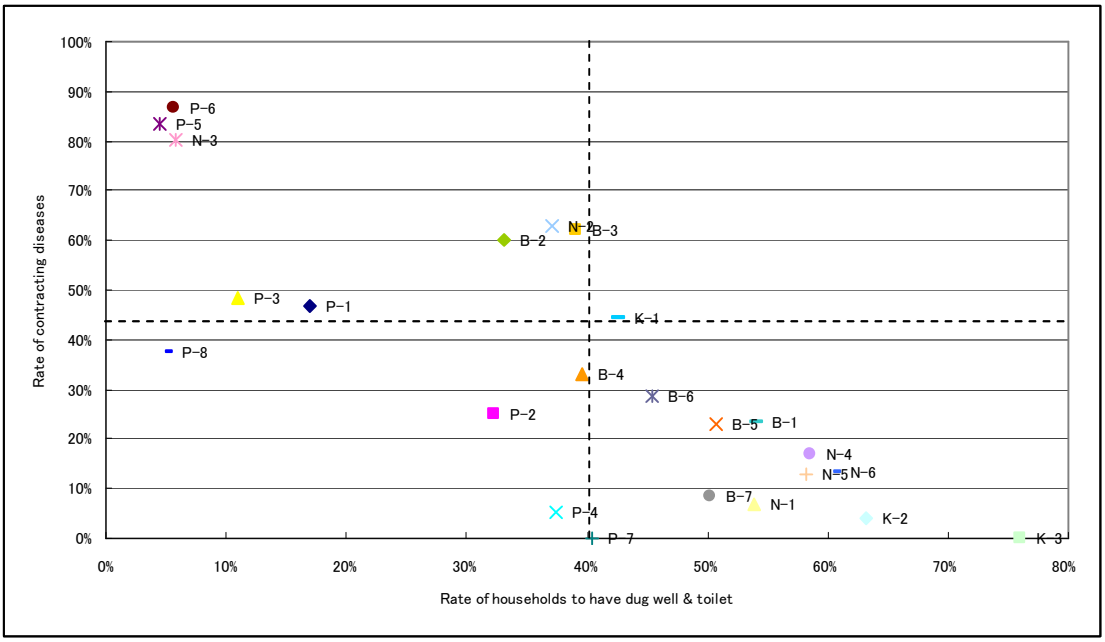


Figure 3.3.1 Correlation between "Households who have both Toilet and Dug Well" and "Contract Diseases"

3.3.3 Other (Ethnic Aspect)

(Correlation between "rate of minority people's households" and "necessity of water supply")

There exists tendency that minority people concentrate to live in their specific community, basically in the scale of village. In this line, there are significant differences of minority people's population from villages to villages even within the same commune.

Reflecting the tendency, the following table shows the correlation between the rate of minority people's households by village basis and the necessity of water supply.

In the same manner as before, the communes located in lower right column have stronger correlation of two analysis items, indicating larger proportion of minority people and higher necessity rate of water supply. According to the table, some villages of Phu Yen and Ninh Thuan in particular are placed in the column.

Table 3.3.5 Correlation between "Rate of Minority People's Households" and "Necessity of Water Supply"

Rate of minority people/ necessity	Necessity points 0.0-0.74	0.75-1.49	1.50-2.24	2.25-3.0
0-19%	P2: Định trung 2 (0.58) P2: Long Hòa (0.67) P2: Định Trung 3 (0.00) P4: Hòa Đa (0.48) P4: Giai Sơn (0.61) P8: Thân Bình Đông(0.67) P8: Mỹ Bình (0.67) K-2: Quang Duc (0.00) K-2: Suoi Cat (0.00) K-2: Vinh Thai (0.00) N6 : Từ Thiện (0.68) B5: Thôn3 (0,44) B_7: Thôn2 (0.63)	P1: Phú Hội (0.89) P2: Định Trung 1 (0.76) P2: Phong Niên (0.88) P2: Phong Hanh (0.82) P2: Phong Thăng (1.09) P2: Phong Hậu (0.86) P4: Phú Long (0.97) P7: Phú Hữu(0.82) P7: Tân Phú(1.2) P8: Bình Thắng(1.08) P8: Lễ Lộc Bình(1.25) P8: Lạc Điền(0.94) P8: Trường Thành (1.29) N5: Từ Tâm2 (0.95) B5:thôn8(1,14) B5:Thôn 5(1,43) B5:Thôn 4(0,98) B5:Thôn 1(1,35) B6: Thon1:(1,34) B6: Thon2:(1,4) B6: Thon3:(1,26) B6: Thon6:(1,4) B6: Thon7:(1) B_7:Thôn1 (1.42) B_7:Thôn8 (0.95) B_7:Thôn9 (1.18)	P1: Phú Xuân A (1.81) P1: Phú Xuân B (1.59) P1: Phước Hòa (1.51) P3: Phú Mỹ (2.00) P4: Phú Hòa (1.65) P-5: Tân Bình(1.83) P7: Tân Thành(1.67) P7: Tân An(2.06) P8: Phú Thịnh(1.57) P8: Thành An (2.17) K1: Cửa Tùng(1.73) K1: Hiền Lương (2.18) K1: Thuỷ Ba(2.05) K3: Bãi giếng 2(2.02) K3: Bắc Vĩnh (2.11) N1: Mỹ Tường2 (1.90) N5: Từ Tâm1 (1.75) N5: Hoà Thuỷ (1.97) N6 : Sơn Hải 1 (1.74) N6 : Sơn Hải 2 (1.77) N6:Vĩnh Trường (1.50) B-1: Đại Thành (1.96) B-3: Thôn 1(1.60) B-3: Thôn 3(1.57) B-3: Thôn 4(2.24) B-3: Thôn 5(2.10) B-3: Thôn 6(2.00) B-3: Thôn 7(1.89) B4: THON 5(1.53) B5:Thôn 7(1,5) B5:Thôn 6(2,11) B5: Thôn2(1,8) B6: Thon4:(1,52) B6: Thon5:(2,17) B_7:Thôn3 (1.75) B_7:Thôn4 (1.89) B_7:Thôn5 (1.63) B_7:Thôn7 (1.87)	P3: Kim Sơn (2.57) P3: Lam Sơn (2.25) P3: Phú Cần (2.68) P3: Quảng Đức (2.5) P4: Tân Lập (3.0) K1: Tân An(2.32) K1: Triệu Hải(2.56) K3: Bãi Giếng 1 (2.28) K3: Tân Hải (2.56) N1: Mỹ Tường1 (2.48) N1: Khánh Phước (3.00) N1: Khánh Nhơn (2.85) N2: Hiệp Thành (2.8) N2: Hiệp Khiết (2.64) N3: Láng Me (2.33) N3: Bình Nghĩa (2.92) N3: Xóm Bằng (2.94) N4: Quán thẻ1 (2.84) N4: Quán thẻ2 (2.71) N4: Lạc Tiến (2.96) B-1: Đằng Thành(2.37) B-1: Văn Phong (2.4) B2: Thôn 1 (2.26) B2: Thôn 3 (2.86) B2: Gia Huynh (2.57) B-3: Thôn 2(2.32) B4: THON 1(2.5) B4: THON 2(2.73) B4: THON 4(2.5) B4: THON 6(2.72) B_7:Thôn6 (2.41)
20-49%				P6: Kiến thiết(2.3) N6 : Bầu Ngứ (2.40) B2: Thôn 2 (2.56) B4: THON 3(2,42)
50-79%		N2:Bình Tiên (1.00)	P-5: Tân Hòa(2.19) P-5: Hòn Ông (1.71)	P6: Độc lập b(3.0) P6: độc lập c(2.7) N2: Suối giếng (2.36)
More than 80%			P-5: Tân Hiên(1.5) B5: thôn 9(1.63)	P-1Suối Mây (2.67) P-5: Ma Gú(3.0) P6: Độc lập a(3.0) P7: Suối Bạc(2.36) P7: Tân Lập(2.3) N2: Suối Vang (2.88) N2: Xóm Đèn (3.00) N2: Kà Rơm (2.93) N5: Thành Tín (2.31)

3.4 Commune Profile

The following table shows the basic framework of each commune:

Table 3.4.1 Commune Profiles for each Commune 1

			village	Land area (hectare)	Population	Ratio of population increase	Number of household	Ethnic Kin:	Ethnic Minority	Farming household	Fishing household	Other (jobs) household	Ratio of poverty household	Number of primary school	Number of junior high school	Number of high school	Number of hospital	Number of clinics	Existence of factory or similar business entities	Existence of landmine and/or bomb (Yes/No)	# of households to have toilet	% of paved road	% of electrification	% of households to have telephone (fixed line)	Organizations providing assistance (including bilateral/multilateral government, NGO etc)	Contents	Period
Phu Yen	P-1	Xuan Phuoc	Phu Xuan A		1,742		334	334																			
			Phu Xuan B		2,722		536	536						1	1	1	0	1	0	No							
			Phuoc Hoa		2,777		548	548						1													
			Phu Hoi		1,438		289	289																			
			Suoi May		380		75	0	75	0																	
	Commune_Total			**8188**	**9,059**	**0.58%**	**1,782**	**1,707**	**75**	**1,461**	**0**	**321**	**20.9%**	**2**	**1**	**1**	**0**	**1**	**0**		**1158**	**45.7%**	**97%**	**19.6%**	**Obayashi Corporation**	**Made toilets**	**2,005**
	P-2	An Dinh	Dinh Trung 1		594		157	157	0																		
			Dinh Trung 2		1,185		342	342	0																		
			Dinh Trung 3		425		109	109	0																		
			Phong Nien		1,309		311	311	0																		
			Phong Hanh		332		74	74	0																		
			Phong Thang		246		92	92	0																		
			Phong Hau		1,030		264	264	0																		
			Phong Hoa		755		182	182	0																		
	Commune_Total			**6157**	**5,876**	**1%**	**1,531**	**1,531**	**0**	**1,384**	**0**	**147**	**13.9%**	**1**	**1**	**0**	**0**	**1**	**1**	**No**	**228**	**10%**	**99%**	**5%**	**Nothing**	**Nothing**	
	P-3	An Tho	Phu Can	930	1,325		300	300			0			1	1	0		1	0	No							
			Phu My	780	694		164	164			0			1		0											
			Lam Son	854	573		121	121			0			1		0											
			Kim Son	680	364		71	71			0			1		0											
			Quang Duc	820	286		61	61			0			1		0											
	Commune_Total			**4,064**	**3,242**	**1.6%**	**717**	**717**	**0**	**669**	**0**	**48**	**29%**	**5**	**1**	**0**	**0**	**1**	**1**	**No**	**28**	**0%**	**97%**	**6%**	**Nothing**	**Nothing**	
	P-4	An My	Hoa Da	437	4,268		1,060	1,060	0	931	128			1	1	1	0	1	1								
			Phu Long	407	2,968		742	742	0	633	91																
			Giai Son	282	3,122		755	755	0	352	391			1													
			Phu Hoa	230	697		174	174	0	57	24																
			Tan Lap	180	372		85	85	0	37																	
	Commune_Total			**1,536**	**11,427**	**1.2%**	**2,816**	**2,816**	**0**	**2,010**	**634**	**172**	**9.7%**	**2**	**1**	**1**	**0**	**1**	**1**	**No**	**1991**	**60%**	**99%**	**35%**	**Nothing**	**Nothing**	
	P-5	Son Phuoc	Ma Gu						18																		
			Tan Vien						16																		
			Tan Hoa						154																		
			Tan Binh						186																		
			Hon Ong						78																		
	Commune_Total			**2,835**	**3,347**	**1.17%**	**772**	**320**	**452**	**710**	**0**	**62**	**28.19%**	**1**	**1**	**0**	**0**	**1**	**1**	**No**	**45**	**0%**	**90%**	**3%**	**Project HDB**	**Planting forest, building the clinics, made wells**	
	P-6	Ea Cha Rang	Kien Thiet	3,655	1,161		281	102	179	262	0																
			Doc Lap A	1,282	377		82	13	69	78	0																
			Doc Lap B	1,105	255		61	11	50	57	0																
			Doc Lap C	2,239	790		165	29	136	159	0																
	Commune_Total			**8,281**	**2,583**	**1.25%**	**589**	**155**	**434**	**556**	**0**	**33**	**41%**	**1**	**1**	**0**	**0**	**1**	**0**	**Yes**	**17**	**0%**	**92%**	**14%**	**-About health project of VietNam - Netherlands**	**About health, hygiene**	**2004**
	P-7	Suoi Bac	Tan Lap		463		107	7	100	101	0	6															
			Tan An		645		161	161	0	147	0	14															
			Tan Thanh		820		235	230	5	163	0	72															
			Tan Phu		1,514		403	400	3	207	0	196															
			Phu Huu		430		114	114	0	95	0	19															
			Suoi Bac		1,632		372	55	317	346	0	26															
	Commune_Total			**3,089**	**5,504**	**0.94%**	**1,392**	**967**	**425**	**1,059**	**0**	**333**	**30%**	**1**	**1**	**0**	**0**	**1**	**0**	**No**	**1,651**	**30%**	**90%**	**10%**	**-About health project of VietNam - Netherlands-CBRIP project**	**-About health -Traffic, fresh water, education**	**2001 2006**
	P-8	Son Thanh Dong	Than Binh Doi	390	507		114	114		110																	
			Phu Thinh	655	1,315		300	300		295																	
			Le Loc Binh	359	991		254	254		248																	
			Binh Thang	588	1,089		251	250	1	248																	
			My Binh	371	1,565		324	324		320																	
			Lac Dien	258	1,419		311	311		305																	
			Truong Thanh	486	838		186	186		183																	
			Thanh An	600	514		118	118		118																	
	Commune_Total			**3,707**	**8,238**	**0.86%**	**1,858**	**1,857**	**1**	**1,827**	**0**	**31**	**25%**	**2**	**1**	**0**	**0**	**1**	**0**	**Yes**	**93**	**10%**	**75%**	**5%**	**Nothing**	**Nothing**	
PhuYen_Total				**37,857**	**49,276**	**0**	**11,457**	**10,070**	**1,387**	**9,676**	**634**	**1,147**	**0**	**15**	**8**	**2**	**0**	**8**	**4**	**2Yes & 6No**	**5,211**	**19.5%**	**1**	**0**	**4**		
Khanh Hoa	K-1	Cam An Bac	Cua Tung	144	1,269		251	251	0	260	0				1				0								
			Trieu Hai	185	1,289		239	239	0	260	0			1				1	0								
			Hien Luong	215	1,293		243	243	0	250	0								0								
			Thuy Ba	193	1,094		202	202	0	180	0								0								
			Tan An	188	1,219		240	240	0	180	0			1					0								
	Commune_Total			**925**	**6,164**	**0.8%**	**1,175**	**1,175**	**0**	**1,130**	**0**	**45**	**22.04%**	**2**	**1**	**0**	**0**	**1**	**0**	**No**	**823**	**5%**	**90%**	**30%**	**Atlantic Philanthropies -Fred Hollows Foundation**	**Support for clinics**	**2006**
	K-2	Cam Hiep Nam	Quang Duc	155	1,565		357	357	0	252	0										147						
			Suoi Cat	94	2,628		568	568	0	324	0										184						
			Vinh Thai	1,246	1,920		377	377	0	337	0										129						
	Commune_Total			**1,495**	**6,113**	**1%**	**1,302**	**1,302**	**0**	**913**	**0**	**389**	**15.8%**	**1**	**1**	**0**	**0**	**1**	**0**	**No**	**460**	**85%**	**99.6%**	**31%**	**Nothing**	**Nothing**	
	K-3	Cam Hai Tay	Bai Gieng 1	571	3,010		669	669	0																		
			Bai Gieng 2	564	2,869		654	654	0																		
			Bac Vinh	352	2,152		414	414	0																		
			Tan hai	432	2,501		540	540	0																		
	Commune_Total			**1,919**	**10,532**	**0.03%**	**2,277**	**2,277**	**0**	**1,694**	**109**	**474**	**9%**	**2**	**1**	**1**	**0**	**1**	**0**	**No**	**1,366**	**75%**	**90%**	**60%**	**Official Development Assistance**	**-Built one primary school & one clinics**	**1999 2007**
KhanhHoa_Total				**4,339**	**22,809**	**0**	**4,754**	**4,754**	**0**	**3,737**	**109**	**908**	**0**	**5**	**3**	**1**	**0**	**3**	**0**	**0Yes & 3No**	**2,649**	**55%**	**1**	**0**	**2**		

Table 3.4.2 Communes Profile for each Commune 2

			village	Land area (hectare)	Population	Ratio of population increase	Number of household	Ethnic Kin:	Ethnic Minority	Farming household	Fishing household	Other (jobs) household	Ratio of poverty household	Number of primary school	Number of junior high school	Number of high school	Number of hospital	Number of clinics	Existence of factory or similar business entities	Existence of landmine and/or bomb (Yes/No)	# of households to have toilet	% of paved road	% of electrification	% of households to have telephone (fixed line)	Organizations providing assistance (including bilateral/multilateral government, NGO etc)	Contents	Period
Ninh Thuan	N-1	Nhon Hai	My Tuong 1	521	4,120		628	628	0	502																	
			My Tuong 2	672	3,376		679	679	0	475	3																
			Khanh Phuoc	250	2,100		358	358	0	286																	
			Khanh Nhon	570	4,560		850	850	0	595																	
	Commune_Total			**2,013**	**14,156**	**0**	**2,515**	**2,515**	**0**	**1,859**	**3**	**653**	**13%**	**2**	**1**	**0**	**0**	**1**	**0**	**No**	**1,761**	**5%**	**90%**	**12%**	**Nothing**	**Nothing**	
	N-2	Cong Hai	Hiep Kiet		1,149		287	287	0																		
			Hiep Thanh		324		63	63	0																		
			Suoi Vang		2,002		326	310	16																		
			Suoi Gieng		2,020		456	110	346																		
			Xom Den		686		139	6	133										1								
			Karom		963		152	12	140										1								
			Binh Tien		237		60	10	50										1								
	Commune_Total			**2,535**	**7,381**	**0**	**1,483**	**798**	**685**	**1,186**	**59**	**237**	**25.3%**	**1**	**1**	**0**	**0**	**1**	**3**	**No**	**445**	**30%**	**90%**	**30%**	**-About health project of VietNam - Netherlands-CBRIP project**	**-Way to disinfect water -Built common house, irrigation canal**	**2000 2006**
	N-3	Bac Son	Binh Nghia	2,341	2,886		485	5	480																		
			Xom Bang	1,863	2,407		416	23	393																		
			Lang Me	2,088	1,254		240	239	1																		
	Commune_Total			**6,292**	**15,128**	**0**	**1,141**	**267**	**874**	**970**	**0**	**171**	**32%**	**3**	**1**	**0**	**0**	**1**	**1**	**No**	**342**	**32%**	**90%**	**38%**	**Nothing**	**Nothing**	
	N-4	Phuoc Minh	Quan The 1	3,000	916		241	231	10	208	0																
			Quan The 2	3	250		77	74	3	0	0																
			Lac Tien	4,765	1,800		560	549	11	494	0																
	Commune_Total			**7,768**	**2,966**	**0**	**878**	**854**	**24**	**702**	**0**	**176**	**8%**	**2**	**1**	**1**	**0**	**1**	**1**	**No**	**351**	**0%**	**100%**	**30%**	**Nothing**	**Nothing**	
	N-5	Phuoc Hai	Tu Tam 1	1,423	3,640		743	743		743	0																
			Tu Tam 2	899	2,003		398	398		398	0																
			Thanh Tin	725	4,500		680	0	680	578	0																
			Hoa Thuy	411	2,000		358	358		358	0																
	Commune_Total			**3,458**	**12,143**	**0**	**2,179**	**1,499**	**680**	**2,077**	**0**	**102**	**16%**	**3**	**2**	**0**	**0**	**1**	**0**	**No**	**1,090**	**30%**	**95%**	**25%**	**Nothing**	**Nothing**	
	N-6	Phuoc Dinh	Son Hai 1	1,944	4,320		810	809	1	162	648																
			Son Hai 2	1,240	2,300		426	426		340	86																
			Tu Thien	900	1,033		210	210		147	20																
			Bau Ngu	921	127		42	42		20	42																
			Vinh Truong	670	504		94	94		2	92																
	Commune_Total			**5,675**	**8,284**	**0**	**1,582**	**1,581**	**1**	**671**	**888**	**23**	**20%**	**4**	**1**	**0**	**0**	**3**	**0**	**No**	**633**	**25%**	**90%**	**35%**	**Nothing**	**Nothing**	
NinhThuan_Total				**27,741**	**60,058**	**0**	**9,778**	**7,514**	**2,264**	**7,465**	**950**	**1,362**	**0**	**15**	**7**	**1**	**0**	**8**	**5**	**0Yes & 6No**	**4,621**	**20.3%**	**1**	**0**	**1**		
Binh Thuan	B-1	Muong Man	Van Phong		1,824		403	403	0																		
			Dai Thanh		2,386		506	506	0																		
			Dang Thanh		2,477		511	511	0																		
	Commune_Total			**5,734**	**6,687**	**0**	**1,420**	**1,420**	**0**	**1,132**	**0**	**288**	**0**	**3**	**1**	**0**	**0**	**1**	**2**	**No**	**768**	**90%**	**95%**	**0**	**Nothing**	**Nothing**	
	B-2	Gia Huynh	Thon 1		2,026		422	398	24																		
			Thon 2		1,530		318	225	93																		
			Thon 3		2,375		480	480	0																		
	Commune_Total			**3,977**	**5,931**	**0**	**1,220**	**1,103**	**117**	**995**	**0**	**225**	**8.4%**	**2**	**1**	**0**	**0**	**1**	**1**	**No**	**397**	**1**	**1**	**36%**	**Nothing**	**Nothing**	
	B-3	Nghi Duc	Thon 1		1,424		285	284	1	242											114						
			Thon 2		1,313		262	262		222											104						
			Thon 3		1,279		256	256		217											102						
			Thon 4		1,617		330	330		280											132						
			Thon 5		1,588		324	324		275											129						
			Thon 6		1,267		253	253		215											101						
			Thon 7		1,707		342	342		290											136						
	Commune_Total			**8,726**	**10,195**	**0**	**2,052**	**2,051**	**1**	**1,741**	**0**	**311**	**0**	**2**	**1**	**0**	**0**	**1**	**1**	**No**	**818**	**10%**	**100%**	**43%**	**Nothing**	**Nothing**	
	B-4	Tan Duc	Thon 1	351	978		183	183																			
			Thon 2	298	865		65	65																			
			Thon 3	506	1,230		245	180	65																		
			Thon 4	491	1,470		137	137																			
			Thon 5	318	647		149	149																			
			Thon 6	915	589		256	256																			
	Commune_Total			**2,879**	**5,779**	**0**	**1,035**	**970**	**65**	**880**	**0**	**155**	**30%**	**2**	**0**	**0**	**0**	**1**	**2**	**Yes**	**381**	**90%**	**100%**	**40%**	**Nothing**	**Nothing**	
	B-5	Me Pu	Thon1	390	2,127		439	439	0																		
			Thon2	300	1,370		290	290	0																		
			Thon3	390	1,795		394	394	0																		
			Thon4	460	1,944		449	449	0																		
			Thon5	350	1,885		337	337	0																		
			Thon6	105	813		177	177	0																		
			Thon7	70	189		42	42	0																		
			Thon8	350	2,705		490	490	0																		
			Thon9	150	418		78	0	78																		
	Commune_Total			**2,565**	**13,246**	**0**	**2,696**	**2,618**	**78**	**2,157**	**0**	**539**	**9.8%**	**3**	**1**	**1**	**1**	**1**	**0**	**No**	**809**	**65%**	**80%**	**19%**	**Nothing**	**Nothing**	
	B-6	Sung Nhon	Thon 1	170	1,192		255	237	18	230																	
			Thon 2	345	1,500		356	356	0	320																	
			Thon 3	530	1,175		270	270	0	270																	
			Thon 4	228	1,200		260	255	5	250																	
			Thon 5	347	1,183		235	235	0	230																	
			Thon 6	612	734		142	139	3	98																	
			Thon 7	590	791		150	140	10	140																	
	Commune_Total			**2,822**	**7,775**	**0**	**1,668**	**1,632**	**36**	**1,538**	**0**	**130**	**12%**	**4**	**1**	**0**	**0**	**1**	**16**	**Yes**	**917**	**65%**	**98%**	**25%**	**Nothing**	**Nothing**	
	B-7	Da Kai	Thon 1	753	1,167		226	226	0	194	0										181						
			Thon 2	534	828		170	166	4	148	0										136						
			Thon 3	400	1,098		224	216	8	171	0										179						
			Thon 4	750	1,442		272	270	2	199	0										218						
			Thon 5	600	1,691		329	324	5	219	0										263						
			Thon 6	600	1,523		337	334	3	282	0										270						
			Thon 7	700	1,313		295	292	3	230	0										236						
			Thon 8	800	969		171	162	9	159	0										137						
			Thon 9	900	967		200	187	13	177	0										160						
			Thon 10	1,500	438		132	111	21	129	0										106						
	Commune_Total			**7,537**	**11,436**	**0**	**2,356**	**2,288**	**68**	**1,908**	**0**	**448**	**23%**	**2**	**1**	**0**	**0**	**1**	**4**	**Yes**	**1,886**	**80%**	**90%**	**16%**	**Nothing**	**Nothing**	
BinhThuan_Total				**34,240**	**61,049**	**0**	**12,447**	**12,082**	**365**	**10,351**	**0**	**2,096**	**0**	**18**	**0**	**0**	**0**	**0**	**26**	**3Yes & 4No**	**5,976**	**68.6%**	**1**	**0**	**0**		
TOTAL				**104,177**	**193,192**	**0**	**38,436**	**34,420**	**4,016**	**31,229**	**1,693**	**5,513**	**0**	**53**	**18**	**4**	**0**	**19**	**35**	**5Yes & 19No**	**18,457**	**0**	**1**	**0**	7		

CHAPTER 4

GEOPHYSICAL SURVEY

CHAPTER 4 GEOPHYSICAL SURVEY

4.1 Outline of Survey

4.1.1 Purpose of Survey

Geophysical survey, which are Vertical Electrical Sounding (hereinafter referred to as "the VES") and Horizontal Electrical Profiling (hereinafter referred to as "the HEP"), was carried out for the following purposes;

- To figure out the geological / hydrogeological / aquifer features at the geophysical survey point and its environment, and
- To select the test drilling points that one test drilling point was selected in one commune.

4.1.2 Survey Area and Quantity

The VES points were selected several points (4 to 6 points) in one commune based on the topographic / geological features, the accessibility / trafficability for the mobilization of the drilling machine and recommendation by CPC, and the total quantities were 120 points in the study area (24 communes).

The HEP locations were selected in the mountainous / high land area in order to select a suitable point for carrying out the VES and the total quantities were 8 locations in the study area.

Table 4.1.1 and Table 4.1.2 show name of survey points and their coordinates of the VES and the HEP, respectively.

Table 4.1.1 List of the VES Points

Province	Commune	No.	Site No.	Longitude	Latitude
Phu Yen	Xuan Phuoc	1	P1-V01	109.04763	13.30627
		2	P1-V02	109.05224	13.30922
		3	P1-V03	109.07340	13.28493
		4	P1-V04	109.06560	13.28207
		5	P1-V05	109.06455	13.29846
	An Dinh	6	P2-V01	109.18610	13.31733
		7	P2-V02	109.17199	13.30958
		8	P2-V03	109.19393	13.31627
		9	P2-V04	109.19050	13.31160
		10	P2-V05	109.18390	13.31608
	An Tho	11	P3-V01	109.23522	13.18552
		12	P3-V02	109.19827	13.18843
		13	P3-V03	109.20375	13.18470
		14	P3-V04	109.22368	13.18357
		15	P3-V05	109.23685	13.16800
	An My	16	P4-V01	109.27622	13.20745
		17	P4-V02	109.28665	13.21245
		18	P4-V03	109.26032	13.20465
		19	P4-V04	109.27591	13.20181
		20	P4-V05	109.27375	13.20423
	Son Phuoc	21	P5-V01	108.95410	13.16323
		22	P5-V02	108.95817	13.17155
		23	P5-V03	108.94947	13.15452

Province	Commune	No.	Site No.	Longitude	Latitude
		24	P5-V04	108.94895	13.13786
		25	P5-V05	108.94702	13.14215
	Ea Cha Rang	26	P6-V01	108.87908	13.07672
		27	P6-V02	108.90424	13.09448
		28	P6-V03	108.86507	13.11598
		29	P6-V04	108.87983	13.09627
		30	P6-V05	108.88983	13.09458
	Suoi Bac	31	P7-V01	108.94917	13.10238
		32	P7-V02	108.95142	13.09567
		33	P7-V03	108.95342	13.07947
		34	P7-V04	108.99033	13.08817
		35	P7-V05	108.97866	13.07398
	Son Thanh Dong	36	P8-V01	109.09148	13.01648
		37	P8-V02	109.11197	12.98622
		38	P8-V03	109.09624	12.98316
		39	P8-V04	109.10292	12.97412
		40	P8-V05	109.10530	12.99578
Khanh Hoa	Cam An Bac	41	K1-V01	109.12097	12.01617
		42	K1-V02	109.09699	12.01506
		43	K1-V03	109.08685	12.00962
		44	K1-V04	109.10944	12.01639
	Cam Hiep Nam	45	K2-V01	109.12402	12.02368
		46	K2-V02	109.12902	12.02652
		47	K2-V03	109.10707	12.03734
		48	K2-V04	109.11666	12.03486
		49	K2-V05	109.12827	12.03160
	Cam Hai Tay	50	K3-V01	109.15905	12.08190
		51	K3-V02	109.13629	12.07627
		52	K3-V03	109.14546	12.07385
		53	K3-V04	109.13306	12.07147
		54	K3-V05	109.14737	12.08743
		55	K3-V06	109.15768	12.07332
Ninh Thuan	Nhon Hai	56	N1-V01	109.12168	11.60660
		57	N1-V02	109.11865	11.59965
		58	N1-V03	109.12011	11.60302
		59	N1-V04	109.10742	11.60083
	Cong Hai	60	N2-V01	109.09824	11.79810
		61	N2-V02	109.09243	11.79183
		62	N2-V03	109.07350	11.78408
		63	N2-V04	109.07503	11.77538
		64	N2-V05	109.08343	11.77642
	Bac Son	65	N3-V01	109.06242	11.68220
		66	N3-V02	109.06308	11.68133
		67	N3-V03	109.06353	11.67787
		68	N3-V04	109.05710	11.64578
		69	N3-V05	109.10068	11.65592
	Phuoc Minh	70	N4-V01	108.85867	11.44328
		71	N4-V02	108.88852	11.43540
		72	N4-V03	108.87812	11.43811
		73	N4-V04	108.89443	11.40153
	Phuoc Hai	74	N5-V01	108.96930	11.52790
		75	N5-V02	108.95677	11.51895
		76	N5-V03	108.97513	11.53368
		77	N5-V04	108.96143	11.52262

Province	Commune	No.	Site No.	Longitude	Latitude
		78	N5-V05	108.97363	11.50437
	Phuoc Dinh	79	N6-V01	108.96447	11.46692
		80	N6-V02	109.00703	11.44615
		81	N6-V03	108.99053	11.43239
		82	N6-V04	108.97865	11.39493
		83	N6-V05	109.01024	11.46692
Binh Thuan	Muong Man	84	B1-V01	108.00282	10.97410
		85	B1-V02	108.00353	10.97195
		86	B1-V03	107.99748	10.97407
		87	B1-V04	108.00655	10.97107
		88	B1-V05	108.00748	10.96757
	Gia Huynh	89	B2-V01	107.61388	11.04988
		90	B2-V02	107.54102	10.99072
		91	B2-V03	107.62590	11.01860
		92	B2-V04	107.64247	11.03473
		93	B2-V05	107.61508	11.05322
		94	B2-V06	107.61702	11.04813
	Nghi Duc	95	B3-V01	107.67082	11.22638
		96	B3-V02	107.66753	11.22573
		97	B3-V03	107.66320	11.23233
		98	B3-V04	107.67053	11.22900
		99	B3-V05	107.67708	11.22235
		100	B3-V06	107.67686	11.22182
	Tan Duc	101	B4-V01	107.59330	10.85243
		102	B4-V02	107.59865	10.84205
		103	B4-V03	107.61253	10.84217
		104	B4-V04	107.59442	10.84323
		105	B4-V05	107.57534	10.82451
		106	B4-V06	107.58599	10.83631
	Me Pu	107	B5-V01	107.61638	11.24233
		108	B5-V02	107.62790	11.23756
		109	B5-V03	107.61860	11.24233
		110	B5-V04	107.61488	11.21912
		111	B5-V05	107.61540	11.23680
	Sung Nhon	112	B6-V01	107.58065	11.25750
		113	B6-V02	107.58842	11.23370
		114	B6-V03	107.59673	11.23785
		115	B6-V04	107.58755	11.25138
	Da Kai	116	B7-V01	107.53851	11.27358
		117	B7-V02	107.56096	11.26505
		118	B7-V03	107.56483	11.26525
		119	B7-V04	107.56630	11.2633
		120	B7-V05	107.55422	11.27364

Table 4.1.2 List of the HEP Points and Line

Province	Commune	No.	Site No.	Longitude	Latitude	Line of the HEP
Khanh Hoa	Cam An Bac	1	K1-H01	109.08626	12.01165	240 m to W 260m to E
	Cam Hiep Nam	2	K2-H01	109.10724	12.03747	260 m to S 45 W 260 m to N 45 E
Ninh Thuan	Bac Son	3	N3-H01	109.06308	11.68133	260 m to W 260 m to E
	Phuoc Minh	4	N4-H01	108.85867	11.44328	260 m to N 70 W 260 m to E 20 S
	Phuoc Dinh	5	N6-H01	108.99211	11.43531	520 m to N 40 E
Binh Thuan	Nghi Duc	6	B3-H01	107.67980	11.22059	540 m to N 75 W
	Tan Duc	7	B4-H01	107.58599	10.83631	260 m to S 35 W 260 m to N 65 E
	Me Pu	8	B5-H01	107.61550	11.23804	140 m to N 15 W 400 m to S 75 E

The location maps of geological survey for the target communes of FS are shown from Figure 4.1.1 to Figure 4.1.9.

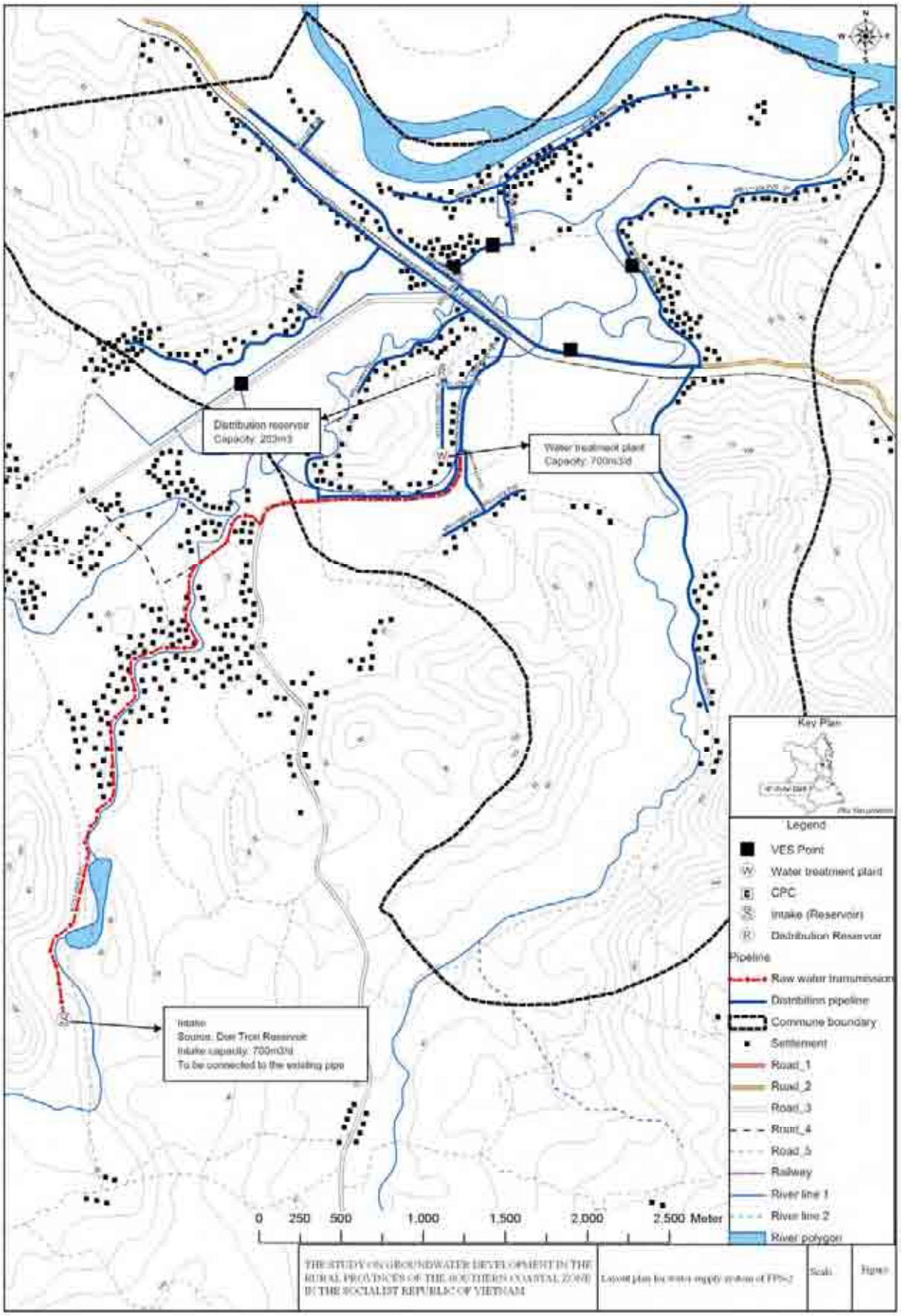


Figure 4.1.1 Location Map of Geological Survey in FPS-2

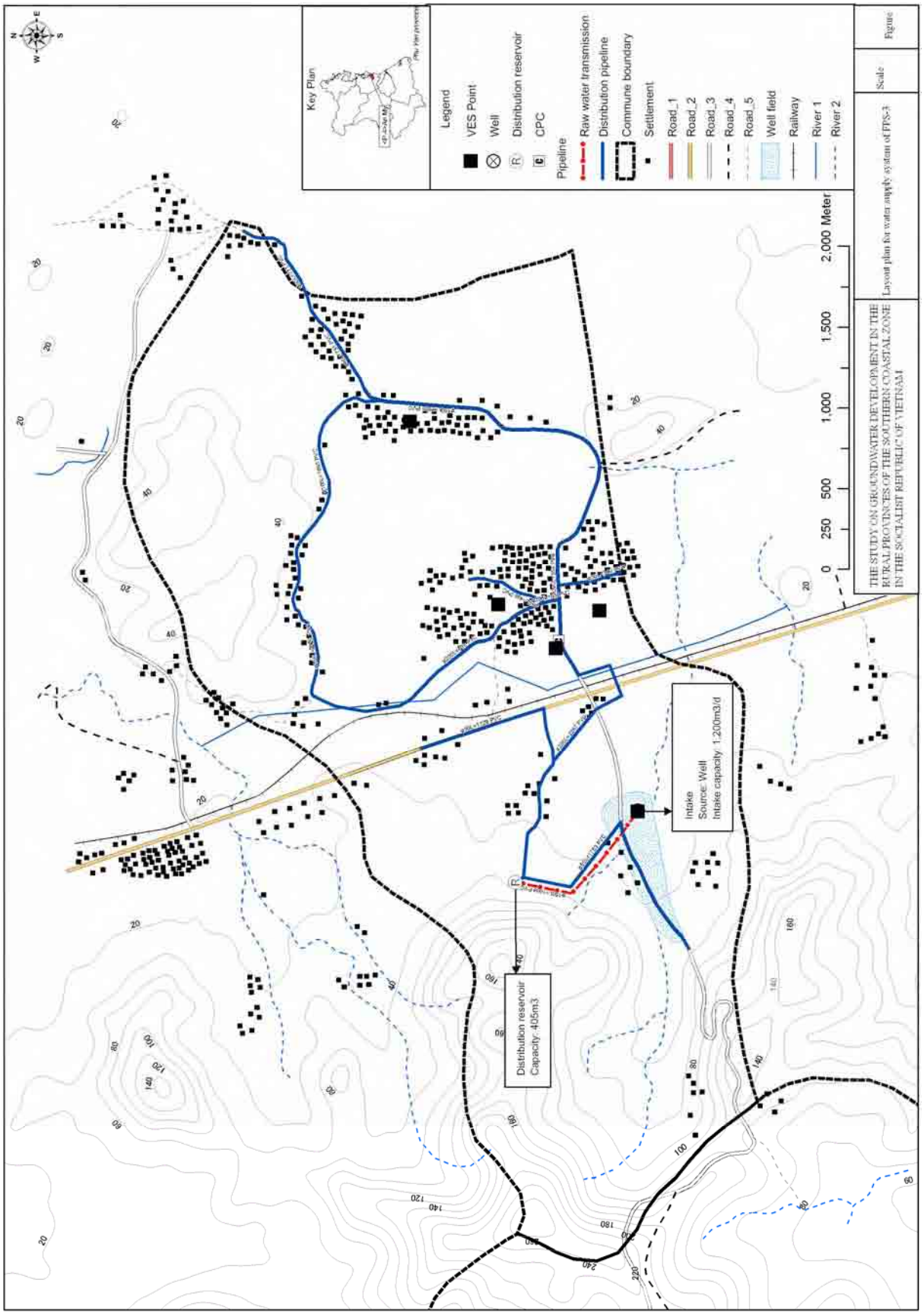


Figure 4.1.2 Location Map of Geological Survey in FPS-3

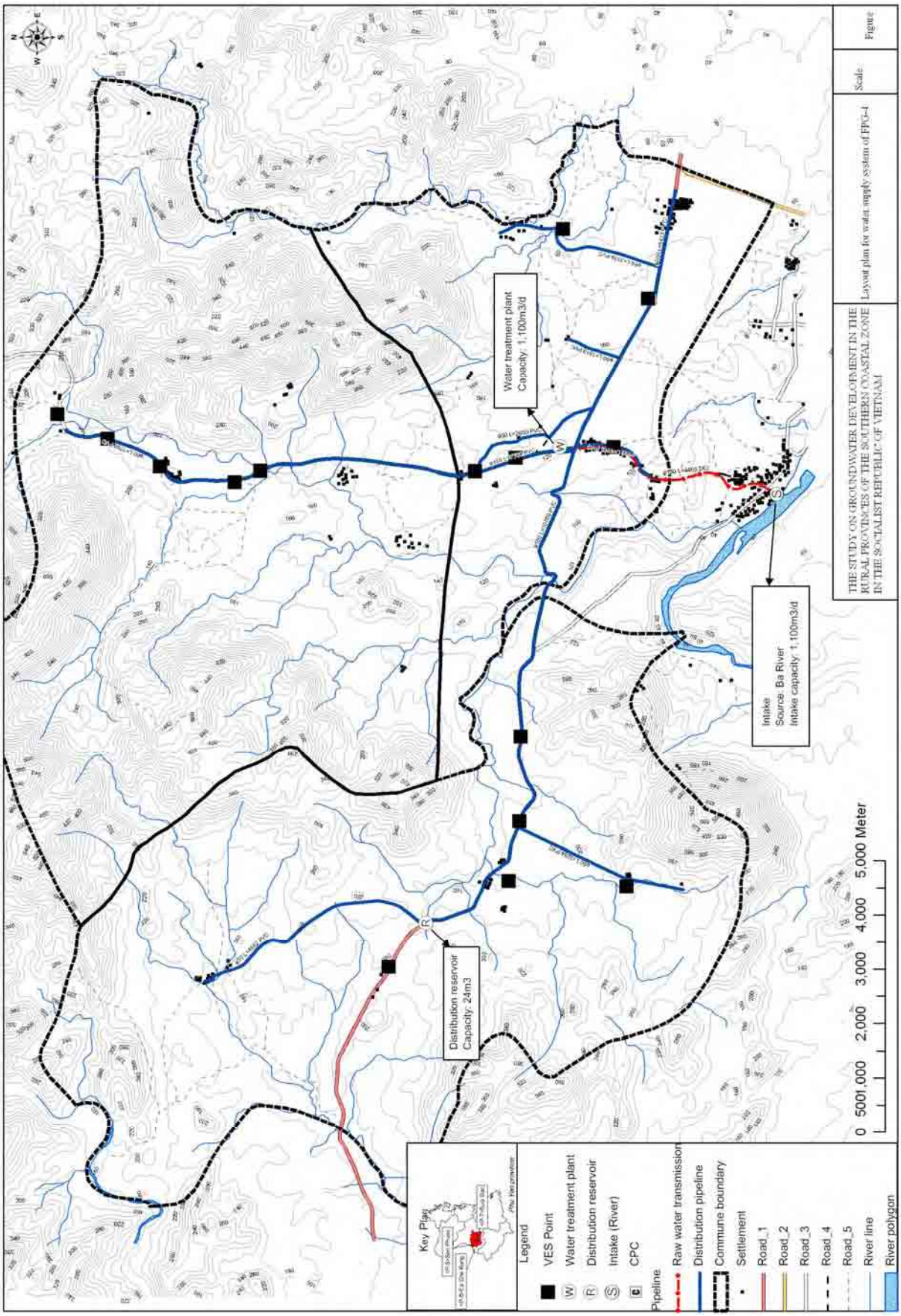


Figure 4.1.3 Location Map of Geological Survey in FPG-4

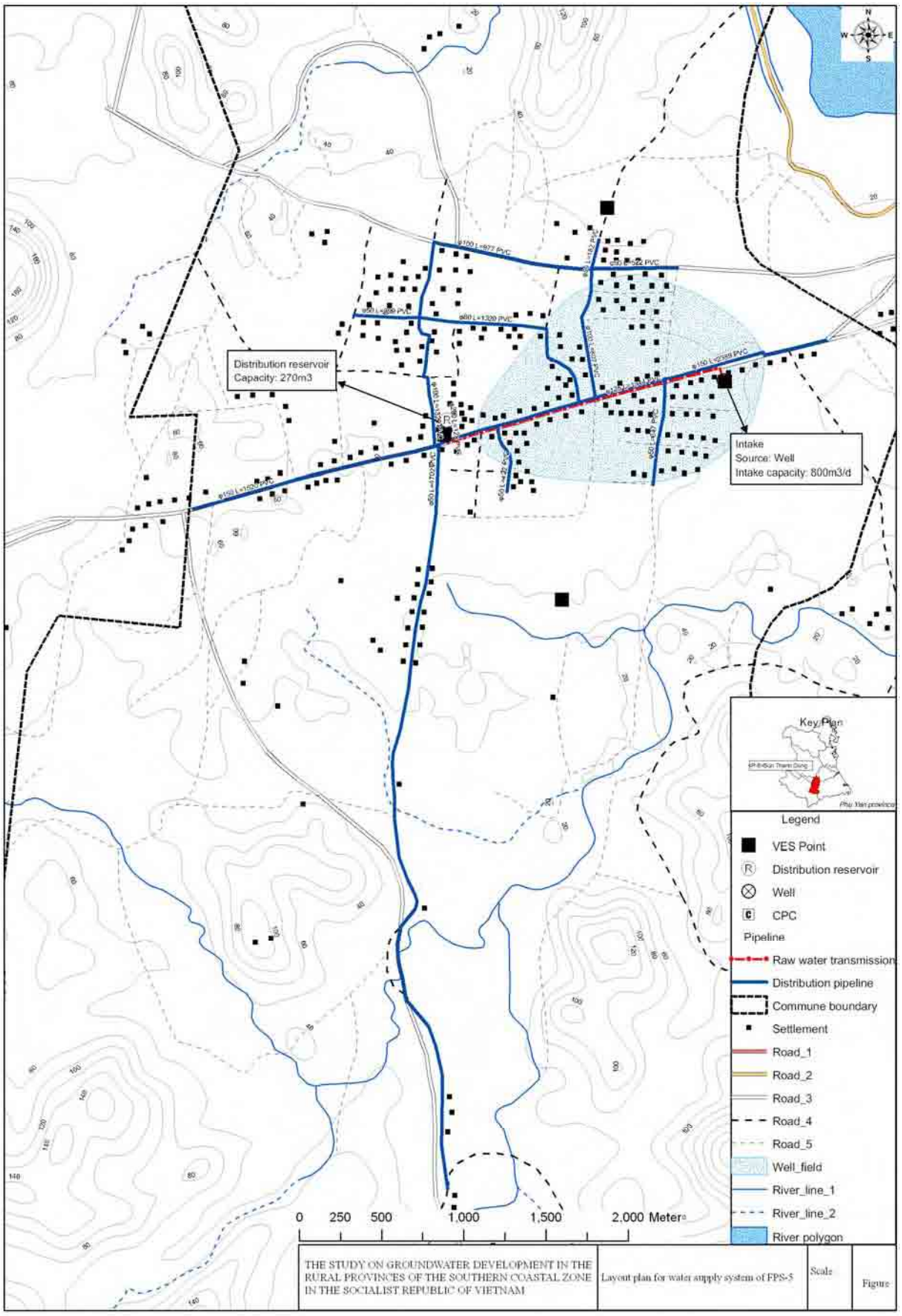


Figure 4.1.4 Location Map of Geological Survey in FPS-5

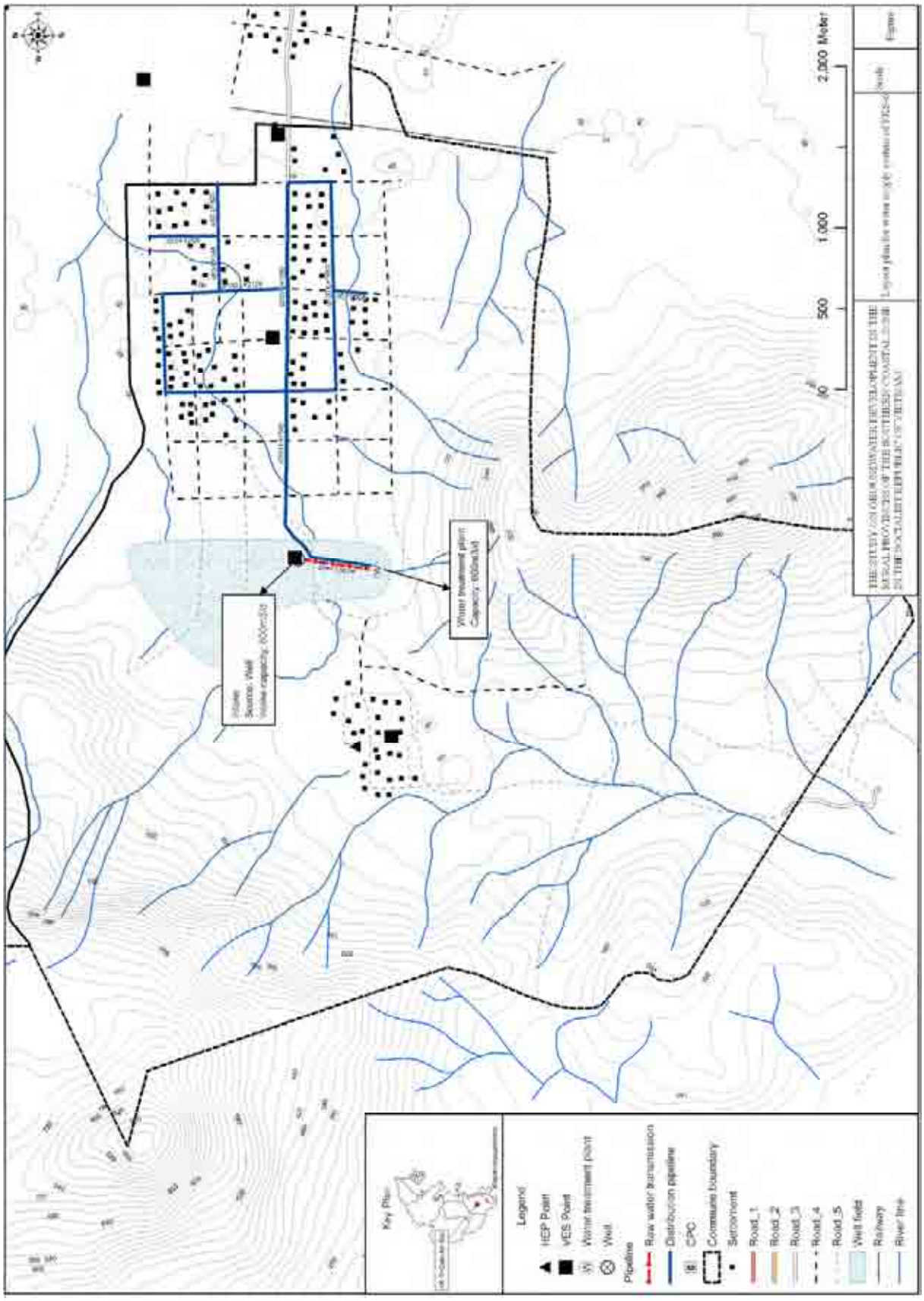


Figure 4.1.5 Location Map of Geological Survey in FKS-6

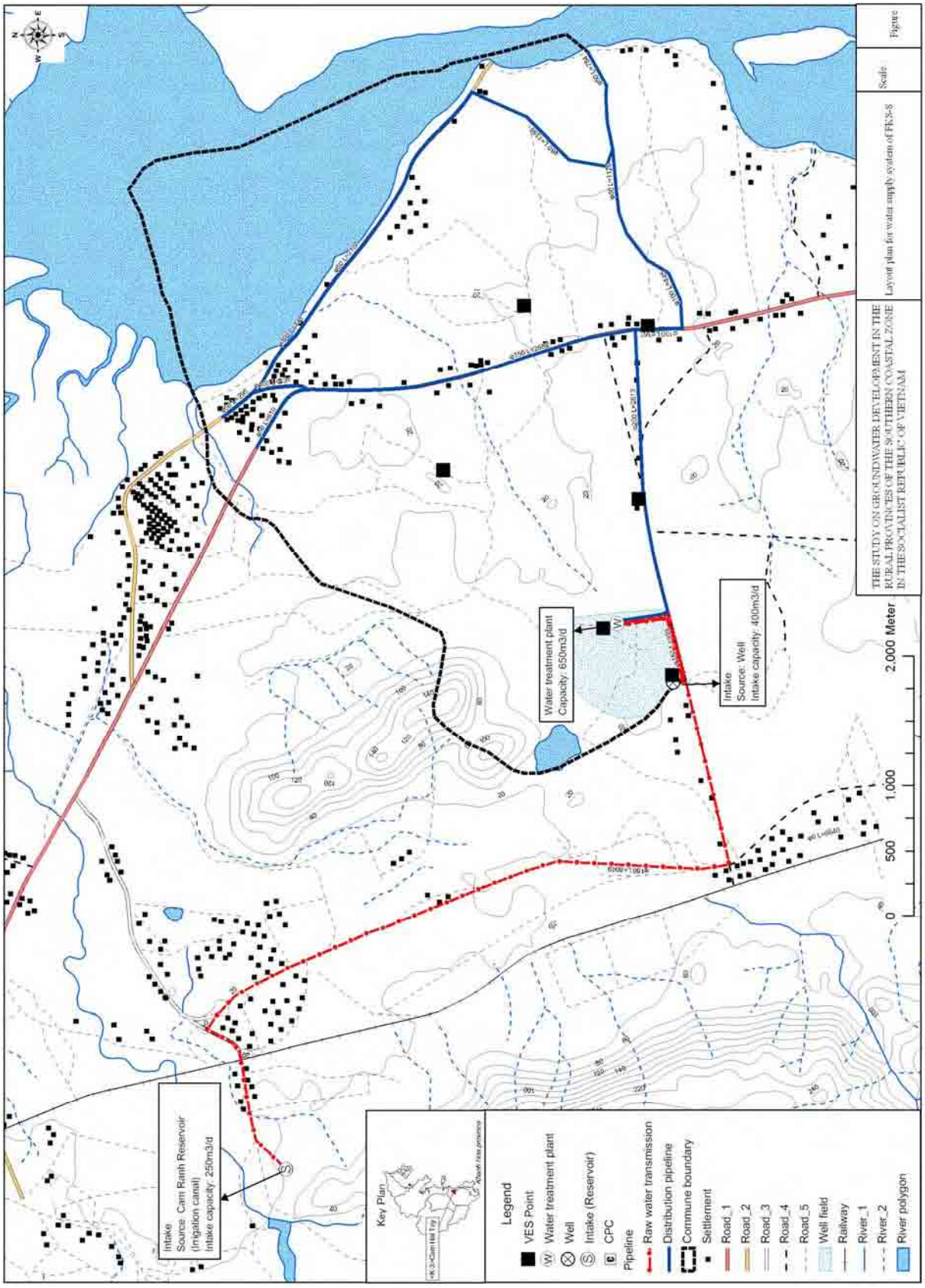


Figure 4.1.6 Location Map of Geological Survey in FKS-8

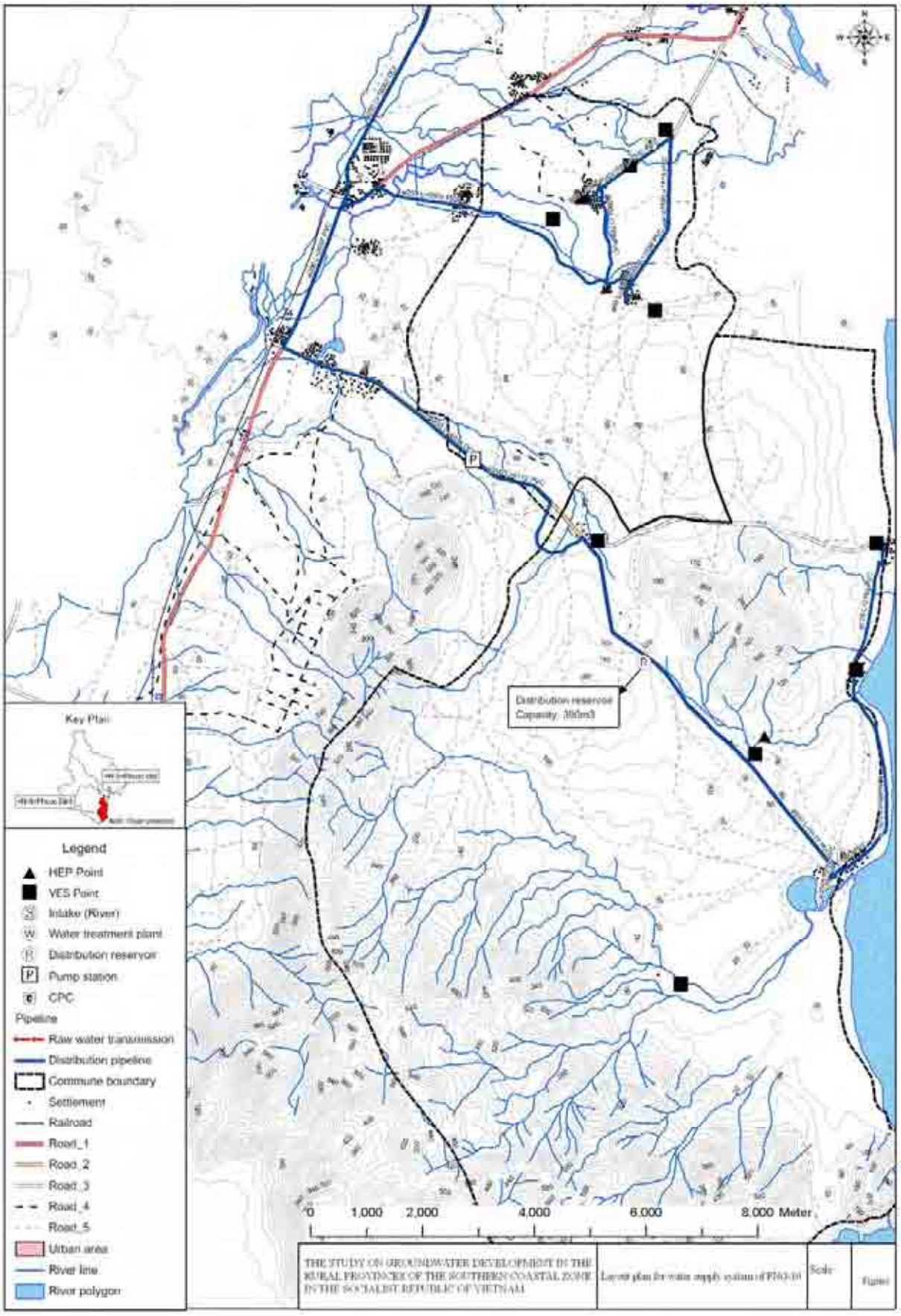


Figure 4.1.7 Location Map of Geological Survey in FNG-10

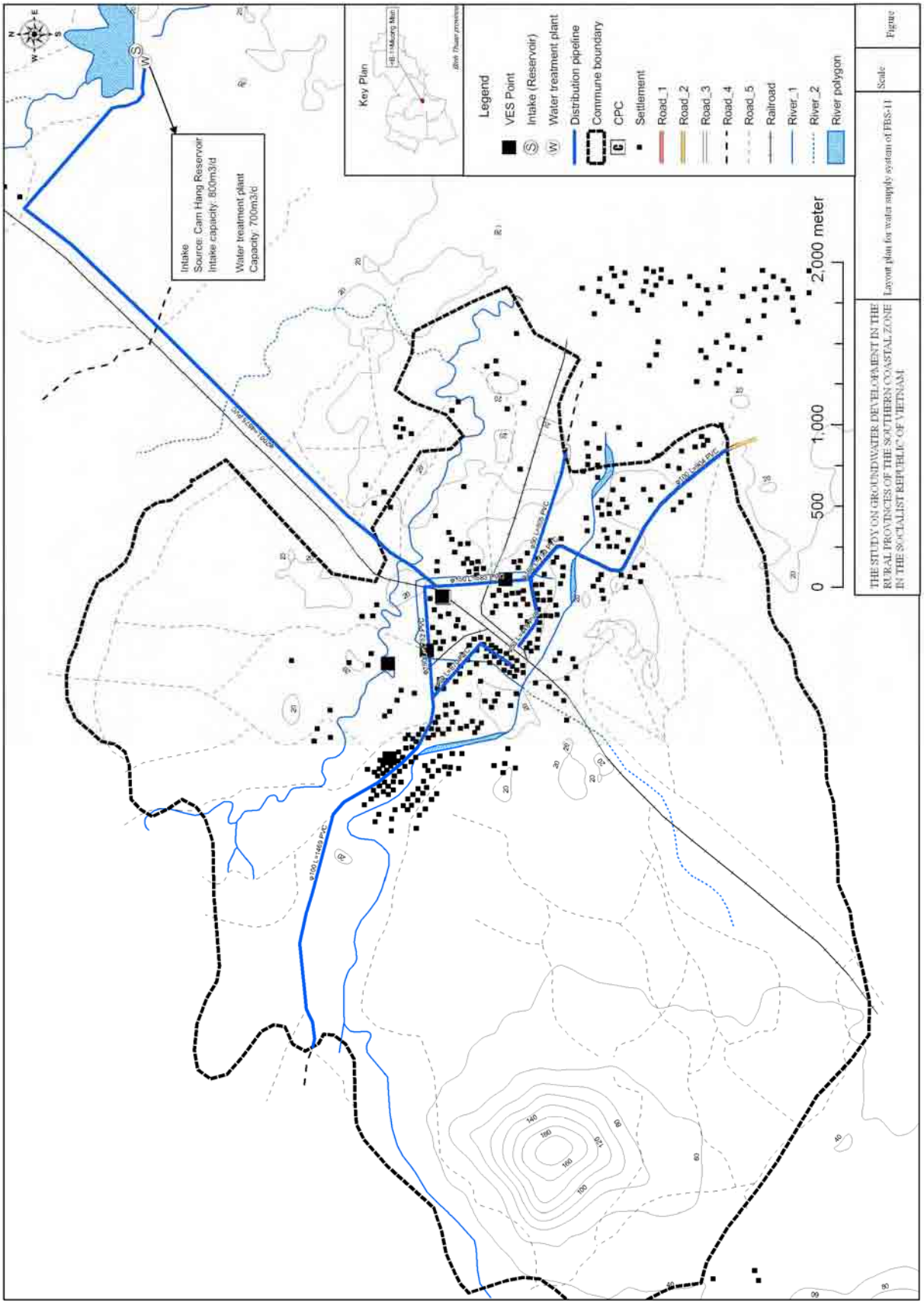


Figure 4.1.8 Location Map of Geological Survey in FBS-11

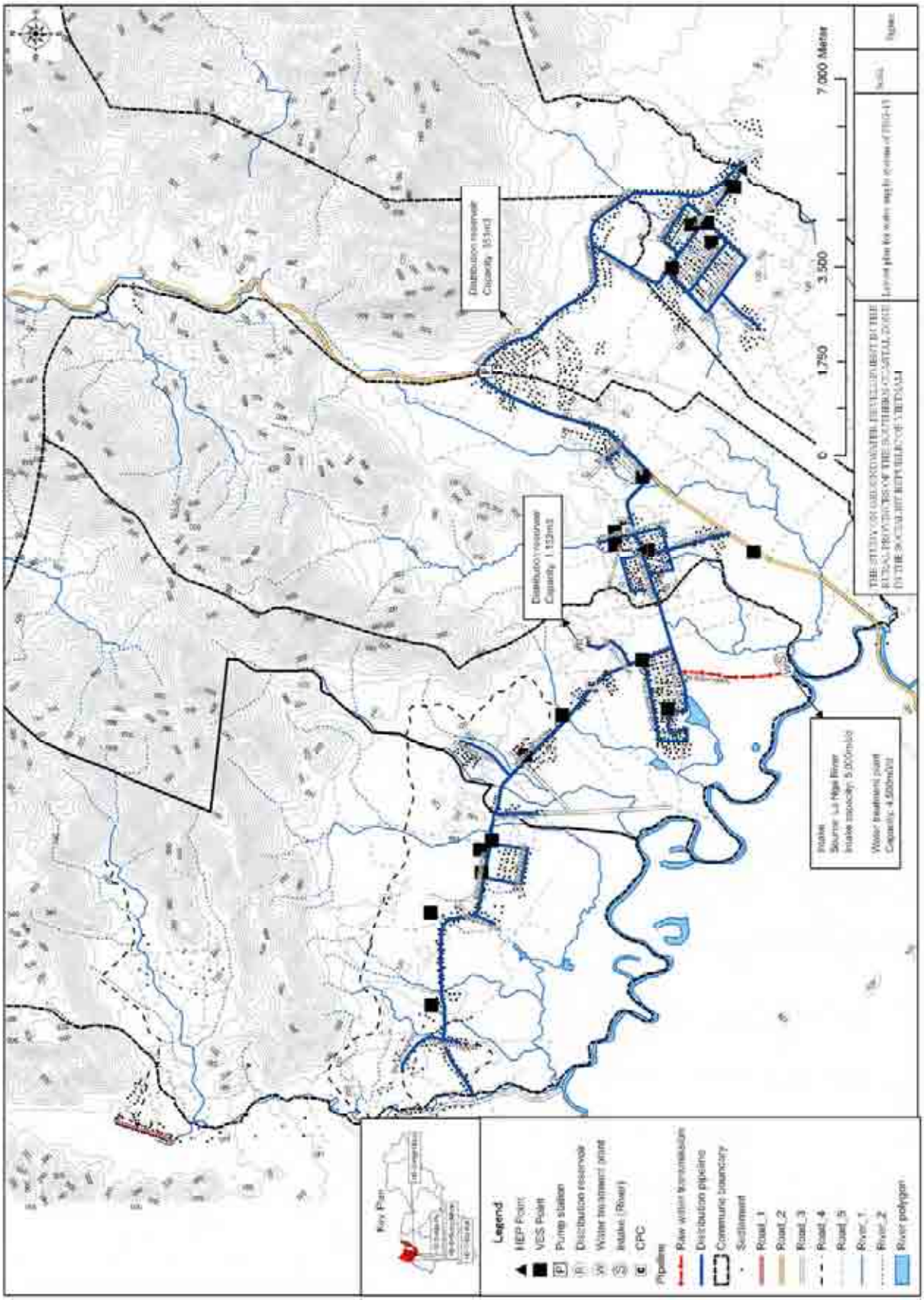


Figure 4.1.9 Location Map of Geological Survey in FBG-13

4.2 Methodology of the VES and HEP

Most of fresh bedrocks have quite high resistivity except for mudstone or shale, an actual resistivity of the strata usually are dominated by the resistivity of the groundwater in pore spaces. The pore spaces in fault and fracture zones are often larger than the pore spaces of the original rocks. Such a zone with high water content: namely, fracture zone, usually has considerably low resistivity. In addition, the resistivity of the fresh rocks remarkably decreases since weathering or alteration transforms them into sandy or clayey materials. Consequently, rock resistivity usually varies widely: e.g. about 10-1 ohm-m for fault clay to about 105 ohm-m for fresh rocks. Resistivity should be dealt with an effective index for detecting anomalous zones in strata for groundwater exploration.
Figure 4.2.1 shows the conceptual diagram about resistivity.

Resistivity	Small ⟷ Large
Soil	[Clay] [Silt] [Sand] [Gravel]
Particle Size	Small ⟷ Large
Water Saturation	Large ⟷ Small
Water Contents (Porosity * Saturation)	Large ⟷ Small
Electric Conductivity (EC) of Groundwater	Large ⟷ Small

Figure 4.2.1 Conceptual Diagram of the Factor versus Resistivity

4.2.1 Principals

Schlumberger electrode array and Wenner array was adopted for the VES and HEP, respectively.
As to the VES, a pair of current electrodes was arranged around the survey point on the both sides symmetrically. The spacing of the current electrodes (A-B) was more than three times of the spacing of potential electrodes (M-N) as shown in Figure 4.2.2.

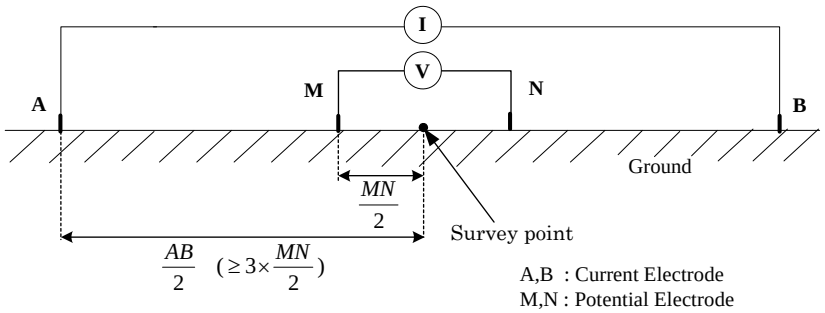


Figure 4.2.2 Electrode Array for the VES: Schlumberger Configuration

As to the HEP, a pair of current electrode was arranged same as the VES. The spacing of the

current electrodes (A-B) was three times of the spacing of electric potential electrodes (M-N), it means that the spacing of A-M, M-N and N-B were same as shown in Figure 4.2.3.

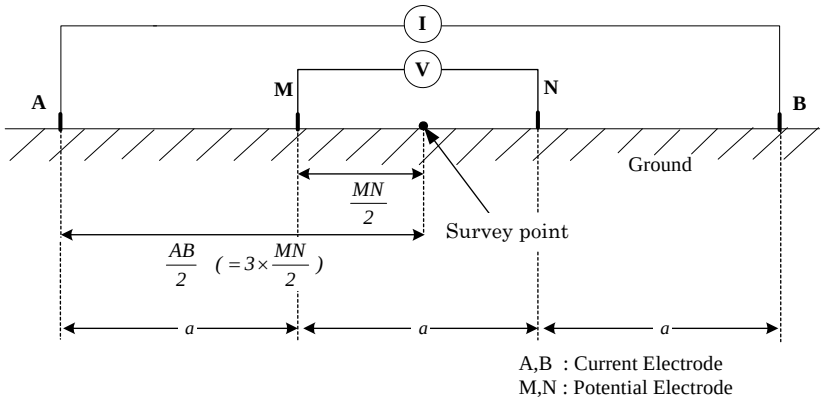


Figure 4.2.3 Electrode Array for the HEP: Wenner Configuration

When the electrical current is injected from the current electrodes put on the outside, the electric potential difference (voltage) around the center is measured between the potential electrodes. An apparent resistivity value can be calculated from the electrode spacing, the electric current value and the electrical potential difference value that these are measured at that time. As the actual ground is not homogeneous, apparent resistivity value shows the average resistivity in hemisphere, which a diameter is made an electrode spacing at that time. In general, in case that electrode spacing is short and wide, apparent resistivity value reflects the resistivity of the shallow and deep portion, respectively. Therefore, the analysis of the underground structure is examined by applying various electrode spacing and its measurement.

4.2.2 Field Measurements

As to the VES, target depth of the survey was 200 m, and the electrode spacing as shown in Table 4.2.1 was adopted.

Table 4.2.1 Electrode Spacing of the VES: Schlumberger Configuration

No.	AB/2 (m)	MN/2 (m)	K
1	1.5	0.5	6.2832
2	2.5	0.5	18.8496
3	3	0.5	27.4889
4	4	0.5	49.4801
5	5	0.5	77.7544
6	6	0.5	112.3119
7	7	0.5	153.1526
8	8	0.5	200.2765
9	8	3	28.7979
10	10	0.5	313.3739
11	10	3	47.6475
12	13	3	83.7758
13	17	3	146.6077

No.	AB/2 (m)	MN/2 (m)	K
14	20	3	204.7271
15	25	3	322.5368
16	30	3	466.5265
17	40	3	833.0457
18	50	3	1304.2846
19	60	3	1880.2432
20	80	3	3346.3198
21	80	20	471.2389
22	100	3	5231.2754
23	100	20	753.9822
24	130	20	1295.9070
25	170	20	2238.3848
26	200	20	3110.1767

As to the HEP, target depth of the survey was 40 m. Hence, the electrode spacing by Wenner configuration was AM = MN = NB = 40 m, interval of Wenner configuration was 20m and length of the survey line was around 500 m as shown in the Figure 4.2.4.

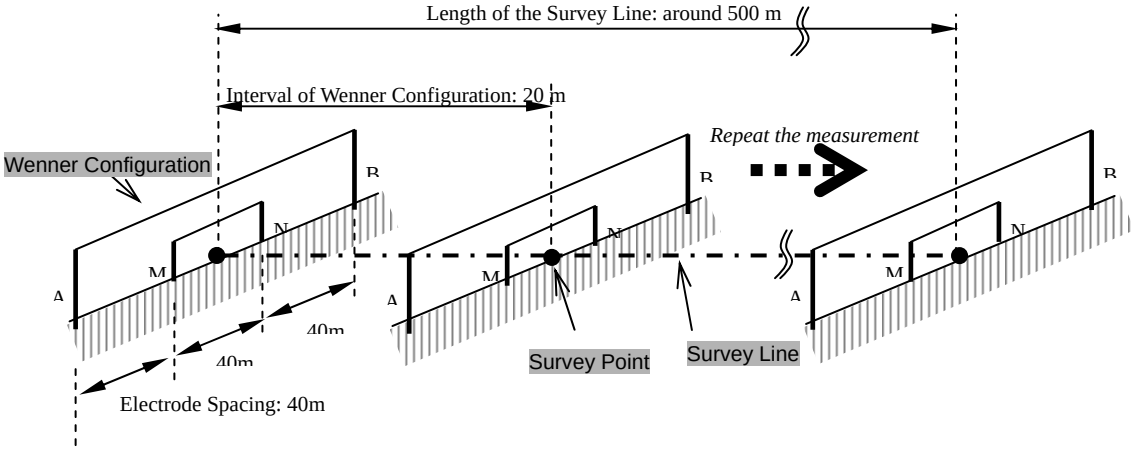


Figure 4.2.4 Spreading out of the HEP

4.2.3 Analysis

The flow chart of the automatic inversion for the VES is shown in Figure 4.2.5. This is based on an iterative method.

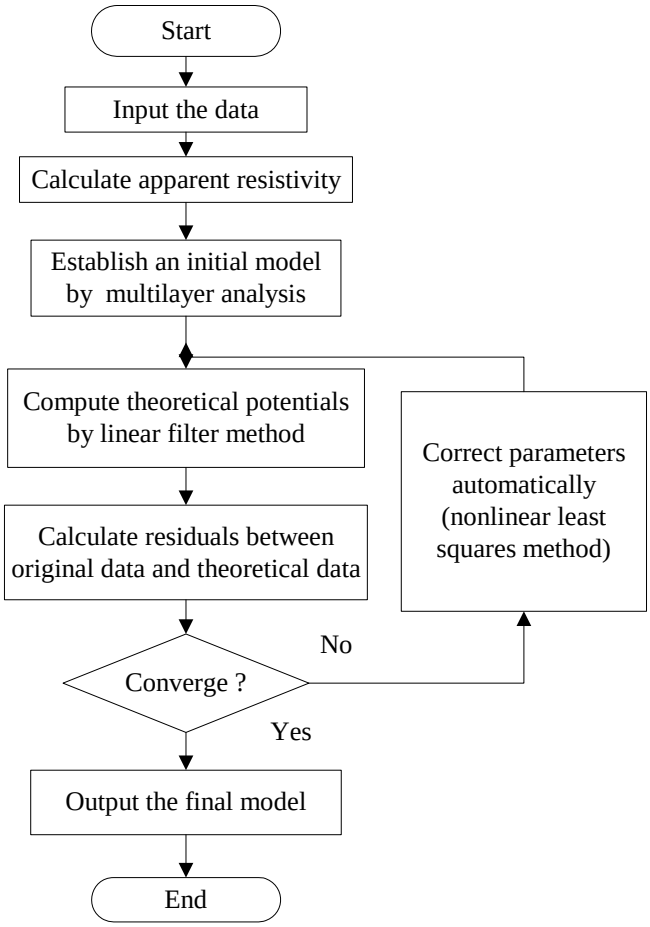


Figure 4.2.5 Flowchart of Automatic Inversion

First, an apparent resistivity is calculated from the collected data by following equation.

$$\rho_a = \pi \frac{AB^2 - MN^2}{4 \cdot MN} \cdot \frac{V}{I} = K \cdot \frac{V}{I}$$

This apparent resistivity is plotted in graphical paper on logarithmic scale. An abscissa is electrode spacing corresponding to the prospecting depth.

Next, theoretical potential data corresponding to the model are computed. Alternatively, if the underground has an approximately horizontally layered structure, the digital linear filter method can be used to conduct continuous one-dimensional inversion. After theoretical potential data are calculated, the model is modified to reduce the residuals between the theoretical data and the measured data. To find the model giving the minimum residuals, the non-linear least squares technique is applied. This modification process is iterated until the residuals become sufficiently small or subsequent changes to the model no longer improve the fitting. At this point, the inversion is considered to have converged. An analysis program called ELPAC1 developed by OYO Corporation was used for the study..

An analysis result (Figure 4.2.6) is shown on both logarithm graphs that a vertical and a horizontal

axis is depth and apparent resistivity / resistivity, respectively. The point plotted by square mark shows the measured apparent resistivity value. The hatched block shows the resistivity structure model of the underground, and the curve line is fitting curve for the apparent resistivity computed by the model. When obtained apparent resistivity and computed curve are fit well, a residual error shows small value, the resistivity structure of the underground can be explained with this model, and this model becomes an analysis result. "RMS" is an abbreviation of a Root Mean Square of residual error.

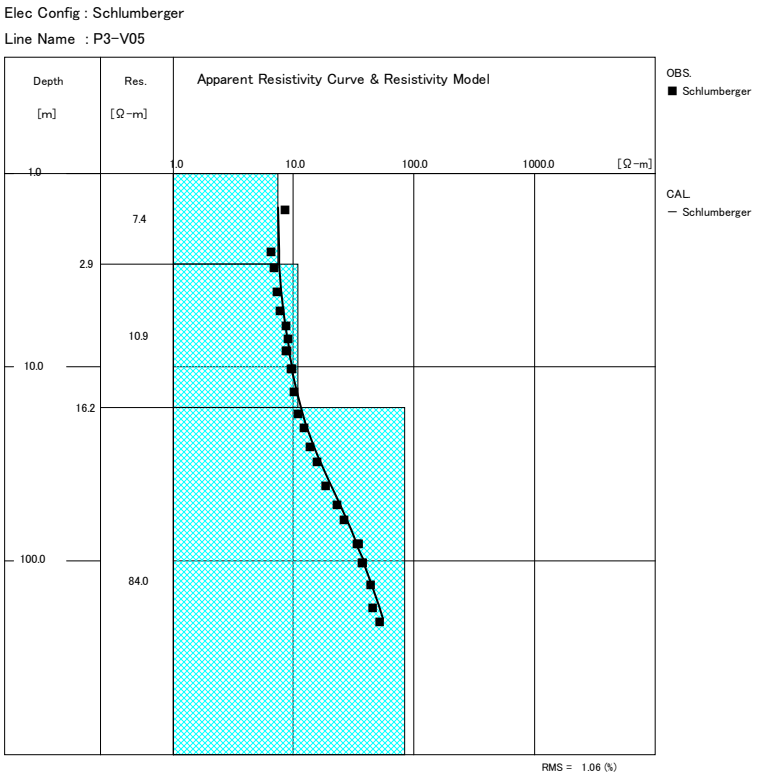


Figure 4.2.6 Example of the Analysis Results of the VES

Regarding the HEP, the apparent resistivity value is utilized in order to select a location of the VES as shown in Figure 4.2.7.

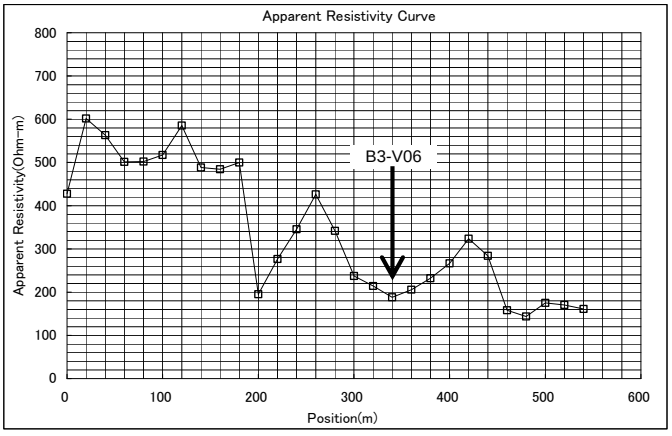
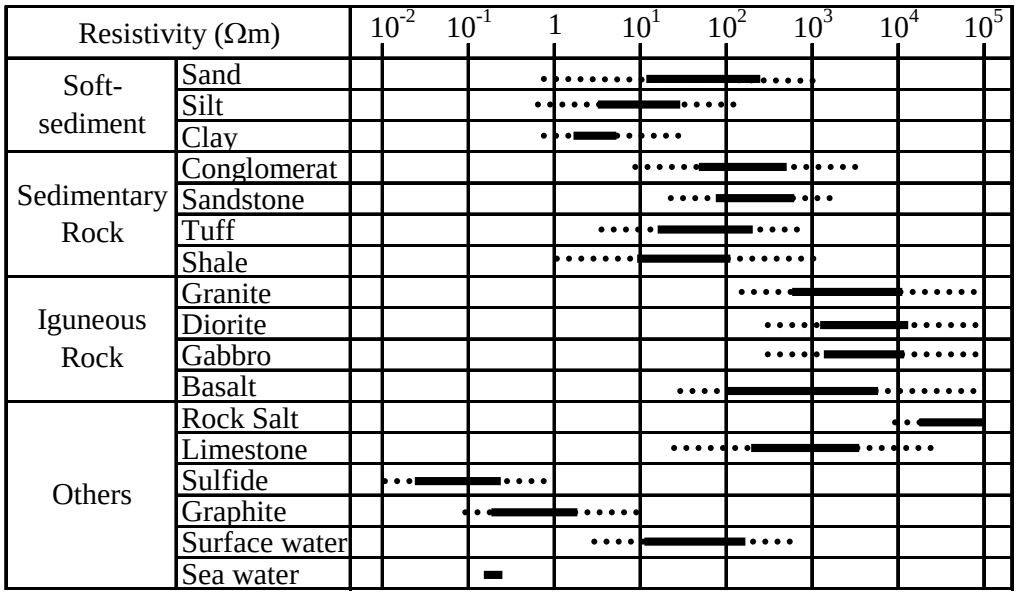


Figure 4.2.7 Example of the Analysis Results of the HEP

4.3 Results and Considerations

4.3.1 Resistivity Features for Geology

Geology type generally relates with resistivity of its materials as shown in Figure 4.3.1, which is based on the experience in Japan.



After "Zukai Buturi Tansa (in Japanese)"

Figure 4.3.1 General Relationship between Soil/Rock Type and its Resistivity in Japan

Table 4.3.1 and Figure 4.3.2 show relationship between local geology with rock type classification and its resistivity obtained by this Study by each province in order to provide a basic information for the future project of groundwater development in this study area and its environments. It is noted that some results that have possibility of seawater intrusion were excluded from the above mentioned tabulation.

Table 4.3.1 Relationship between Geology / Rock Type and its Resistivity by each Province

Commune	Geological Layer	Rock Type	Resistivity (ohm-m)			Numbers of Data
			Minimum	Maximum	Average	
Phu Yen	Bengiang-Queson Complex	Weathering/Fractured Granite	(59)	(59)	59	1
		Granite	107	696	342	15
	Vancanh Complex	Weathering/Fractured Granite	45	139	109	3
		Granite	90	501	222	6
	Pliocene to Pleistocene Basalts	Weathering/Fractured Basalt	3	242	37	13
		Basalt	24	479	157	20
Khanh Hoa	Deoca Complex	Weathering/Fractured Granite	25	81	51	2
		Granite	160	1,111	438	17
Ninh Thuan	Deoca Complex	Weathering/Fractured Granite	14	154	87	11
		Granite	147	1,377	471	18
Binh Thuan	Bandon Formation	Sedimentary Rock	218	415	285	5
	Ankroet-Dinhquan Complex	Weathering/Fractured Granite	48	260	156	12
		Granite	202	1,545	607	42
	bQ_{II-IV}	Alteration Basalt	19	42	32	2
		Basalt	56	228	108	6

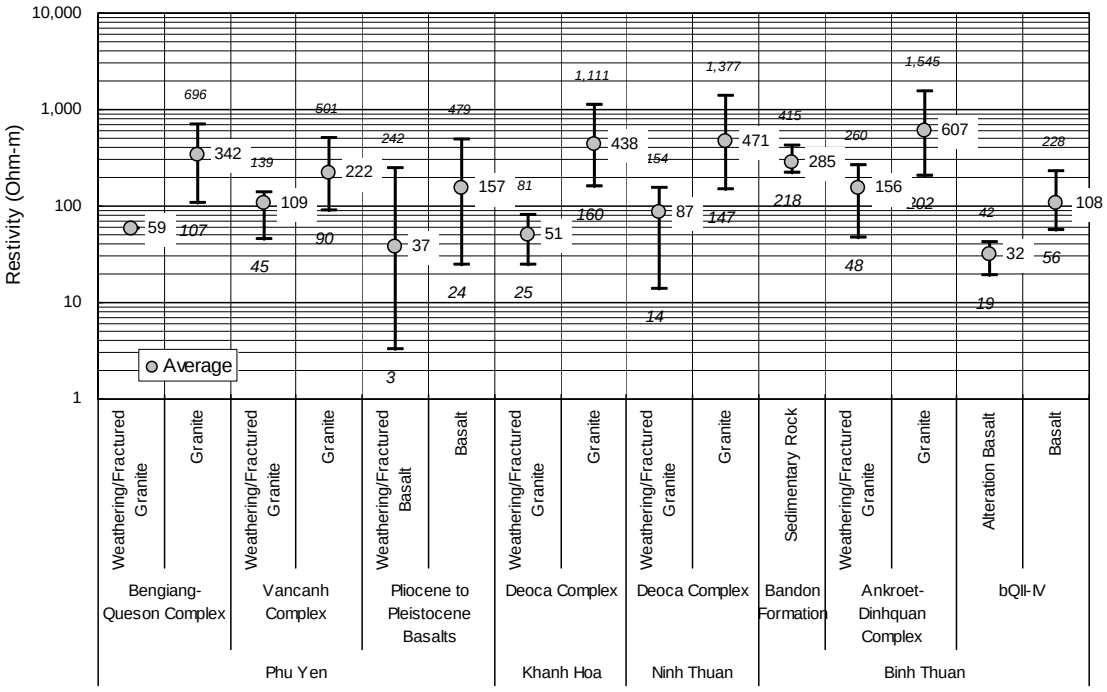


Figure 4.3.2 Relationship between Geology / Rock Type and its Resistivity by each Province

Granite widely distributed in the target communes. The resistivity of weathering and / or fractured granite indicates 50 to 150 ohm-m, and the resistivity of granite with some crack / fissure mostly shows 200 to 600 ohm-m, especially over 1,000 ohm-m corresponds with a hard rock of granite.

In a part of the target communes in Phu Yen and Binh Thuan, basalt is distributed. The resistivity of weathering / fractured / jointed / alteration of basalt indicates around 30 ohm-m, and the resistivity of basalt with some crack / fissure shows around 100 ohm-m.

Sedimentary rock is distributed in a part of the target communes in Binh Thuan, and its resistivity indicates around 300 ohm-m according to the limited data in this Study.